

by the addition of essential oils, again, by the use of synthetic flavors, and also by the treatment of some vegetable product with the alcoholic spirit to extract the flavoring ingredients. It is likewise the general custom to color cordials." (*U. S. Dept. Agr. F. I. D., 125*).

In view of the above considerations it is apparent that all of our ten samples are either cordials or juices fortified with alcohol, although five of them were distinctly labeled as "brandy". That they are of most diverse character is shown by the following tabulation, which gives the maxima and minima for the various ingredients:—

	Max.	Min.
Alcohol.....	32.55	10.53
Extract.....	47.00	18.53
Sucrose.....	4.15	None
Invert Sugar.....	42.21	14.12
Ash.....	0.318	0.115
Ash, water-soluble.....	0.298	0.113
Acidity (cc. $\frac{n}{10}$ alkali per 100cc.).	98.4	56.0
Alkalinity of sol. ash (cc. $\frac{n}{10}$ acid per 100 cc.).....	27.0	8.5

Not only were none of the brandies genuine, but the two samples from *E. E. Hall and Son, New Haven*, were also adulterated, containing salicylates and glucose. No coal-tar color was detected in any of the samples.

MALT EXTRACT.

Under the name "malt extract" two entirely different preparations are found on the market, one being a strong beer, the other an extract prepared from malt and composed chiefly of dextrin and maltose with some albumen and phosphates. A genuine malt extract, in the U. S. P. sense, should contain all the soluble principles of malt in a permanent form. It is made by extracting and digesting coarsely powered malt with water and evaporating the strained liquor at low temperature to the consistency of thick honey. Such an extract contains from 48 to 70 per cent. maltose, 2 to 16 per cent. dextrin, and, according to Jungk should, "when properly prepared, contain diastase sufficient to convert its own weight of starch into dextrose at 100° F. in 10 minutes".

Twenty-three samples of "malt extract" were analyzed. Only two of these, *Maltine and Trommer Diastatic Malt Extract*, have any claim whatever to the name, and both of these contain some alcohol. These preparations are quite similar in composition except that the latter contains about 5 per cent. more glycerin.

The separation of the sugars in malt extract is a matter of great difficulty. Direct reduction will give the reducing matters, viz.: maltose, dextrose and malto-dextrins. The specific reducing powers of the latter are not uniform or are unknown. The reducing matters after hydrolysis will be due to hydrolyzed maltose, the original dextrose, the converted dextrins, cane sugar, and soluble starch, if present. Roughly we may say that the direct reduction gives maltose and dextrose, and that the increase after hydrolysis is due to converted dextrin. The difficulty lies in not knowing how much of the direct reduction is due to maltose and how much to dextrose. Since the specific reducing power of maltose is only 62 per cent. of that of dextrose, it is evident that to calculate all as dextrose will give results which are too low, and to calculate all as maltose will give figures much too high.

On account of these difficulties we have determined the direct reducing power of the extracts and expressed it as dextrose recognizing that it is due chiefly to maltose and dextrose, and that maltose predominates. This difficulty is emphasized in the "*Maltine* and *Trommer* samples, where the sum of the maltose (as calculated in the table) and the dextrin fails to equal the total sugar solids by 11.52 and 9.35 per cent.

Diastatic power. 0.2 gm. of *Maltine* digested 0.2 gm. of soluble starch in 20 minutes at 55° C. The conversion was apparently complete judged by the iodine reaction. At the end of 10 minutes the starch reaction was negative and the test for achroodextrin (red color with iodine) was also negative. 0.2 gm. of the *Trommer* extract digested soluble starch in a similar manner, although at the end of 10 minutes the test for achroodextrin was positive and remained so at the end of one hour. With 0.5 gm. of sample and 0.2 gm. of soluble starch this test was negative at the end of one hour.

The diastatic power of the beer preparations is of course negligible.

These other samples are more or less concentrated beers, or

TABLE VIII:—

Station No.	Brand.
1603	A. D. S. Malt Extract, American Druggists Syndicate, New York.....
1747	Ballantine's Ideal Malt Extract, P. Ballantine & Sons, Newark, N. J.....
1035	Berkshire Pure Malt Extract, Berkshire Brewing Assn., Pittsfield, Mass..
1108	Long Island Bottling Co.'s Braunschweiger Mumme Compound of Malt and Hops, F. M. Doyle & Co., Boston.....
1617	Long Island Bottling Co.'s Braunschweiger Mumme Compound of Malt and Hops, F. M. Doyle & Co., Boston.....
1728	Malt Extract, distilled by John A. Dunn, Norwich.....
1601	Malt Stout, James M. Harriman, New Haven.....
1037	Malt Extract, Albert Harris, New York.....
1034	Johann Hoff'sches. Malt-Extract, Johann Hoff, Berlin, etc.....
1627	Johann Hoff's Extract, Johann Hoff, Berlin, etc.....
1707	Leopold Hoff's Malt, The Leopold Hoff Malt Co., Hamburg, Germany....
1033	Jaynes Improved Liquid Extract of Malt, Jaynes Drug Co.....
1746	Gold Rock Malt Extract, The Lathrop Co., Hartford.....
1100	Liebig's Malt Tonic, Liebig Malt Extract Co., Jersey City, N. J.....
1121	Liebig's Malt Extract, Liebig Malt Extract Co., New York.....
1625	Maltine, Plain, Maltine Mfg. Co., New York.....
1036	Pabst Extract, Pabst Brewing Co., Milwaukee, Wis.....
1729	Malt Extract, The Pioneer Malt Extract Co., New York.....
1626	King's Pure Malt, Pure Malt Department, Boston.....
1620	Pure Canada Malt Extract, The Quebec Malt Extract Mfg. Co., Montreal, Canada.....
1709	Trommer Diastatic Extract of Malt, The Trommer Co., Freemont, O....
1722	Wampole's Liquid Extract of Malt, Henry K. Wampole & Co., Phila- delphia, Pa.....
1058	Wyeth's Liquid Malt Extract, John Wyeth & Bro., Philadelphia, Pa.....

diluted extracts. The maxima and minima of these twenty-one samples are as follows:—

	Max.	Min.
Alcohol.....	9.11	2.52
Extract.....	15.32	5.39
Ash.....	0.37	0.14
Protein.....	1.09	0.34
Sugar Solids.....	14.04	4.84
Maltose.....	11.17	1.41
Dextrin.....	5.80	2.03

All of the samples bore a guaranty for alcohol except *Harriman's Malt Stout*, which showed the highest percentage. Twelve of the twenty-three samples contained more alcohol than claimed.

MALT EXTRACTS.

Price per Bottle.	Specific Gravity @ 15.6°C.	Alcohol By Vol.		Grams per 100cc.						
		Claimed.	Found.	Extract.	Ash.	Protein.	Glycerin.	Sugar Solids.	*Maltose.	Dextrins.
cts.	1.0179	4	5.56	6.57	0.21	0.56	....	5.80	1.71	4.09
13	1.0297	3.7	3.53	9.02	0.20	0.40	....	8.42	4.57	3.85
15	1.0283	-5	6.96	9.57	0.30	1.09	....	8.18	2.43	5.75
15	1.0203	-6	5.50	7.32	0.29	0.64	....	6.39	1.84	4.55
15	1.0204	-6	5.68	7.38	0.29	0.64	....	6.45	1.84	4.61
15	1.0301	-6	4.90	9.70	0.21	0.46	....	9.03	5.25	3.78
10	1.0122	0	9.11	6.31	0.37	0.76	....	5.18	1.65	3.53
10	1.0192	4.5	4.52	5.77	0.30	0.56	....	4.91	2.03	2.88
10	1.0192	4.5	5.45	7.48	0.23	0.69	....	6.56	1.41	5.15
25	1.0231	4.15	5.45	7.48	0.23	0.69	....	6.69	1.41	5.28
25	1.0233	4.95	5.08	7.68	0.24	0.75	....	5.51	2.48	3.03
35	1.0178	3-4	5.00	6.36	0.27	0.58	....	5.51	2.48	3.03
15	1.0151	3-4	4.67	5.39	0.21	0.34	....	4.84	2.81	2.03
15	1.0182	4	4.25	6.31	0.19	0.41	....	5.71	2.22	3.49
15	1.0199	-6	5.14	6.78	0.27	0.84	....	5.67	2.36	3.31
10	1.0225	5	5.29	7.56	0.30	0.83	....	6.43	2.06	4.37
75	.....	3.88	3.10	73.85	1.15	7.25	1.40	64.05	*38.60	13.93
20	1.0433	-5	3.71	12.26	0.37	0.69	....	11.20	5.40	5.80
15	1.0208	-4.5	4.17	6.88	0.14	0.44	....	6.30	2.54	3.76
25	1.0201	-6	5.60	7.06	0.32	0.66	....	6.08	1.98	4.10
10	1.0188	3-4	4.43	6.39	0.18	0.49	....	5.72	2.59	3.13
100	.....	2.6	4.05	75.67	1.10	5.63	6.80	62.14	*33.48	19.31
30	1.0285	7	8.77	10.03	0.33	0.98	....	8.72	2.95	5.77
25	1.0552	2.5	2.52	15.32	0.30	0.98	....	14.04	11.17	2.87

* Maltose and dextrose, all calculated as dextrose. See page 253.

CLAIMS OF THE LABELS.

The labels of these preparations bear much false and misleading advertising matter. Their concentration, food value, and diastatic power are greatly over-emphasized, and inasmuch as they are commonly used by convalescents and by consumptives and others suffering from wasting diseases, the advertisements leading one to confuse these spurious extracts with the genuine U.S.P. extract, constitute a serious and dangerous abuse. The U. S. P. extract, it should be remembered, is a non-alcoholic preparation.

The *Harris* and *Gold Rock* brands claim to be "concentrated", and yet they are among the most dilute of all the preparations. The *Johann Hoff*, *Leopold Hoff*, *Liebig*, *Pioneer*, *Quebec* and *Wampole* brands are specially recommended as "remedies for consumption". The *A. D. S.* brand makes the equivocal claim that it affords great comfort to "those of a cold temperament".

PROPRIETARY MEDICINES.

We have analyzed 130 of these preparations this year. Many of them have been analyzed before in other laboratories, but the results of the analyses are not available to the citizens of this state. Furthermore, experience has also shown that it is unsafe to depend upon former analyses of many of these remedies, as the formulas are frequently changed, usually without any notice to the public. A comparison of our analyses with those made at the time of the passage of the Food and Drugs Act shows a gratifying change in many instances. Habit-forming and other dangerous drugs are far less common in these nostrums than they were ten years ago. The average sufferer, unless he be a drug habitué, generally takes alarm at the words "morphine", "opium", "heroin", "cocaine", and even "alcohol", and fears to use remedies whose labels bear these words. The manufacturer dare not withhold this information, and in many cases has made substitutions to allay the public distrust. The patient failing to obtain the customary effect of the active and dangerous drug discontinues the use of the medicine, so that we find certain of the most widely advertised of these nostrums gradually being withdrawn from public sale.

Patent or proprietary medicines as a rule fall into one of three quite well-defined classes; those which are out-and-out fakes; those which consist of simple well-known drugs of more or less efficacy but sold under a fancy name at an equally fanciful price; and those which contain habit-forming or other dangerous drugs. Generally speaking most of these remedies are more or less fakes, either because of the extravagant, if not actually dishonest, claims made for them, or because of their excessive cost.

Of our 130 samples 35 might be passed as possessing some merit, but even these are expensive; they are generally toilet preparations and in certain cases possibly the convenience of their use might justify their purchase even at the high prices.

Sixty-one samples are fakes; many of these can be of no possible

benefit to one suffering from most of the long list of diseases for which they are recommended; some may do great harm to the patient suffering from a disease incurable by medical treatment, like consumption, kidney diseases, cancer or epilepsy, by the delay they encourage; others are fakes in that they claim for such common drugs as ordinary salt, borax, Epsom salts, Rochelle salts, sugar, etc., curative powers contrary to all human experience.

The remaining 34 preparations all contain dangerous drugs; these may be summarized as follows (alcohol is omitted as it was present in most of the liquid preparations):—

3 Ammoniated mercury.	1 Paraphenylene diamine.
1 Arsenic oxide.	1 Pyramidon.
2 Barium sulphide.	10 Santonine.
2 Bromides.	1 Silver nitrate.
5 Corrosive sublimate.	2 Thyroid gland.
4 Lead acetate.	2 Wood alcohol.
1 Morphine.	

Most of these dangerous or poisonous drugs do not come within the group, whose presence the law requires to be stated on the label. Generally the purchaser receives no warning as to the dangerous nature of these medicines, and often he is lulled into a false sense of security by the lying phrase "Absolutely Harmless".

The responsibility for the wide use of these nostrums of course rests in a large measure on their makers, but even the most misguided manufacturer would not continue to make what he could not sell. The physician, the newspaper, the druggist and the consumer must share the responsibility for this menace to the health of our people. Some physicians make "patent medicines", some testify for a consideration as to their worth, some actually prescribe them, in spite of the fact that in many cases they must be uncertain as to the composition of the medicines they are prescribing; the responsibility of such physicians is great. The newspapers must likewise bear much of the responsibility as they for mere dollars continue to allow their advertising columns to be used for the exploitation of remedies whose worthlessness, fraudulence and dangerous character have been exposed over and over again; they give the nostrum maker his chief stock in trade, publicity, and totally disregard their obligation to supply their readers with honest advertisements as well as accurate news. The druggist, both

wholesaler and retailer, as the purveyor of these wares, is equally responsible. In spite of the frequent claim made by him that he would prefer not to handle "proprietarys", we find that his advertisements generally lay stress not on his ability to compound accurate and reliable prescriptions but that he sells patent nostrums at cut-price rates. Not only does he sell these proprietary, but with hardly an exception each druggist makes his own little line of "just as good" preparations, thereby putting himself on the same basis as the general manufacturer. The mere fact that a group of 10,000 or 25,000, or 100,000 druggists makes a line of preparations widely acclaimed as "not patent medicines" in no wise removes them from the category of the nostrum makers.

And, lastly, the consumer. His responsibility is indeed great and he is the main sufferer. He has been encouraged to indulge in that dangerous luxury "self-medication"; sometimes he has felt benefitted, in his ignorance confusing stimulation or deadened pain with cure. It will take a long time to reform the manufacturer, the physician, the newspaper, and the druggist, but the consumer *can* reform himself. He can refuse to buy this stuff and by his example encourage others to imitate him.

The identification of vegetable drugs in complex mixtures is extremely difficult, and at times impossible. It is not claimed, therefore, that our analysis is complete in all of these remedies, especially those in pill form and those containing vegetable extractives. We have, however, in all cases determined the active drugs present in appreciable amount. Likewise in certain hair preparations, cantharidin, pilocarpin and resorcin are frequently used in extremely minute quantities, so minute that ordinary methods of detection fail, unless inordinate amounts of the preparation are used. When there has been the slightest doubt as to the presence of these drugs, we have given the manufacturer the benefit of the uncertainty.

The following preparations were analyzed, and are discussed on subsequent pages in the order given below:—

<i>Alcoholism</i> (page 260 to 261).	Phy-thy-rin.
Orrine.	Marmola.
White Ribbon Remedy.	<i>Antiseptics</i> (page 264 to 267).
<i>Anti-Fat</i> (page 261 to 264).	Liquocide.
Parnotis.	Purogen.
Clark's Thinning Salts.	Vilane Powder.
Phytoline.	

<i>Bitters</i> (page 267 to 275).	Hairwand.
A. D. S. Iron Tonic Bitters.	Liquid Arvon.
Atwood's Vegetable Physical Jaundice Bitters.	Luxuriant Hair Tonic and Grower.
Boker's Stomach Bitters.	Nyal's Hirsutone.
Bucklen's Electric Bitters.	Parisian Sage Compound.
Burdock Blood Bitters.	Parker's Hair Balsam.
Hopkin's Celebrated Union Stomach Bitters.	Penslar Hair Tonic.
Hostetter's Celebrated Stomach Bitters.	Plain Yellow Minyol.
Kaufmann's Sulphur Bitters.	Potter's Walnut Tint Hair Stain.
Lash's Kidney and Liver Bitters.	Stephan's Clescalp.
Nyal's Iron Tonic Bitters.	Ther-Ox.
Zadoc Porter's Medicated Stomach Bitters.	Westphal's Auxiliator.
Severa's Stomach Bitters.	Wyeth's Sage and Sulphur Hair Remedy.
Thompson's Laxative Appetizing Bitters.	Yale's Excelsior Hair Tonic.
Turf Club Bitters.	<i>Kidneys and Liver</i> (page 292 to 295).
Von Koster's Bitters.	Carter's Little Liver Pills.
<i>Catarrh, Coughs and Colds</i> (page 275 to 278).	Hood's Vegetable Pills.
Eckman's Alterative.	Doan's Kidney Pills.
Sage's Catarrh Remedy.	Kilmer's Swamp Root.
Munyon's Catarrh Tablets.	<i>Skin and Complexion</i> (page 295 to 307).
Bull's Cough Syrup.	Cadum.
Hale's Honey of Horehound and Tar.	Champlin's Liquid Pearl.
<i>Deodorants</i> (page 278 and 279).	Citrox.
Amolin Deodorant Powder.	D. D. D. Prescription.
Mum.	Derma-Royale.
<i>Depilatories</i> (page 279 and 280).	El-Gantis Beautifier.
Del-A-Tone.	Epp-o-tone.
Fluvol Powder.	Eptol.
<i>Hair and Scalp</i> (page 281 to 292).	Hill's Freckle Lotion.
A. D. S. Hair Reviver.	Hind's Honey and Almond Cream.
Allen's World's Hair Color Restorer.	Holmes' Fragrant Frostilla.
Ayer's Hair Vigor.	Kingsbery's Freckle Lotion.
Birt's Head Wash.	Kintho Beauty Cream.
Canthrox.	Kroy Wen Ointment.
Coke Dandruff Cure.	Luxor.
Danderine.	May-A-Tone.
Germicidal Shampoo Powder.	McCorrison's Famous Diamond Lotion.
Goldman's Gray Hair Color Restorer.	Mercolized Wax.
Hair Reviver.	Othine.
	Perry's Moth and Freckle Lotion.
	Ruppert's World Renowned Face Bleach.

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| Sartoin. | Kardene. |
| Saxolite. | Rexall Every Tay Tonic. |
| Saxon Salve. | Tōna Vita. |
| Spurmax. | Vinol. |
| Zintone. | * Waterbury's Compound, Plain. |
| <i>Soothing Syrups</i> (page 307 to 309). | <i>Worm Syrups</i> (page 323 to 325). |
| Kopp's Baby's Friend. | Adee-Co. Worm Syrup. |
| Nyal's Soothing Syrup. | Dike's Worm Syrup. |
| Winslow's Soothing Syrup. | Hand's Worm Elixir. |
| <i>Stomach and Bowels</i> (page 309 to 316). | Hobson's L a x a t i v e Santonine Worm Syrup. |
| Beecham's Pills. | Manhattan Worm Syrup. |
| Cardiol. | Notkin's Worm Syrup. |
| Edwards' Olive Tablets | Nyal's Worm Syrup. |
| Eno's Fruit Salt-Derivative. | Penlar Worm Syrup. |
| Fruitola. | Rexall Worm Syrup. |
| Mayr's Wonderful Stomach Remedy. | True's Elixir. |
| Munyon's Paw-Paw Pills Compound. | Wadewitz's Vegetable Worm Syrup. |
| Pape's Diapepsin. | Whitman Worm Syrup. |
| Mi-o-na. | <i>Miscellaneous</i> (page 326 to 332). |
| Dilaxin Pills. | Chi-Ches-ter's Diamond Brand Pills. |
| Para-Lax. | Hanford's Balsam of Myrrh. |
| <i>Tender Feet</i> (page 316). | Kosine. |
| Calocide Compound. | Crystos. |
| <i>Tonics</i> (page 316 to 323). | Nurito. |
| Greene's Nervura. | Sargol. |

REMEDIES FOR ALCOHOLISM

ORRINE.

3222. *Orrine No. 1, Secret Remedy*, prepared for the Orrine Co., Washington, D. C. Price \$1.00 per box of 12 powders, weighing 88.72 grains, or 0.185 oz. Powders of a slightly yellowish color, with a salty taste.

Reducing sugars (lactose).	84.48	Nitrogen, as ammonia.....	4.14
Chlorine.....	11.27	Gold (0.32)=gold chloride...	0.49

The material contains about 84.5 per cent. milk sugar, 15 per cent. ammonium chloride and 0.5 per cent. gold chloride. The papers containing the powders gave a distinct reaction for gold, showing that unless the patient consumed the papers as well as the powder he would fail to receive even the small amount of gold chloride originally in the remedy.

Gold chloride, the so-called "gold cure", according to leading authorities has no specific action on the alcohol habit.

WHITE RIBBON REMEDY.

3408. *White Ribbon Remedy for the Cure of Alcoholism*, Wm. R. Brown, Boston, Mass., manufactured expressly for Mrs. A. M. Townsend, Boston, Mass. Price \$1.00 per box of 12 powders, weighing 92.43 grains, or 0.193 oz. White powders with a salty taste.

Reducing sugars (lactose)...	94.68	Gold.....	none
Chlorine.....	3.95	Alkaloids.....	none
Nitrogen, as ammonia.....	1.51		

The material contains about 94.5 per cent. milk sugar and 5.5 per cent. ammonium chloride, an expectorant and mild stimulant.

The following extraordinary claims are made in the folder accompanying this mixture of milk sugar and ammonium chloride. (*italics ours*):

"In offering to the public White Ribbon Remedy for the treatment and cure of Intemperance (habitual or excessive indulgence in alcoholic liquors) Dr. William R. Brown does so with the knowledge that this *specific will cure* or destroy the diseased appetite for alcoholic stimulants. Whether the patient is a confirmed inebriate, or a 'tippler', a social drinker or a drunkard, White Ribbon Remedy will *cure*. It is impossible for anyone to have an appetite for alcoholic liquors after using this specific. Not only does the White Ribbon Remedy *extirpate the insatiable desire* for alcoholic stimulants, but *will neutralize the alcohol in the system, giving strength* to the nerve forces, and the determination to resist temptation. * * * Is the only reliable, safe, quick and *permanent* remedy for intemperance that can be given to the patients without their knowledge. * * * The price of the *specific* is so low that it is within the reach of all, and the small quantity that it takes to effect a *permanent cure* is as astonishing as it is effective. Requires from two to six boxes to make a *cure except in special cases when a special remedy will be prepared by Dr. Brown.*"

Even if the ammonium chloride had any virtue as a remedy for alcoholism, the patient would have to use eighteen powders to obtain the ordinary dose of 7.5 grains.

REMEDIES FOR REDUCING FLESH. (ANTI-FAT).

PARNOTIS.

3520. *Parnotis*, for Making Flesh Reducing Remedy, H. S. Peterson & Co., Chicago. Price 50 cents for 3.7 oz. A cream-colored powder.

Sodium oxide.....	37.28	Carbon dioxide.....	much
Sulphuric anhydride.....	11.90		

The preparation appears to be a mixture of about 76 per cent. sodium bicarbonate (saleratus). and 24 per cent. impure sodium sulphate (Glauber's salts). The same amount of saleratus and Glauber's Salts would not cost more than two or three cents.

CLARK'S THINNING SALTS.

3695. *The Famous French Clark's Thinning Salts, The Original Bath Powder*, See Amaigrissant Clark's Corp., New York. Price 25 cents for 7.5 oz.

Loss @ 100° C.....	27.20	Sodium oxide.....	39.81
Boric acid, combined.....	9.27	Chlorine.....	trace
Carbon dioxide.....	much	Organic matter.....	small amount

The preparation appears to consist essentially of about 7.55 per cent. anhydrous borax and 64.03 per cent. crystalline sodium carbonate, with a small amount of organic matter (essential oil).

PHYTOLINE.

3452. *Phytoline*, Walker Pharmacal Co., St. Louis., Mo. "A Powerful Anti-Fat and Anti-Rheumatic. A Remedy prepared from the Active Principle of the Berries of *Phytolacca Decandra*". "Alcohol 23.5 per cent". Price \$1.50 for 2.17 fl. oz. A dark-brown liquid with a pleasant odor, suggesting a malted preparation.

Specific gravity @ 15.5° C.....	1.0285
Alcohol by volume.....	21.20
Wood alcohol.....	none
Solids.....	12.39 gms. per 100 cc.
Ash.....	0.84 " " "
Reducing sugars, as dextrose...	8.18 " " "
Salicylic acid.....	0.85 " " "
Undetermined organic matter..	2.48 " " "
Iodine, alkaloids.....	none

Poke root (*Phytolacca decandra*), which the manufacturer claims to be present, has emetic, purgative and somewhat narcotic properties. "It is not fit for use as an emetic" (U.S.D., p. 942), but it has been employed in the treatment of chronic rheumatism. It

appears to have no specific value as an anti-fat, any more than any other purgative. Furthermore its use is not unattended with danger.

No thyroid extract was present, and no alkaloids. It contained 12.39 gms of solids per 100 cc, of which about two-thirds was reducing sugar; the remaining solids consisted of 0.84 gm. ash, 0.85 gm. salicylic acid and 2.48 gms. of an organic extract (possibly derived from poke berries).

"The introduction of this medicine has * * * brought a certain and positive treatment within the reach of all."

The manufacturer advises abundant exercise "to the extent of decided weariness several times a day", a strict diet, avoidance of alcoholic beverages, and moderate bathing. In referring to other methods of treating obesity the manufacturer states that they are "too expensive for any but a plethoric purse". This preparation costs \$1.50 for about two fluid ounces, a quantity sufficient for about four days treatment according to the directions given.

PHY-THY-RIN.

3690. *Phy-ty-rin Compound*, The Lesslie Co., Dayton, O. Price 75 cents for 54 yellow coated pills, weighing 34.67 grms., or 535 grs.

Loss @ 100° C.....	3.14	Water-soluble.....	50.08
Ash.....	51.21	Alcohol-soluble.....	7.54
Ash insoluble in HCl.....	0.39	Iodine.....	0.0294
Calcium oxide.....	23.66	Carbon dioxide.....	much
Magnesium oxide.....	2.80	Na, SO ₃ , Cl, P ₂ O ₅	trace
Sucrose.....	20.68	Unidentified alkaloid.....	trace

The coating of these pills is made up essentially of calcium and magnesium carbonates and sugar. The organic iodine indicates the presence of dried thyroid gland, and possibly other organic drugs are present. The danger from the use of thyroid preparations is referred to later under *Marmola* (see below).

MARMOLA.

3522. *Marmola Prescription Tablets*, The Marmola Co., Detroit, Mich. Price 75 cents for 36 brown uncoated tablets, weighing 21.70 gms., or 335 grs.

Loss @ 100° C.....	2.43	Water-soluble.....	40.08
Ash.....	32.28	Alcohol-soluble.....	13.05
Ash insoluble in HCl.....	1.58	Iodine.....	0.030
Iron and aluminum phosphate	1.12	Phenolphthalein.....	present
Magnesium oxide.....	1.32	Carbon dioxide.....	much
Calcium oxide.....	15.32	So ₂ , Cl, Na, K.....	traces
Sucrose.....	37.20		

The ash is made up chiefly of calcium and magnesium carbonates. The organic matter, 65.29 per cent., consists of sugar, phenolphthalein, dried thyroid gland and possibly powdered sea weed (bladder wrack). Thyroid gland extract is used to some extent in anti-fat remedies, and it is effectual in reducing flesh, but at the same time it reduces the user's strength as well. Such preparations in unskilled hands are dangerous to use, and by no means "a safe, scientific and effectual treatment for the reduction of fat".

The American Medical Association reports in *Nostrums and Quackery*, p. 389, an analysis made in 1911, showing that thyroid extract was no longer an ingredient of *Marmola*, and that the tablets consisted principally of phenolphthalein and cascara. Our sample may be of old stock, but it certainly contained iodine in organic combination. The Company's booklet accompanying the sample speaking of the *Marmola Prescription* says:

"These three ingredients are Peppermint Water, Extract Cascara Aromatic and Marmola. What Peppermint Water is everybody knows. That the Aromatic Cascara is a natural regulator of the digestive organs and liver, and is also well known. Likewise, as everybody knows Marmola is another pure product, that is most powerful in its influence over obesity, though always gentle and safe in its action."

These Statements regarding *Marmola* are not true.

A sample of *Dilaxin Pills* accompanied *Marmola*; and these are discussed on page 315.

ANTISEPTICS.

LIQUOCIDE.

3403. *Liquocide*, formerly called Liquozone, The Liquozone Co., Chicago. Price 50 cents for 7.5 fl. oz. A clear colorless liquid with the odor of sulphurous acid.

Specific gravity @ 15.5° C.....	1.0039	Residue on evaporation....	0.549
Sulphuric anhydride.....	0.332	Residue on ignition.....	0.022
Sulphurous anhydride.....	0.312	Reaction.....	acid
Alcohol.....	none		

This preparation contains over 99 per cent. of water, with very small amounts of sulphuric and sulphurous acids. The residue on evaporation was black, carbonaceous, and strongly acid, and was characteristic of the result of the action of sulphuric acid on organic matter. On strong heating, fumes of sulphuric anhydride were given off. It is apparent, therefore, that *Liquocide* is possessed of acid rather than oxygenating properties as claimed.

Some of the claims made for this preparation are as follows:—

The great value of *Liquocide* lies in the fact that it is deadly to germs. It is a germicide so certain that for years we have published an offer of \$1,000 to the physician or scientist who discovered a disease germ which *Liquocide* could not kill. Yet such a germ, so far as we know, has not yet been discovered."

"Impure air has been atomized with 1-125th the same volume of *Liquocide*. * * * Yet every germ in the air was destroyed. * * * "There is no disease germ, as far as is known, which can resist it." "*Liquocide* is unique in the fact that, while deadly to germs, it is harmless to bodily cells. It is this fact which gives to the product its enormous importance. Common germicides are poisons when taken internally. They destroy the tissues as well as the germs. That is why medicine has been so helpless in a germ disease. * * * Drugs that cannot kill germs are of little effect in a germ trouble. That has been the reason for perfecting this gas-made germicide. It is based on the fact that germs are of vegetable origin. And there are numerous gases which are deadly to vegetables, yet harmless to animals. * * * Thus *Liquocide* is deadly to vegetable matter, but helpful to animals. Put a vegetable into *Liquocide* and the tissues are gradually destroyed; but on meat *Liquocide* acts as a preservative."

The following are a few of the diseases for which *Liquocide* is recommended. The list covers almost the whole gamut of human ailments:—

"Abscess, Anaemia, Asthma, Blood Poison, Bowel Troubles, Bronchitis, Coughs, Colds, Cancer, Catarrh, Consumption, Contagious Diseases, Dysentery, Diarrhoea, Dyspepsia, Dandruff, Eczema, Erysipelas, Fevers, Gall Stones, Goitre, Gout, Gonorrhoea, Gleet, Hay Fever, Influenza, La Grippe, Leucorrhoea, Malaria, Neuralgia, Piles, Quinsy, Rheumatism, Scrofula, Syphilis, Skin Diseases, Throat Troubles, Tuberculosis, Tumors, Ulcers, also most forms of Kidney Diseases, Liver Troubles, Stomach Troubles and Women's Diseases."

"It should be understood that the very effectiveness of *Liquocide* may sometimes increase, for a little time, the symptoms which germs cause. *Liquocide* may lead to some temporary skin eruption, or to some other indication that Nature is getting rid of impurity. * * * Do not

attribute any such temporary discomfort to the belief that Liquocide is harming you * * * If skin eruptions appear, apply Liquocide to them and they will soon disappear."

The above quotations from the company's booklet have been given at considerable length to show the absurdity and falsity of the claims made for it. That an extremely dilute solution of sulphuric and sulphurous acids in water can serve as a "cure-all" is taxing one's credulity to the utmost. That the continued use of these active acids, even in small quantities, is entirely harmless is certainly open to question.

PUROGEN.

3525. *Purogen*, the Perfect Antiseptic, The Wilcox Co., Providence, R. I. "Composed of C.P. Boric Acid, Menthol, Eucalyptol, non-poisonous Phenols, and the antiseptic constituents of a number of essential oils". "Absolutely harmless". "Alcohol 25 per cent". Price 25 cents for 2.97 fl. oz. A colorless solution with the odor of menthol and eucalyptol.

Specific gravity @ 22° C.	0.9779	Volatile oils	0.30
Alcohol by volume	24.80	Non. volatile solids	0.14
Wood alcohol	none	Ash	0.08
Boric acid	2.15		

The preparation is a strongly alcoholic solution containing 2.15 per cent. of boric acid and small amounts of menthol, eucalyptol and possibly other volatile oils. Its rather simple and familiar constituents can scarcely justify such claims as the following:—

"Purogen is the exemplification of the wonderful progress made in the production of antiseptics. It is in fact a crystallization of years of exhaustive effort in the field of chemistry, and embodies in rare degree all the essential features of a thoroughly reliable general antiseptic."

While the physiological action of boric acid is rather feeble, severe cases of poisoning from its use are on record, and it would seem that the manufacturers of this preparation rather over-emphasize the claim that it is "absolutely harmless".

VILANE POWDER.

3694. *Antiseptic Compound Vilane Powder*, The Blackburn Products Co., Dayton, O. Price 79 cents for 8 oz. A white powder with the odor of thymol.

Loss @ 100° C.	4.40	Chlorine	25.21
Loss on strong ignition	28.25	Sodium	present
Boric acid	16.62	Menthol, oil wintergreen	present
Carbonic acid	18.35	Thymol, eucalyptol probably	present
Salicylic acid	2.69		

From these data the powder appears to have approximately the following composition:—

Water and volatile matter (including menthol, oil wintergreen and probably thymol and eucalyptol)	4.40	Sodium chloride	41.60
		Borax, anhydrous	13.54
		Sodium salicylate	3.12
		Sodium carbonate and bicarbonate	37.34

BITTERS.

For the description, names of manufacturers and analyses of these preparations see Table IX, page 272.

A. D. S. IRON TONIC BITTERS.

"Is a most useful remedy in cases of exhaustion and general debility following attacks of wasting diseases. It tends to improve the appetite, to increase the oxygenating power of the red blood-corpuscles, and to increase the general tone of the whole system."

These wonderful results are claimed for a solution containing 18 per cent. of alcohol and 11 per cent. of solids (a large portion of which is glycerine and sugar), with a trace of iron and a small amount of quinine. The "bracing" effect of this drink would seem to depend chiefly upon its high percentage of alcohol.

ATWOOD'S VEGETABLE PHYSICAL JAUNDICE BITTERS.

"Recommended for jaundice, headache, dyspepsia, worms, dizziness, loss of appetite, darting pains, colds and fevers. For cleansing the blood from humors and moistening the skin. It is also good for liver complaints, strangury, dropsy, croup and phthisic."

This "vegetable" medicine contains 2.18 per cent. of ash (mineral matter), of which 0.98 per cent. is potash and 0.23 per cent. lime; sulphates, chlorides and carbonates are present, with traces of iron, magnesia and phosphates. As noted for the previous preparation it would seem that its 13.5 per cent. of alcohol must be its really active ingredient.

BOKER'S STOMACH BITTERS.

"For sale by all prominent *grocers, wine merchants, druggists, etc.* * * * The most consummate harmony of palatable and invigorating ingredients and the only perfect stomach bitters * * * Being free of the taste and smell of the apothecary shop, but full and rich in flavor, are used in different ways and convenient proportions *in all the refined drinks of the bar.* * * * However, their *highest and most estimable value* must be found in their *Medicinal Properties.* * * * Whoever feels irregularities in his digestive organs, or pains in the bowels, will find in them *invariable* and quick *relief.* They alleviate the most persistent cases of dyspepsia, and if judiciously used, they will *cure* them gradually but effectively. They have constantly proved a reliable *preventive* against fever and ague, and the dreaded attacks of the cholera; and these diseases may even be *cured,* if recourse be had to these Bitters at the appearance of the first symptoms" (italics ours.)

It is interesting to note that, in spite of their "estimable" value for quite an array of formidable diseases, the first emphasis is placed upon their being sold by grocers and wine merchants, and in their great value in concocting fancy mixed drinks. These "stomach bitters" contain 42.5 per cent. of alcohol (almost as much as whiskey), with 4.47 per cent. of solids, nearly half of which is sugar. In spite of this high alcoholic content we are told that "the weakened child and the delicate lady, the infirm and the convalescent" may use these bitters with safety.

BUCKLEN'S ELECTRIC BITTERS.

"The great Electric Remedy. Positively *cures all diseases of the stomach, liver and kidneys,* biliousness, general debility, fever and ague, and blood disorders" (italics ours.)

These claims are made for an intoxicant containing 19 per cent. of alcohol, 1.12 per cent. of sugars and 0.93 per cent. of vegetable extractives. The claims are clearly false and fraudulent.

BURDOCK BLOOD BITTERS.

"Has no *harmful* ingredients." "Has proven unfailing in relieving and *curing* diseases and afflictions caused by impure blood and irregularities or disorders of the *major organs* of the body.* * * * Primarily a blood medicine* * * * makes rich, red, life-giving blood* * * * Tones and stimulates the stomach and enables it to pour out *just the proper amount* of gastric or stomach fluids* * * * For *liver complaint in any form** * * * will be found *invaluable** * * * *In a way,* also,

Burdock Blood Bitters has an influence upon the kidneys, giving them tone and strength * * * * *Revitalizes and stimulates every function* * * * * Removes all blotches, eruptions and chronic sores, and makes the skin smooth and clear * * * * It can be used by young or old, weak or strong, *with perfect safety.*" (italics ours.)

This "safe" remedy contains over 19 per cent. of alcohol, with only 4.85 per cent. of solids (nearly half of which is sugar), and alkaloids possibly derived from hydrastis. The amount of vegetable extractives is small, certainly not enough to give the results claimed.

DR. HOPKINS' CELEBRATED UNION STOMACH BITTERS.

"Sarsaparilla and other Roots and Barks compounded so as to act in concert, and assist nature in Eradicating Disease. * * * * A Pure Vegetable Medicine. * * * * Remedy for diseases of the Stomach and Nervous System, Dyspepsia, Liver Complaint and Consumption, and species of Indigestion, Loss of Appetite, etc., for Malarial Fevers, Chills and Ague * * * * For Piles."

This "consumption" remedy contains 15.54 per cent. of alcohol, a small amount of quinine, and 9.77 per cent. of solids, all but 0.81 per cent. of which is sugar. That this small amount of vegetable extractives will produce the results claimed is beyond credence. The efficiency of the medicine is illustrated by the directions to take from two to six bottles for fever and ague.

HOSTETTER'S CELEBRATED STOMACH BITTERS.

This material contains nearly 25 per cent. of alcohol, a small amount of quinine, and only 4.57 per cent. of solids, all but 0.80 per cent. of which is sugar. Of course as in the other cases cited above, the alcohol is the main active ingredient, and the small amount of vegetable extractive present cannot possibly act as an efficient remedy for Dyspepsia, Liver Complaint, Costiveness, Indigestion, Intermittent Fever, Fever and Ague, Flux, Colic, Cholera, "mild and safe invigorant and corroborant for delicate females," an "anti-bilious alterative," "a powerful recuperant," "a depurative of the blood and other fluids," as claimed.

DR. KAUFMANN'S SULPHUR BITTERS.

"Recommended for Loss of Appetite, Dyspepsia, Indigestion, Dropsy, Nausea, That Tired and All-Gone Feeling, Gout, Habitual Costiveness, Pimples and Humor on Face and Body, Sick Headache, Scrofula, Colds,

Jaundice, Ulcers, Catarrh, Coughs, Colic, Piles, Kidney Complaint, Rheumatism, Female Weakness, Bilioussness, Neuralgia, Tape, Pin and Other Worms, Dysentery, Faintness of the Stomach, Erysipelas, etc." In other parts of the company's literature it is recommended for Syphilitic Diseases, for Catarrh "the father of Consumption," Leucorrhoea, Painful Menstruation, Prolapsus Uteri, Sterility, Suppression of Menses, Urinary Troubles and all Uterine and Vaginal Ulcerations. In the company's pamphlet directions for the use of the medicine in special cases are given in German and French, *but not in English*. "De deux à cinq bouteilles pour faiblesse prématurée, et aider à récupérer le mâle vigueur diminuée ou affaiblie pour suite d'excès de jeunesse."

Translation—"Two to five bottles for premature weakness, and as an aid in restoring male vigor lessened or weakened by youthful excesses.)

The medicine contains over 22 per cent. of alcohol, or about half as much as ordinary whiskey. This quantity is far from being homeopathic and if the directions are followed the patient will assuredly acquire a pretty substantial taste for alcoholic stimulants.

The preparation contains little else besides the alcohol, only 2.32 per cent. of solids, one-third of which is sugar, some sulphur and a bitter principle, and less than one per cent. of vegetable extractives, "Gentianae Radix, Prunus Virginica, Aloe Socotrina, Eupatorium Tanacetum, Balmony, Podophyllum, Senna Indica and Calamus" being claimed.

The medicine is accompanied by a booklet of over one hundred pages entitled "Kaufmann on Disease," in which the symptoms are given for scores of diseases, always with the assurance that the Sulphur Bitters is the great and only remedy for the complaint. The most interesting section of the booklet, however, is a chapter of four pages on "Startling Facts and Figures of the Rum Traffic," concluding with this sentence:

"What man, what woman, what child would not vote to have that whole street" [where liquor is sold], "with its awful traffic in the infernal stuff, sunk to the lowest depths of perdition and covered ten thousand fathoms deep under the curses of the universe?"

And yet the author prescribes as much as twelve bottles of a concoction containing 22 per cent. of "the infernal stuff." Incidentally, the bitters are sold in a bottle quite similar to a whiskey flask.

LASH'S KIDNEY AND LIVER BITTERS.

"Is purely vegetable and contains no ingredients that can in any way be injurious" * * * Recommended for Cure of Constipation, Bilioussness, Malaria, Dyspepsia, Indigestion, Chills and Fever, Sick Headache, Sour Stomach and Affections of the Kidneys and Bladder" * * * "Especially adapted for women and children."

This popular bar-room bitters (our sample was purchased in a saloon) contains 21.46 per cent. of alcohol and 7.83 per cent. of solids, with 2.42 per cent. of vegetable extractives of a more or less laxative nature. The suggestive pictures used to advertise these bitters show it better fitted for the bar-room than the sick-chamber.

NYAL'S IRON TONIC BITTERS.

"An Ideal Tonic. It Stimulates the Gastric Flow of the Stomach, thus Aiding Digestion and Increasing the Blood Supply. It is of Great Value in All Diseases connected with an Enfeebled State of the System or other Exhausting Conditions."

This preparation contains 18.32 per cent. of alcohol with 19.21 per cent. of solids, 12.91 per cent. of which is sugar. It contains 1.15 per cent. of ash, in which iron, chlorides, phosphates and sulphates were found, with a trace of magnesia; also about 5 per cent. of vegetable extractives, which give a reaction for unidentified alkaloids.

MR. ZADOC PORTER'S MEDICATED STOMACH BITTERS.

We are told in the company's literature that "the great-great-grand uncle of Dr. Porter was among the early settlers of this country. When he left Europe, an aged Doctor, of high repute, gave him (Mr. Porter) the recipe for preparing these medicines * * * * Mr. Porter, being a man of generous feelings and considerable wealth, seeing much distress in the colony by sickness, had the liberality to furnish them without charge to all the inhabitants, by which great sufferings were relieved and health promoted over a large extent of country. Mr. Porter used no other medicines during his life, which was continued to 115 years, and died without suffering." "The present proprietor (Dr. Porter) * * * * regrets that he is unable to furnish them to the present generation on the same liberal terms that his esteemed and generous ancestor did, namely, *without charge*; but since he cannot, he will come as near to giving away as possible."

This remedy introduced by a philanthropist (?) is claimed to be

"A powerful corrector of the Stomach and all Nervous Affections * * * * Nausea of the Stomach, Weakness, General Languor, Dizzi-

TABLE IX:

Station No.	Brand.	Volume.	Cost.	Alcohol guaranteed.	Specific Gravity @ 15.5°C.
		fl. oz.	cts.		
1107	A. D. S. Iron Tonic Bitters. American Druggists' Syndicate, Long Island City, N. Y.....	10.7	79 20		1.0202
1104	Atwood's Vegetable Physical Jaundice Bitters. Manhattan Medicine Co., New York City.....	6.8	25 16.5		1.0722
1619	Boker's Stomach Bitters. L. Funke, Jr., N. Y. City.	11.3	65 42.1		0.9607
1106	Electric Bitters. H. E. Bucklen & Co., Chicago, Ill.	10.8	50		0.9846
1118	Burdock Blood Bitters. Poster-Milburn Co., Buffalo, N. Y.....	9.8	90 22		0.9964
1635	Dr. Hopkins' Celebrated Union Stomach Bitters. F. S. Amidon, Hartford.....	20.2	125 15.5		1.0184
1105	Hostetter's Celebrated Stomach Bitters. The Hostetter Co., Pittsburg, Pa.....	18.0	80 25		0.9873
1708	Dr. Kaufmann's Sulphur Bitters. A. P. Ordway & Co., New York City	10.3	100 22.3		0.9805
1711	Lash's Kidney and Liver Bitters. Lash's Bitters Co., New York City.....	19.9	75 21		1.0083
1123	Nyal's Iron Tonic Bitters. New York & London Drug Co., New York City.....	15.0	100 20		1.0609
1122	Mr. Zadok Porter's Medicated Stomach Bitters. Hall & Ruckel, New York City.....	3.2	25 28.5		0.9774
1622	Severa's Stomach Bitters. W. F. Severa Co., Cedar Rapids, Ia.....	8.9	50 25		0.9902
1716	Laxative Appetizing Bitters. E. W. Thompson & Co., New Britain.....	7.6	25 25		1.0084
1710	Turf Club Bitters. P. F. Bowe, Waterbury.....	24.1	100 15		1.0286
1724	Von Koster's Bitters. Von Koster Bitters Co., Fairfield.....	20.0	75 0		1.0408

ness, Loss of Appetite, Belching of Wind, Sourness of the Stomach, Indigestion, Ague, Diarrhoea, Summer Complaints, Teething of Children, Worms * * * * Heartburn, Waterbrash, Dyspepsia, Sick Headache Vomiting Food, Jaundice, etc." "Those who use Ardent Spirits will find the Stomach corrected in a most remarkable manner by this preparation."

BITTERS.

Alcohol by Volume.	Solids.	Sucrose.	Reducing Sugar.	Non-Sugar Solids.	Ash.	Alkaloids.	Oxymethylan-thraquinones.	Remarks.
17.89	11.06 0	1.58	9.48	0.57	Yes	No	Iron (Fe ₂ O ₃), 0.05; quinine and glycerine present.	
13.55	19.69 0	11.59	8.10	2.18	Trace	Yes	Potash, 0.98; lime, 0.23; sulphates, chlorides and carbonates present; traces of iron, magnesia and phosphates.	
42.56	4.47 0.87	0.98	2.62	0.05	None	*No		
19.13	2.05 0	1.12	0.93	0.11	None	Yes		
19.28	4.85 0	2.30	2.55	0.47	Yes	*No		
15.54	9.77 6.56	2.40	0.81	0.01	Yes	No	Quinine present.	
24.82	4.57 2.13	1.64	0.80	0.08	Yes	No	Quinine present.	
22.39	2.32 0	0.61	1.71	0.16	None	†Yes	Sulphur present.	
21.46	7.83 0	4.94	2.89	0.47	None	*Yes		
18.32	19.21 0	12.91	6.30	1.15	Yes	No	Iron (Fe ₂ O ₃), 0.16; chlorides, phosphates and sulphates present; trace of magnesia.	
30.65	13.24 0.42	0	2.82	0.91	None	No	Soda, 0.43; potash, 0.12; traces of chlorides, sulphates, phosphates, lime, magnesia and iron; glycerine present.	
24.48	16.04 0	0.42	5.62	0.08	Yes	*Yes	Emodin and glycerine present.	
14.80	6.77 0	3.83	2.94	0.36	None	*Yes		
18.49	11.66 0	8.29	3.37	0.47	None	*Yes		
3.30	5.85 0	0.10	5.75	3.54	None	*Yes	Soda, 1.99; carbonates, much; traces of lime, iron and sulphates.	

* A red-orange color was extracted from ethereal solution with ammonia water. † A pink color was extracted from ethereal solution with ammonia water; color was not strong and had a faint bluish fluorescence. ‡ Glycerine present.

The remedy contains over 30 per cent. of alcohol, with only 3.24 per cent. of solids, a considerable part of which is sugar, glycerine and mineral matter. Soda and potash are present with

traces of chlorides, sulphates, phosphates, lime, magnesia and iron. Such a strongly alcoholic concoction can hardly be considered a safe remedy for users of ardent spirits, nor is this intoxicant as cheap as many others of its class.

SEVERA'S STOMACH BITTERS.

"A Reliable Remedy for Dyspepsia, every species of Indigestion, Intermittent Fever, and all kinds of Periodical Disorders."

The bitters contain 24.48 per cent. of alcohol, with 6.04 per cent. of solids, part of which is sugar and glycerine. Emodin is present with unidentified alkaloids.

BOWE'S TURF CLUB BITTERS.

"Advised for Constipation, Sick Headache and Nausea, Indigestion, Acid Stomach and Gases * * * * Recommended for Use in sickness following an alcoholic debauch and as constituent of cocktails and makes an excellent highball."

A strange remedy for alcoholism and yet excellent for cocktails and highballs. It contains 18.49 per cent. of alcohol and 11.66 per cent. of solids, over 8 per cent. of which is sugar. About 3 per cent. of vegetable extractives is present, which give the oxymethylantraquinone reaction, showing the presence of cathartic drugs.

VON KOSTER'S BITTERS.

"Contains no narcotics or alcohol." "The Greatest of all Blood Purifiers." "Especially put up for hotels and cafes." Under "Directions" we read "take a teaspoonful of the Bitters in a glass of whiskey morning and evening. This will act as a laxative and keep the system in a healthy condition."

Contrary to the manufacturer's claim we find 3.30 per cent. of alcohol present, and even if it were non-alcoholic the express directions are to take it in whiskey twice a day. It contains 5.85 per cent. of solids, with 3.54 per cent. of ash, consisting chiefly of a sodium carbonate with traces of lime, iron and sulphates. An oxymethylantraquinone is present.

THOMPSON'S LAXATIVE APPETIZING BITTERS.

"Recommended for Constipation, Biliousness, Dyspepsia, Indigestion, Loss of Appetite, Headaches, Jaundice and all disorders arising from a torpid liver.

It contains 14.80 per cent. of alcohol (25 per cent. claimed), and 6.77 per cent. of solids, one-half of which is sugar. A positive test for oxymethylantraquinone was obtained, showing the presence of vegetable cathartics.

REMEDIES FOR CATARRH, COUGHS AND COLDS.

ECKMAN'S ALTERATIVE.

3519. *Eckman's Alterative*, Eckman Mfg. Co., Philadelphia, Pa. "Does not contain Opium, Morphine, Codeine, Heroin, or other narcotics; nor any poisonous drugs". "Alcohol 14 per cent. "Alcohol used only as a solvent". Price \$2 for 8.4 fl. oz. A brown liquid, containing some sediment, with the odor and taste of oil of cloves.

Specific gravity @ 15.5° C.	1.0176	Ash.....	4.04
Alcohol by volume	14.44	Calcium oxide.....	1.96
Wood alcohol.....	none	Chlorine.....	2.38
Solids.....	5.31	Insoluble residue.....	0.084
Glycerine.....	none	Alkaloids.....	none

The material contains 14.44 per cent. of alcohol with 5.31 per cent. of solids, of which 3.88 per cent. is calcium chloride and 1.27 per cent. organic extractives. Calcium chloride has the property of increasing the coagulability of the blood and has, therefore, been used to a considerable extent for checking internal hemorrhage. If taken in the prescribed dose, a teaspoonful before each meal and before retiring, *Eckman's Alterative* would furnish about one-half the minimum dose of calcium chloride as laid down by the U. S. Dispensatory. The 14 per cent. of alcohol, however, would probably have the effect of making the patient *think* he felt better.

This preparation in its present labeling is recommended for "Tuberculosis (Consumption), Catarrhal Bronchitis, Bronchial Asthma and Stubborn Colds". The following well-guarded claims are made, showing the effect of the present law's insistence on honest labeling (*italics ours*):—

"After these changes occur and the system comes under the influence of the alterative, a gradual improvement *should* follow; the appetite *generally* increases, nausea, vomiting and indigestion *usually* cease; expectoration is *facilitated* and the sputum becomes a lighter yellow, thinner and *sometimes* frothy; the severity of the coughing spells *is expected to lessen*; fever *should lessen* and sleep become more restful; chest pains and night

sweats usually subside. Generally, as repair progresses, toxic symptoms—anaemia, weakness, emaciation, etc.—are remedied and the mental condition often changes to one of interest and contentment. * * * * Do not use spirituous or malt liquors."

In spite of the above cautious and colorless claims, the booklet issued by the company, and which does not accompany the medicine, throughout its pages constantly suggests the remedy as a "cure" for consumption. A patient who believed that calcium chloride in dilute solution might be of assistance to him, could secure the amount contained in this whole bottle for about one-half of a cent at any drug store.

The advice not to use spirituous or malt liquors comes with a medicine which contains more alcohol than any malt liquor contains, more than most wines, and over one-fourth that contained in gin, rum, whiskey or brandy.

DR. SAGE'S CATARRH REMEDY.

3397. *Dr. Sage's Catarrh Remedy*, World's Dispensary Medical Association, Buffalo, N. Y. Price 50 Cents for 0.42 oz. A greenish powder with a salty taste and an odor of camphor and phenol.

Loss @ 100° C.....	1.65	Sulphates, phenol, resin....	present
Ash.....	88.15	Blue pigment.....	present
Organic matter.....	10.20	Iron.....	trace
Sodium oxide.....	45.45	Alkaloids (hydrastis).....	present
Chlorine.....	52.24		

The mixture consists of about 86 per cent. of common salt and 14 per cent. of volatile and organic matter. The matter other than salt consists chiefly of hydrastis and possibly other vegetable drugs, with resin and a phenolic compound; a blue pigment is also present.

The proprietor advertises this remedy as "beyond all comparison the best preparation ever invented. * * * * Its ingredients are simple and harmless, yet when scientifically and skillfully combined, in just the right proportions, they form a most wonderful and valuable healing medicine."

The treatment for catarrh as outlined in the company's circular is interesting. First the patient cleanses his system with *Pierce's Golden Medical Discovery*, then *Dr. Sage's Catarrh Remedy*; if that

fails he is to use, *Dr. Pierce's Fountain Nasal Injector* or *Douche*; a sort of "hit-or-miss" system; if the one does not do what the manufacturer claims, try one of the others for which equally positive claims are made.

MUNYON'S CATARRH TABLETS.

3400. *Munyon's Catarrh Tablets*, Munyon Remedy Co., Philadelphia, Pa. Price 25 cents for 19 tablets weighing 6.72 grams.

Only a qualitative examination was made of these tablets. They were found to consist chiefly of sodium bicarbonate, borax, sodium chloride, and possibly a trace of carbolic acid. No alkaloids, heavy metals, sugars or starch were present.

The Munyon remedies, according to the company's literature, are sold specifically as "cures" for the various diseases. Under "Catarrh" we read as follows:—

"CATARRH POSITIVELY CURED—Are you a sufferer with catarrh? Have you taken all sorts of drugs and patent nostrums? Are you tired of paying big doctor bills without being cured? Are you willing to spend 50 cents for a cure that permanently cures catarrh by removing the cause of the disease? If so, ask your druggist for a 25-cent bottle of Munyon's Catarrh Cure and a 25-cent bottle of Catarrh Tablets. The Catarrh-Cure will eradicate the disease from the system and the Tablets will cleanse and heal the afflicted parts and restore them to a natural and healthful condition."

The freshness of our sample of the tablets is attested by the presence of a Spanish-American War (1898) revenue stamp.

DR. BULL'S COUGH SYRUP.

3219. *Dr. Bull's Celebrated Cough Syrup*, A. C. Meyer and Co., Baltimore, Md. "Contains 3 per cent. alcohol". Price 25 cents for 2.3 fl. oz.

Specific gravity @ 15.5° C.	1.2452
Alcohol by volume.....	5.00
Chloroform extract.....	0.071 grs. per fl. oz.
Ammonia.....	present
Chlorine = ammonium chloride...	8.3 grs. per fl. oz.
Bromides.....	none

This sample was only analyzed in part, chiefly for the presence of habit-forming drugs. The medicine contained 5 per cent. of alcohol, and 8.3 grs. per fl. oz. of ammonium chloride. with 0.07

gr. per fl. oz. of chloroform extract. The latter gave the general reaction for morphine derivatives with sulphuric acid and formaldehyde but we hesitate to say such are present, as recent investigations in this laboratory show that certain emodin-containing drugs likewise give this reaction. The North Dakota department reports the medicine formerly to contain 3.72 per cent. alcohol, 55.54 per cent. solids, most of which was commercial glucose, and 0.48 gr., codeine per fl. oz.; sassafras and possibly wild cherry were also present (*Spec. Bull. 1, 1911, p. 401*).

The claims for this medicine have been considerably modified in recent years and the formula undoubtedly has been changed.

HALE'S HONEY OF HOREHOUND AND TAR.

3215. *Hale's Honey of Horehound and Tar*, The Chas. N. Crittenton Co., New York City. "Alcohol 13 per cent." "For Coughs, Colds and Influenza and Affections of the Throat and Lungs". Price 25 cents for 1.5 fl. oz.

Specific gravity @ 15.5° C.....	1.1258
Alcohol by volume.....	13.87
Chloroform extract.....	0.077 gr. per fl. oz.
Bromides.....	none

This sample likewise was examined only for habit-forming drugs. It contained 13.87 per cent. alcohol and 0.077 gr. per fl. oz. of chloroform extract. As already stated under *Dr. Bull's Cough Syrup*, this chloroform extract gave the reaction for morphine derivatives with sulphuric acid and formaldehyde, but for the reasons there given we do not feel justified in claiming that morphine or a morphine derivative is present. At one time this preparation contained $\frac{5}{13}$ gr. of opium per fl. oz. and later $\frac{1}{4}$ gr. of codeine per fl. oz. Apparently these and similar alkaloids are no longer present. The medicine is especially recommended for the use of children, in spite of its high alcoholic content.

DEODORANTS.

AMOLIN DEODORANT POWDER.

3482. *Amolin Antiseptic Deodorant Powder*, Amolin Chemical Co., New York City. "Contains no talcum or other insoluble ingredient. Relies chiefly upon a coal-tar derivative of the phenol

hydro-carbon series, which differs from carbolic acid in being agreeable in odor." "Healthful and Absolutely Harmless". Price 15 cents for 1.48 oz.

It is a white powder, practically all boric acid, scented with thymol.

There is no question as to the value of boric acid as a dusting powder and antiseptic. However, calling it *Amolin Deodorant Powder* in no way enhances its value.

The harmlessness of this preparation is doubtful. While the physiological action of boric acid is rather feeble, still severe cases of poisoning are on record. Its use in foods, even in small quantities, is forbidden in many of the states. In view of the manufacturer's statement that "for all vaginal inflammations * * * Amolin Powder * * * may be used * * * as frequently as desired", the following from the *U. S. Dispensatory* is of interest:—"Fatal cases of boric acid poisoning have been produced by the immoderate use of its solution in washing out internal cavities. Two ounces of boric acid in the vagina produces violent poisoning."

MUM

3448. *Mum*, Mum Mfg. Co., Philadelphia, Pa. "A delicate deodorant indispensable for the toilet." Price 25 cents for 0.28 oz. A white ointment with the odor of rose.

Loss at 100° C.....	7.12	Chloroform insoluble.....	14.85
Ether extract.....	76.13	Zinc oxide.....	14.30
Ether extract unsaponifiable.....	14.57	Benzoic acid.....	3.30
Ether extract saponifiable.....	61.56	Boric acid, salicylic acid, phenols, alumina, starch.	None
Alcohol extract (hot 95%).....	80.57		

This material consists essentially of 14.3 per cent. zinc oxide and 3.3 per cent. benzoic acid, possibly derived from benzoin, with an undetermined fatty base.

DEPILATORIES.

DEL-A-TONE.

3524. *Del-A-Tone*, for Superfluous Hair, Sheffield Pharmacal Co., Chicago. Price one dollar for 1.9 oz. A fine, gray powder with the odor of hydrogen disulphide and nitrobenzene.

Starch.....	66.29	Sulphur, as sulphide.....	3.35
Barium, total.....	16.62	Insoluble in hydrochloric acid.....	1.77
Barium, as sulphide.....	15.69	Loss @ 100° C.....	7.85
Barium, as sulphate.....	0.96	Loss on ignition.....	76.60
Sulphur, total.....	3.67		
Sulphur, as sulphate.....	0.32		

The preparation is a mixture of about 19.35 per cent. barium sulphide, 1.63 per cent. barium sulphate, 66.29 per cent. starch, 7.85 per cent. water and volatile matter, with 4.88 per cent. undetermined matter.

Barium sulphide, although not an official drug, has been used to some extent as a depilatory. The barium salts are generally poisonous and are not safe remedies for careless or indiscriminate use.

FLUVOL POWDER.

3692. *Fluvol Powder*, for the Removal of Superfluous Hair on Face, Arms or Body, The Lesslie Co., Dayton, O. Price 69 cents for 1.1 oz.

Loss @ 100° C.....	3.17	Sulphur, as sulphate.....	1.90
Ash.....	63.89	Starch.....	24.05
Barium.....	20.11	Insoluble in hydrochloric acid.....	46.96
Sulphur, total.....	4.65		
Sulphur, as sulphide.....	2.75		

From the above data the following composition is indicated: Water and volatile matter 3.17, barium sulphide 14.69, barium sulphate 13.91, starch 24.05, and talc, by difference, 44.18 per cent. The preparation is somewhat similar to *Del-A-Tone*, already discussed. It is a stronger preparation, however, containing considerably more barium, and a part of the starch is replaced with a talc-like mineral. As already stated the barium salts are generally poisonous and are unsafe for careless or indiscriminate use.

The manufacturers apparently are not entirely sure of the efficacy of the remedy, for they tell us "Should the hair again grow use the powder as before."

HAIR AND SCALP PREPARATIONS.

A. D. S. HAIR REVIVER.

3423. *A. D. S. Hair Reviver*, American Druggists Syndicate, Long Island City, N. Y. "Alcohol 27 per cent." Price 50 cents for 6.0 fl. oz. A greenish liquid with the odor of menthol (?).

Specific gravity @ 15.5° C.	0.9704	Ash.....	0.04
Alcohol by volume.....	26.76	Quinine, pilocarpine and salicylates.....	present
Wood alcohol.....	none	Cantharidin.....	(?)
Solids.....	0.69	Heavy metals, boric acid.	none
Glycerine.....	0.57		

The preparation is strongly alcoholic with a very small amount of solids (0.69 per cent.), most of which is glycerine. Quinine, pilocarpine and a salicylate are present in extremely small amounts, the first two of which are tonics and the last an antiseptic. Cantharidin may also be present in small quantity.

MRS. S. A. ALLEN'S WORLD'S HAIR COLOR RESTORER.

3431. *Mrs. S. A. Allen's World's Hair Color Restorer*, Mrs. S. A. Allen, New York City. Price one dollar for 8.7 fl. oz. A water-white liquid containing much sediment, with a cinnamon-like odor.

Specific gravity @ 15.5° C.	1.0795	Lead (1.57) = lead acetate	2.88
Alcohol.....	none	Acetates.....	present
Solids.....	24.94	Alkaloids, boric and salicylic acids.....	none
Glycerine.....	17.62	Reaction.....	neutral
Ash.....	2.13		
Sulphur.....	1.76		

This is a glycerine-water solution of lead acetate with considerable free sulphur.

"A Superior Dressing for the Hair. A Preparation for Beautifying and Dressing the Hair; rendering it soft, silky and glossy, and disposing it to remain in any desired position; quickly cleansing the scalp, and imparting a healthy and natural color to the hair. Youthful Color and Beauty Imparted to Gray Hair."

The use of any preparation, even externally, containing such a dangerous poison as lead acetate, must be deprecated.

AYER'S HAIR VIGOR.

3205. *Ayer's Hair Vigor*, Dr. J. C. Ayer and Co., Lowell, Mass. New improved formula; "Alcohol, 15 per cent., capsicum, sodium chlorid, sage, quinin, sulphur, glycerin, water and perfume." Price 85 cents for 7.2 fl. oz. A water-white liquid containing considerable sediment, with the odor of oils of lemon, neroli and lavender.

Specific gravity @ 15.5° C.	1.0366	Sulphur.....	1.48
Alcohol by volume.....	15.84	Q u i n i n e , capsicum,	
Wood alcohol	none	chlorides.....	present
Solids.....	21.62	Heavy metals, boric and	
Glycerine.....	17.29	salicylic acids.....	none
Ash.....	0.27	Reaction.....	neutral

This preparation formerly contained lead and its omission has certainly "improved" the formula. The present formula as given is essentially correct. It is an aqueous-alcohol-glycerine solution containing quinine, a very small amount of common salt and capsicum, with considerable free sulphur.

The following are some of the claims made for the medicine:

"Destroys dandruff, makes hair grow, stops falling hair. * * * *
This new preparation certainly destroys the germs of dandruff and falling hair; supplies nourishment to the hair, etc., etc." "Ayer's Hair Vigor, new improved formula, is a regular hair food. It feeds, nourishes, builds up, strengthens. The principal ingredient which makes this possible is glycerin."

The tonic properties of quinine and capsicum are well known. On the other hand, this preparation is not a "hair food," for no such preparation exists, any more than skin foods, brain foods or nerve foods. Certainly glycerine has no such food value. Speaking of glycerine the *U. S. Dispensatory* says:

"All our physiological evidence goes to show that glycerine has, unless in very immoderate quantities, no distinct physiological or therapeutic properties other than those of a feeble laxative."

BIRT'S HEAD WASH.

3210. *Birt's Head Wash*, The Omega Chemical Co., New York City. "Is made of the following ingredients: Refined Soap, Cochin Cocoanut Oil, White of Eggs, Glycerine and Salicylic

Acid." Price 25 cents for 1.83 oz. A pink paste with odor of rose water.

Loss @ 35-40° in vacuo...	19.02	Ash (sodium carbonate	
Glycerine.....	8.93	from soap).....	14.31
Ether extract.....	16.56	Heavy metals.....	none
Nitrogen (0.04) = pro-		Boric and salicylic acids.	none
tein.....	0.25	Caustic alkali.....	none
Soap, by difference.....	55.24		

It is a mixture of soap, oil and glycerine with a very small amount of nitrogenous matter, possibly egg albumin. The ordinary tests failed to show any salicylic acid.

CANTHROX.

3216. *Canthrox*, for Hair Shampoo, H. S. Peterson Co., Chicago. Price 45 cents for 3.7 oz. A white powder.

Soap (absolute alcohol ex-		Potassium oxide.....	0.38
tract).....	33.42	Boric acid.....	15.87
Unsaponifiable matter....	43.56	Loss at 100° C.....	21.48
Ash, total.....	49.34	Heavy metals, alkaloids,	
Ash, from soap.....	8.66	ether extract, salicylic	
Carbon dioxide.....	16.87	acid, caustic alkali.....	none
Sodium oxide.....	26.99		

The above data may be summarized as follows:

Granulated soap.....	33.42
Sodium borate, anhydrous.....	12.93
Sodium bicarbonate, anhydrous.....	32.22
Loss at 100° C.....	21.48

This preparation is apparently of inconstant composition. The Kansas Board of Health found it to contain 75 per cent. of soap and 25 per cent. of potassium carbonate, while the Indiana Board of Health reports it to be granulated soap, both of which analyses are decidedly at variance with our own.

COKE DANDRUFF CURE.

3387. *Coke Dandruff Cure and Hair Tonic*, The Kells Co., Newburgh, N. Y., and Toronto, Can. Price 50 cents for 4.7 fl. oz. "For external use only." "Contains no grease, mineral or other

deleterious substances." A reddish-brown liquid with a greenish fluorescence, and the odor of rose water.

Specific gravity @ 15.5° C.	0.9861	Boron, capsicum, resorcin.	present
Alcohol by volume.....	13.36	Cantharidin.....	(?)
Wood alcohol.....	none	Salicylic acid, alkaloids,	
Solids.....	1.29	ether extract.....	none
Glycerine.....	0.86	Reaction.....	neutral
Ash.....	0.08		

Inspections in North Dakota in 1905 and in New Hampshire in 1907 showed the presence of wood alcohol in this preparation. It is apparent from our analysis that the formula has been changed. The claims made for this material are entirely reasonable, barring the use of the word "cure." The total active solid ingredients, however, amount to not more than 0.43 per cent.

DANDERINE.

3202. *Danderine*, Knowlton Danderine Co., Chicago. Price 25 cents for 2.6 fl. oz. "The Great Hair Remedy and Scalp Invigorator, Alcohol 9 per cent." A yellowish-brown liquid with the odor of oil of bay.

Specific gravity @ 15.5° C	1.000	Boric acid, salicylic acid,	
Alcohol by volume.....	9.26	resorcin, capsicum.....	present
Wood alcohol.....	none	Cantharidin.....	(?)
Solids.....	5.16	Heavy metals, ether ex-	
Glycerine.....	4.19	tract, alkaloids.....	none
Ash.....	0.08		

It is a dilute alcohol-glycerine solution containing small amounts of boric acid, salicylic acid, resorcin, capsicum and, possibly, cantharidin.

GERMICIDAL SHAMPOO POWDER.

3402. *Germicidal Shampoo Powder*, Davies, Rose and Co., Boston. Price 25 cents for 0.85 oz. A white powder with the odor of rose.

Loss @ 100° C.....	10.69	Carbonic acid.....	13.68
Alcohol insoluble.....	47.44	Sodium.....	present
Alcohol soluble.....	37.37	Heavy metals, alkaloids,	
Boric acid.....	19.84	salicylic acid, ether ex-	
Ash.....	49.92	tract.....	none

The above analysis indicates the preparation to consist of soap, borax and a sodium carbonate in nearly equal parts.

GOLDMAN'S GRAY HAIR COLOR RESTORER.

3407. *Mary T. Goldman's Gray Hair Color Restorer, No. 1*, Mary T. Goldman Co., St. Paul, Minn. "A Colorific Preparation". Price one dollar for 5.5 fl. oz. A water-white liquid with an ammoniacal odor.

Specific gravity @ 15.5° C.	1.0053	Nitrogen as ammonia....	0.281
Alcohol.....	none	Nitrogen as nitric.....	0.058
Solids.....	0.84	Boric and salicylic acids..	none
Ash.....	0.52	Reaction.....	strongly alkaline
Glycerine.....	none		
Silver (0.481) = silver			
nitrate.....	0.76		

It is a weak ammoniacal solution of silver nitrate. The silver nitrate present of course acts as a dye, the silver being reduced on contact with the organic matter of the hair. It would seem that such a powerful caustic must be injurious to the hair. The following are some of the remarkable statements made in connection with this preparation:—

"In the past years it has been impossible to restore gray or faded hair to its original color. It has been the effort of the writer for the past 20 years to compound something that would act directly, and therefore quickly, on the life-giving functions of the hair. * * * * Is a clean and harmless preparation. * * * * Give it the most severe tests you can, and you will find that the color is in the hair, through and through, and really is lasting and natural."

HAIR REVIVER.

3404. *Hair Reviver*, prepared for T. P. Gillespie and Co., New Haven. "Alcohol 30 per cent." Price 50 cents for 5.8 fl. oz. A reddish liquid.

Specific gravity @ 15.5° C.	0.9871	Quinine.....	present
Alcohol by volume.....	28.12	Cantharidin.....	(?)
Wood alcohol.....	none	Heavy metals, boric acid,	
Solids.....	8.99	salicylic acid.....	none
Glycerine.....	8.29	Reaction.....	neutral
Ash.....	0.02		

A strongly alcoholic solution containing glycerine, quinine and possibly cantharidin.

HAIRWAND.

3691. *Concentrated Hairwand Powder*, The Lesslie Co., Dayton, O. "A concentrated compound of the highest efficiency for the treatment of the hair and as a tonic and scalp dressing. Makes one pint liquid hair tonic." Price 43 cents for 0.46 oz. A red-brown powder, colored with a coal-tar dye and with the odor of oil of bitter almonds.

Loss @ 100° C.	11.80	Salicylic acid.....	3.23
Chlorine.....	26.32	Sodium, resorcin.....	present
Boric acid.....	30.75	Capsicum.....	present (?)

The above data indicate that *Hairwand* consists of about 44 per cent. common salt, 47 per cent. crystallized borax, 4 per cent. sodium salicylate and 5 per cent. of water and volatile matters, with small amounts of resorcin and possibly capsicum.

The label tells us that by using *Hairwand* "the removal of dandruff, and the vitality and lustre of the hair soon follows", a most damaging statement, if true. Possibly here the manufacturer's English is more at fault than his preparation.

LIQUID ARVON.

3686. *Liquid Arvon for Removing Dandruff*, The R. L. Watkins Co., Cleveland, O. "Alcohol 5 per cent." "For external use only". Price one dollar for 4.0 fl. oz. A brown solution with a green fluorescence, of undertermined odor, possibly rose geranium.

Specific gravity @ 15.5° C	1.0033	Ash = potassium carbonate	0.42
Alcohol by volume.....	4.84	Salicylic acid.....	present
Wood alcohol.....	none	Resorcin.....	probably
Solids.....	2.72	Heavy metals, borax.....	none
Glycerine.....	1.49		

This is an extremely dilute alcohol-glycerine solution containing salicylic acid, potassium carbonate and possibly resorcin.

JACOBS' LUXURIANT HAIR TONIC AND GROWER.

3395. *Luxuriant Hair Tonic and Grower*, J. M. Jacobs, New Haven. "Alcohol 20 per cent.; free from grease." Price 25 cents

for 2.9 fl. oz. A brownish-yellow liquid with the odor of wild cherry.

Specific gravity @ 15.5° C.	1.0020	Quinine, resorcin.....	present
Alcohol by volume.....	15.60	Cantharidin.....	(?)
Wood alcohol.....	none	Heavy metals, boric acid,	
Solids.....	8.58	salicylic acid.....	none
Glycerine.....	7.33	Reaction.....	acid
Ash.....	0.02		

A strongly alcoholic solution containing glycerine, resorcin, considerable quinine and possibly cantharidin. It contains 4.40 per cent. less alcohol than is claimed.

NYAL'S HIRSUTONE.

3430. *Nyal's Hirsutone*, New York and London Drug Co., New York City. "Alcohol 15 per cent." Price 50 cents for 5.5 fl. oz. A pale yellow liquid with the odor of rose geranium.

Specific gravity @ 15.5° C.	0.9942	Boric acid, quinine.....	present
Alcohol by volume.....	13.96	Capsicum, cantharidin.....	(?)
Wood alcohol.....	none	Heavy metals, salicylic	
Solids.....	3.62	acid.....	none
Glycerine.....	2.17	Reaction.....	acid
Ash.....	0.38		

An alcoholic solution containing about 2 per cent. of glycerine with small amounts of boric acid, quinine and possibly capsicum and cantharidin.

PARISIAN SAGE COMPOUND.

1124. *Parisian Sage Compound*, The Giroux Mfg. Co., Buffalo, N. Y. "12 per cent. alcohol." Price 36 cents per 4.0 fl. oz. A yellowish-brown liquid with the odor of lavender and probably other volatile oils.

Specific gravity @ 15.5° C	0.9915	Sage, resorcin, capsicum....	present
Alcohol by volume.....	11.60	Cantharidin.....	(?)
Wood alcohol.....	none	Heavy metals, alkaloids, sul-	
Solids.....	2.54	phur, salicylic acid, boric	
Glycerine.....	1.95	acid, pilocarpine, ether ex-	
Ash.....	0.05	tract.....	none

This preparation appears to be an alcoholic infusion of sage and small amounts of resorcin, capsicum, glycerine and possibly cantharidin. "Sage unites tonic, astringent and aromatic properties. By the ancients it was highly esteemed; it is at present little used, except as a condiment." *U. S. Dispensatory, 19 Ed.*, p. 1080.

PARKER'S HAIR BALSAM.

3432. *Parker's Hair Balsam*, Hiscox and Co., Patchogue, N. Y. Price 50 cents for 4.0 fl. oz. It is a water-white liquid with considerable sediment and the odor of sassafras.

Specific gravity @ 15.5° C.	1.0836	Lead (1.55) = lead acetate	2.84
Alcohol.....	none	Acetates.....	present
Solids.....	26.58	Boric acid, salicylic acid	
Glycerine.....	19.67	alkaloids.....	none
Ash.....	2.12	Reaction.....	neutral
Sulphur.....	1.79		

This a glycerine-water solution of lead acetate with considerable free sulphur. It closely resembles *Allen's Hair Color Restorer* in composition and the same criticisms against its use apply (See page 281).

PENSLAR HAIR TONIC.

3203. *Penstar Hair Tonic*, Peninsular Chemical Co., Detroit, Mich. "Alcohol 20 per cent. Contains F. E. Arbor Vitae, Tinct. Cantharides, Pilocarpin, Cinchonidine, Salicylic Acid, Resorcin." Price 50 cents for 5.8 fl. oz. A yellowish liquid with the odor of cologne.

Specific gravity @ 15.5° C.	0.9792	Quinine, pilocarpine, re-	
Alcohol by volume.....	17.30	sorcin, salicylic acid....	present
Wood alcohol.....	none	Cantharidin.....	(?)
Solids (non-volatile).....	0.14	Heavy metals, ether ex-	
Ash.....	0.04	tract, glycerine.....	none
		Reaction.....	acid

It is an alcoholic solution containing minute quantities of quinine, pilocarpine, resorcin, salicylic acid and possibly cantharidin. The rather imposing formula given on the label loses much of its significance in view of the fact that only 0.14 per cent. of non-volatile solids is present.

PLAIN YELLOW MINYOL.

3523. *Plain Yellow Minyol Compound*, The Prescription Products Co., Dayton, O. "The Third Degree." "Valuable for the Treatment of Hair and Scalp." Price 75 cents for 4.80 oz.

Sodium oxide.....	40.73	Ether extract.....	2.83
Chlorine.....	46.82	Water and volatile matter..	15.47

This remedy, therefore, which possesses according to its claim "antiseptic, disinfectant, alterative, demulcent, detergent, herpetic, nutritive, restorative and tonic" properties, is composed of 77.25 per cent. common salt, 2.83 per cent. fatty base and 15.47 per cent. water, with small amounts of camphor, oil of rose and possibly menthol.

"Maud writes: 'Can anything be done for an itching scalp? My scalp is covered with dandruff and I am in great distress.' Answer: You can very easily be cured of an itching scalp, also dandruff, if you will get a four oz. jar of plain yellow minyol and use according to directions given on the jar. Two or three applications have been known to cure. Try it fairly and you will advocate its use to your friends."—*The Doctor's Advice by Dr. Lewis Baker.*

MRS. POTTER'S WALNUT TINT HAIR STAIN.

3420. *Mrs. Potter's Walnut Tint Hair Stain*, Mrs. Potter's Hygienic Supply Co., Cincinnati, O. "Alcohol 12 per cent. Guaranteed free from lead, sulphur and silver." Price one dollar.

The preparation consists of two small bottles of liquid, one (1.3 fl. oz.) colorless, the other (1.2 fl. oz.) brown, with considerable black sediment. The cork of the former was bleached and the solution contained 1.16 per cent. of absolute hydrogen peroxide. The solution in the second bottle was partially decomposed and showed the following composition:—

Specific gravity @ 15.5° C	0.9879	Solids.....	0.90
Alcohol by volume.....	11.80	Ash.....	0.56
Wood alcohol.....	none	Paraphenylene diamine...	present

Many authorities have called attention to the poisonous qualities of paraphenylene diamine.

"Eighteen cases of poisoning have been reported by Cathelineau. Brocq described a severe form of dermatitis due to this chemical; Balso reports a case of poisoning due to wearing hose which had been dyed

with the chlorate of paraphenylene diamine, and Mewborn reported a case of dermatitis from the use of a hair dye having this chemical for its base."—*Nostrums and Quackery*, p. 353. In addition to the above, thirty-two cases of poisoning due to the use of the Potter Stain itself have been reported to the *Journal of the American Medical Association*.

Not only is this preparation exceedingly dangerous to use but its manufacturer attempts to allay fears as to its poisonous properties by emphasizing the fact that it is "free from lead, sulphur and silver". Furthermore, she claims that "this scientific preparation is the only known remedy for ruined hair—caused by the use of peroxide and other powerful chemicals", and yet one of the liquids making up the stain consists of hydrogen peroxide, which this manufacturer insists is particularly ruinous to the hair. Before the passage of the Federal Food and Drugs Act the stain was labeled "Walnut Juice," not "Walnut Tint", the name now being changed to avoid the charge of misbranding.

STEPHAN'S CLESCALP.

3220. *Stephan's Clescalp*, E. S. Stephan, New Haven. "Removes the Cause of Dandruff". Price 35 cents for 8.8 fl. oz. A greenish liquid with the odor of geraniol. (?)

Specific gravity @ 15.5° C.	1.0040	Arsenic.....	0.246
*Wood alcohol by volume	1.19	Alkaloids, formaldehyde,	
Solids.....	0.67	salicylic acid, ether ex-	
Ash.....	0.56	tract.....	none
Boron, sodium, potash....	present	Reaction.....	slightly acid

* See below.

It is a very dilute aqueous solution of potassium arsenate containing a small amount of wood alcohol and borax. Here we have exhibited a preparation containing two dangerous poisons without the slightest word of warning to the intending purchaser. The manufacturer insisting that wood alcohol did not enter into his formula and that its presence was due to an error in compounding, a second sample was bought in the open market from another dealer, and in this no wood alcohol was found.

THER-OX.

3393. *Ther-Ox*, The American Ther-Ox Co., Detroit, Mich. Price 75 cents for 3.53 oz. (weight claimed 4 oz.) A dry white powder.

Boric acid.....	78.86	Sodium.....	present
Ash insoluble in acid.....	7.00		

The material consists essentially of 93 per cent. of borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 5\text{H}_2\text{O}$) and 7 per cent. of talc or a similar substance. A small quantity of borax worth a few cents, by being given the name "Ther-Ox" acquires a value of 75 cents. The manufacturer, apparently not content with the price charged, gives 0.47 oz., or 12 per cent., less weight than claimed.

WESTPHAL'S AUXILIATOR.

3227. *Westphal's Auxiliator*, Paul Westphal, New York City, "55 per cent. grain alcohol." Price 50 cents for 5.3 fl. oz. A yellowish liquid with the odor of rose water.

Specific gravity @ 15.5° C.	0.9469	Boron.....	present
Alcohol by volume.....	47.24	Cantharidin.....	(?)
Wood alcohol.....	none	Alkaloids, salicylic acid,	
Solids.....	3.90	heavy metals.....	none
Glycerine.....	3.27	Reaction.....	neutral
Ash.....	0.20		

This is a strongly alcoholic solution containing a small amount of solids, mostly glycerine, a boron compound and possibly cantharidin. The formula has evidently been changed in part as in 1907 the New Hampshire Board of Health found nearly 11 per cent. of wood alcohol present. It contains nearly 8 per cent. less than the claimed amount of alcohol.

WYETH'S SAGE AND SULPHUR HAIR REMEDY.

1125. *Wyeth's Sage and Sulphur Hair Remedy*, The Wyeth Chemical Co., New York City. "Alcohol 5 per cent. An Ideal Hair Remedy and Dressing. Imparts color to faded and gray hair, etc., etc." Price 50 cents for 5.5 fl. oz. A greenish-yellow liquid with considerable sediment and the odor of rose water.

Specific gravity @ 15.5° C.	1.0109	Lead (0.43) = lead acetate	0.79
Alcohol by volume.....	3.52	Sulphur.....	1.72
Wood alcohol.....	none	Sage, acetates.....	present
Solids.....	3.39	Alkaloids, salicylic acid,	
Glycerine.....	0.83	boric acid, ether extract,	none
Ash.....	0.70	Reaction.....	neutral

The manufacturer emphasizes on the label the presence of sage, sulphur, glycerine, cantharides, capsicum and alcohol, but is silent as to lead acetate, its most active ingredient. The presence of lead acetate makes the remedy a dangerous one to use, and shows the falsity of the claim that it is "good for the hair and scalp", and that "everything entering into the composition of this great hair Remedy combines to make it an ideal preparation for preserving and restoring the color of the hair, for removing dandruff, for stopping hair falling, and for making the hair grow". The glycerine, lead acetate and sulphur together amount to 3.34 per cent., so that not more than 0.05 per cent. of the other valuable "remedies", sage, cantharides and capsicum, can be present. It is a weak glycerine-water-alcohol solution of lead acetate with considerable free sulphur and a minute amount of sage infusion with possible traces of cantharidin and capsicum.

MME. YALE'S EXCELSIOR HAIR TONIC.

3455. *Mme. Yale's Excelsior Hair Tonic*, Mme. M. Yale, New York City. "Alcohol 20 per cent." Price one dollar for 12.5 fl. oz. A pale yellow liquid with slight sediment and the odor of oil of bergamot.

Specific gravity @ 15.5° C.	0.9833	Ash.....	.02
Alcohol by volume.....	18.08	Quinine.....	present
Wood alcohol.....	none	Heavy metals, boric acid,	
Solids.....	1.68	salicylic acid.....	none
Glycerine.....	1.25	Reaction.....	neutral

This is an alcoholic solution containing glycerine and quinine, and possibly other ingredients in minute quantities. 100cc. of the preparation gave no reaction for resorcin, cantharidin, phenols or capsicum. Since prosecution under the federal law this preparation no longer claims to "stop hair falling, cures and prevents dandruff and all scalp diseases and overcomes any heredity tendency to baldness and grayness."

REMEDIES FOR KIDNEY AND LIVER DISEASES.

CARTER'S LITTLE LIVER PILLS.

3391. *Carter's Little Liver Pills*, Carter Medicine Co., New York. "Purely vegetable." Price 15 cents for 42 pills, weighing

1.84 gms., or 28.4 grs. White pills (interior black) with the taste and odor of aloes.

Loss @ 100° C.....	4.45	Starch.....	14.08
Ash.....	5.15	Alcohol extract.....	60.49
Petroleum ether extract....	1.05	Aloes.....	present
Reducing sugars, as dextrose	21.92	Soap, capsicum, alkaloids....	none

These are essentially aloes pills, that drug largely predominating, although podophyllin and licorice may be present. In the advertising matter we are especially warned against "those medicines which depend on their strongly cathartic properties for their success—with their violent purgative action." The chief constituent of the Carter pills, aloes, is an active cathartic, and podophyllin, which they are reported to contain, is a drastic purgative.

HOOD'S VEGETABLE PILLS.

3386. *Hood's Vegetable Pills*, C. I. Hood Co., Lowell, Mass. "The Great Liver Invigorator." "Purely vegetable. Price 25 cents for 52 pills, weighing 5.11 gms., or 78.9 grs. Light-brown pills (interior black) with the taste and odor of aloes and capsicum.

Loss @ 100° C.....	3.60	Alcohol extract.....	64.48
Ash.....	2.90	Aloes, capsicum.....	present
Petroleum ether extract....	3.85	Soap, ginger, phenols, alka-	
Reducing sugars, as dextrose	13.24	loids.....	none
Starch.....	11.59		

These are essentially aloes and capsicum pills. Colocynth, ginger and jalap have been reported in English analyses (and the manufacturer claims gamboge, podophyllin, gentian and ipecac as well), but we were unable by available methods to identify these drugs in the present sample.

DOAN'S KIDNEY PILLS.

3201. *Doan's Kidney Pills*, Foster-Milburn Co., Buffalo, N. Y. "Contain no morphine, cocaine, nor other habit-producing drugs." Price 50 cents for 40 pills, weighing 13.3 grams. Gray pills with a brownish-yellow interior, with a resinous odor and a sweet, pitchy taste.

Water and volatile matter. 7.52	Ash..... 6.70
Starch..... 22.25	Potash..... 3.58
Reducing sugars, as dextrose 28.48	Nitric nitrogen..... 1.11
Petroleum ether extract... 15.50	= Potassium nitrate..... 7.98
Other organic matters..... 19.55	Alkaloids..... none

The active ingredients of the pills appear to be potassium nitrate (saltpeter), pitch and possibly a trace of oil of juniper, and other unidentified organic drugs (powdered fenugreek according to a British analysis).

Self-medication for kidney diseases is particularly dangerous, especially when the remedy comes laden with false statements and misrepresentations. As an illustration of the advertising methods and the reliability of the testimonials of *Doan's Kidney Pills*, we may cite the fact that

"The *Blackwell* (Okla.) *News* of August 24, 1911, contained an advertisement in which a Mrs. Charles Butcher of that city testified as to the virtues of *Doan's Kidney Pills*. As a matter of fact, Mrs. Charles Butcher had been dead nearly two months before the advertisement appeared; and she died of kidney disease."—*Nostrums and Quackery, 1912, p. 687*.

DR. KILMER'S SWAMP ROOT.

1605. *Dr. Kilmer's Swamp Root*, Dr. Kilmer and Co., Binghamton, N. Y. "Kidney, Liver and Bladder Remedy." "9 per cent. alcohol." Price one dollar for 10.5 fl. oz.

Specific gravity @ 15.5° C. 1.1771	Reducing sugars, as dextrose 5.08
Alcohol by volume..... 8.68	Non-sugar solids..... 2.49
Wood alcohol..... none	Ash..... 0.06
Solids..... 42.39	Alkaloids..... none
Sucrose..... 34.72	Oxymethylanthraquinone... present

The preparation is an alcoholic sugar solution with a small amount of vegetable extractives of drugs yielding emodin or chrysophanic acid. In the pamphlet accompanying the sample we read:

"It is not recommended to cure all diseases to which flesh is heir" and yet on the opposite page we find it recommended for forty-seven different ailments. We also read:

"Have you ever tried the simple test of setting aside your urine in a bottle or common glass for twenty-four hours? A sediment or settling in the urine is usually an indication of either kidney or bladder trouble, or perhaps both."

Such a result is generally not an indication of kidney or bladder trouble, and is frequently found in normal urine.

Throughout all the company's literature we find a most skillful evasion of legal responsibility for misleading statements. For instance:

"We do not wish to have anyone take Swamp Root who does not need it, but if people take it who need it, the remedy will do the rest and thus fulfill its great mission—thus affording relief and *restoring health to the afflicted*" (*italics ours*).

If these words do not imply that the remedy is a "cure," what do they mean? Furthermore, it is hard to conceive of a physician prescribing a remedy containing nearly 9 per cent. of alcohol for a patient suffering from Bright's disease, or one containing 40 per cent. of sugar for a diabetic.

SKIN AND COMPLEXION REMEDIES.

CADUM.

3218. *Cadum*, Omega Chemical Co., New York. "The New Remedy for Eczema and other Skin Troubles." "Soothing, Healing, Antiseptic." "Is made of oil of cade, zinc oxide, washed sulphur, salicylic acid, eucalyptol, soft white petrolatum, white ceresin." Price 25 cents for 1.1 oz.

Loss @ 100° C. (water and volatile)..... 0.65	Zinc oxide..... 13.05
Ether extract (—sulphur) .76.72	Free sulphur..... 6.45
Ether extract unsaponified. 61.55	Salicylic acid..... 0.91
Ether extract saponified... 15.17	Oil of cade..... present
Alcohol extract (hot 95%) .35.64	Eucalyptol..... present
Chloroform insoluble..... 13.11	Boric acid, starch, alkaloids... none

This preparation, therefore, consists of about 15 per cent. saponified oils and fats, 61.5 per cent. unsaponified fats (probably base), 13 per cent. zinc oxide, 6.5 per cent. sulphur, 1 per cent. salicylic acid, 0.5 per cent. water and volatile matter, and 2.5 per cent. undetermined, thereby in general confirming the manufacturer's formula.

CHAMPLIN'S LIQUID PEARL.

3406. *Champlin's Liquid Pearl*, Champlin Mfg. Co., New York City. "Alcohol 1 per cent." "Contains nothing injurious

to the most delicate skin." Price 50 cents for 3.6 fl. oz. A clear liquid with the odor of lemon oil, and with much sediment.

Specific gravity @ 22° C...	1.0899	Bismuth oxide.....	2.52
Alcohol by volume.....	1.88	Calcium oxide.....	5.39
Wood alcohol.....	none	Carbonates.....	present
Solids.....	14.44	Other heavy metals.....	none
Glycerine.....	present		

The material is a weakly alcoholic solution containing 2.85 per cent. bismuth subcarbonate ($\text{Bi}_2\text{O}_2 \cdot \text{CO}_2 \cdot \text{H}_2\text{O}$) and 9.62 per cent. calcium carbonate, with glycerine.

CITROX.

3458. *Citrox*, for the Treatment of Eczema, Tetter, Ringworm and other Scaly Skin Diseases, United Citrox Co., Detroit, Mich. Price 75 cents for 3.88 oz.

It was found to be entirely sodium hyposulphite colored blue, possibly with indigo.

"The Citrox Treatment is offered with great confidence because of the success with which it has already been used in various cases of long standing. It is simple and economical and merits a thorough trial. Do not expect it to cure a bad case in a few days; although it has been remarkably effective, no claim is made that it will work miracles."

Sodium thiosulphate (photographers' "hypo"), undoubtedly useful for parasitic affections of the skin, can be bought for 10 or 15 cents per pound.

D. D. D. PRESCRIPTION.

3394. *D. D. D. Prescription for the Skin and Scalp*, Ordinary Strength, D. D. D. Co., Chicago and Toronto. "Alcohol 38 per cent., chloral hydrate 7 grs. per oz." "For external use only." Price 49 cents per 2.2 fl. oz. A yellow solution with the odor of wintergreen and phenol.

Specific gravity @ 22° C.....	0.9822
Alcohol by volume.....	32.10
Wood alcohol.....	none
Solids.....	8.60
Ash.....	0.02
Glycerine.....	present
Chloral hydrate.....	7.8 grs. per fl. oz.
Phenol, thymol, methyl salicylate	
salicylic acid.....	present

The analysis shows the material to be a strongly alcoholic solution containing 7.8 grs of chloral hydrate per fl. oz., with small amounts of phenol, thymol, salicylic acid and oil of wintergreen. The ingredients of this preparation doubtless have antiseptic value. The claims made for it, however, are as follows:

"Diseases cured by D. D. D. Eczema in all forms, acne and pimples, dermatitis, ring worms, herpes, hives, bites of insects, poisonous rashes, itching piles, psoriasis, dandruff and affections of the scalp, barber's itch and sycosis, salt rheum and tetter, scabies, lichen, red nose, roughness, and itch of all kinds."

"The thousands of patients who have testified to remarkable cures indicate that ultimately, even the most obstinate cases of eczema, psoriasis, barber's itch, or similar skin diseases, must yield to this remedy." "There is no doubt that D. D. D. Prescription cures skin diseases, thousands and thousands of people can and do testify to that." "The second or third bottle has cured thousands." "Is a specific for just one kind of a disease."

In view of the above statements it is strange that in the list of sixty-five drugs given by the U. S. Dispensatory as useful in the treatment of eczema, chloral hydrate, phenol and oil of wintergreen are not mentioned.

DERMA-ROYALE.

3456. *Derma-Royale*, The Derma-Royale Co., Cincinnati, O. "Alcohol 2 per cent". Price 85 cents for 7.7 fl. oz.

Specific gravity @ 22° C..	0.9944	Ash.....	0.15
Alcohol by volume.....	2.48	Heavy metals, borates, sali-	
Wood alcohol.....	none	cylates, phenols.....	none
Solids.....	3.55	Camphor.....	present
Glycerine.....	2.93	Myrrh, benzoin...probably	present
Non-volatile suspended			
solids.....	0.25		

This preparation is a dilute alcohol-glycerine solution with small amounts of camphor, myrrh, benzoin, and possibly other aromatics in suspension.

Notwithstanding the extreme simplicity of this preparation, it is surprising to note the curative powers claimed for it.

"Nothing will cure, Clear and Whiten the skin so quickly as *Derma-Royale*." "The new discovery for curing cutaneous affections, removing discolorations from the cuticle, and bleaching, brightening and beautifying the complexion. It is as pure and mild as dew, and so harmless one may

drink a whole bottleful without any bad effects. * * * * Those, however, who are troubled with eczema, tetter, acne, blotches, eruptions, or other cutaneous affections, should apply *Derma-Royle* several times a day. They need suffer no longer from any defect of the skin." "There Never was Anything Like It." "It has never failed—IT CANNOT FAIL."

EL-GANTIS BEAUTIFIER.

3228. *El-Gantis Beautifier*, Seaside Laboratory, Bridgeport, Conn. "A liquid face powder, absolutely greaseless." Price 50 cents for 5.5 fl. oz. A colorless solution containing much heavy white sediment.

Specific gravity @ 22° C.....	1.1142
Alcohol.....	none
Solids.....	17.98 gms. per 100 cc.
Bismuth oxide.....	2.25 gms. per 100 cc.
Zinc oxide.....	10.13 gms. per 100 cc.
Residue on ignition.....	11.98 gms. per 100 cc.
Nitrates, glycerine.....	none
Carbonates, lime.....	present
Odor, orris root.....	

The above analysis indicates a composition of 2.55 per cent. bismuth sub-carbonate and 10.13 per cent. zinc oxide, with about five per cent. of precipitated chalk.

EPP-O-TONE.

3449. *Epp-o-tone*, for the Complexion. The La Cattel Mfg. Co., Detroit, Mich. Price 50 cents for 3.28 oz.

Magnesium oxide.....	18.10	Color, cochineal
Sulphuric anhydride.....	35.40	

The preparation is partially dehydrated Epsom salts, $MgSO_4 \cdot 6H_2O$, colored with cochineal. It is a "prescription" very similar to *Spurmax* (see page 306).

"The formula for Epp-o-tone is the discovery of an eminent Parisian specialist. The secret of this preparation has been heretofore guarded jealously, but it was obtained by an American woman, who was the guest of a friend in Paris, from whom the ingredients were obtained."

The above analysis is almost a cruel revelation of another of the "mysteries of Paris."

EPTOL.

3688. *Eptol*, for making Greaseless Vanishing Massage Cream, Cooper Pharmacal Co., Chicago. Price 50 cents for 1.5 oz. A white powder perfumed with rose.

Loss @ 100° C.....	10.75	Heavy metals.....	none
Boric acid.....	24.06	Stearic acid and soap.....	present
Alcohol soluble (hot 95%)...	97.80		

From the above the preparation appears to consist essentially of about 37 per cent. crystalline borax and 63 per cent. stearic acid and soap, perfumed with rose.

HILL'S FRECKLE LOTION.

3479. *Hill's Freckle Lotion*, J. V. Hill, Providence, R. I. "Poison" label on back of the bottle. "This lotion has been in constant use for fifty years, and is absolutely harmless when used externally according to directions." Price 75 cents for 5.7 fl. oz. A clear, colorless solution.

Specific gravity @ 22° C..	1.0154	Mercuric chloride.....	1.84
Alcohol.....	none	Salicylates and phenols.....	none
Glycerine.....	none		

It is an aqueous solution of 1.84 per cent. of mercuric chloride (corrosive sublimate).

"Removes moth, tan, freckles, pimples, ringworms and all eruptions of the skin."

It contains 18.4 parts of corrosive sublimate per 1,000, and is an extremely dangerous preparation. For the danger from using corrosive sublimate see remarks under *Kingsbery's Freckle Lotion*, page 300. If one part in 2,000 is dangerous, it is surely criminal to offer for indiscriminate use a solution thirty-six times that strength.

HINDS HONEY AND ALMOND CREAM.

3212. *Hinds Honey and Almond Cream*. A. S. Hinds, Portland, Me. "Alcohol 7 per cent." "For the face, hands, skin and complexion." Price 45 cents for 4.5 fl. oz. A white emulsion with the odor of oil of bitter almonds.

Specific gravity @ 22° C..	0.9862	Ether extract.....	5.98
Alcohol by volume.....	7.28	Glycerine.....	5.79
Wood alcohol.....	none	Boric acid.....	0.97
Solids.....	13.26	Sodium.....	present
Ash.....	0.86	Sugar, heavy metals.....	none

It is essentially an emulsion containing 7.28 per cent. alcohol, 5.79 glycerine, 5.98 partly saponified beeswax and 1.49 per cent. crystallized borax, scented with oil of bitter almond. No honey was present.

HOLMES' FRAGRANT FROSTILLA.

3208. *Holmes' Fragrant Frostilla*, for the Toilet, Clay W. Holmes, Elmira, N. Y. "Alcohol 17 per cent." "Contains nothing greasy or sticky." "Contains no chemical salts whatever." Price 25 cents for 1.9 fl. oz. A whitish turbid liquid with the odor of rose.

Specific gravity @ 22° C..	1.0034	Ash.....	0.08
Alcohol by volume.....	16.64	Gum tragacanth.....	0.87
Wood alcohol.....	none	Glycerine.....	present
Solids.....	15.02	Heavy metals.....	none

This material is essentially a mixture of alcohol, glycerine and gum tragacanth.

KINGSBERY'S FRECKLE LOTION.

3476. *E. W. Kingsbery's Freckle Lotion*, 1st Strength, E. W. Kingsbery, Randolph, Mass. Price 25 cents for 4.1 fl. oz. A clear, colorless solution.

Specific gravity @ 22° C..	1.0045	Mercuric chloride.....	0.532
Alcohol.....	none	Salicylates and phenols.....	none

It is an aqueous solution of 0.53 per cent. of mercuric chloride (corrosive sublimate).

"Will positively remove freckles, tan, moth patches, etc. from the face, hands and arms without the slightest injury to the most sensitive skin." "Unequaled for use in ivy and dogwood poison, insect bites and stings, salt rheum, eczema and all skin irritations, stopping the itching immediately and counteracting the poison."

This preparation contains 5.3 parts of corrosive sublimate per 1,000, and is an exceedingly dangerous remedy to use. The U. S.

Dispensatory speaks as follows regarding the use of corrosive sublimate as an antiseptic:

"The solution of one in one thousand may be used for washing the hands, disinfecting furniture, etc., and is even employed in the disinfecting of wounds; usually, however, a much weaker solution than that just mentioned is employed by the surgeon. It is rarely if ever justifiable to use upon a mucous surface or a wound a solution stronger than one in two thousand, and if the solution is to be used freely and continuously, as in washing out the vagina, etc., one in ten thousand is as strong as should be employed indeed, the employment of a vaginal wash of this strength has been followed by violent poisoning * * * * In a number of cases a solution of one part in fifteen hundred used locally by the surgeon has produced death."

Although this preparation is recommended only for external use, it is caustic in its action and might cause an open sore in its destruction of the freckled cuticle. Furthermore, the average face is seldom free from some abrasion of the skin, especially when suffering from ivy poisoning or insect bites, for which this remedy is especially recommended. The authority above quoted tells us that "its (corrosive sublimate) use requires care, as fatal poisoning has followed a single application of the alcoholic solution of corrosive sublimate to a moderate surface of ringworm."

The preparation bears no poison label nor is there any warning as to its dangerous character except the wholly inadequate clause "for external use only."

KINTHO BEAUTY CREAM.

3531. *Kintho Beauty Cream*, Kintho Mfg. Co., Buffalo, N. Y. Price 40 cents (wholesale) for 1.27 oz. A white ointment with the odor of rose.

'Loss @ 100° C. (water and volatile).....	20.83	Bismuth oxide.....	5.56
Alcohol extract (hot 95%)..	36.94	= Bismuth subnitrate.....	7.05
Chloroform soluble.....	58.85	Borax, ammonia, nitrates, chlorides.....	present
Chloroform insoluble.....	20.32		
Mercury.....	8.95	Phenols, salicylates, starch....	none
= Ammoniated mercury.	11.28		

The preparation contains in part 20.8 per cent. water and volatile matter, 7.1 per cent. bismuth subnitrate, 11.3 per cent. ammoniated mercury (white precipitate), and 1.9 per cent. borax

and undetermined. Any preparation containing such a dangerous poison as ammoniated mercury should be used with extreme care. Formerly this was labeled "harmless," but since prosecution by the U. S. government for misbranding, the caution "Do not allow the cream to get into the eyes or open cuts or sores" appears on the label.

KROY WEN OINTMENT.

3211. *Kroy Wen Ointment*, Manhattan Drug Co., New York. "A Harmless Healing Nutritive Emollient for Wounds, etc., and all Skin Diseases." "Contains the healing and antiseptic properties of carbolic acid, witch hazel, arnica, menthol, thymol, zinc oxide, oil of hemlock, oil of cajaput, oil of cade, sulphur and boracic acid, combined with a readily absorbent, non-irritating and healing base." Price 25 cents for 1.92 oz.

Loss @ 100° C. (water and volatile).....	19.96	Insoluble in chloroform.....	8.84
Ether extract (—sulphur) ..	66.70	Zinc oxide.....	5.61
Ether extract unsaponified.	47.62	Free sulphur.....	1.16
Ether extract saponified....	19.08	Phenols.....	0.33
Alcohol extract (hot 95%) ..	38.43	Menthol, boric acid.....	present
		Alkaloids, starch.....	none

The above analysis may be summarized as follows: water and volatile matter (phenol, menthol, etc.) 20 per cent., saponified oils and fats 19 per cent., unsaponified fats (probably base) 47.5 per cent., zinc oxide 5.6 per cent., sulphur 1.2 per cent., boric acid and undetermined 6.7 per cent.

LUXOR.

3217. *Luxor*, for making Eczema Remedy, H. S. Peterson and Co., Chicago. Price 39 cents for 3.2 oz.

Zinc oxide.....	28.40	Water, by difference.....	11.84
Boric acid.....	59.76		

This is a mixture of about two parts of boric acid and one part of zinc oxide.

MAY-A-TONE.

3521. *May-A-Tone*, The May-A-Tone Co., Chicago. Price 75 cents for 1.92 oz.

Magnesium oxide.....	14.42	Sodium.....	present
Sulphuric anhydride.....	28.26	Color, cochineal or cudbear	
Boric acid.....	13.18		

The above analysis indicates a mixture of about 87 per cent. Epsom salts, Mg SO₄ · 7 H₂O, and 13 per cent. anhydrous borax, Na₂ B₄ O₇, colored with cochineal or cudbear.

In its advertising May-A-Tone claims responsibility for the "soft and velvety" skin of the Japanese women, and that its formula was given to the world through Madame D'Mille "one of Paris' most famous beauties just passing through Chicago."

MRS. MCCORRISON'S FAMOUS DIAMOND LOTION.

3528. *Mrs. McCarrison's Famous Diamond Lotion*, No. 1, E. K. Guenther, Waldoboro, Me. Price 75 cents for 3.4 fl. oz. A clear, colorless solution.

Specific gravity @ 22° C..	1.0240	Alcohol, glycerine, salicylates,	
Mercuric chloride.....	2.82	phenols.....	none

An aqueous solution of 2.82 per cent. of mercuric chloride (corrosive sublimate).

"Will remove moth, tan, freckles, pimples, blackheads, salt rheum, eczema, and all the various affections of like character." "It is unlike any other preparation for the skin and complexion."

Unfortunately, it is not "unlike any other preparation" for *Kingsbery's Freckle Lotion*, *Hill's Freckle Lotion*, *Perry's Moth and Freckle Lotion* and *Madame Ruppert's Face Bleach*, elsewhere referred to, are very similar preparations. The *McCarrison* compound, however, has the distinction of being even more dangerous than the others, as it contains 28.2 parts of corrosive sublimate per 1,000. (See remarks under *Kingsbery's Freckle Lotion*, page 300.)

MERCOLIZED WAX.

3425. *Pure Mercolized Wax*, Dearborn Supply Co., Chicago, Ill. Price 85 cents for 1.0 oz. A white ointment with the odor of rose.

Loss @ 100° C. (water and volatile).....	19.08	Mercury.....	4.46
Alcohol extract (hot 95%) ..	61.54	= Ammoniated mercury..	5.61
Chloroform soluble.....	64.85	Ammonia, boric acid.....	present
Chloroform insoluble.....	16.07	Phenols, salicylates, alkaloids,	
Zinc oxide.....	9.65	starch.....	none

The above analysis may be summarized as follows: water and volatile matter 19.08, chloroform, soluble (petrolatum or paraffin base) 64.85, zinc oxide 9.65, ammoniated mercury 5.61, and boric acid (by difference) 0.81 per cent.

This is another of the familiar "prescriptions" of the Health and Beauty Columns, in which familiar ingredients are combined under a fancy name. Any preparation containing such a dangerous poison as ammoniated mercury should be used with the greatest caution.

OTHINE.

3685. *Othine—Double Strength*, for the Removal of Freckles, Othine Laboratories, Buffalo, N. Y. "Do not let the Cream get near the eyes or open cuts." Price one dollar for 1.4 oz.

Loss @ 100° C.....	15.45	Ammoniated mercury.....	11.52
Ether extract.....	54.92	Bismuth subnitrate.....	7.65
Ether extract saponified....	47.28	Phenols, salicylates, alkaloids..	none
Ether extract unsaponified.	7.64		

This preparation contains 15.5 per cent. water and volatile matter, 7.7 per cent. bismuth subnitrate, 11.5 per cent. ammoniated mercury (white precipitate) with a fatty base. It resembles *Kintho Beauty Cream* very closely in composition, and its use is equally dangerous (see page 301). The manufacturer recognizes this danger by the warning noted above.

PERRY'S MOTH AND FRECKLE LOTION.

3532. *Perry's Moth and Freckle Lotion Compound*, Brent Good & Co., New York City. Price \$2.00 per 5.1 fl. oz. A colorless solution containing considerable white sediment.

Specific gravity @ 22° C..	1.0147	Lead.....	0.132
Alcohol, glycerine.....	none	Phenols, salicylates.....	none
Mercuric chloride.....	1.646		

The preparation is an aqueous solution of 1.65 per cent. of mercuric chloride (corrosive sublimate) with a lead salt equivalent to 0.13 per cent. of lead.

"A specific remedy for those brown spots or discolorations on the face and neck, called chloasma or moth patch and lentigo or freckles."

While we are advised by the bottle label that the lotion "is intended for external application only. It must not be taken internally under any circumstances," and while the bottle bears a "poison" label, we are told in the circular accompanying the bottle that the "lotion is for the safe and speedy eradication of moth patches, freckles and tan." These are certainly contradictory statements. No preparation containing 16.5 parts of corrosive sublimate per 1,000 can be considered a "safe" remedy even for external use. Furthermore, we are told that the lotion is "the only sure cure for them (moth and freckles) known to dermatology," obviously a false statement.

MADAME RUPPERT'S WORLD RENOWNED FACE BLEACH.

3529. *Madame Ruppert's World Renowned Face Bleach*, Madame A. Ruppert Co., New York City. "Alcohol 6 per cent." Wholesale price \$1.34 for 7.7 fl. oz. A solution with considerable sediment, and with the odor of benzoin.

Specific gravity @ 22° C..	0.9939	Mercuric chloride.....	0.413
Alcohol by volume.....	4.60	Benzoin.....	present
Wood alcohol.....	none	Salicylates, phenols.....	none

This is an alcoholic solution of 0.41 per cent. of mercuric chloride (corrosive sublimate), with a small amount of benzoin.

This solution, containing four parts of corrosive sublimate per 1,000, is falsely labeled "harmless." "Positively removes all skin blemishes, harmless and sure." The same objections apply to its use as already noted in our discussion of similar preparations. (See *Kingsbery's Freckle Lotion*, page 300.)

SARTOIN.

3530. *Sartoin*, Globe Pharmaceutical Co., Chicago. Price 50 cents for 3.2 oz. (claimed weight four oz.)

Magnesium oxide.....	17.95	Boric acid.....	0.99
Sulphuric anhydride.....	34.29	Color, cochineal or cudbear	

It consists, therefore, of about 99 per cent. of partially dehydrated Epsom salts, $MgSO_4 \cdot 6H_2O$, and 1 per cent. of boric acid, colored with cochineal or cudbear.

This preparation for the skin and complexion was sold as "Sar-

toin Skin Food" with most extravagant claims, until the interference of the U. S. Government caused a change of name and a modification of its claims. The sample analyzed was 0.8 oz., or 20 per cent., short weight.

SAXOLITE.

3450. *Pure Powdered Saxolite*, Dearborn Supply Co., Chicago. Price 40 cents for 1.0 oz.

Magnesium oxide.....	6.30	Aluminum oxide.....	6.80
Sulphuric anhydride.....	33.64	Potassium oxide.....	6.27

The preparation is approximately a mixture of 63.14 per cent. of potash-alum, $Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$, and 36.86 per cent. of Epsom salts, $MgSO_4 \cdot 7H_2O$. This is another beauty prescription for the removal of wrinkles, etc.

"My wrinkles I got rid of by an equally simple method. By dissolving an ounce of powdered saxolite in a half-pint of witch hazel and bathing my face in the solution, every line completely disappeared. First the finer lines, finally the deep crow's feet, vanished entirely."—*Mona Morrow in Town Tatler*.

SAXON SALVE.

3478. *Saxon Salve*, for Skin Affections, Chester Kent & Co., Boston. Price 50 cents for 2.25 oz.

Loss @ 100° C.....	8.00	Zinc oxide.....	12.16
Ether extract.....	*83.47	Sulphur, free.....	10.38
Ether extract, saponified....	54.58	Phenol, resorcin, oil of winter-	
Ether extract, unsaponified*	28.89	green.....	present
Chloroform, insoluble.....	15.39	Salicylic acid, starch.....	none

This preparation contains 8.00 per cent. water and volatile matter (phenol, oil of wintergreen), 12.16 per cent. zinc oxide, 10.38 per cent. free sulphur, resorcin and a fatty base. The claims made for it are more guarded than usual. The claim that "there is from two to four times as much in the package as in other eczema remedies sold at the same price," however, is not true.

SPURMAX.

3209. *Spurmax*, for making Face Lotion, H. S. Peterson & Co., Chicago. Price 50 cents for 3.63 oz.

* Not corrected for free sulphur.

Magnesium oxide.....	16.63	Color, erythrosin
Sulphuric anhydride.....	32.48	Odor, rose geranium

The preparation is ordinary Epsom salts, $MgSO_4 \cdot 7H_2O$, colored with erythrosin and scented with oil of rose geranium. This is one of the "Beauty Column" prescriptions, in which the user pays 50 cents for Epsom salts worth about one cent.

"Miss. H. O.—Your skin trouble sounds as if it were caused by your use of ordinary face powders. They give an artificial look—especially if one is inclined to be sallow or pimpled. The very thing for you is spurmax—the best liquid lotion I know about. It is economical because you mix it yourself at home. Get four oz. spurmax (at any drug store) and mix it with one-half pint hot water, add two teaspoonfuls glycerine, apply it to face, neck and arms. The effect will surprise you with its beauty and naturalness. It will cling as if a part of your skin, and last during an entire evening. It will not only disguise cold sores, blemishes, etc., but in time it will relieve them entirely."—*The Home Beauty Parlor*, by *Betty Dean*.

ZINTONE.

3689. *Zintone*, for Softening and Whitening the Skin, Cooper Pharmacal Co., Chicago. Price 50 cents for 0.9 oz. A grayish white powder perfumed with vanillin.

Loss @ 100° C.....	5.65	Alcohol soluble (hot 95%)..	96.30
Boric acid.....	14.88	Heavy metals.....	none

The material consists of about 23 per cent. crystallized borax and 77 per cent. stearic acid and soap. The name *Zintone* suggests the presence of zinc, which we find to be absent.

SOOTHING SYRUPS.

KOPP'S BABY'S FRIEND.

3527. *Kopp's Baby's Friend*, The Kopp's Baby's Friend Co., York, Pa. "Alcohol 8.5 per cent., $\frac{1}{8}$ gr. morphine sulphate per fl. oz., besides other medicinal ingredients." Price 25 cents per 1.3 fl. oz.

Specific gravity @ 15.5° C.....	1.1444
Alcohol by volume.....	8.70
Morphine or morphine derivative.....	0.068 gr. per fl. oz.
Bromides.....	none

A partial analysis of this remedy shows 8.70 per cent. alcohol and about one-sixteenth of a grain per fl. oz. of morphine or a

morphine derivative. An analysis made by the American Medical Association in 1905 showed about one-third of a grain of morphine sulphate per fl. oz. *Nostrums and Quackery*, p. 431, reports the death of eight children from using this remedy. The same authority refers to experiments of Dr. Siegelstein of Cleveland, who gave 30 drops of the preparation to a three-days-old puppy and the same amount to a two-weeks-old kitten, both animals being "put to sleep forever." In spite of these facts this medicine is claimed to be "The King of Baby Soothers," and the prescribed dose for a child two months old is from 20-25 drops, only a little less than the dosage of Dr. Siegelstein which killed a puppy and a kitten.

NYAL'S SOOTHING SYRUP.

3392. *Nyal's Soothing Syrup*, New York and London Drug Co., New York City. "Each fluid ounce represents: sodium bromide 16 grs., fennel seed syrup and lupulin syrup, q. s." "Contains no opiates." Price 25 cents per 2.0 fl. oz.

The material contained 11.2 grs. sodium bromide per fl. oz.; lupulin was present; no opiates.

This soothing syrup is free from the objection of opiates being present. While sodium bromide has a less depressant action than the potassium salt, bromides are not a desirable ingredient in children's medicines, especially in unskilled hands.

MRS. WINSLOW'S SOOTHING SYRUP.

3213. *Mrs. Winslow's Soothing Syrup*, Anglo-American Drug Co., New York City. "Contains neither opium or morphine or their derivatives. Purely vegetable, not narcotic." "Contains five per cent. alcohol, oil of aniseed, caraway, coriander, jalap 1-1500th, senna, sugar syrup." Price 25 cents per 1.7 fl. oz.

Specific gravity @ 15.5° C. 1.2440	Essential oils present
Alcohol by volume 5.42	Morphine none
Senna present	Bromides none

This soothing syrup used to contain 1-10th gr. morphine sulphate per fl. oz.; a later English analysis reported two per cent. potassium bromide and no opiates; our analysis is entirely different from either of these, and yet in spite of these changes in the formula we are told by the manufacturer—

"For over seventy years we have put up and sold throughout the world this well-known household remedy—the prescription of one of the most experienced and skillful nurses in New England."

STOMACH AND BOWEL REMEDIES.

BEECHAM'S PILLS.

3221. *Beecham's Pills*, Thomas Beecham, St. Helens, Eng. and New York. Price 10 cents for 12 pills, weighing 1.41 gms., or 21.8 grs. White pills (interior black) with the taste and odor of aloes.

Loss @ 100° C. 4.25	Reducing sugars, as dextrose 2.04
Ash 36.40	Starch 12.38
Ash insoluble in HCl 29.60	Aloes present
Alcohol extract 41.90	Ginger ?
Petroleum ether extract 4.45	

The British Medical Association analyzed these pills and found the approximate composition per pill to be aloes 0.5 gr., powdered ginger 0.55 gr. and powdered soap 0.18 gr. We find 36.4 per cent. ash, of which 29.6 is a talc-like mineral, and 59.35 per cent. organic matter, of which 2.04 is sugar, 12.38 starch, and the remainder aloes, soap and possibly ginger.

"Beecham's Pills will cure bilious and nervous disorders, indigestion, want of appetite, fullness after meals, vomiting, sickness at the stomach, torpid liver, sick headache, cold chills, flushings of heat, lowness of spirits, etc." The pills are also recommended for headache, insomnia, scurvy and scorbutic affections, skin diseases, ulcers, kidney and urinary disorders, rheumatism, constipation and "for females of all ages Beecham's Pills are specially suitable."

The medical ingredients of this remedy, which has been on the market for many years and which is claimed to be efficacious for such a wide range of diseases, appear to be simply aloes, ginger and soap. We are told that the pills "are made entirely from medicinal herbs," in spite of the fact that they contain nearly 30 per cent. of acid-insoluble mineral matter.

CARDIOL.

3693. *Compound Essence Cardiol Concentrated*, The Prescription Products Co., Dayton, O. "17 per cent. alcohol." Price

39 cents for 0.97 fl. oz. A dark-brown liquid flavored with oil of wintergreen.

Specific gravity @ 15.5° C.	1.0378	Glycerine.....	none
Alcohol by volume.....	18.70	Reducing sugars, as dextrose.	3.00
Wood alcohol.....	none	Other organic extractives....	9.38
Solids, non-volatile.....	14.19	Senna, cascara.....	present
Ash.....	1.81		

This preparation appears to be nothing more than a flavored, slightly sweetened fluidextract of senna and cascara sagrada.

DR. EDWARDS' OLIVE TABLETS.

3467. *Dr. Edwards' Olive Tablets*, a Substitute for Calomel, The Olive Tablet Co., Columbus, O. "Contains only vegetable drugs." Price 25 cents for 45 tablets, weighing 8.075 gms., or 124.6 grs. Green pills (interior blackish-brown) with the taste and odor of aloes and ginger.

Loss @ 100° C.....	3.40	Reducing sugars, as dextrose	27.28
Ash, (chiefly calcium carbonate).....	28.00	Starch.....	1.32
Petroleum ether extract....	1.90	Other organic matter (chiefly aloes and ginger).....	38.10

The active ingredients of these tablets are aloes and ginger. If any olive oil is present it must be so in an amount less than two per cent. an altogether negligible quantity when the dosage is considered.

"Every one knows that calomel is one of the best laxatives—we mean the best to produce bowel action. But calomel is injurious—its after-effects are not only unpleasant, but in many cases dangerous. Doctors have sought for years to discover a substitute. It remained for Dr. Edwards to develop this compound. For fifteen years while practicing he sought the desired combination for the sole benefit of his patients. He developed it to perfection and found it too good to confine to a few. So it is now placed within the reach of all."

Aloes, the active ingredient of these tablets, has been known for centuries as an active cathartic.

ENO'S FRUIT SALT-DERIVATIVE COMPOUND.

3454. *Eno's Fruit Salt-Derivative Compound*, J. C. Eno, Ltd., London, Eng., J. Bailey and Son, Baltimore, Md. "Containing about 48 per cent. of Fruit Derivative together with about 52

per cent. of Alkaline Salt for Producing Effervescence." Price 90 cents for 9.1 oz. A white powder with a slightly acid taste.

Carbon dioxide.....	24.20	Tartaric acid.....	48.67
Sodium oxide.....	22.27		

These data indicate that it is made up of about 46.24 per cent. sodium bicarbonate, 30.26 per cent. sodium bitartrate and 23.60 per cent. tartaric acid. The preparation is therefore quite similar to ordinary Seidlitz powder, sodium bitartrate being substituted for the Rochelle salt.

It is true that tartaric acid in a sense may be considered a fruit derivative, as it is made from tartar, or argol, a substance deposited on the inside of wine casks during the fermentation. It is difficult, however, to appreciate wherein the tartrate present in this compound becomes a "natural means for regulating the action of the liver." Few direct statements are made concerning the *Fruit Salt*, but indirectly it is recommended as a cure or preventive of fevers, biliousness, constipation, sick headache, measles, skin eruptions, diarrhoea, seasickness, impure or impoverished blood, colds, influenza and consumption. Surely a long list of ailments to be cured or prevented by Seidlitz powders, known for many years as a useful and pleasant aperient.

FRUITOLA.

3477. *Fruitola*, Pinus Medical Co., Los Angeles, Cal. "System Cleanser. Recommended for Gall Stones and Stomach Trouble." Price one dollar. It consists of 4.7 oz. of an oil, and two powders weighing one oz. and 0.23 oz., respectively.

The liquid is olive oil flavored with anise, with a specific gravity @ 15.5° C. of 0.9176, and refractive index of 1.4710 at the same temperature.

The powder in the blue paper contained sodium oxide 17.11, potassium oxide 12.09, tartaric acid 39.45 per cent., with considerable carbon dioxide. These were equivalent to 74.22 per cent. Rochelle salt and 25.78 per cent. sodium bicarbonate. The powder in the white paper proved to be simply tartaric acid. The proportions of Rochelle salt, sodium bicarbonate and tartaric acid were almost identical with those required for Seidlitz powders by the Pharmacopoeia.

The manufacturer claims that "it is purely vegetable." The oil is certainly vegetable, but the powders contain 17 per cent.

potash, 12 per cent. soda and considerable carbon dioxide, certainly not vegetable compounds. The medicine is especially recommended for "gall stones;" "it has been successfully used in hundreds of cases of Stomach Trouble and Gall Stones." Of nine testimonials published in the booklet accompanying *Fruitola* its efficacy for the removal of gall stones is affirmed in all. The following extracts are taken from these testimonials:

"After taking the first bottle of *Fruitola*, I passed fully a teacupful of gall-stones, the second brought fully as many, and the third more than either of the other two." "Took fourteen or fifteen bottles. I passed more gall stones than you could hold in your hat." "The following morning I passed 268 gall stones, some as large as hickory nuts." "I was relieved of at least a pint of gall stones in twenty-four hours." "More than a hundred gall stones were removed."

It is well-known that giving a patient large doses of olive oil, especially when followed by a dose of salts, will result in the passing of soapy concretions. These greenish lumps of various sizes are mistaken by the uninformed for "gall stones," and the victim "feels he is getting his money's worth in proportion to the number of these 'stones' that are passed." Analysis of such "gall-stones" in the laboratory of the American Medical Association has shown them to be principally mixtures of fatty acids and soaps produced by the action of the alkaline intestinal fluids on the large amount of oil taken.

When the American Medical Association analyzed *Fruitola* in 1910, the sample for which one dollar was charged consisted of 8 oz. of oil and six powders. Our sample selling at the same price contained 4.7 oz. of oil and only two powders; in other words the amount supplied was diminished by more than half.

MAYR'S WONDERFUL STOMACH REMEDY.

3533. *Mayr's Wonderful Stomach Remedy*, Geo. H. Mayr, Chicago. Price one dollar. It consists of 5 oz. of an oil and two powders weighing 0.64 and 0.45 oz., respectively.

The liquid was olive oil colored a reddish brown, with a specific gravity @ 15.5° C. of 0.9156, and refractive index of 1.4713 at the same temperature.

Powder No. 1, weighing 0.64 oz., was light yellow in color with the taste of licorice; it contained 16.08 per cent. magnesium oxide and 31.83 per cent. sulphuric anhydride, equivalent to 98.2 per cent. Epsom salts, $MgSO_4 \cdot 7H_2O$, and 1.8 per cent. licorice powder.

Powder No. 2, weighing 0.45 oz., of a white color, contained 34.46 per cent. sodium oxide, 39.54 per cent. phosphoric anhydride, and lost on ignition 25.80 per cent. This appears to be partially dehydrated sodium pyrophosphate, $Na_4P_2O_7 \cdot 10H_2O$. 74.13 per cent of the anhydrous salt with 25.87 per cent. water would show an analysis very close to the above.

While all published analyses of this remedy with which we are familiar agree as to the identity of the oil, the powders differ very materially in composition, showing that the "wonderful remedy" is made according to the whim of the compounder according to what drugs happen to be on hand. The analysis of the American Medical Association reported in *Nostrums and Quackery*, page 443, showed one powder to consist of Rochelle salt with six per cent. of compound licorice powder, the other of the same salt with four per cent. powdered licorice root. The North Dakota department reported in Special Bull. ii, No. 16, June, 1913, page 269, that powder No. 1 contained 85.74 per cent. of sodium sulphate and 14.26 per cent. of sodium hydrogen phosphate, while No. 2 was entirely commercial sodium acid phosphate. The Michigan department in *Fakes and Frauds*, page 4, reports No. 1 as being effervescent Epsom salts and No. 2 as Rochelle salt. Thus we have reported four entirely different analyses of the powders.

This remedy is very similar in nature and effect to *Fruitola*, and the criticisms of that remedy apply to this (see page 311). The following are some of the claims made for it in its literature (italics ours):—

"For Stomach Troubles, Indigestion, Gas on the Stomach and Intestines, Dizziness and Fainting Spells, Colic Attacks, Torpid Liver, Constipation, etc. The above ailments are mainly caused by the clogging of the intestinal tract with mucoid and catarrhal accretions allowing of the poisonous fluids into the stomach and otherwise deranging the digestive system. *This remedy painlessly removes these accretions without surgical operation * * * ** allays inflammation in the intestinal tract and assists in rendering the same antiseptic."

"I was preparing to submit to the operation (for gall stones) when my attention was called to a remedy that the *most eminent physicians of France* were employing with successful results, and after satisfying myself regarding the merits of the remedy, *I sent for* and obtained a supply for myself."

"In the spring of 1909, I had labels and cartons printed, and the sale of the remedy, the main ingredients of which *I obtain in France*, has been

growing and extending so rapidly that I am now employing a large number of people constantly in the bottling and preparing it for the market."

"I am not a professional 'Patent Medicine Man' as this is the first and only remedy that I have ever put up and offered to the public outside of my drug stores, *but in self-defense I had to put this remedy on the market.* * * * * I would not think of offering any remedy unless that remedy had the most unusual and exceptional merit, and in these days of quackery and many patent nostrums the discerning public must undoubtedly welcome this meritorious gift to stomach sufferers."

"This medicine is not the powerful drug that a great many people believe it must be to obtain such results. The contents of the bottle is composed of nothing but strictly pure nature's ingredients and would not harm a child or the weakest stomach."

As in the case of *Fruitola* the "gall-stones" passed after use of *Mayr's Wonderful Stomach Remedy* are mainly soap.

MUNYON'S PAW-PAW PILLS COMPOUND.

3480. *Munyon's Paw-Paw Pills Compound*, Munyon Remedy Co., Philadelphia, Pa. Price 20 cents for 57 pills, weighing 3.907 gm., or 60.3 grs.

The pills contained 6.02 per cent. water, 13.24 ash and 80.74 organic matter. The ash was insoluble in water, and considerable was also insoluble in hydrochloric acid; no carbonates present.

The diastatic action of the pills was slight, 0.5 gm. of the powdered pills digesting 1cc. of one per cent. starch solution to the red-violet stage after six hours at 50°C.

The proteolytic action was very faint, if present at all. The surface of the gelatin showed some unevenness and was less firm than a corresponding blank trial; this surface was not appreciably lowered after 48 hours at room temperature.

From the above data it is evident that not more than a trace of the ferments of the paw-paw can be present in these pills, certainly not enough to warrant the use of the word "paw-paw" in connection with them.

PAPE'S DIAPEPSIN COMPOUND.

3422. *Pape's Diapepsin Compound*, The Pape, Thompson and Pape Co., Cincinnati, O. "Pure aseptic pepsin, papain, diastase, prec. calcium carbonate, cascara sagrada, powdered ginger, powdered cardamon, sugar q.s., oil Canada snake root." Price 45 cents for 46 tablets weighing 63.977 gms., or 2.26 oz.

The tablets, "triangles," contained 1.55 per cent. water, 38.51 ash and 59.94 organic matter. The ash was insoluble in water, partly soluble in dilute hydrochloric acid with much effervescence; considerable was acid-insoluble.

The diastatic action was not strong, 0.5 gm. of the powdered tablets having only partially digested 1 cc. of one per cent. starch solution after six hours at 50°C.

The proteolytic action of the tablets, as compared with an equal weight of straight powdered pepsin, was almost negligible. The gelatin surface was uneven and less firm than in blank trials with 0.1 per cent. hydrochloric acid alone and might have been due to some slight peptonizing action. The tests were continued through 48 hours at room temperature with toluol as an antiseptic.

It is evident that the great digestive powers claimed for these tablets do not exist, and it is unnecessary to repeat here the long list of digestive troubles for which they are recommended.

MI-O-NA.

3468. *Mi-o-na*, Booth's Hyomei Co., Buffalo, N. Y. Price 50 cents for 47 yellow uncoated tablets of a sweet, bitter taste, and weighing 12.77 gms., or 197 grs.

Loss @ 100° C.	5.04	Magnesium oxide.....	0.41
Ash.....	35.00	Water-soluble.....	38.44
Reducing sugar, as dextrose	25.36	Alcohol-soluble.....	26.62
Bismuth oxide.....	11.80	Strychnine, gallic acid.....	present
Calcium carbonate.....	23.69	Na, K.....	present

The tablets consist essentially of bismuth subgallate, calcium carbonate, extract of nux vomica and sugar. Practically no claims are made for this remedy either on the label or in the booklet accompanying the medicine. According to the manufacturer our sample represents old stock, the new formula being materially different from that shown above.

DILAXIN PILLS.

3522a. *Dilaxin Pills*, The Marmola Co., Detroit, Mich. Four pills, enclosed as a sample with *Marmola*, and weighing 1.04 gms., or 16 grs. They contained phenolphthalein in large amount and possibly cascara. They are supposed to be used in connection with *Marmola*, although that remedy itself contains phenolphthalein, and cascara is claimed as one its ingredients.

PARA-LAX.

3573. *Para-Lax*, The Kellogg Food Co., Battle Creek, Mich.
Price one dollar for 16 oz.

Water.....	34.3	Oil.....	60.8
Solids.....	65.7	Acacia and flavor.....	present
Ash.....	0.25		

The oil obtained by the Roese-Gottlieb method was colorless, odorless and tasteless. Its specific gravity was about 0.865, its refractive index @ 20° C. was 1.47209, and it was insoluble in hot acetic anhydride. These properties are characteristic of liquid paraffin (Russian mineral oil). The material used to effect the emulsion appeared to be acacia; no saccharin was found. The preparation appears to be, therefore, a flavored emulsion of about 61 per cent. of liquid paraffin with acacia. It is claimed to be "an efficient and harmless remedy for constipation, colitis and intestinal auto-intoxication", claims which are quite in accord with modern medical practice.

REMEDIES FOR TENDER AND TIRED FEET.

CALOCIDE COMPOUND.

3451. *Calocide Compound*, Remedy for Foot Ailments, Medical Formula Co., Chicago. Price 25 cents for 4.23 oz.

Boric acid.....	46.13	Loss @ 100° C.....	8.93
Aluminum oxide.....	8.30	Tannin, sodium.....	present
Chlorine.....	13.60	Potash.....	trace
Sulphuric anhydride.....	23.91		

The above data indicate its composition to be about 22.44 per cent. sodium chloride (common salt), 37.58 per cent borax, 39.35 per cent. sodium aluminum sulphate, $Al_2(SO_4)_3 \cdot Na_2SO_4$, (soda alum) and a small amount of tannin.

TONICS.

GREENE'S NERVURA.

1120. *Dr. Greene's Nervura Blood and Nerve Remedy*, Drs. F. A. and J. A. Greene, New York City. Warranted Pure Vegetable. Contains no poisonous minerals or injurious drugs. Alcohol

18 per cent." Price one dollar for 10.6 fl. oz. A dark brown liquid with considerable sediment.

Specific gravity @ 15.5° C.	1.0081	Ash.....	0.75
Alcohol by volume.....	17.27	Alkaloids	faint trace
Wood alcohol.....	none	Chlorides, sulphates, lime,	
Solids.....	6.69	magnesia.....	present
Sucrose.....	4.43	Phosphates, iron	traces

It is an alcoholic solution containing 1.51 per cent. of vegetable extractives, 4.43 per cent. of cane sugar and 0.75 per cent. of mineral matter. This small amount of vegetable matter is recommended with great assurance as a remedy for

"Nervousness, Nervous Debility, Weakness, Poor Blood, Kidney and Liver Complaints, Rheumatism, Neuralgia, Female Weakness, Malaria, Chills and Fever, Exhausted Nervous Vitality, Nervous Prostration, Sleeplessness, Despondency, Mental Depression, Hysteria, Paralysis, Numbness, Trembling, Pains in the side and back, Apoplexy, Epileptic Fits, St. Vitus Dance, Palpitation, Nervous and Sick Headache, Dyspepsia, Indigestion, Loss of Appetite, Constipation and all Affections of the Nervous System."

In extenuation of the use of such a large amount of alcohol we read:—

"This amount is necessary to extract and hold in solution the medicinal virtues of the herbs, roots, leaves and barks from which Dr. Greene's Nervura is made. Pure grain alcohol is used. It is not only perfectly harmless when compounded as above, but is very beneficial, as it adds a mild strengthening tonic effect, which is permanently maintained by the curative properties of the remedy. If alcohol is objectionable on principle, please expose each dose in a glass or saucer for a few moments before taking, and the few drops contained therein will evaporate."

The prescribed adult dose of the medicine, three teaspoonfuls, or 12 cc., would contain 2 cc. of absolute alcohol, and by exposure to the air "for a few moments" only an inappreciable amount of this alcohol would be lost. To those to whom alcohol "is objectionable on principle" Dr. Greene's advice might be phrased as follows: "Do not drink your wine from the bottle, but, after letting it stand a few moments, from your glass; in this way the alcohol will 'evaporate' ". As a matter of fact this remedy contains much more alcohol than most of the common natural wines.

KARDENE.

3483. *Kardene*, for making Blood Tonic, H. S. Peterson and Co., Chicago. Price 43 cents for 1.64 oz. A brownish powder with a bitter-sweet, acid taste.

Sucrose.....	82.42	Iron oxide (Fe ₂ O ₃).....	1.30
Reducing sugar.....	2.60	Ammonia (NH ₃).....	0.27
Ash.....	1.27	Tartaric acid, total.....	6.60
Quinine sulphate.....	1.94	Tartaric acid, free.....	5.70

From these data *Kardene* appears to be made up about as follows:—

Cane sugar.....	82.42	Tartaric acid.....	5.70
Reducing sugar.....	2.60	Iron and ammonium tar-	
Quinine sulphate.....	1.94	trate, by difference.....	7.34

REXALL EVERY DAY TONIC.

1119. *Rexall Every Day Tonic*, United Drug Co., Boston. "Containing 15 per cent. of alcohol." "A medicinal constitutional tonic against loss of appetite, repugnance to eating, and for the general 'toning up' of the various bodily functions." Price 50 cents for 11.5 fl. oz. A clear brownish-red liquid.

Specific gravity @ 15.5° C.	1.0849	Ash.....	1.18
Alcohol by volume.....	9.75	Iron oxide (Fe ₂ O ₃).....	0.22
Wood alcohol.....	none	Quinine, saccharin, phos-	
Solids.....	24.22	phates.....	present
Glycerine.....	present	Chlorides, sulphates, lime....	traces
Sucrose.....	14.35	Color, fluorescent dye similar	
Reducing sugar, as dextrose	1.05	to phloxin.....	

This preparation contains 9.75 per cent. of alcohol (15 per cent. claimed), with 24.22 per cent. of solids, of which 15.40 per cent. is sugars, 1.18 per cent. ash and 7.64 per cent. glycerine and vegetable extractives. Iron, quinine and saccharin are present, as well as a fluorescent dye giving reactions similar to phloxin. The manufacturer advises us that at the present time the preparation does not contain alcohol, phosphorus or saccharin.

TONA VITA.

3405. *Tona Vita (Tonique Royale)*, The Approved Formula Co., Dayton, O. "Alcohol 20 per cent." "For Tired People, Old

Folks, Invalids and Convalescents. Especially intended for use in cases of debility, malnutrition, impoverished blood, indigestion, nerve exhaustion and as a general stomachic". Price \$1.25 for 23.7 fl. oz. A rather thick brown liquid with the taste and odor of celery.

Specific gravity @ 15.5° C.	1.0356	Ash.....	0.67
Alcohol by volume.....	20.68	Nitrogen.....	0.151
Wood alcohol.....	none	Iron.....	trace
Solids.....	14.51	Celery.....	present
Reducing sugars as dextrose	10.78		

In the pamphlet accompanying the sample we read:

"A tonic was introduced in leading European cities to help build up the countless numbers of run-down, nervous, debilitated people, produced by the strain of modern methods of living. In the chief cities of Europe thousands have renewed their vitality through the use of this tonic * * * * The preparation, itself, is a vegetable compound. It is pleasant to take and contains no minerals or harmful ingredients."

It is difficult to see wherein this preparation differs materially from ordinary *Beef, Wine and Iron*, a much-vaunted preparation of exceedingly small value. The average composition of 92 samples of the latter material analyzed in this laboratory in 1908 showed alcohol 18.39, solids 14.55, ash 0.80, iron 0.114 and nitrogen 0.121 per cent, an analysis singularly like our present one of *Tona Vita*. Whatever virtue this material possesses probably lies in the alcohol it contains.

VINOL.

WATERBURY'S COMPOUND, PLAIN.

4515. *Vinol*, mfgd. for Chester Kent & Co., Boston. "18% alcohol." "The Modern Tonic Reconstructor containing the medicinal extractives of Fresh Cod Livers with Peptonate of Iron." Price one dollar for 15.9 fl. oz.

4521. *Waterbury's Compound, Plain*, Waterbury Chemical Co., Des Moines, Ia. "Alcohol 11%." "Made from cod liver oil, digestive ferments, malt extract unfermented, hypophosphites comp. special, extr. cherry, eucalyptus, aromatics, etc." Price 75 cents for 15.8 fl. oz.

	Vinol	Waterbury's
Specific gravity @ 15.5° C.....	L.0111	1.0499
Alcohol by volume.....	18.69	11.25
Wood alcohol.....	none	none
Total extract, gms. per 100 cc.....	8.72	16.78
Ash, gms. per 100 cc.....	.885	.673
Iron oxide, gms. per 100 cc.....	.240	trace
Sodium oxide, gms. per 100 cc.....	.194	.115
Potassium oxide, gms. per 100 cc.....	.141	.045
Calcium oxide, gms. per 100 cc.....	trace	.014
Phosphoric acid, gms. per 100 cc.....	.090	.092
Nitrogen, gms. per 100 cc.....	.350	.178
Reducing sugars, as dextrose, gms. per 100 cc.....	3.32	9.72
Glycerine, gms. per 100 cc.....	.323	.812
Chloroform-ether extract, acid, gms. per 100 cc.....	.187	.713
Chloroform-ether extract, alkaline, gms. per 100 cc.....	.010	.006
Fatty acids, gms. per 100 cc.....	.016	.032
Salicylic acid, gms. per 100 cc.....	.095	.546
Alkaloids.....	none	none
Acidity per 100 cc. = $\frac{N}{10}$ NaOH.....	55.0	28.5
Polarization @ 23.5° C., direct.....	-2.1°	+3.7°
Polarization @ 23.5° C., invert.....	-2.2°	+3.85°

These two preparations are types of the so-called cod liver oil wines or cordials, which are claimed to contain the medicinal properties of cod liver oil without the oil. No oil is present in either sample, although traces of fatty acids are found in each, which give the Pettenkoffer test for biliary products. That .016 or .032 per cent. of these fatty acids could have any appreciable effect as reconstructives is entirely beyond credence. In fact, actual feeding experiments, made in this laboratory* show very conclusively that *Vinol* and the *Waterbury* preparation at best barely more than sustained normal weight in white rats, whereas ordinary cod liver oil fed under similar conditions resulted in a marked and rapid growth.

It is evident, therefore, that the emphasis placed on the supposed virtues extracted from the cod liver oil is quite unwarranted and that, if they do have any value as tonics and reconstructives, it is due in the case of *Vinol* to the alcohol and peptonate of iron, and

in the case of *Waterbury's Compound* to the alcohol and malt extract.

Vinol is claimed to be "a tonic, body-builder and strength-creator." That the alcohol and iron it contains may have a tonic effect is readily admitted, but there is nothing in its composition which suggests value as "a body-builder and strength-creator".

The following extract explains what an alleged boon *Vinol* is to suffering humanity:

"Up to about 15 years ago, if you needed cod liver oil you could have your choice between the plain, raw oil, and one of the numerous greasy, sticky, white emulsions. If the latter were not quite so hard to take, you had to take twice as much to get the same dose of oil; so that there was little choice after all. But the two great French chemists changed all that. They studied cod liver oil for 20 years and finally proved that it was not a simple oil, but that it dissolved certain ingredients from the cod's liver, and these ingredients are the valuable medicinal and strengthening elements. Let's make this very clear. *It is not the grease, but the medicinal elements which the oil has dissolved out of the livers, that make cod liver oil valuable as a medicine.* * * * * The result is VINOL. It represents the only real advance in the use of cod liver oil for at least 30 years. And this is largely because there is no oil in it, to disgust the palate and offend the stomach."

In opposition to the above claims we may refer to the experiments of Osborne and Mendel with albino rats (*Jour. Biol. Chem.*, 17, 1914, p. 402), who report:

"We have likewise obtained uniform success by substituting cod liver oil for a portion of the lard in our standard diets. * * * * Not only was growth resumed in most cases at a very rapid rate but all evidence of malnutrition, especially the affection of the eyes, promptly disappeared."

The value of cod liver oil itself as a nutrient in comparison with certain other oils such as lard and almond oils being established, it is interesting to note the results of feeding experiments in which such preparations as *Vinol* have been compared with straight cod liver oil. The following are some of the data of our own experiments, already referred to. Young albino rats were fed a standard ration for several months, when an equivalent amount of dealcoholized *Vinol* was substituted for a part of the lard in the ration, the *Vinol* later being substituted by an equivalent amount of cod liver oil. The rats were weighed twice each week with the following results:

* Jour. Amer. Med. Asso., 64, 638-643.

	Rat 17 gms.	Rat 18 gms.	Rat 30 gms.
<i>Vinol</i> period.....	136.1	152.4	170.5
	140.0	151.7	167.8
	141.5	155.9	168.3
	140.8	157.3	164.6
	140.3	159.0	.....
	.....	159.5	.....
	.....	156.7	.....
	.....	157.2	.....
<i>Cod liver oil</i> period.....	154.3	160.9	179.2
	158.8	172.6	188.8
	161.6	175.6	189.8
	163.7	174.6	198.8
	167.3	175.9	200.5

In other words rat 17 with *Vinol* in 16 days gained 4.2 gms; with cod liver oil in 25 days it gained 27.0 gms. Rat 18 with *Vinol* in 18 days gained 4.8 gms.; with cod liver oil in 17 days it gained 18.7 gms. Rat 30 with *Vinol* in 11 days lost 5.9 gms.; with cod liver oil in 17 days it gained 35.9 gms. These experiments seem to indicate that as a "body-builder" *Vinol* is far inferior to ordinary cod liver oil, which it would supplant.

Waterbury's Compound was formerly sold under the name "Waterbury's Metabolized Cod Liver Oil Compound". *Notice of Judgment No. 303* of the U. S. Government declared that when sold under this name the product was misbranded, and the present indefinite name for the preparation was adopted. The label, however, still claims that the compound is made from cod liver oil. We are told that it is

"The blood building tonic, builds tissue rapidly, stimulates impaired digestive and assimilative functions, thereby aids in the utilization of ordinary food material." "The ideal nutrient tonic. No odor of cod liver oil. No taste of cod liver oil. Test this product for its red blood building properties." "Aids digestion, allays fermentation, assists assimilation, but does not disturb the stomach." "Has broadened the field of usefulness of cod liver oil many times as it is now applicable to many conditions for reasons of its palatability and enzymotic efficiency."

In view of these sweeping claims our experiments in feeding this preparation to albino rats in comparison with ordinary cod liver oil are interesting. The experiments were conducted in a similar way to those already referred to in connection with *Vinol*, the details of which are published elsewhere. The weekly weighings of the rats were as follows:

	Rat 22 gms.	Rat 23 gms.	Rat 25 gms.
<i>Waterbury</i> period.....	143.3	136.2	144.2
	131.1	129.3	129.9
	133.5	134.2	134.9
	140.6	140.0	135.4
	146.5	145.2	130.8
	147.5	145.3	.....
<i>Cod liver oil</i> period.....	155.7	155.0	158.9
	160.3	159.9	174.4
	155.4	159.9	175.8
	158.6	160.0	.....
	158.6	161.6	.....
	162.6	164.0	.....
	158.3	165.9	.....
	163.5	172.1	.....

In other words rat 22 with *Waterbury* in 30 days gained 4.2 gms. while with cod liver oil in 60 days it gained 16.0 gms. Rat 23 with *Waterbury* in 30 days gained 9.1 gms.; while with cod liver oil in 56 days it gained 26.8 gms. Rat 25 with *Waterbury* in 14 days lost 13.4 gms.; while with cod liver oil in 18 days it gained 45.0 gms. The last rat was particularly interesting as it was apparently wasting away on the *Waterbury* ration at the rate of over 6 gms. a week, but when cod liver oil was substituted gained at the rate of about 18 gms. a week. Even the presence of malt extract apparently was not sufficient to counteract the lack of nutriment in the *Waterbury* preparation.

The experiments with both *Vinol* and the *Waterbury Compound* show very conclusively that these cod liver oil wines do not possess the nutrient qualities of cod liver oil, and any one using them as a nutrient in place of cod liver oil is certain to be grievously disappointed in the results. The alcohol and iron, or the alcohol and malt extract, may show some tonic effects, but when strength is needed and actual nutriment is desired some other means is necessary than the use of these cod liver oil wines.

WORM SYRUPS (VERMIFUGES).

Twelve of these preparations were analyzed. In general, these consisted of a flavored alcohol extract of santonin together with a cathartic drug (generally cascara or senna), santonin being found in all but two of the syrups. In one instance worm seed (chenopodium) was claimed and in two pinkroot (spigelia) to-

gether with santonin. There is no question of the efficacy of santonin, spigelia and chenopodium in the destruction or expulsion of intestinal worms. However their use, especially in the case of santonin, is by no means unattended with danger. Commenting on the danger from the use of santonin, the U. S. Dispensatory, p. 1087, says:

"In regard to the fatal minimum dose, two grains are said to have killed a feeble child five years old, and one six or seven years old is said to have suffered death from six grains after development of haematuria; four grains produced very serious symptoms in a child four years old."

In addition to the above the writer knows of a two-year old child in New Haven who came close to death after being given a certain worm syrup in the amount directed by the manufacturer. The official prescribed dosage for a two-years old child is from 0.016 to 0.032 gm., or from 0.25 to 0.50 gr. It will be noticed from the table given below that in the ten preparations containing santonin, the amount of this drug contained in one teaspoonful, the quantity prescribed in every case but one, ranges from 0.010 to 0.034 gm., or from 0.15 to 0.52 gr. These amounts, with one exception, are well within the U. S. D. limits, yet the directions generally recommend three daily doses, and in one case the medicine is to be taken every two hours. It is evident that such frequent dosage might easily be dangerous, yet we find three of the preparations labeled "safe and effective," or "harmless in effects."

Nine samples contained alcohol, ranging from 4.2 to 19.1 per cent. The latter sample claimed no alcohol and was clearly misbranded under the law.

Below will be found copies of the labels of the syrups. The samples were tested only for santonin, alcohol and emodin-containing drugs, the results being given in Table X.

3464. *Adee-co Worm Syrup*, prep. for The Alderman Drug Co., Hartford. "Comp. fluid extract of wormseed; contains six per cent. alcohol." Price 25 cents for 2.53 fl. oz.

3463. *Dike's Worm Syrup*, Dike Drug Co., New York (Dist.) "Santonin, sodium bicarbonate, cascara tasteless, aromatics." Price 25 cents for 2.03 fl. oz.

3388. *Dr. Hand's Worm Elixir*, Hand Medicine Co., Philadelphia, Pa. "Alcohol seven per cent." "Contains no stupefying narcotic drugs." Price 25 cents for 1.37 fl. oz.

3411. *Dr. Hobson's Laxative Santonine Worm Syrup*, Pfeiffer Chemical Co., Philadelphia, Pa. "Alcohol 13 per cent." "Safe and effective." Price 25 cents for 1.77 fl. oz.

3421. *Manhattan Worm Syrup*, Manhattan Drug Co., New York. "Alcohol five per cent." "Harmless in effects." Price 25 cents for 1.93 fl. oz.

3401. *Worm Syrup*, prep. for J. A. Notkin, New Haven. "Fl. extr. senna 48, fl. extr. spigelia 50, santonine 5, syrup 300, dil. alcohol 30, oil anise 3 parts." Price 25 cents for 1.77 fl. oz.

3465. *Nyal's Worm Syrup*, New York and London Drug Co., New York. Price 25 cents for 2.20 fl. oz.

3481. *Penstar Worm Syrup*, Peninsular Chemical Co., Detroit, Mich. "Alcohol two per cent." "Each fl. oz. contains pinkroot 36 grs., senna 22, santonin 1." Price 25 cents for 1.80 fl. oz.

3453. *Rexall Worm Syrup*, United Drug Co., Boston. Price 25 cents for 1.90 fl. oz.

3207. *Dr. True's Elixir, Family Laxative and Worm Expeller*, Dr. J. F. True & Co., Auburn, Me. and Knowlton, Que. "Eight per cent. alcohol." "Harmless and effectual." Price 50 cents for 4.67 fl. oz.

3398. *Vegetable Worm Syrup*, E. Wadewitz, New Haven. Price 25 cents for 1.80 fl. oz.

3396. *Whitman Worm Syrup*, prep. for Whitman Chemical Co., Boston. "Alcohol five per cent." Price 25 cents for 1.70 fl. oz.

TABLE X:—ANALYSES OF WORM SYRUPS.

Brand.	Alcohol. Claimed. Found. Per cent.	Santonin. gms. per 100 cc.	Santonin in Prescribed Dose, gms.	Emodin.	Flavor.
Adee-Co.....	6 7.0	0	0	Yes	Wintergreen
Dike's.....	0 0.0	0.564	0.023	Faint	Anise
Hand's.....	7 10.2	0.482	0.010	Yes	Peppermint
Hobson's....	13 9.1	0.269	0.011	Probably	Anise
Manhattan...	5 10.9	0	0	Yes	Anise
Notkin's....	3 4.7	0.862	0.034	Yes	Anise
Nyal's.....	0 0.0	0.597	0.024	?	Anise
Penstar.....	2 4.2	0.249	0.010	Yes	Anise
Rexall.....	0 0.0	0.346	0.014	Faint	Anise
True's.....	8 8.5	0.235	0.009	Yes	?
Wadewitz...	0 19.1	0.727	0.029	Yes	Anise
Whitman....	5 4.4	0.461	0.018	Yes	Anise

MISCELLANEOUS REMEDIES.

CHI-CHES-TERS DIAMOND BRAND PILLS.

3427. *Chi-Ches-ters Diamond Brand Pills*, Chichester Chemical Co., Philadelphia, Pa. Price two dollars for 20 pills, weighing 7.71 grams. White pills with black interior, with the odor and taste of aloes.

Loss @ 100° C.....	6.75	Reducing sugars, as dextrose.	6.60
Ash.....	28.20	Sucrose.....	17.60
Calcium oxide.....	11.40	Alkaloids.....	none
Carbon dioxide.....	9.00	Aloes, glycyrrhiza, jalap....	present
= Calcium carbonate...	20.48	Ergot, tansy.....	?
Iron oxide.....	4.00	Pennyroyal, savin, podo-	
= Iron sulphate.....	7.60	phyllum.....	none
Sulphuric anhydride.....	3.98		

The active ingredients in these pills are aloes and iron sulphate with small amounts of licorice and jalap, and possibly traces of ergot and tansy. The calcium carbonate and sugar, which make up nearly half the weight of the pills, are in the coating.

Formerly these were sold as "*Chichester's English Pennyroyal Pills*," but as no pennyroyal could be found in them the Food and Drugs Act necessitated a change of name to avoid the charge of misbranding. They are a peculiarly vicious preparation because of their reputed abortion-producing properties. There are no restrictions whatever as to their sale; they are shamelessly advertised in our newspapers and equally shamelessly sold by certain of our druggists, who cannot be ignorant of their nature and purpose. As a matter of fact they are simply the well-known aloes and iron sulphate pills, slightly modified.

"Since it is well-known there is no drug or combination of drugs which taken by the mouth, will with certainty produce abortion, it is not probable, to judge from the constituents found in these pills, that they would produce the result desired by the purchaser. Nevertheless, the use of this nostrum is pernicious and in the interest of public health and public morals its sale, and the sale of similar nostrums, should be prohibited."

Jour. Amer. Med. Asso., May 27, 1911.

The following statement in the company's booklet at least suggests the purpose for which they are recommended:

"Treatment may be begun at any time, although in some instances

the pills are more effective if taken about the regular time for the menstrual flow. As a rule, however, it is found that more satisfactory results are secured by beginning treatment at once, and continuing it until the pills give relief. In order to assist the efforts of nature to reestablish the menstrual flow at the regular period, the patient should exercise care in regard to diet and general health."

Here follow some excerpts from the company's testimonials, with their thinly-disguised suggestiveness as to the effectiveness of the pills as abortifacients:

"Am happy to say they had the desired effect. I cannot be thankful enough." "They proved successful after taking only 11 pills." "They had the desired effect." "Proved very effective in my case." "Found immediate relief." "Brought speedy relief." "Only took five pills which was all that was necessary."

A sample of pennyroyal and one of tansy, bought by us for experimental purposes, each contained an advertisement of these pills. As pennyroyal has the property of "exciting the menstrual flux" and tansy "has been used to a considerable extent as a domestic abortifacient," the implied purpose of these pills is obvious, in spite of the guarded statements in the company's literature.

HANFORD'S BALSAM OF MYRRH.

3526. *Hanford's Balsam of Myrrh*, G. C. Hanford Mfg. Co., Syracuse, N. Y. "Wood alcohol 80 per cent." Price 25 cents for 1.4 fl. oz. A brown liquid with black sediment and the odor of wood alcohol.

Specific gravity @ 22° C..	0.8586	Solids.....	7.39
Wood alcohol.....	81.31	Myrrh.....	present

The material appears to be essentially a tincture of myrrh and possibly other vegetable drugs in which wood alcohol is used as the solvent. The medicine is recommended at present only for external use on domestic animals.

KOSINE.

3223. *Kosine*, The Kosine Co., Washington, D. C. "A Reliable Remedy for Epilepsy, St. Vitus Dance and all nervous disorders due to a diseased condition of the nervous system." "Con-

tains no alcohol, morphine or any preparation of opium." Price \$1.50 per 16 fl. oz. A dark-brown liquid with a salty taste and neutral reaction.

Specific gravity 15.5° C.....	1.0712
Alcohol.....	none
Solids.....	12.21 gms. per 100cc.
Ash.....	5.87 gms. per 100cc.
Antipyrine.....	0.75 gms. per 100cc.
Bromine.....	6.89 gms. per 100cc.
Nitrogen.....	0.872 gms. per 100cc.
= Ammonia.....	1.12 gms. per 100cc.
Sodium oxide.....	0.616 gms. per 100cc.
Sugars, alkaloids.....	none

The material is an aqueous solution of 0.75 gm. of antipyrin, 6.50 gms. of ammonium bromide and 2.04 gms. of sodium bromide per 100 cc. The analysis shows that the activity of the remedy depends largely on bromides, drugs commonly used in the various epilepsy "cures" on the market. It is well recognized by competent authorities that the bromides are not a "cure" for epilepsy, but simply a palliative or sedative tending to suppress the attacks. There is no drug treatment known that will cure this disease, which is one of the most intractable diseases to treat. Furthermore, the long-continued use of the bromides is not without danger.

"If pushed too far, death may intervene with acute bromide poisoning. This happened in the case of a boy of 12 years, whom I knew, whose parents gave him too frequent doses of a patent nostrum, the essential ingredient of which, as with the bulk of patent epileptic cures, was bromide of potassium. It is a frequent experience to see patients brutalized by bromide, go months without fits, but with a loss of mental and physical activity."—*Dr. W. T. Spralling*, quoted in *Nostrums and Quackery*, page 302.

The amount of drugs in the 16 oz. bottle of *Kosine* would cost at retail about 7.5 cents.

CRYSTOS.

3399. *Crystos*, for making Eye Remedy, H. S. Peterson & Co., Chicago. Price 50 cents for 0.92 oz. A white powder with a salty taste.

Boric acid, total.....	78.61	Chlorine.....	13.95
Boric acid, free.....	70.68	Sodium.....	present

The above analysis indicates a composition of about 23 per cent. sodium chloride, seven per cent. anhydrous borax and 70 per cent. boric acid.

"George L.:—A home-made eye tonic that will prevent your eyes from becoming dull, red or inflamed is easily procurable. Just get from your druggist one ounce of *crystos*, and dissolve it in a pint of water * * * * This tonic keeps the eyes bright and clear, strengthens the sight, and will benefit you if you wear glasses."—*Health and Beauty Advice by Mrs. Mae Martyn.*

NURITO.

3466. *Nurito*, The Magistral Chemical Co., New York City. "A prescription for Rheumatism, Sciatica and Neuritis. Free from Opiates and Narcotics." Price 87 cents for five powders weighing 79.7 grains, or one-sixth of an ounce.

Phenolphthalein.....	6.51	Lactose.....	33.84
Pyramidon.....	59.65	Chloroform-insoluble.....	33.20

Each powder contains about one grain of phenolphthalein, 9.5 grains of pyramidon and 5.5 grains of milk sugar. Pyramidon itself is a proprietary preparation derived from antipyrine and has the latter's antipyretic and anodyne properties. Its toxic effects are not clearly known as yet, although some observers claim that it is more likely to cause collapse than either antipyrine or acetophenetidine, both well-known dangerous remedies.

SARGOL.

3456. *Sargol*, for the thin and emaciated, The Sargol Co., Binghamton, N. Y. Price 85 cents for box of pills. The three boxes purchased contained 41, 36 and 38 pills, weighing 22.96, 18.22 and 18.50 gms., respectively.

The coatings were separated from a number of the pills, six tablets showing 55.6 per cent. mass and 44.4 per cent. coating, while another lot of 25 tablets showed 58.1 per cent. mass and 41.9 per cent. coating.

The coating showed the following composition:—

Sucrose.....	58.00	Lime.....	8.23
Starch.....	7.00	Iron and aluminum silicate.	2.82
Ash.....	17.26	Carbonates.....	present

In other words the coating consisted of sugar, starch, calcium carbonate and a talc-like mineral.

The finely ground tablets were analyzed as well as the separated mass, in part, as follows:

	Tablets.	Dried Mass.
Water.....	2.32	4.44
Sucrose.....	27.21	.....
Starch.....	2.93	.....
Ash.....	38.37	42.00
Ash, insol. in acid.....	4.35	9.59
Calcium oxide.....	8.86	4.98
Hypophosphorous acid.....	8.76	14.52
Magnesium oxide.....	4.70	1.67
Potassium oxide.....	1.92	2.89
Sodium oxide.....	1.63	2.16
Water-soluble.....	55.10	38.91
Alcohol-soluble.....	30.56	23.97
Ether-soluble.....	2.81	3.79
Nitrogen.....	0.26	.....
Chloroform-soluble.....	0.13	.....
Strychnine.....		present
Emodin.....		present
Heavy metals.....		none
Organic acids.....		none

The phosphorus was almost entirely soluble in water; an aqueous solution reduced mercuric chloride and gave no precipitate with ammonium molybdate or magnesia mixture. The phosphorus was not present in organic combination as it was soluble in water and none was extracted by ether. It appears to exist in *Sargol* as *potassium, sodium and calcium hypophosphite*.

The alcohol-soluble portion was likewise partly soluble in water, the latter being precipitated by dilute acid as curdy, greasy flocks, soluble in ether (*soap*). The alcohol-soluble portion was also partly soluble in ether, giving an oily residue which was easily saponified (*fat or vegetable oil*).

Five gms. of the ground tablets gave 0.0066 gm. of residue extracted by chloroform from an acid solution made alkaline with ammonia. This was identified as *strychnine*.

Five gms. of the ground tablets extracted with dilute sulphuric acid and the acid solution extracted with ether gave a residue of 0.0048 gm., which gave reactions for an *emodin-like body*.

The aqueous solution of the pills contained but a trace of chlorides and sulphates; no nitrates, no carbonates, no organic acids (tartaric, oxalic or acetic); calcium, sodium and potassium were present. This solution did not give the biuret reaction for proteins. The source of the small amount of nitrogen present, 0.26 per cent., we were unable to identify, it was not in the form of ammonia, nitrates, or soluble proteins.

No heavy metals were present, special tests for zinc being made with negative results.

The active ingredients identified in the pills were potassium, sodium and calcium hypophosphites, a magnesium salt, strychnine and a vegetable drug or drugs yielding emodin. These were associated in the mass with soap and a fat or vegetable oil. In other words these are simply tonic pills with laxative qualities, and contain nothing, barring of course the sugar and starch of the coatings, which will offer nutriment to the "thin and emaciated".

Furthermore, *Sargol*, according to published analyses, is of most variable composition. An English analysis shows ash 3.75, protein 7.45, alcohol-soluble phosphatides 0.017, and caffeine and theobromin present. (Abstracted in *Chem. Abstr.*, 7, 3188.) Still another English analysis showed sugar 18.0, coagulable albumins 10.8, soluble albumins 4.2, sodium and potassium hypophosphite 7.7, lecithin 1.9, zinc phosphide 0.7, with talc as an excipient. An analysis made by the North Dakota Station is quite dissimilar to either ours or the English analyses.

The following quotations are taken from the company's circular:

"Sargol is offered as this missing link between food eating and fat making, as the cog wheel which your system lacks. Sargol should give you the power to assimilate what you eat. When you do that you will fat up to the proper proportions quickly. * * * * The new treatment for turning food into flesh. Those who have tried Sargol state that it is the most marvelous body builder which science has, so far, produced. * * * * Is not a 'tonic' in the common sense, yet by its use the system is toned. * * * * Is not a stimulant, yet when you take it you soon have a feeling of better condition; weakness gives way to strength, and all the time you are gaining flesh daily, all the time your figure is rounding out. * * * * Sargol should make you assimilate your food properly. Its plan is to make the sugars, the starches, the albuminoids and the fats turn into their proper channels, and not pass fruitlessly away from you as heretofore. * * * * The use of Sargol should increase the amount of the blood and promote what is known as cellular activity."

"Sargol, according to letters received, seems to possess a most remarkable effect in quickly and permanently rounding out the feminine form divine. It does not develop one portion of the figure at the expense of another, but in perfect harmony; the face should fill out to the perfect oval, the neck and bust become firm and plump, the arms round out to graceful proportions, and the limbs take on the curves which alone are signs of beauty."

"Let crazy diet alone; eat what you want, throw the nerve foods out

of the window, wave a last farewell to the health resorts and sanitariums, by restoring to the body that which has been destroyed, the assimilative principle."

In each regular package of *Sargol* there is a coupon entitling the purchaser to a special letter of advice from the manufacturer. We took advantage of this generous offer and sent such a coupon to the Binghamton office, receiving in return a circular (type-written) letter entitled "Special Suggestions regarding Diet and General Health which help to promote gain in weight." The suggestions made are in some respects excellent: Eat plenty of flesh-making foods, as milk, cream, raw eggs, cocoa, chocolate, oat meal, potatoes, beans, bread, cheese, nuts, salads with oil dressing, sugar, etc.; chew the food thoroughly; avoid constipation; drink plenty of water; exercise moderately but regularly; don't worry; get plenty of calm, restful sleep; and all the time take *Sargol* four times a day.

It is apparent that should there be a gain in weight by following such advice, a result most likely to be secured, *Sargol* cannot be responsible for it. The hypophosphites have been believed by some to possess tonic properties, but they are largely discredited at the present time by the most competent authorities. Strychnine of course is a valuable tonic and stimulant, and doubtless whatever value *Sargol* has is mainly dependent upon the strychnine it contains. Although *Sargol* is claimed to be "not a laxative," the emodin-yielding drugs, such as aloes and senna, possess that quality.

FOOD AND DRUG PRODUCTS EXAMINED FOR THE DAIRY AND FOOD COMMISSIONER.

Twelve hundred and fifty-one samples were examined for the Dairy and Food Commissioner. Since the details regarding them in many instances were not supplied to us, only a brief summary of the results is given here. Of the whole number of samples examined 548 were not found to be adulterated, 14 were legally labeled compounds, while 460 were adulterated, misbranded or below standard.

Butter and Butter Substitutes. Of 49 samples examined 6 were butter, 22 renovated butter and 21 oleomargarine.

Cider. Five samples were tested for preservatives with negative results.

Eggs. One hundred and ninety-two samples of storage eggs were examined in connection with the new egg law. Candling and subsequent breaking indicated that the eggs were of widely varying quality. While most of them were acceptable storage eggs, in six cases the eggs were distinctly bad.

Fish Scrap. The sample examined was of excellent quality, but, although sold as a poultry food, it did not bear a statement of the percentages of protein and fat as required by law.

Honey. Two samples were tested for water; one contained 22.0, the other 28.1 per cent, the latter exceeding the Government standard by 3.1 per cent.

Ice Cream. Thirty-seven samples were examined in connection with a study of the butter-fat content of Connecticut ice creams. The samples, taken in twelve towns, ranged from 5.5 to 22 per cent. fat, with an average of 12.2 per cent.; six contained less than 8 per cent., thirteen from 8 to 12, fourteen from 12 to 16 and four over 16 per cent. Previous analyses made in 1911, 1912 and 1913 of sixty-nine samples showed a range from 1 to 18.5 per cent. In spite of this wide range in composition it is apparent that good ice cream may be purchased in Connecticut, although in the absence of a standard a product of almost any quality may be purchased under the name "ice cream."

Jam. The sample of strawberry jam examined contained no chemical preservative.

Milk. Four hundred and four samples were examined. Of these 182 conformed to the legal standards, while 78 were deficient only in solids-not-fat. One hundred and thirty-five were below standard in solids, 55 in fat, and 218 in solids-not-fat, 222 samples failing to meet the legal requirements in one or more particulars. Two samples were skimmed, and 50 were watered.

The skimmed milks were taken in Brookfield and Wethersfield; the watered milks in Newington, Wethersfield, Huntington, Meriden, Bristol, North Branford, Orange, Marlboro, Newtown, Naugatuck, Hamden, Norwich, Danielson, Ansonia, Guilford, Greenwich, Southington, Woodstock, Torrington, Putnam and Brookfield.

Molasses. The four samples examined were not adulterated.

Olive Oil. Two samples were examined; one was not adulterated, while the other contained cotton seed oil.

Salt. The sample examined contained 97.09 per cent. sodium chloride, 1.02 calcium sulphate and 0.69 calcium chloride.

Temperance Drinks. Eighty-nine samples were examined chiefly for the presence of saccharin and artificial color. Of the 89 samples only 31, chiefly ginger ales, were found to contain neither of these adulterants; 25 contained saccharin, 9 saccharin and a permitted coal-tar color, 20 a permitted coal-tar color, 3 an unpermitted coal-tar color (acid magenta), and 1 benzoic acid and a permitted coal-tar color. Fifty-one samples, in connection with this same examination, were analyzed in 1913. The following summary, which accurately reflects the bottled temperance drink business in this state, gives our findings for the whole 140 samples:

47 no saccharin or coal-tar color.	26 permitted coal-tar color.
44 saccharin.	5 unpermitted coal-tar color.
15 saccharin and permitted coal-tar color.	1 benzoic acid and permitted coal-tar color.
2 saccharin and unpermitted coal-tar color.	

In other words 61, or 44 per cent., of the samples contained saccharin.

Vinegar. Two hundred and ninety-four samples of vinegar were tested for acidity, solids and ash. Of these, 151 met the legal requirements for acidity and solids for cider vinegar; 42 distilled, 2 malt, 1 sugar and 16 compound vinegars were sold under the proper designation. Twelve samples of distilled vinegar were sold as cider vinegar, 3 distilled as cider, 15 compound vinegars as cider, and 2 compound as malt vinegar. Seventeen cider vinegars were below standard in acidity, 17 in solids, and 5 in both acidity and solids; 6 compound vinegars, 4 distilled and 1 wine were low in acidity.

Whiskey. Five samples of whiskey and one of kummel and rum were tested for alcohol. They contained 44.94, 37.34, 36.30, 45.33, 49.42 and 40.79 per cent. by volume. None of the samples contained wood alcohol or chloral hydrate.

Bay Rum. One sample contained 49.64 per cent. ethyl alcohol, the other, 26.32 per cent., the latter showing a great deficiency.

Tincture of Aconite. Forty samples were analyzed; they contained from 0.013 to 0.051 gm. aconitine per 100 cc, 28 samples being below the U.S.P. standard of 0.045 gm. Two samples bore no "poison" label.

Tincture of Belladonna. Forty samples were analyzed; they contained from 0.0040 to 0.0471 gm. belladonna alkaloids per 100 cc; 23 samples being below the U.S.P. standard of 0.030 gm. Five samples bore no "poison" label.

Tincture of Nux Vomica. Forty samples were analyzed; they contained from 0.082 to 0.105 gm. strychnine per 100 cc; only two were notably deficient, these containing 0.082 and 0.084 gm. instead of the 0.10 gm. required by the U.S.P. Three samples bore no "poison" label.

Tincture of Opium (Laudanum). Forty samples were analyzed, 36 of which ranged from 1.116 to 1.321 gms. of crystallizable morphine per 100 cc., reasonably close to the U. S. P. standard, 1.2 to 1.25 gm. One sample was excessively strong, containing 1.44 gms., while three were weak, containing 1.094, 1.080 and 1.008, respectively. One sample bore no "poison" label.

Turpentine. The two samples examined were adulterated with mineral oil.

MISCELLANEOUS MATERIALS SENT BY PRIVATE INDIVIDUALS.

Milk. Of the 47 samples tested 32 were of standard quality. Six samples were watered, 4 were skimmed, and 5 were below standard in one or more particulars.

Cream. Forty samples were analyzed; these ranged from 15.0 to 53.5 per cent. fat, all but one meeting the legal standard of 16 per cent. However, 15 samples sold as 40 per cent cream, ranged from 28.5 to 40.8 per cent, only 4 containing the guaranteed amount.

Skim Milk. The sample contained 90.3 per cent. water, 1.1 fat, 3.3 protein, 0.7 ash and 4.6 lactose.

Human Milk. The sample contained 12.7 solids and 4.8 per cent. fat.

Dried Skimmed Milk. The sample contained 4.4 water, 1.4 fat, 32.9 protein, 8.1 ash and 53.2 lactose.

Milk Albumen. The sample contained 4.7 water, 4.3 fat, 56.5 protein, 22.0 ash and 12.5 lactose.

Butter. The single sample examined was not adulterated.

Vinegar. Of the 94 samples examined 48 satisfied the legal

standards for acidity and solids. Twenty samples were low in acidity, 20 in solids and 3 in both acidity and solids; three samples contained excessive ash; one sample contained 12.71 per cent. solids.

Berries. A sample suspected of containing poison from spraying contained no arsenic.

Casein. A sample of No. 60 Casein of the Casein Mfg. Co., New York, contained 81.79 per cent. casein.

Cheese. A sample suspected of having poisoned certain users of it contained no preservative or metallic poison. An assistant in the laboratory consumed a considerable quantity with no ill effects.

Cider. One sample contained 4.15 per cent. alcohol by volume and 0.08 per cent. salicylic acid; the other sample contained 3.16 per cent. alcohol.

Color. A sample of color used in making ice cream cones proved to be Naphthol Yellow S, a coal-tar color, one of the permitted dyes.

Grape Juice. A sample of Haines' Grape Juice had a specific gravity @ 15.6° C. of 1.0811 and contained 0.45 per cent. alcohol by volume, 24.91 per cent. invert sugar and 0.011 per cent. sulphurous acid.

Ice Cream. The eleven samples, all from New Britain, contained from 4.0 to 21.0 per cent. of fat, three containing less than 8 per cent. and five over 15 per cent.

Infant Food. A sample of *Mamma-la*, an imported food, contained 5.15 water, 5.50 ash, 25.58 protein, 10.95 fat and 52.82 per cent. nitrogen-free extract; no starch present.

Jelly. A sample suspected of having caused sickness contained no chemical preservative.

Nuts. A sample of whole pecan nuts was found to be coated with an ochre-like substance or a "rouge", the color being due chiefly to oxide of iron mixed with an unidentified organic vehicle.

Olive Oil. One sample was not adulterated; the other, *Umberto Albertini Brand*, Meyer and Lang, New York, consisted largely of cotton seed oil.

Salt. The sample contained 49.96 per cent. chlorine, equivalent to 82.43 per cent. sodium chloride and 14.95 per cent. calcium sulphate (plaster).

Sanatogen. The sample contained 82.17 per cent. casein.

Sugar. The sample contained 99.8 per cent. sucrose and no insoluble mater.

Water. A sample of water suspected of having poisoned several people was tested for lead with negative results.

Whiskey. A sample of *Antiquary* Scotch whiskey contained 45.82 per cent. ethyl alcohol by volumes; a sample of so-called "Polish" whiskey contained 39.70 per cent. ethyl alcohol by volume.

Arsenate of Lead. One sample contained 31.57 arsenious oxide, 0.43 of which was water-soluble (24 hours), and 63.35 per cent. lead oxide. Another sample showed only 0.25 per cent. water-soluble arsenious oxide after ten days.

Cocaine, Heroin, Morphine and Opium. Thirty samples of these drugs were analyzed in connection with the police crusade against their sale in New Haven. Four samples contained cocaine, sixteen heroin, seven morphine and three gum or powdered opium. Four other samples sent in in connection with the above proved to be milk sugar, talcum powder, or *Sal Hepatica*.

Drug. A powder sent in by the user consisted largely of sodium salicylate with an unidentified bitter principle (not strychnine or quinine); no alkaloids present.

Poisoning Cases. A sample of a well-known proprietary cod liver oil preparation contained 3.03 per cent. of corrosive sublimate, which had been introduced with criminal intent.

Another sample, tea, contained 2.29 grs. of potassium cyanide. The contents of fifteen bottles, seized at the house of the suspect, were analyzed in part. Among other miscellaneous materials identified were fusel oil, hydrochloric acid, oxalic acid, chloride of gold, oil of cloves, sodium carbonate, fixing powder, developer, sodium bicarbonate, and laxative pills, all but the latter probably having been used for photographic purposes.

Miscellaneous. The sediment found in cream bottles picked up on a city dump contained 27 per cent. of ash, consisting chiefly of lime. A suspected fatty residue from milk was found to be butter fat. The stomachs of two cows, suspected of having been poisoned, were tested for arsenic with negative results. A piece of meat, supposed to be poisoned bait, contained no arsenic or strychnine. A sample of suspected cracked corn contained no arsenic. A sample of wood suspected of having been injured by arsenical spraying, was received; 2 gms. of the wood taken from

the middle of the shoot showed a very slight trace of arsenic; the deposit found on the wood contained 9.53 per cent. arsenious oxide and 32.88 per cent. lead oxide.

TABLE XI:—SUMMARY OF RESULTS OF EXAMINATION OF FOOD AND DRUG PRODUCTS, 1914.

	Not found adulterated.	Adulterated or below standard.	Compound.	Total number examined.
<i>Sampled by Station</i>				
Biscuits and Crackers.....	..	..	..	88
Bran Biscuits and Laxative Preparations.....	..	..	..	12
Condensed Soups.....	2	..	..	2
Diabetic Foods.....	..	..	..	72
Wheat Bran.....	5	..	..	5
Bay Rum.....	19	24	..	43
Belladonna Plasters.....	5	2	..	7
Blackberry Brandy and Cordial.....	5	5	..	10
Malt Extract.....	..	21	2	23
Proprietary Medicines.....	..	..	..	130
Total.....	36	52	2	392
<i>Sampled by Dairy Commissioner</i>				
Butter.....	6	43	..	49
Cider.....	5	..	..	5
Eggs.....	..	..	..	192
Fish Scrap.....	..	1	..	1
Honey.....	1	1	..	2
Ice Cream.....	..	..	..	37
Jam.....	1	..	..	1
Milk.....	182	*222	..	404
Molasses.....	4	..	..	4
Olive Oil.....	1	1	..	2
Salt.....	1	1	..	1
Temperance Drinks.....	27	48	14	89
Vinegar.....	196	82	16	294
Whiskey.....	2	4	..	6
Bay Rum.....	1	1	..	2
Tincture Aconite.....	12	28	..	40
Tincture Belladonna.....	17	23	..	40
Tincture Nux Vomica.....	38	2	..	40
Tincture Opium.....	38	2	..	40
Turpentine.....	..	2	..	2
Total.....	532	461	30	1251
<i>Sampled by Private Individuals</i>				
Total from all sources.....	129	112	..	275
	697	625	32	1918

*Including 78 below standard in solids-not-fat only.

III. SPECIAL INVESTIGATIONS.

During the past year the chemical laboratory has undertaken a number of special investigations, all of which are completed. The results of these experiments will be published elsewhere. The following were the projects undertaken:

1. The Carbohydrates and Enzymes of the Soy Bean. (in press in *Jour. Ind. and Eng. Chem.*)
2. The Feeding Value of Sanatogen compared with Commercial Casein with respect to Maintenance and Growth (published in *Jour. Amer. Med. Asso., Nov. 21, 1914, pp. 1831-35.*)
3. The Comparative Nutritive Value of Cod Liver Oil Cordials and Cod Liver Oil. (The cordials tested were Hagee's, Vinol, Wampole's and Waterbury's Compound). (Published in *Jour. Amer. Med. Asso., Feby. 20, 1915, pp. 638-643.*)
4. The Differentiation of Vegetable Drugs yielding Emodin and Chrysophanic Acid. (*Amer. Jour. Pharmacy, 87, 145.*)
5. Methods for determining Phenolphthalein in Medicinal Preparations.
6. Co-operation with the Association of Official Agricultural Chemists in studying methods for determining (a) morphine, (b) the availability of organic nitrogen in fertilizers, and (c) caffeine and antipyrin in admixture.
7. The chief chemist as a member of the Standards Committee of the A. O. A. C. prepared definitions and standards for gluten flour, gluten bread, diabetic foods, asafetida, colocynth, beef wine and iron, and saccharin preparations. Studies on the composition of bread and the moisture content of dried fruits are also under way.

THE EFFECT OF FOOD INSPECTION IN CONNECTICUT.

A REVIEW OF NINETEEN ANNUAL INSPECTIONS.

The first general pure food law in Connecticut went into effect on August 1, 1895. Inspections were made by the Station under this law until January 1, 1908, when the present law, closely resembling the Federal Food and Drugs Act, became operative. Under the first law the Station made frequent inspections of the different classes of foods, and any adulteration or form of illegal sale was reported to the Dairy and Food Commissioner. At times second samples were taken by that official as a basis for prosecution. The Station has, therefore, not only made all the necessary chemical and microscopical analyses for the Dairy and Food Commissioner, but has also conducted many independent inspections. The latter because of their frequency and the way in which they were made, give useful evidence as to the relative purity of the various classes of foods at the time of the different inspections. In these inspections no effort was made to select samples suspected of adulteration, but rather to take from 50 to 100 or more samples from all grades of stores in different parts of the state, and thus gain an idea as to the relative purity of the food in question throughout the state. On the other hand, the samples taken by the Commissioner, except in the case of vinegar and molasses which were collected under special statutes, were usually taken because they were suspected of adulteration, and data secured from such inspections of course do not reflect accurately the general condition of such foods in the markets of the state. The Station has made no independent inspection of butter, analyzing only the samples taken by the Commissioner, but in regard to most other important classes of food products its records supply sufficient data to give a very close approximation of food conditions in Connecticut, and to show whether or not our food laws have had any material effect in improving the quality of our food.

The word "purity" in the following discussion has been used in its strictest sense. Under the law correct labeling of a food in many cases makes its sale legal whereas otherwise it could justly be condemned as adulterated. A jam or jelly, for instance, in which glucose has been largely substituted for granulated sugar, and in which artificial color and flavor have been used, may be legal in this state if the manufacturer has stated these facts clearly

on the label. It would seem to be equally obvious however, that such a jam or jelly is not a "pure" product, if the popular understanding and the practices of the best manufacturers are to have any weight in forming a judgment.

The present Connecticut law is almost identical with the Federal law. Accordingly, any regulations made by the Washington authorities affect the administration of the law in our own state. Whatever may be the attitude of the state authorities towards the governmental sanction of the use in foods of benzoate of soda and certain specified coal-tar colors, it is futile to attempt prosecutions when these extraneous materials are found, as the precedents and the prestige of the government are almost insuperable barriers against the state. By force of governmental regulation, therefore, the use of benzoate and the seven permitted coal-tar colors is unwillingly recognized in this state. In the following discussion only those food products are classed as "pure" which conform to the standards of the national standards committee and to the best trade practice and the term does not include "compounds." It must be clearly understood, however, that lack of "purity," while generally indicating inferiority, does not necessarily carry with it the idea of harmfulness. A pepper containing pepper shells, a buckwheat flour containing wheat flour, a cocoa containing corn starch, or a coffee containing chicory is certainly no more injurious to health than the pure articles, yet its sale without notice of its compound nature is a fraud, and even with such notice on the label it is removed from the category of "pure" food in the following tabulations.

TABLE I.—FOODS EXAMINED 1896-1914.

No. of Samples.	Food	Purity at Last Inspection.	No. of Samples.	Food	Purity at Last Inspection.
206	Allspice	% 84	318	Carbonated drinks	% 30
14	Almond extract	57	105	Cheese	98
1	Asparagus, canned . . . . .	..	2	" head . . . . .	..
141	Baking powder	83	6	Cherries, Maraschino	0
2	Banana extract	0	49	Chili sauce	50
10	Beans, canned	100	112	Chocolate	88
2	Beets, canned . . . . .	..	17	Cider	71
101	Biscuits and crackers . . . . .	..	206	Cinnamon	100
201	Bread . . . . .	..	173	Cloves	82
64	Breakfast foods	100	166	Cocoa	97
779	Butter and substitutes . . . . .	..	2	Cocoonut, shredded . . . . .	..

No. of Samples.	Food.	Purity at Last Inspection.	No. of Samples.	Food	Purity at Last Inspection.
28	Codfish.....	13	3	Milk powders.....	%
588	Coffee, ground.....	100	33	Mince meat.....	90
3	“hygienic.....	3666	321	Molasses.....	90
15	“substitutes.....	100	43	Mustard.....	93
204	“whole.....	80	50	“prepared.....	94
13	Colors and flavors.....	73	6	Noodles.....	0
305	Confectionery.....	7	3	Nutmeg.....	100
29	Cordials.....	7	591	Nut oil.....	100
62	Corn, canned.....	..	31	Olive oil.....	86
1	“oil.....	..	95	Orange extract.....	60
1	Cotton seed oil.....	90	15	Oysters.....	95
407	Cream.....	93	15	Paprika.....	80
512	Cream of tartar.....	..	1	Peanut butter.....	100
1	Curd.....	..	134	“oil.....	..
5	“Dehydro” foods.....	13	1	Peas, canned.....	87
32	Dessert preparations.....	..	515	Pecan nuts.....	..
336	“Diabetic” foods.....	..	153	Pepper, black.....	88
2	Egg powders.....	..	147	“cayenne.....	95
192	Eggs.....	..	18	“white.....	96
3	Flour, banana.....	66	69	Peppermint extract.....	24
270	“buckwheat.....	..	13	Pickles and relishes.....	43
1	“potato.....	..	39	Pineapple extract.....	0
2	“rye.....	..	23	Preservatives.....	..
31	“wheat.....	..	10	Pumpkin, canned.....	70
3	“Frostlene”.....	..	20	Raspberry extract.....	14
102	Fruits, dried.....	78	62	Rice.....	50
104	Fruit juices.....	36	12	Root beer extract.....	92
23	Gelatin.....	86	2	Sage.....	..
286	Ginger.....	89	11	Salad dressing.....	75
37	“extract.....	22	24	Salt.....	86
23	Hamburg steak.....	50	44	Sardines.....	98
193	Honey.....	96	21	Sauces, table.....	95
1	Horse radish.....	..	420	Sausage.....	40
155	Ice cream.....	..	..	Soda Water. See Car-	..
28	“cones.....	81	..	bonated drinks.....	..
14	“powders.....	..	271	Soda water syrup.....	13
26	Infant foods.....	..	55	Soups, canned.....	100
153	Jams and preserves.....	7	2	Starch, arrowroot.....	..
133	Jelly.....	32	28	“corn.....	100
343	Ketchup.....	7	2	“potato.....	..
1	“Konut.....	..	1	“tapioca.....	..
4	“Korno” preparations..	..	31	Strawberry extract.....	0
1031	Lard.....	90	7	Succotash, canned.....	..
1	“oil.....	..	24	Sugar.....	..
393	Lemon extract.....	31	10	Syrup.....	..
22	Liquors, distilled.....	..	91	Tea.....	100
54	“malt.....	74	42	Tomatoes, canned.....	78
56	Macaroni, vermicelli and spaghetti.....	95	2	Vanilla crystals.....	..
4	Mace.....	390	..	“extract.....	53
10	Maple sugar.....	100	3271	Vinegar.....	63
167	“syrup.....	27	1	Wesson’s cooking oil.....	..
1	Meat, chopped.....	..	5	Wheat bran.....	100
40	“extract.....	28	43	Wine.....	..
5477	Milk.....	37	12	Wintergreen extract.....	50
78	“condensed.....	89	450	Special investigations..	..

The present bulletin summarizes the data secured by the station in its nineteen inspections. Brief reference will also be made to the forms of adulteration observed during that period, and to those forms which still persist.

From 1896 to the present time the annual appropriation granted to the Station by the state for food investigation has been \$2,500.

Table I shows the total number of foods, 26,012 samples, examined in this laboratory from 1896 to 1914 inclusive, and the percentage purity shown at the last inspection of each food, of which sufficient samples were taken on which to base a fair judgment. Reference to the tables which follow will show the comparative purity of the various individual classes of foods from inspection to inspection.

TABLE II.—DAIRY PRODUCTS.

	No. of Samples	Percentage Purity.																
		'96	'97	'98	'00	'01	'02	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14
Butter....	779	..	90	59	25	47	66	..	62	24	57	39	40	18	35	45	15	12
Cheese....	105	*100	..	..	..	*67	..	..	..	..	..	..	..	..	..	..	..	..
Cream....	407	..	..	*88	73	93	80	94	96	92	94	55	..	73	*92	..	69	70
Condensed Milk....	78	..	..	..	..	..	..	86	..	38	..	..	89	..	..	..	..	..
Milk.....	5477	*78	*94	..	*72	*90	*89	*92	*61	*55	70	80	75	72	*37	20	39	47

* Only suspected samples examined, except in the years marked with an asterisk.

Butter being inspected under a special law by the Commissioner, the Station has never made a general inspection of the product. The percentages given in the table, therefore, refer only to suspected samples and give no indication of the actual purity of butter as generally sold. The first inspection of cheese was for foreign fats only, none being found; the inspection of 1902 was for preservatives only in fancy cheeses; an examination of 86 samples of cheddar cheese made during the present year, and not included in the table, showed no filled cheese and only two samples deficient in fat. Cream has been inspected but twice by the Station, both inspections showing a high degree of purity. The last inspection of condensed milk shows a high purity; the inspection

of 1906, being limited to a relatively small number of samples, is hardly comparable with those of 1904 and 1909. The last inspection of market milk made in 1911 shows Connecticut milk still to be in a very unsatisfactory condition; watering, skimming and milk of sub-standard quality are all too prevalent; chemical preservatives, however, are found only in very rare instances at the present time.

TABLE III.—BAKING MATERIALS, FLOUR AND NOODLES.

	No. of Samples	Percentage Purity.						
		'96	'00	'01	'04	'05	'06	'07
Baking Powder.....	141	..	89	..	83	..	..	..
Cream of Tartar.....	512	70	69	79	79	90	92	93
Buckwheat Flour.....	270	..	55	..	57	..	..	66
Noodles.....	50	..	..	14	0	..	..	..

Baking powder shows no material change in purity; the purity of cream of tartar has increased from 70 to 93 per cent.; that of buckwheat flour from 55 to 66 per cent. At the last inspection of 22 brands of noodles none was found to be genuine egg noodles.

TABLE IV.—SAUCES AND RELISHES.

	No. of Samples	Percentage Purity.								
		'97	'01	'02	'04	'05	'07	'09	'10	'11
Chili Sauce.....	49	..	11	..	0	..	0	..	..	50
Ketchup.....	343	15	18	..	0	..	4	..	7	..
Pickles and Relishes..	90	..	..	5	..	..	..	43	..	69
Prepared Mustard....	43	..	..	..	27	0	..	..	..	..

Chili sauce, pickles and relishes show a marked improvement. Ketchup in 1910 was no purer than it was in 1897, but it was as a rule much more honestly labeled, except as to the amount of benzoate of soda present, which was commonly understated. The last inspection of prepared mustard in 1905 showed all the brands to contain cereal starch, salicylic acid, turmeric or coal-tar colors, the turmeric possibly being a permissible ingredient.

TABLE V.—CHOCOLATE, COCOA AND COFFEE.

	No. of Samples	Percentage Purity.													
		'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'09	'11
Chocolate....	112	..	..	..	..	..	..	..	73	..	..	..	70	..	88
Cocoa.....	166	..	..	..	..	..	..	58	..	..	..	..	90	..	97
Coffee, ground	588	9	13	32	80	80	84	91	70	54	52	74	82	100	..
“ whole.	204	75	92	84	98	..	..	..	100	..	..	..	..	..	..

Chocolate shows a steady improvement and cocoa a very great increase in purity; the claims for cocoa as regards strength and nutritive value are still very commonly grossly exaggerated. Ground coffee shows the greatest improvement in purity of any of the food products examined, increasing from nine per cent. in 1896 to 100 per cent. in 1909. The last examination of whole coffee made in 1903 showed no adulteration, while in 1896 75 per cent. was impure.

TABLE VI.—CARBONATED DRINKS, FRUIT JUICES AND SODA WATER SYRUPS.

	No. of Samples	Percentage Purity					
		'99	'02	'09	'11	'13	'14
Carbonated Drinks (Soft Drinks)....	318	63	41	..	..	31	30
Fruit Juices.....	104	71	24	67	36	..	..
Soda Water Syrups.....	271	42	33	..	13	..	..

Carbonated and other bottled temperance drinks, fruit juices and soda water syrups show no improvement in purity compared with 1899. They are, perhaps, more honestly labeled than at that time, but they are still grossly adulterated, glucose, chemical preservatives, synthetic flavors, coal-tar colors and saccharin being frequently present.

TABLE VII.—HONEY, JAM, JELLY, MAPLE SYRUP AND MOLASSES.

	No. of Samples	Percentage Purity.														
		'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'12
Honey....	193	22	..	73	..	..	..	..	..	..	..	92	..	..	..	96
Jams and Preserves.	153	..	..	8	..	..	..	..	..	..	..	..	7	..	..	..
Jellies....	133	..	..	29	..	..	..	..	..	..	..	..	32	..	..	..
Maple Syrup....	167	*79	..	..	..	..	..	..	..	..	8	39	..	27	..	..
†Molasses.	3666	..	68	84	79	85	87	83	96	98	93	99	98	99	100	93

* Misleading, as very imperfect methods of examination were used in 1896.
 † Not examined for sulphurous acid.

Honey shows a great improvement, from 22 to 96 per cent. purity. Molasses likewise shows an increased purity from 68 to 93 per cent., although it must be remembered that usually it has been tested only for glucose, no examination for sulphurous acid having been made. The first examination of maple syrup is misleading as the methods of analysis used in 1896 were very incomplete and unsatisfactory. Modern methods were used in 1906, 1907 and 1909, and a slight improvement was noted in the last year compared with 1906. The purity of jams, preserves and jellies shows little improvement over 1898, but as pointed out elsewhere these products at the present time are as a rule legally labeled, aside from the amount of preservative present.

TABLE VIII.—FLAVORING EXTRACTS.

	No. of Samples.	Percentage Purity.						
		'01	'05	'06	'07	'08	'09	'10
Lemon.....	393	20	41	40	52	40	31	..
Orange.....	31	33	..	..	..	..	..	60
Vanilla.....	390	30	29	31	51	50	53	..
Miscellaneous.....	137	5	..	..	..	..	..	24

The condition of flavoring extracts continues to be very unsatisfactory. As a rule they are legally labeled, but the percentage of pure extracts of full standard strength is still very low.

TABLE IX.—SPICES.

Kind.	No. of Samples.	Percentage Purity.									
		'96	'97	'98	'01	'02	'04	'05	'06	'07	'08
Allspice.....	206	..	54	81	63	97	71	..	98	84	..
Cinnamon.....	206	..	76	92	79	93	90	..	..	100	..
Cloves.....	173	..	54	65	76	86	78	..	..	82	..
Ginger.....	286	..	..	74	84	..	..	100	..	88	89
Mustard.....	321	22	..	69	55	..	..	88	84	94	..
Pepper, black.....	515	59	67	86	59	55	55	78	78	88	..
cayenne.....	153	..	60	100	85	89	65	..	59	..	..
white.....	147	71	80	92	76	96	47	75	87	96	..

The spices sold in Connecticut are as a rule of a very high degree of purity. The average purity has increased from 65 per cent. in 1897 to 90 per cent. in 1907. The increase in purity of mustard from 22 to 94 per cent. is very striking.

TABLE X.—MISCELLANEOUS FOODS.

	No. of Samples.	Percentage Purity.																	
		'96	'97	'98	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14
Codfish.....	28	..	0	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..
Gelatin.....	23	..	..	..	..	..	..	..	..	..	..	..	63	..	..	..	86	..
Lard.....	1031	54	..	..	87	..	65	50	..	55	66	77	..	90	..	..	..	..
*Mince																			
Meat.....	33	..	100	100	..	..	..	..	..	..	..	..	..	90	..	..	..	..
Olive Oil....	591	..	68	..	60	..	..	..	..	65	75	86	..	100	86	..	..	..
*Oysters....	95	..	80	..	..	..	..	..	..	..	95	..	..	..	..	..	..	..
Sausage....	483	..	36	26	..	..	..	..	..	..	52	..	..	50	..	..	40	..
Vinegar....	3271	..	61	63	71	80	85	82	81	..	50	77	62	75	77	48	..	67	63

* Examined for preservatives only.

Lard shows an increase in purity from 54 to 90 per cent., very little adulterated lard being sold in the state at present. Olive oil also has increased in purity from 68 per cent. in 1897 to 100 per cent. in 1906; the slight decrease noted in 1910 was due to the fact that the inspection of that year was limited to drug stores from which the oil was not purchased in original packages, such samples always showing a higher degree of adulteration. Sausage

offers an interesting example of how food conditions in the state have changed. The low percentage of purity in 1897 was due to the very general use of boric acid as a preservative; in 1912 only a slight increase in purity was shown, but boric acid was found in no sample and sulphurous acid in only a few, the adulterant generally being either cereal or potato starch; in other words a harmful chemical preservative had been supplanted by harmless, though commercially objectionable, starches. An examination just completed confirms the continued absence of boric acid in sausage, and shows that the use of sulphurous acid and cereal starches is constantly lessening. Vinegar has shown scarcely any improvement in quality during a period of 18 years.

SUMMARY.

The above data are summarized for the most extensively inspected foods in the following tables. Table XI includes the simpler foods and Table XII those of a more or less compound nature. In the foods of the first group the average purity has increased from 59 to 90 per cent.; in the compound foods the increase has been only from 27 to 34 per cent., but as already pointed out the great majority of these compound foods are so labeled that the intelligent consumer by reading the label may know the quality of the food offered to him.

TABLE XI.—AVERAGE PURITY OF SIMPLE FOODS.

	Inspection.			Inspection.	
	First.	Last.		First.	Last.
Cream.....	88	92	Allspice	54	84
Cream of tartar	70	93	Cinnamon.....	76	100
Buckwheat flour	55	66	Cloves	54	82
Chocolate	73	88	Ginger.....	74	89
Cocoa.....	58	97	Mustard	22	94
Coffee, ground	9	100	Pepper, black.....	59	88
“ whole.....	75	100	“ cayenne	60	95
Honey.....	22	96	“ white	71	96
Molasses.....	68	93	Vinegar	61	63
Lard.....	54	90			
Olive Oil.....	68	86	Average	59	90

TABLE XII.—AVERAGE PURITY OF COMPOUND FOODS.

	Inspection.			Inspection.	
	First.	Last.		First.	Last.
Chile sauce	11	50	Maple syrup	8	27
Ketchup	15	7	Lemon extract	20	31
Pickles and relishes .	5	69	Orange extract.....	33	60
Carbonated drinks...	63	30	Vanilla extract.....	30	53
Fruit juices	71	36	Miscellaneous extract	5	24
Soda water syrups...	42	13	Sausage.....	36	40
Jams and preserves..	8	7			
Jellies.....	29	32	Average	27	34

FORMS OF FOOD ADULTERATION OBSERVED IN CONNECTICUT, 1896-1914.

Allspice. Clove stems, cocoanut shells, peas and wheat.

Baking Powder. Gypsum, talc and tremolite.

Beer. Salicylic acid.

Buckwheat Flour. Corn starch, oat flour, sand and wheat flour.

Butter. Oleomargarine and renovated butter sold as genuine butter.

Cheese. Boric acid, deficiency in fat, excessive water.

Chocolate. Cane sugar, cocoanut oil, corn starch, potato starch, saccharin and wheat starch.

Cider. Benzoic acid, saccharin and salicylic acid.

Cinnamon. Buckwheat hulls, cocoanut shells, corn starch, cotton seed meal, ginger, mustard hulls, red sandalwood, sand and wheat.

Cloves. Allspice, clove stems, cocoanut shells, nut shells, peas, sand and wheat.

Cocoa. Arrowroot starch, cane sugar, cocoa shells, corn starch, sand and wheat starch.

Codfish. Boric acid.

Coffee. Chicory, imitation coffee, peas and wheat.

Confectionery. Charcoal, coal-tar colors, gelatin and starch.

Cordials. Coal-tar colors and glucose.

Corn Oil. Cotton seed oil.

Cream. Boric acid, formaldehyde, succrate of lime and water.

Cream of Tartar. Alum, corn starch and gypsum.

Flavoring Extracts. In *almond extract*, hydrocyanic acid and nitrobenzol; in *lemon extract*, coal-tar colors, glycerin, synthetic flavors, turmeric, wood alcohol and deficiency in oil; in *orange extract*, coal-tar colors, synthetic flavors, turmeric and deficiency in oil; in *vanilla extract*, acetanilid, caramel, coumarin, glucose, glycerin and synthetic vanillin and coumarin; in *ginger extract*, capsicum, caramel, glycerin, molasses and deficiency in resins and alcohol; in *miscellaneous extracts*, coal-tar colors and synthetic flavors.

Fruit Juices and Syrups. Alcohol, benzoic acid, coal-tar colors, glucose, salicylic acid, saccharin, sulphurous acid (lime juice) and synthetic flavors.

- Fruits, Dried.* Glucose (figs), sand (currants) and sulphurous acid.
- Ginger.* Buckwheat hulls, cayenne, charcoal, cocoanut shells, coffee hulls, corn starch, gypsum, mustard hulls, rice, sawdust, turmeric and wheat starch.
- Honey.* Glucose and cane sugar.
- Ice Cream.* Coal-tar colors and synthetic flavors.
- Ice Cream Cones.* Boric acid and coal-tar colors.
- Jams and Jellies.* Apple stock, benzoic acid, coal-tar colors, glucose, phosphoric acid, salicylic acid, starch paste, synthetic flavors and tartaric acid.
- Jelly Powders.* Coal-tar colors and synthetic flavors.
- Lard.* Beef stearin, cotton seed oil and mineral oil.
- Mace.* Bombay mace.
- Maple Sugar.* Cane sugar.
- Maple Syrup.* Cane sugar, glucose and excessive water.
- Maraschino Cherries.* Benzoic acid, coal-tar colors and synthetic flavors.
- Meat extracts.* Salicylic acid, saltpeter and excessive salt.
- Milk.* Boric acid, color, formaldehyde, skimmed milk and watered milk.
- Mince Meat.* Benzoic acid and sulphurous acid.
- Molasses.* Glucose, sulphurous acid and excessive water.
- Mustard.* Cassava starch, color, corn starch, gypsum, rice, sand, turmeric and wheat starch.
- Mustard, Prepared.* Benzoic acid, color, salicylic acid, starch and turmeric.
- Noodles.* Color, turmeric and deficiency in egg.
- Olive Oil.* Cotton seed oil, peanut oil and sesame oil.
- Oysters.* Boric acid.
- Paprika.* Olive oil.
- Pepper, Black.* Beans, buckwheat hulls, cayenne, charcoal, cocoanut shells, coffee hulls, corn starch, linseed hulls, mustard hulls, nut shells, olive stones, pepper shells, sand, sawdust, turmeric and wheat products.
- Pepper, Cayenne.* Buckwheat hulls, coal-tar colors, corn starch, gypsum, nut shells, red sandalwood, sand, sawdust, turmeric and wheat products.
- Pepper, White.* Buckwheat hulls, cassava starch, cayenne, corn starch, gypsum, olive stones, rice, sawdust and wheat products.
- Pickles.* Alum, benzoic acid, color, glucose, saccharin and salicylic acid.
- Rice.* Glucose and talc.
- Root Beer Extract.* Benzoic acid.
- Salad Dressing.* Benzoic acid, boric acid, coal-tar colors and turmeric.
- Salt.* Calcium carbonate phosphate and sulphate, magnesium carbonate and chloride, and sodium sulphate.
- Sausage and Chopped Meat.* Boric acid, coal-tar colors, corn starch, potato starch, sulphurous acid and wheat starch.
- Spaghetti.* Artificial color.

Table Sauces. (*Chili sauce, ketchup, Worcestershire sauce, etc.*). Benzoic acid, coal-tar colors, saccharin and salicylic acid.

Tea. Tea fruit.

Temperance Drinks. Alcohol, benzoic acid, boric acid, capsicum (ginger ale), coal-tar colors, glucose, saccharin, salicylic acid and synthetic flavors.

Vegetables, Canned. Copper (peas), sodium fluoride (asparagus), sulphurous acid, tin (peas and pumpkin), and excessive water.

Vinegar. Deficiency in acidity and solids; colored distilled vinegar sold for cider or malt vinegar; use of second pressings and other sugary material.

PRESENT FOOD CONDITIONS IN CONNECTICUT.

Many of the adulterations enumerated above are no longer found in Connecticut foods. Such gross adulterations as imitation whole coffee beans, ground rock in baking powder, chicory and cereals in coffee, and wholesale manipulation of the various spices are rarely, if ever, found in this state at the present time. The present law, moreover, which is essentially an honest labeling law, requires the label to tell the truth, and this requirement is quite generally complied with. Consequently while the percentage purity of our jams, jellies and ketchups, for instance, is scarcely higher than it was 19 years ago, yet with very few exceptions the labels of these products tell the truth and give the consumer full warning as to their real quality.

The following are some of the more important adulterations found at the present time.

Butter. Much oleomargarine and renovated butter is still sold as genuine butter, and there is a decided tendency to incorporate more water in the butter than the standard allows. Unfortunately an Act of Congress permits the coloring of butter, and consequently the dairyman is allowed to sell butter colored to resemble June butter 12 months of the year, while the oleo manufacturer using a similar color must pay a tax of 10 cents per pound for colored oleo.

Confectionery. Glucose is very commonly used wholly or in part for cane sugar; gelatin is used in such candies as marshmallows and jelly beans; the glaze on fudge, burnt almonds and some kinds of chocolates has been found to contain traces of arsenic; charcoal is commonly found in licorice candies, and anise flavoring instead of licorice; occasionally paraffin is found

in caramels and "molasses kisses"; mottoes and the various wafers frequently contain excessive amounts of starch; and coal-tar dyes are very commonly used. Artificial color is rarely used in confectionery for deceptive purposes, and its use can be viewed with more tolerance in candy than in any other food product. The charges made against confectionery, especially of the cheaper sorts, are largely sensational and have little basis of fact. The unsanitary conditions under which candy is often sold, and the excessive consumption of it by young children at inappropriate times calls for much more condemnation than the adulterants occasionally found.

Cream. Cream is sold on an entirely illogical basis. The state standard requires a minimum of 16 per cent. of butter fat. The law makes no distinction between light and heavy cream, and as a result we find creams containing from 16 to 56 per cent. of fat sold at the same price. Chemical preservatives are rarely used, but the Station has frequently found sucrate of lime, or "viscogen," added to give a fictitious appearance of richness to a thin pasteurized cream.

Flavoring extracts. As a rule these are honestly sold, but the consumer must read the extract labels very carefully to avoid being deceived. Tonka bean and synthetic vanillin and coumarin are commonly used in the compound and artificial vanilla extracts, as well as caramel for coloring purposes. Lemon extract is often found below the standard strength of five per cent. of lemon oil, and colored with turmeric or a coal-tar dye. The terms "one-fifth" or "two-fifths standard strength" on the label should always be a warning to the consumer that the product is of inferior quality. The so-called "terpeneless" extracts are widely sold, and generally legally, but they are essentially simply bottled smell and do not have the flavor and body of a genuine lemon extract. Such extracts as banana, pineapple, raspberry and strawberry consist almost always of artificial flavors, although during the last year or two certain manufacturers have put on the market genuine flavors of this class.

Fruit Juices. These are far from being in a satisfactory condition. Benzoic acid, coal-tar colors, glucose and saccharin are widely used. In sweet cider salicylic acid is often found; in grape juice and lime juice, sulphurous acid and excessive water.

Ice Cream. At the present time this term has little meaning

in this state other than referring to the temperature of the product. Samples have been found containing only one or two per cent. of milk fat, while others contained as much as 20 per cent. Gelatin, thickeners, coal-tar colors and artificial flavors are commonly used.

Jams and Jellies. The percentage of pure jams and jellies sold in the state is very small. Glucose is commonly substituted in large measure for cane sugar; apple stock is the predominating ingredient in the cheaper products no matter what the alleged name; benzoate of soda, coal-tar colors and synthetic flavors are still widely used. The labeling of these products, however, usually complies with the law.

Lard. An adulterated lard is seldom found at the present time. Compound lards and lard substitutes, containing beef stearin and cotton seed oil, are still sold, but usually under a correct label.

Maple Syrup. Glucose is seldom found now as an adulterant as it was in the past, but granulated sugar or brown sugar are frequently used; excessive water is also a common adulterant in this product. The compound maple syrups require careful inspection of the label. The words "made from granulated sugar and maple sugar" usually mean that very little maple syrup is present, seldom over 10 per cent. When the word "maple," however, appears first in the descriptive labeling the consumer may be reasonably certain that maple syrup predominates in the compound.

Milk. Milk is still very frequently watered, occasionally skimmed, and rarely both watered and skimmed. This condition will maintain until our courts cease to look upon the pure food law as a joke, and inflict more severe punishments than the ridiculously inadequate fine of one dollar, even this sometimes being remitted. Chemical preservatives, however, are rarely found in Connecticut milk at the present time, formaldehyde being the only preservative detected, and that only four times, in over 2,000 samples in the past eight years.

Mince meat. In this product meat is often present in extremely small amounts, in some brands no meat whatever being used; benzoic acid and sulphurous acid are occasionally found.

Molasses. This is scarcely ever adulterated with glucose at the present time, but excessive water is frequently found, and the practice of "sulphuring" molasses is very prevalent.

Noodles. Eggs, which are an essential ingredient of this food, are often used very sparingly, and at times are entirely absent; the deficiency in eggs is frequently concealed by the use of turmeric or a coal-tar dye.

Olive oil. This product is rarely adulterated in this state, especially when bought in original containers. When the packages have been broken, the Station still continues to find occasional adulteration with cotton seed, peanut and sesame oils.

Pickles. These are generally legally labeled. Benzoic acid is used as a preservative, alum to make the pickles crisp, saccharin as a substitute for cane sugar, and coloring matter to give old cucumbers a fictitious appearance of youth and tenderness.

Sausage. Boric acid as a preservative in sausage has practically ceased to be used in this state, and sulphurous acid is only occasionally found. The use of cereal or potato starch has become a rather common practice, owing to the water-retaining property of the starch, and the manufacturer is thus enabled to obtain a pork price for starch and water. In frankfurts coal-tar colors are frequently found.

Spices. Probably no food product sold in the state shows a higher degree of purity than the spices. When reference is made to the long list of adulterants found by the Station in spices, as given on an earlier page, the striking effect of our pure food legislation is shown. In no state of the Union is the consumer offered purer spices than in Connecticut.

Table sauces. The ketchups and similar table sauces are in a condition very much like that of jams and jellies. While a few pure brands, in the sense of freedom from preservatives and artificial color, are sold, the vast majority are of a compound nature. Benzoate of soda, coal-tar colors and saccharin are widely used, and worst of all the tomato or apple stock used as the base of the ketchups is at times decomposed and moldy, and entirely unfit for human consumption.

Temperance drinks. The bottled "soft" drinks and soda fountain syrups are probably more widely adulterated than any other food product in the state. Coal-tar colors, benzoic acid, saccharin, glucose and artificial flavors are commonly found. Ginger ale is very frequently fortified with capsicum to give the desired "bite." The conditions of manufacture and sale of

these very popular beverages often seem quite as objectionable as the ingredients used in their preparation.

Vegetables, canned. This class of products, as a rule, requires only commendation. The use of saccharin and sulphurous acid in corn has practically ceased; sulphate of copper has been forbidden by the government, and no imported "French" peas containing it are now admitted to our ports. The use of the lacquered and "sanitary" can has greatly improved the purity and quality of the canned products. Slack fill, the use of soaked peas and beans and over-mature corn, and excessive added water, especially in tomatoes, offer the chief basis of criticism of canned vegetables at the present time.

Vinegar. Cider vinegar is still frequently adulterated, and much inferior vinegar is sold. On the part of the farmer and small producer this is generally due to defects in manufacture; on the part of the larger manufacturer it is due to the coloring of distilled vinegar with molasses vinegar or an infusion of malt, the addition of acetic acid, or the use of second pressings or other sugar-containing matter.

SUMMARY.

From the above outline of present day adulterations of food it is evident that the millennium of pure food has not yet arrived. We are now rather in the era of legal food, and, while this indicates a distinct forward step, it throws an added burden of responsibility on the consumer. The law requires the label to tell the truth, but if the consumer fails to read the label, or does not understand the label after he has read it, the main protection given to him under the law confers little benefit upon him. A careful reading of many a food label should be sufficient to condemn that food in any well conducted household, and refusal to buy such foods would be even more effective in driving them from our markets than the most drastic legislation. The manufacturer produces only what he can sell, and when the consumer learns to insist that his foods shall not contain chemical preservatives, coal-tar colors, saccharin and other injurious and non-nutritious ingredients, the manufacture of foods of this class will certainly cease.

Generally speaking, therefore, most of our food products show

a gratifying increase in purity. The problem of the future will be in part the insistence that legal food shall also be pure food, but even more the requirement that all of our food shall be made from good, sound raw material and that the manufacture, sale and handling of our foods shall be conducted in a sanitary manner.

CORRECTION.

The first line on p. 235 of this report should be transferred to p. 234, first line.

PART VI.

REPORT OF THE BOTANIST FOR 1914.

G. P. CLINTON.

CHLOROSIS OF PLANTS WITH SPECIAL REFERENCE TO CALICO OF TOBACCO.

CHLOROSIS TROUBLES IN GENERAL.

Definition. Chlorosis as considered here is that unusual state of a green plant in which the chlorophyll, through either diseased or limited development, does not possess its normal bright green color, but becomes lighter, yellowish-green, or even distinctly yellowish or whitish. In extreme cases, the leaf even loses its yellow tint, and becomes a pure white, when the term albinosis or albinism is applied.

Chlorosis may show as a general yellowing of the leaves from lack of sufficient sunlight or various other causes. It is not, however, such types that we wish particularly to discuss in this article, but rather the more unusual and abnormal mottling or variegation whereby greenish, yellowish, or whitish spots are scattered indefinitely over the leaves in the normal green tissue, or occur in rather constant and definitely placed areas, bands or borders.

The Century dictionary describes chlorosis as follows:—"Etiolation. The term is sometimes limited to the blanching which occasionally occurs in plants from lack of iron, an element which is found to be essential to the formation and green color of chlorophyll granules." Cowles (Textbook of Botany, p. 523) gives a somewhat similar definition:—"Iron salts and nitrates are regarded as favorable for chlorophyll development, whitening due to lack of iron being called chlorosis."

The Century's definition of variegation agrees more nearly with the type of chlorosis considered here, and is as follows:—"A condition of plants in which the leaves become partially white or of a very light color from suppression or modification of the

chlorophyll. Plants showing this unnatural condition may be otherwise quite healthy, and are often prized on account of their peculiar appearance. The cause is not well known. It sometimes occurs in a single branch of a tree, and may be thence propagated by grafting. As a permanent and often congenital peculiarity it is to be distinguished from chlorosis."

In common with Baur and other writers, however, we have taken the term chlorosis in a more general sense, covering all of these variations, rather than limited, as in the above definitions, to a uniform diminution of chlorophyll throughout the tissues.

Types—Variegation. One of the most common types of chlorosis is that met with in the so-called "variegated" plants, when limited to those forms which merely show a variation from the normal green through direct modification of the chlorophyll, (exclusive of those where it is merely obscured by other coloring matter, etc.), and are known as horticultural varieties of the normal species, such as *variegata*, *alba*, *aurea*, "golden," etc.

We have made a cursory study of many of these plants from the rather extensive collections in a local nursery. The plants as a whole do not have a sickly look, appearing almost as vigorous as the normal green specimens. Under unfavorable conditions, however, such as drought and cold, they do not usually survive in as good shape. Ordinarily these plants are propagated by cuttings, etc., and usually come true to type, though a certain percentage, especially of some forms, may revert to the normally green condition. A few reproduce the variegations through their seed, though this method is much less reliable.

Most of these varieties have originated from cuttings made from abnormal branches or plants, and have appeared suddenly for no particular reason as far as ordinary observation could detect. We have in mind a variegated Japanese barberry, that appeared as a single seedling in the New Haven City nursery, which the superintendent, Mr. Amrhyn, has propagated by cuttings. The leaves show blotches of yellowish or whitish-green, and less frequently of a reddish color. Some years ago we found in the Elm City Nursery a plant of *Elaeagnus umbellata* that had a single branch with the leaves irregularly blotched with light to whitish-green. A cutting from this showed somewhat similar markings on some of the new leaves during the year or two when the plant was under observation.

Baur (5-7) of Germany, among recent investigators, has thrown the most light on the nature of such variegations. He found that certain of these were propagated through cuttings and grafts, while certain others were not only so propagated, but had the power to transfer their peculiarity to the new growth of the normal stock or cion with which they were united. So he distinguishes two forms of chlorosis, namely, non-infectious and infectious.

Among the many vines and shrubs which show chlorosis, chiefly of the variegated type, and apparently of non-infectious form, may be mentioned the following: Golden elderberry, *Sambucus canadensis aurea*, with the normal green of the leaves more or less replaced by a golden-yellow or yellow-green color (see Plate XXVI a); variegated elderberry *Sambucus* sp., with leaves more or less irregularly mottled with white; *Euonymus radicans variegata*, with a variable band of white around the margin of the leaves; *Hibiscus syriacus variegata*, with a narrow whitish border around margin of leaves, and some light spotting in the interior; *Spiraea bumalda* (a Japanese variety) with some of the small axillary shoots quite abnormal, having golden-yellow, sickly looking leaves; *Diervilla rosea variegata*, quite variable, with leaves having a wide, irregular, light or greenish-yellow border.

Examples among trees are perhaps not so numerous, but are fully as striking. A number of our ordinary cultivated species are now represented by variegated or aurea types, of which the following are examples: Golden-leaf English elm, *Ulmus campestris* var. (Plate XXV b), with most of the leaves thickly speckled with small whitish or light greenish spots, or sometimes with larger, irregular mottled areas of normal green, light suppressed green, and pure white, usually limited by the veins; Variegated Sycamore maple, *Acer pseudoplatanus*, with large whitish areas, the green mottled with lighter spots (Plate XXV a); Golden Box Elder, *Negundo aceroides* var. (Plate XXV c), with a yellowish or whitish band occupying a wide, but quite variable area around the margin of the leaf, the normal green being limited to the center, usually surrounding the midribs, and often separated in places from the whitish area by a lighter submerged green. A variegation similar to the last appeared on one of the branches of a seedling in our forest nursery some years ago, and

no doubt this variety was originally obtained by such a chance development being propagated through grafts.

Among herbaceous perennials, we have examples of similar variegation in the grasses, such as *Miscanthus sinensis zebrina*, with bands of yellowish-white crosswise of the leaves, and our more common ribbon grass, *Phalaris arundinacea*, with white stripes lengthwise of the leaves. Among greenhouse plants, there is *Vinca major variegata*, frequently used in hanging baskets, having leaves with a wide marginal band of a whitish or yellowish color. Among annual plants, where such abnormalities have to be propagated through the seed, the examples are apparently not so numerous. One of the best is the Variegated Queen variety of nasturtiums, the leaves having irregular areas of green, yellow and white.

Types.—Injuries. Where such peculiarities of foliage appear on ornamental plants, they are considered as adding to the beauty or variety of the plant, and are carefully preserved for further distribution. When, however, the same kind or very similar leaves appear on food plants, they are considered in their true light, as an injured or diseased condition of the plant, which is liable to cause decrease of vigor and production. Sometimes it is rather difficult to determine this decrease, but in other cases it becomes very noticeable, especially in perennial plants.

There are a great many of these chlorosis troubles that appear rarely on individual plants or leaves. These are of no especial importance save from a scientific point of view. During the past few years we have observed a number of these, and it is usually difficult or impossible to explain their occurrence. One occasionally finds on apple trees a small branch with leaves that, for no visible reason, show narrow white areas in the neighborhood of the veins. Not infrequently the common species of clover show yellowish-green irregular areas. Individual stunted plants of corn sometimes have white or longitudinally striped leaves. In deeply shaded places, single leaves or branches of various plants often exhibit unusual variegations.

Previous to defoliation in fall, many trees develop chlorosis of various types, more or less intimately associated with early frosts. Ferns sometimes also exhibit somewhat similar peculiarities. Late spring frosts often produce white spots where the chlorophyll has been entirely obliterated, on young garden plants

(Plate XXVIII c-d) set out too early or accidentally exposed in greenhouses or hotbeds.

A few years ago there were brought to our office for examination leaves of a palm which the owner said had been injured by frost, where a window had been carelessly left open, and on these leaves there was a peculiar mottling of lighter yellowish-green which he said was an exact reproduction of the pattern of the rug in the room. We cannot conceive of such a relationship, though there may have been some connection between this injury and the shading of lace window curtains.

Types—Diseases. We also have types where the chlorosis is so general on the plants, appearing in succeeding new foliage and in perennials usually from year to year, that it can be considered as a disease, and frequently receives a distinct name more or less descriptive of the abnormal condition.

Yellows of raspberry is one of these diseases in which the leaves of the infected plants have an irregular yellowish and green mottled appearance, and are frequently crinkled. The plants gradually decline, decrease in productiveness, and usually die under unfavorable conditions. New shoots are affected, so that the trouble is perpetuated in the plantation, or may be carried into new ones. No remedy is known and very little information concerning the nature of this disease is available, except that it is considered physiological. See Plate XXVI c.

Peach yellows is another disease common in this state. For several years it may be quite abundant, and then gradually decrease. It begins with yellowish foliage, premature and highly colored fruit, and there follows a general decline and death of the trees after a few years. It can be propagated through the buds, and can be thus inoculated into a perfectly healthy tree. In this respect it very much resembles infectious chlorosis of Abutilon and other ornamental shrubs, as described by Baur (5).

Another type of disease, differing from the preceding in that it is communicable by juice from the infected plants, is the calico or mosaic disease of tobacco, tomatoes, etc. So far as we know, this is, with the possible exception of a similar disease of poke-weed, the only disease that can be communicated to healthy growing plants merely by touching their leaves with juice from a diseased plant on the hands. In this disease, which will be fully treated later on, the chief characteristic is a yellowish-green mottling of the leaves. See Plate XXX.

We have occasionally found in greenhouses a disease of sweet peas which resembled that of tobacco, though this plant belongs to an entirely different family. We have made no study of this, but it is evidently the mosaic disease described by Taubenhäus (29) who considers it identical with that of tobacco, although he apparently made no experiments to cross-inoculate them. He did, however, show that the disease could be transferred to healthy vines by aphids, or by a needle pricked first into the diseased leaves and then into the healthy ones.

In 1914 we found at Meriden, a disease of pokeweed (Plate XXVIII a), growing in a moist place. This so nearly resembled the calico of tobacco that we tried to produce the disease by placing crushed, moistened tissues of the pokeweed on tobacco (see Exper. No. 256) without very evident results. In a previous experiment with calicoed tobacco juice on pokeweed (No. 167) we also failed to obtain infection. Allard (2), however, recently described a mosaic disease of pokeweed similar to this that was infectious on healthy pokeweed, though not on tobacco, nor was the tobacco mosaic infectious on pokeweed.

Very similar in appearance to these mosaic diseases are various chlorosis troubles that appear more or less commonly on a variety of cultivated plants. We have noted such troubles briefly in previous Station reports (9) on cultivated Lima and string beans (Plate XXVIII b), muskmelon (Plate XXVII a), and squash. While some of these troubles are scarcely to be distinguished in their effect on the leaves from the calico of tobacco, we have never been able to transfer them to other plants through the juice, or to infect such plants from the juice of calicoed tobacco.

Classification. From the data given in the preceding discussion we may conveniently classify the different types of chlorosis according to their methods of perpetuation, as follows:—

- I. Infectious chlorosis:
 - (A) Communicable through the juice.
 - (B) Communicable through the tissues,
 - (a) By buds.
 - (b) By grafts.
- II. Non-infectious chlorosis:
 - (A) Non-perpetuating,
 - (a) Affecting plants generally.
 - (b) Affecting isolated leaves or branches.

- (B) Perpetuating,
 - (a) Through seeds.
 - (b) Through cuttings.
 - (c) Through buds or grafts.

Nature. All types of chlorosis have at least this feature in common, namely, that the trouble centers in the chlorophyll, or green coloring of the leaf. Very frequently, especially where the chlorosis is of the mosaic or variegated type, it seems to start in the very young tissues, and not after the leaves are fully grown. The work of chlorophyll is well known; under the stimulus of sunlight it elaborates out of inorganic material the carbohydrates so essential both to plant and animal nutrition. The nature of chlorophyll, however, is not so well understood. It is a coloring matter contained in the higher plants in definite, roundish, microscopic, protoplasmic bodies called chloroplasts, situated within certain cells of the leaves and sometimes in exposed cells of the stem. Concerning it, Barnes (Textbook of Botany, p. 367) writes "The yellow-green pigment is called chlorophyll, but it is not a single substance. Several pigments can be separated more or less completely, of which only two are abundant and constant in all higher plants, the one bluish-green and the other pale yellow. The names applied to these are confusing. To distinguish them we shall employ the terms *chlorophyllin* and *carotin*. To the bluish-green one no distinctive term has been generally applied, but it has usually been called chlorophyll (not distinguishing it from the combination) or chlorophyll proper. For the yellow one, *xanthophyll*, *etiolin* and *carotin* have been used. The last is preferable. * * * Etiolin was applied to the pale yellow pigment which appears when plants have been 'etiolated' by being grown or kept for a time in darkness. * * * Chlorophyllin and carotin may be partially separated by their unequal solubilities."

The New International Encyclopaedia states under "chlorophyll": "The chemical nature of chlorophyll is not satisfactorily known. It is a complex and exceedingly unstable nitrogenous carbon compound, probably not containing iron, as once believed. Attempts to analyze result in so complex a series of decomposition products that it is difficult to draw any conclusions. * * * Chlorophyll is chemically related to haemoglobin, the red coloring matter of the blood."

From the preceding statements it can be seen that chlorophyll

is a very important element in plant nutrition, and anything that disturbs or destroys it acts on the general vigor and health of the plant. In most chlorosis troubles the tissues assume a yellowish-green or yellowish appearance; to the writer this indicates that the chlorophyllin in the pigment has been lessened or destroyed, thus allowing the carotin, or yellowish pigment, to give color to the tissues. In cases where the tissues are white, the carotin has also been destroyed; and in those varying from yellowish to whitish its amount is less than normal. Only rarely have we seen examples which seemed to indicate that the carotin was affected sooner than the chlorophyllin, as illustrated in calico of tobacco in a very young state when the affected tissues had a deeper or bluer green than the normal tissues, but later changed into the typical yellowish-green.

Causes. There are apparently a variety of causes that will produce chlorosis, but it is sometimes difficult to determine exactly the particular cause. It is now considered by some investigators that infectious chlorosis troubles are connected in some way with disturbed enzymic activities of the cells, either through the presence of abnormal enzymes or excessive amounts of those normally present; or by their activities being interfered with by the presence of toxins. Sorauer (Handb. Pflanzkrank. 1:308) considers the non-inheritable and non-infectious types due to improper nutrition or to injurious physical conditions, and the inheritable and infectious ones as probably due to enzymic disturbances. To our mind, if these inheritable and infectious diseases are enzymic, it does not preclude the possibility that they may have been due originally to outside causes no longer directly responsible.

We have seen cases where drought undoubtedly caused yellowing of the leaves, as in peaches, pigweed, etc. Again, lack of sufficient light or improper fertilization often appears to produce a general chlorosis of the plant. Likewise, insufficient aeration of the roots in water-soaked soil may have a similar effect. Smith (Cal. Agr. Exp. Stat. Bull. 218:1139) states that mottled leaf of orange is "due to an irregular supply of moisture and plant food." Orton (Journ. Agr. Res. 3:174) describes the pecan rosette as a chlorotic disease which, as indicated by the evidence "is caused by improper nutritive supply, and it seems probable that it is directly related to a lack of balance between two or more soil ingredients."

Frost is a very common cause of non-infectious chlorosis in

which the chlorophyll is locally killed in areas that later show white. We have observed a number of such cases in which there is no question that frost was responsible. Plate XXVIII c-d shows examples of this type of trouble in young cabbage and parsley leaves. In the case of the latter, plants kept under observation for some time afterward showed no indication of the trouble in the leaves which developed later. This seems to be the usual outcome in such cases.

Chlorosis troubles may be caused by local injury by insects, as in the case of stigmonose of carnations by aphids, as mentioned by Woods. Curly top of beets, sometimes classed with chlorosis troubles, is another example of disease caused by insects. Fungi may sometimes cause a chlorotic effect, as in the case of orange rust of blackberry (Plate XXVI b) when the mycelium does not mature the fruiting stage in the infected leaves; a condition almost identical with the so-called yellows of raspberry (Plate XXVI c). Repeated pruning, through starvation of new growth, may cause a chlorosis, such as the dwarf mulberry disease of Japan.

Gas leaks in the soil around trees also produce troubles somewhat similar in nature. Spraying muskmelons with Bordeaux mixture sometimes causes a chlorosis of certain of the leaves (Plate XXVII b) which is scarcely to be distinguished from a similar trouble (Plate XXVII a) of unknown origin, which occasionally occurs on the whole vine.

CALICO OR MOSAIC DISEASE OF TOBACCO.

Nomenclature. This disease of tobacco has received here, as elsewhere, a variety of names, such as "mosaic disease," "Frenching," "brindle," "mongrel," and "gray top," which are in part descriptive of certain stages or supposed differences. The term "calico" is the one by which it is most generally known in Connecticut. Mosaic disease, however, is the name that elsewhere seems to have the most general recognition.

Character. Calico always develops in the very young leaves, and when once strongly showing in a leaf, it seems to be permanent, and to appear in all the new growth, or at least in that which starts above the leaves first infected. The disease shows as lighter, or yellowish-green, irregular areas of varying extent, that mottle the leaves, the normally green tissues as a rule occurring in the neighborhood of the veins (Plate XXX b). Rarely

in very young leaves, we have seen these calicoed areas where they seemed to have a deeper or bluish-green color.

As stated under the discussion of chlorosis in general, this abnormal color is due to a diseased condition or a scarcity of chlorophyll, the green coloring matter in the chloroplasts. Woods (32) says: "That the disease is not primarily of the chloroplasts, as Beijerinck thought, is evident from the fact that in the less pronounced cases the chloroplasts, though fewer in number, are not decreased in size or activity. * * * In some pronounced cases the chloroplasts are light colored or wholly without color." He also found that the cells of the healthy and diseased areas in the leaves differed as follows: "In the latter, in the less pronounced cases of the disease, there is a shortening and broadening of the palisade parenchyma cells, and in the more pronounced cases there is an entire suppression of these cells, so that on simply looking across the surface of the leaf depressions are seen where the light areas occur, and apparently blister-like development in the green area."

Usually the calicoed leaves are more crinkled than the normal, due to the uneven growth of the tissues in the diseased and healthy spots. Ordinarily the shape of the leaves is not changed to any great extent, but they are probably reduced somewhat in size. Occasionally the leaves become somewhat misshapen, chiefly by irregular development at the margin. Rarely strap-shaped leaves (Plate XXX a) are developed, though these are not confined to calicoed plants.

Infected plants average smaller than perfectly healthy ones (Plate XXXII a), the difference varying from a few inches to two or three feet. Certain species of tobacco, such as *Nicotiana rustica scabra* (Plate XXXII b) showed in our experiments a decided dwarfing of plants infected soon after being set out.

Allard (2) has described a peculiar color blotching of the blossoms of calicoed plants. We have noticed this somewhat in the Havana, but in Broadleaf have found little difference evident in the blossoms of healthy and calicoed plants. According to our limited observations, the blossoms on calicoed plants of *Nicotiana forgetiana* seemed to have a deeper red color than on those not calicoed.

A serious leaf injury known locally as "rust" (Plate XXXI b-c) often occurs on the older calicoed leaves. It shows as small,

roundish, reddish-brown spots of dead tissue, more or less thickly covering the leaves; sometimes these merge into large irregular areas, resembling sun scorch injury of other plants. This is probably the same trouble described by various European writers as "pockenkrankheit," ascribed by some to bacteria. In this state rust is not a necessary accompaniment of calico, but rarely if ever occurs except on leaves showing calico or signs of suppressed calico. We believe that it is of the nature of sun scorch, since it usually occurs in bright, hot weather, suddenly following a rainy or cloudy period, and that it develops on the calicoed leaves because of their weakened condition.

Another trouble, not nearly so serious, and occurring on both healthy and calicoed plants, is the "white spot" (Plate XXXI a) which, as the name indicates, shows as white spots of rather small size scattered over the leaves. The cause of this is not definitely known. It may be the same as the "taches blanches" of Delacroix, which he considered a bacterial trouble. We have always thought that white spot might be an injury due to insect punctures, although we have no definite evidence along this line.

Hosts. Calico occurs in Connecticut not only in the tobacco, but also less frequently in the tomato fields. As first shown by us (9), this disease is readily transferred from one host to the other (Plate XXIX b). A mosaic trouble occasionally found here on sweet peas has apparently been proved by Taubenhause (29) to be the same or a similar disease. By infection experiments we have also produced this disease on a number of different species of tobacco and a few related plants (see Conclusions, Nos. 24-25), but we have not found it on these otherwise. Orton (Phytopath. 3: 69) and Melchers (23) report its occurrence on potatoes, but we have never seen it in our potato fields, and have never succeeded in producing it on the vines, though we did once succeed in infecting a greenhouse seedling.

Prevalence. Calico has probably been present in Connecticut tobacco fields for a long time, though first reported in 1898 by Sturgis (27). Calico in tomato fields was first reported by the writer (9) in 1907. The disease, while not so prevalent on the latter host, seems to be on the increase.

It is difficult to estimate the percentage of infected tobacco plants, since this varies in different fields and from year to year. Counts (see Table VI) made some years ago in twenty-four differ-

ent fields showed 2,343 plants calicoed out of 18,044, or 13 per cent. This is probably too high an average for the state, as several fields included in these counts were calicoed to an unusual degree.

Injury. We have never tried to estimate the injury to tomato plants from this disease, though last year it was so common in the Station field that it must have caused some injury which was not very evident from a superficial examination. Norton (Phytopath. 4: 398) states that in the greenhouse healthy plants set 33 per cent. more fruit than the calicoed.

With tobacco we have shown (Table VII) that calicoed plants averaged considerably less in height than the healthy (Plate XXXII a), and this must result in a decreased yield of leaves. How much this decreased yield would average per plant cannot be stated; however, the loss in yield is not the chief injury caused, since calico is generally regarded as greatly affecting the quality of the leaves, and buyers frequently cut the price if they find that the crop contains a considerable percentage of calico. As a result, growers sometimes pull up calicoed plants, preferring to lose them outright rather than run the risk of a possible reduction in price. We know of cases where calico was so serious that the growers estimated the damage as amounting to several hundred dollars.

Distribution. Calico occurs in all tobacco regions not only in this country, but apparently all over the world where it is grown; at least, it has long been known in various European countries, and has been reported in the tobacco fields of the East and West Indies, Asia and Africa, and elsewhere.

Literature. Sturgis (27) of this Station was the first investigator in America to discuss calico, and he conducted later (28) a few experiments for its prevention by liming. Loew (21) soon after made observations on the nature and causes of the disease. Important papers by Woods (31 and 32) also appeared about this time, in which he propounded his oxidase-enzyme theory, and gave the results of his observations and experiments. More recently, Selby (25), Allard (1-4), Chapman (8), the writer (9), and others, have published the results of investigations.

However, calico was first discussed by investigators of Europe, and much of our knowledge concerning it is due to them. Among the more prominent of these we may mention Mayer (22), who in 1885 made the first important contribution on this subject,

Iwanowski (17 and 18), Beijerinck, Koning, Hunger (15 and 16), Delacroix (10 and 11), and Westerdijk (30). We give at the end of this article references to their work and that of others, with brief abstracts, so that it will not be necessary to further discuss the subject here, except in relation to theories advanced as to cause.

Theories. Concerning the cause of calico of tobacco there have been many theories advanced. These have ranged from that considering it as a purely physiological, non-infectious trouble to those claiming it as a highly infectious germ or enzymic disease. Evidence has now clearly shown that it is infectious, though there is still much difference of opinion whether or not germs, enzymes or toxins are responsible. Further data concerning these theories are given under the abstracts of literature. Recently rather full bibliographies and discussions of these theories have been published by Melchers (23) and Allard (4).

Among recent American writers Allard (3) and Flexner (12) favor the germ theory. Except for its infectious nature, there is no evidence that calico is a bacterial or similar disease, but the possibility of ultra-microscopic organisms has been made to apply here. Also the discovery of various filterable viruses, such as that of infantile paralysis, by Flexner, and the discovery of bacteria as the cause of crown gall, by Smith and Townsend, have been advanced as favoring a germ theory for this disease.

Taubenhaus (29) is another recent writer who favors this theory or a modification of it. He writes: "In my investigations, repeated trials failed to reveal the presence of either fungus or bacteria in culture. Nevertheless, I do not believe with Woods that the disease is physiological and enzymic. I strongly believe the trouble to be either bacterial or protozoic, and the pathogenic nature of the disease strongly points to this conclusion. That all attempts to obtain a living micro-organism in pure culture have failed does not argue against the possibility of its being either bacteria or protozoa, but simply that our present cultural or filtering methods are not suitable for its detection or retention."

On the other hand, Chapman (8), who has been making a special chemical study of the subject, has recently come out clearly in favor of Woods' (32) enzymic theory of the disease. In the review of his recent short article on calico he says: "Mosaic, 'brindle,' 'calico' or 'mottled top' of tobacco is a physiological

disease purely, and has no fungous or bacterial origin. It is caused by the excessive activity of the oxidase and peroxidase enzymes in the plant and the partial loss of function of catalase, another enzyme, which carries off some of the residual products of the others mentioned. It is not due to one enzyme alone, or to any specialized virus." He also states that in a future paper more detailed information will be given. As yet we have not seen this paper.

Our personal observations and experiments lead us to believe with Woods and Chapman that the disease is in some way bound up with a local disturbance of the enzymic activities of the affected cells, and that the disturbing enzyme or enzymes are infectious and capable of re-creation in the young tissues. For more detailed statements, see Nos. 30 to 36 of our Conclusions given later.

EXPERIMENTS WITH CALICO OF TOBACCO, ETC.

In the following paragraphs we give details of numerous experiments and observations, chiefly with calico of tobacco, carried on by us during the past nine years. During the last few years we have been under obligations for help in carrying these out to our assistant Mr. Stoddard.

In 1906, E. S. Hale Farm, Portland.

Exp. 1. June 10, calicoed leaves were crushed in hand, and young upper leaves of 50 half grown field plants were rubbed lightly, leaving pieces of crushed calicoed leaf on each. July 30, when examined again, every one of the plants had developed conspicuous cases of calico in the upper leaves. Plants began to show calico within two weeks after touching, according to Mr. Hale. Plants dwarfed somewhat. Calicoed, 100%.

Exp. 2. Check to No. 1, no treatment. At the other end of this row, out of 50 plants examined July 30, only 4 showed calico. Calicoed, 8%.

Exp. 3. July 30, upper fully grown leaves of 6 topped plants were touched after crushing calicoed leaves in hand. Plants harvested twenty-one days later showed no signs of calico on main leaves, according to Mr. Hale. Calicoed, 0%.

Exp. 4. Check to No. 3. Another man, with no calico juice on his hands, touched 6 similar plants at the same time. No calico developed. Calicoed, 0%.

In 1907, Experiment Station Farm, Centerville.

Exp. 5. July 1, 152 plants were set out (plants in Nos. 6-27 were also set at this time) that had been watered several times by Mr. Hale while in the seedbed at Portland with tobacco water from calicoed last year stems. This is a treatment sometimes given in order to kill angle worms. At the time of pulling only half a dozen plants showed calico in the seedbed, and only one of those transplanted showed it. July 20, no calico showing yet. July 30, 80 plants, or 53%, showed calico. Aug. 5, 96 plants, or 63%, calicoed. Aug. 14, 106 plants, or 70%, showed some signs of calico. Aug. 26, 109 plants, or 72%, calicoed. Sept. 10, 111 plants, or 73%, calicoed. Of these, 66 were very badly, 29 moderately, and 16 slightly, calicoed.

Exp. 6. Check to No. 5. These were 75 plants from the same seedbed not watered with tobacco water. Examined July 20 and 30, Aug. 5, 8, 14, 26, and no calico found on any of them. On Aug. 26 some of these were used for other calico experiments, but 43 left for checks, and of these on Sept. 10, only 2 showed slight signs of calico, and 1 considerable calico, or 7% calicoed, as compared with 73% in Experiment 5.

Exp. 7. Aug. 5. The leaves of every other one of 20 plants, eight to twenty inches high were pulled through hands containing calico juice. Experiment made at 5:00 P. M. on a cloudy day. Aug. 14, one plant calicoed; Aug. 23, all plants showed calico on upper leaves; Sept. 10, all badly calicoed. Calicoed, 1st exam., 10%; last exam., 100%.

Exp. 8. Check to No. 7, treatment same except leaves of the odd numbered plants were pulled through hands containing no calico juice. Aug. 14, and 23, 1 plant calicoed. Sept. 10, 5 out of the 10 calicoed, 3 slightly and 2 badly; Sept. 25, 2 free, 5 slightly, and 3 badly calicoed. The calicoed plant of Aug. 14th was probably an outside infection, and from it more or less of the subsequent infection may have followed. Calicoed, 1st exam., 10%, last exam., 80%.

Exp. 9. Aug. 8, treatment same as in No. 7, made with 10 alternate plants, at 4:00 P. M. of a bright day. Aug. 23, all plants showed calico in upper leaves. Sept. 10, all badly calicoed. Calicoed, 1st and last exam., 100%.

Exp. 10. Check to No. 9, with treatment same as in No. 8. Aug. 23, none of the plants calicoed. Sept. 10, 3 out of the 10 slightly calicoed. Sept. 25, 5 free, 4 slightly, and 1 badly calicoed. Calicoed, 1st exam., 0%; last exam., 50%.

Exp. 11. Checks, 15 plants with no treatment whatever. Aug. 28, no calico; Sept. 25, 10 plants with no, and 5 with little calico. Calicoed, 1st exam., 0%; last exam., 33%.

Exp. 12. Aug. 14, water in which had been crushed fresh calicoed tobacco leaves (soaked in minimum of water for a few minutes) was poured over 7 plants. Aug. 23, slight indications of calico appearing; Sept. 10 and 25, all showed calico on upper leaves. Calicoed, last exam., 100%.

Exp. 13. Check to No. 12. Pure water was poured over 7 plants. Sept. 25, only one plant calicoed (apparently accidentally). Calicoed, 14%.

Exp. 14. Aug. 14, leaves of 12 plants about two feet high were rubbed with calico juice on hands, touching (a) upper young leaves of 6, and (b) lower mature leaves of the other 6. Aug. 23, calico began to show on young leaves of some plants. Aug. 28, all plants showed calico on young upper leaves, but none on old lower leaves. Plants where young leaves were touched showed the calico somewhat more prominently than those where old leaves were touched. Sept. 10, upper leaves of all plants badly calicoed, but those where young leaves had been touched averaged about eleven calicoed leaves to a plant, and those where old leaves were touched, about seven. Calicoed, last exam., 100%.

Exp. 15. Aug. 26, a calicoed tobacco leaf was placed on each of 10 plants, without otherwise touching them. Sept. 10, 5 plants showed signs of calico, though very evident only on one. Sept. 25, same as before, but calico now evident on 5 plants. Calicoed, 1st and last exam., 50%.

Exp. 16. Aug. 26, young calicoed leaves were drawn across young leaves of 10 tobacco plants, without touching plants. For first 5 plants unbruised leaves were used, and for second 5, leaves somewhat bruised. Sept. 5, only 1 of first 5 showed calico, while all 5 of second lot showed it. Sept. 25, same as Sept. 5, but more evident. Calicoed, 1st and last exam., 60%.

Exp. 17. Aug. 26, same as No. 16, except old calicoed leaves showing rust stage were used on 10 plants. Sept. 10, all but one of first 5 showed calico, and all of second 5. Sept. 25, same as before, but more advanced. Calicoed, 1st and last exam., 90%.

Exp. 18. Aug. 26, crushed calicoed tobacco leaves were soaked for one hour in ether, and the mixture poured on leaves of 5 tobacco plants. On contact with the ether, the tissues immediately turned blue-green and then brown, showing serious injury. Sept. 25, no signs of calico. Injured tissues dropped out. Calicoed, 0%.

Exp. 19. Check to No. 18, pure ether was poured over leaves of 5 plants. Sept. 25, no calico, injury by ether same as in No. 18.

Exp. 20. Aug. 28, using atomizer, leaves of 5 plants were sprayed with strained juice from crushed calicoed leaves soaked twenty-four hours in ether. Sept. 25, no calico.

Exp. 21. Aug. 28, juice from crushed young calicoed leaves soaked twenty-four hours in water, strained, and sterilized one-half hour in autoclave, was poured on young leaves of 8 plants. Sept. 25, no calico.

Exp. 22. Check to No. 21, treatment same, except calicoed juice not sterilized used on 8 plants. Sept. 25, 4 showed calico, or 50%.

Exp. 23. Aug. 28, same as No. 22, but juice poured only on old lower leaves of 2 plants. Sept. 25, neither showed calico.

Exp. 24. Sept. 4, tobacco worm taken from calicoed plant was placed on a healthy one. It squirted juice on the leaves, but probably did not stay long on the plant, as it was replaced once or twice. Sept. 25, showed no calico.

Exp. 25. Sept. 6, 5 plants were topped by cutting off with a knife which, each time before using, was cut through a calicoed leaf. Sept. 25,

calico showed in suckers of all except one, which was broken at base when topped. Calicoed, 80%.

Exp. 26. Check to No. 25. Treatment the same, except that knife was not used on calicoed tobacco, and was thoroughly wiped each time before topping the 5 plants. Sept. 25, calico showed in none of the suckers, except on one plant, a leaf of which had been broken by a calicoed plant leaning against it. Calicoed, 20%.

Exp. 27. Sept. 10, a short slit was cut in top of stem of 5 plants, after using knife each time to cut through a calicoed plant. Sept. 25, calico showed in only 1 plant, or 20%.

In 1907-08, Station Greenhouse, New Haven.

Exp. 28. Nov. 11, tomato plant was touched after crushing fresh leaves of calicoed tobacco in hands. Nov. 25, young leaves and stems showed elongated, irregular, discolored streaks or burns, like a bacterial disease, but no true calico-like appearance. Check plants showed no similar trouble. Jan. 8, plant dead of wilt, but before dying, some leaves showed signs of true calico. The bacterial-like burn of the leaves, however, was the conspicuous trouble.

Exp. 29. Nov. 27, juice and crushed fragments of leaves from tomato plant used in No. 28 were placed on a larger tomato. Jan. 8, plant dead of wilt, but before dying, showed some little burn, as No. 28, and more or less calico (leaves mottled and crinkled).

Exp. 30. Nov. 27, same treatment as in No. 29, but sprinkled with water after treatment. Dec. 11, first showed burn on one leaf. Eventually, burn became more prominent, especially on the stem, and there were slight signs of calico on the leaves.

Exp. 31. Nov. 27, same treatment as Exp. 30, but on small plant. No burn showed at any time, but after a considerable period calico showed slightly on youngest leaves.

Exp. 32. Nov. 27, juice and fragments of leaves from tomato used in No. 28 transferred by hand to tobacco plant. Dec. 12, showed calico, but no burn. Calico appeared prominently later. Here we have a case of transferring calico to tobacco from a tomato showing burn prominently, but little calico; this tomato was originally infected from calicoed tobacco (see Plate XXIX b, showing leaves from these three generations).

Exp. 33. Nov. 27, juice from calicoed tobacco transferred by hand to tomato. This did not show burn, and for quite a while no calico, though eventually the young leaves became calicoed.

Exp. 34. Nov. 27, same as No. 33, but plant sprinkled with water afterwards. Dec. 6, showed slight burn injury on young leaves, which became more prominent by Dec. 9. This burn was finally the most noticeable of any on plants treated Nov. 27 (see Plate XXIX a).

Exp. 35. Jan. 9, a young tobacco plant (a) and a tomato plant (b) sprayed with cultures of bacteria in water. These bacteria originally came from rusted spots in calicoed tobacco leaves, but may have been accidental surface bacteria. Apr. 27, no calico showed for some time, but did on this date on both plants. No rust spots present. Whether

this infection was due to the bacteria or to adjacent calicoed plants is not certain.

Exp. 36. Jan. 31, young tomato plants, size for transplanting, exposed to out of door temperature at 15° Fahr. for short periods, with the following results: (a) Plant exposed five minutes, with result that all leaves and tip of stem were killed; (b) plant exposed ten minutes, with same results, but stem more severely injured; (c, d) plants exposed one minute, with result that lower leaves were killed, and upper more or less frosted at edges, but stem not injured; (e) plant exposed two minutes, with results same as in c, d; (f, g) check plants not exposed. Feb. 13, all plants set in greenhouse bed; no signs of calico on any as yet; (a, b) sending out buds from base of plants. Mar. 1, (a, b) now dead, as frost injury was too severe to allow of transplanting. Neither they nor the other plants showed any signs of calico. By July 14 all plants but one were dead, but none of them showed any signs of calico.

Exp. 37. Mar. 17, young tobacco plants exposed out of doors at temperature of about 33° Fahr., as follows: (a) One plant for five minutes (b) one plant for ten minutes; (c) one plant for one hour and forty minutes. July 21, none of these plants showed calico, though none were appreciably injured by frost at the time of exposure.

Exp. 38. Apr. 14, leaves of 2 tobacco plants rubbed with juice and fragments of perfectly healthy tobacco on hand. July 21, no signs of calico.

Exp. 39. Same as No. 38, but leaves of 3 tomato plants were rubbed. July 21, no signs of calico.

Exp. 40. Same as No. 38, but leaves of 2 tobacco plants were rubbed with juice on hands from calicoed tobacco plant. Apr. 28, both plants showed calico plainly on new leaves.

Exp. 41. Same as No. 40, but 3 healthy tomato plants used. Apr. 28, no signs of calico, but slight burn on one plant. May 11, burn now evident, but calico not. July 21, all 3 plants now showed calico plainly, though it was much longer in appearing than in No. 40.

Exp. 42. Apr. 14, 2 healthy tobacco plants cut off near base, leaving small bud. July 21, no signs of calico.

Exp. 43. Apr. 14, healthy tomato plant cut off near ground, leaving one small basal sprout. On February 17th this plant was pruned in a similar way. July 21, no signs of calico.

Exp. 44. Check tobacco plant for tobacco experiments of Apr. 14, no treatment. July 21, no signs of calico.

Exp. 45. Two check tomato plants for tomato experiments of Apr. 14, no treatment. July 21, no signs of calico.

Exp. 46. Apr. 27, same as No. 35, on (a) tobacco and (b) tomato plant, except that bacteria were from a different colony in the original Petrie dish. May 11, no signs of calico, but a few small burned spots on the tomato. July 21, no signs of calico on tobacco, and tomato dead, having never shown calico, as far as observed.

Exp. 47. Apr. 27, same as No. 46, but bacteria from separate cultures obtained from stem of tomato plant in No. 30. May 11, no signs of calico

on either host. July 21, no sign of calico on tobacco; tomato dead, apparently not calicoed.

In 1908, Experiment Station Farm, Centerville.

Exp. 48. July 20, upper young leaves of the alternate odd-numbers in a row of 50 plants, touched with fresh calicoed juice on hands, renewed each time before touching plant. July 31, every one of the 25 plants showed signs of calico. Aug. 6, every plant evidently calicoed in upper leaves. Aug. 24 and Sept. 16, plants all badly calicoed on upper leaves. Calicoed, first and last exam., 100%.

Exp. 49. Checks to Nos. 48 and 50, every even-numbered plant was touched without calico juice on hands. July 31, none of the plants showed calico. Aug. 6, only one calicoed plant. Aug. 24, 18 plants without calico, 1 with calicoed main leaves, and 6 with calicoed suckers only. Sept. 16, 10 without calico, 1 with main leaves calicoed, 14 with calicoed suckers. On Aug. 5th a severe wind storm blew the tobacco over, so that the healthy came in contact with the calicoed, and this may account for the later appearing calico in the suckers of these checks, and also in some of the other experiments. Calicoed, 1st exam., 0%; last exam., 60%.

Exp. 50. July 20, same as No. 48, but only lower full-grown leaves of 25 plants were touched. July 31, all apparently showing calico, but not so evident as in No. 48. Aug. 6, every plant evidently calicoed in upper leaves only. Aug. 24 and Sept. 16, every plant badly calicoed in upper leaves. Calicoed, 1st and last exam., 100%.

Exp. 51. July 20, crushed, dried calicoed tobacco leaves, which had been kept in-doors since the previous fall, were soaked in water for two hours, and used as follows: (a) Placed a handful of wet leaves around uncovered roots of 10 plants, and then recovered with dirt; (b) poured half a pint of this strong tobacco water on exposed roots of 15 plants, and re-covered; (c) Sprinkled leaves of 21 plants freely with this tobacco water. July 31, (a) and (b) showed no calico; (c) all showed calico except possibly one. Aug. 6, (a) and (b) no calicoed plants; (c) all plants calicoed evidently in upper leaves, some badly calicoed and stunted. Aug. 24, (a) 9 free, 1 calicoed in sprouts; (b) 14 free, 1 calicoed in sprouts; (c) all badly calicoed. Sept. 16, (a) 7 free, 3 with calicoed sprouts; (b) 11 free, 4 with calicoed sprouts; (c) same as on Aug. 24. Calicoed, 1st exam., (a) 0%, (b) 0%, (c) 100%(?); last exam., (a) 30 %, (b) 27 %, (c) 100%.

Exp. 52. July 20, same as No. 51-c, but calicoed tobacco water sprinkled over (a) 20 to 25 nearly full-grown potato vines, and (b) 10 large tomato plants. Aug. 6, no sign of calico on potato vines, but some indication of it on the tomatoes. Aug. 13, calico showed plainly on some tomatoes, but not prominently. Sept. 15, no calico appeared on potatoes (perhaps too old when treated), but most of the tomatoes showed calico on some of the young leaves, though not so prominent as on tobacco in No. 51-c.

Exp. 53. July 20, crushed stems and leaves of dried "yellows" asters (kept indoors over winter) soaked for two hours in water, and

used as follows: (a) Poured half a pint of this "yellows" water on uncovered roots of 10 tobacco plants, and re-covered with dirt; (b) sprinkled leaves of 20 tobacco plants freely with this "yellows" water. July 31, no calico showing. Aug. 6, no calico showing except in one plant in (a), which was probably an accidental outside infection. Aug. 24 (a), 6 plants free, 1 with main leaves calicoed, and 3 with calicoed sprouts; (b) 18 free, 2 calicoed in sprouts. Sept. 16, (a) 5 free, 1 with calicoed main leaves, 4 calicoed in sprouts; (b) 13 free, 7 with calicoed sprouts. Calicoed, 1st exam., (a) and (b) 0%; last exam., (a) 50%, (b) 35%.

Exp. 54. July 20, two fresh leaves of calicoed tobacco were drawn rather gently, so as not to tear the tissues, over leaves of 25 tobacco plants. July 31, no calico showing, except possibly on one plant. Aug. 6, all plants except one showing calico. Aug. 24, all plants but one evidently calicoed on main leaves, and on Sept. 16 this plant also showed it on the suckers. Calicoed, 1st exam., 4%, last exam., 100%.

Exps. 55-65. July 23-4, 25 grams of fresh calicoed leaves (in Nos. 55-60, tobacco, in Nos. 61-65, tomato leaves), cut in small fragments were soaked over night in 100 grams of liquid as indicated below. Next morning, the liquid was strained through cheese cloth, and used on tobacco plants that afternoon, as follows:

Exp. 55. After filtering off alcohol used in No. 58, the cut fragments of calicoed leaves were soaked again for one and one-half hours in 50 cc. distilled water, and then poured on the leaves of 5 plants. Aug. 6, 2 showed calico; Aug. 24 and Sept. 16, 1 free, 1 missing, 2 calicoed on main leaves, and 1 on sprouts. Calicoed, 1st exam., 40%, last exam., 60%.

Exp. 56. Chloroform water was used as the liquid, and after straining, this was poured on the leaves of 5 plants. Aug. 6, 2 showed calico; Aug. 24 and Sept. 16, 2 missing, 1 calicoed on main stem, 2 on sprouts. Calicoed, 1st exam., 40%, last exam., 60%.

Exp. 57. Distilled water was used as the liquid, and after straining, this was poured on leaves of 5 plants. Aug. 6, none calicoed. Aug. 24 and Sept. 16, 1 missing, 3 free, 1 calicoed in sprouts. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 58. 95% alcohol was used as the liquid, and after straining, and evaporating most of this over a water bath by gentle heat, the remainder was placed on leaves of 5 plants. Aug. 6, 2 calicoed; Aug. 24 and Sept. 16, 2 free, 1 calicoed in main leaves, 2 in sprouts. Calicoed, 1st exam., 40%, last exam., 60%.

Exp. 59. Pure chloroform used as the liquid. Treated same as in No. 58, and then the paste-like residue rubbed on the leaves of 5 plants. Aug. 6, 1 calicoed; Aug. 24, 3 free, 1 calicoed in stem leaves, 1 in sprouts; Sept. 16, another plant showed calicoed sprouts. Calicoed, 1st exam., 20%, last exam., 60%.

Exp. 60. The chloroform in No. 59 did not mix with some of the juice extracted from the leaves, and this latter was poured off, diluted with 50 cc. water, and then poured over leaves of five plants. Aug. 6, none calicoed. Aug. 24, 4 free, 1 with calicoed leaves. Sept. 16, 3 free,

1 with calicoed leaves, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 40%.

Exp. 61. Same treatment as in No. 56, except calicoed tomato leaves were used, and the liquid poured on 5 tobacco plants. Aug. 6, 3 calicoed. Aug. 24 and Sept. 16, 1 missing, 3 with calicoed leaves, 1 with calicoed sprouts. Calicoed, 1st exam., 60%, last exam., 80%.

Exp. 62. Same treatment as in No. 57, except calicoed tomato leaves were used. Aug. 6, 2 calicoed. Aug. 24, 1 free, 1 doubtful, 2 calicoed in leaves, 1 calicoed in sprouts. Sept. 16, 2 with calicoed leaves, 3 with calicoed sprouts. Calicoed, 1st exam., 40%, last exam., 100%.

Exp. 63. Same treatment as in No. 58, except calicoed tomato leaves were used. Aug. 6 and 24, none calicoed. Sept. 16, 2 free, 3 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 60%.

Exp. 64. Same treatment as in No. 60, except calicoed tomato leaves were used. Aug. 6, 1 calicoed. Aug. 24 and Sept. 16, 2 free, 1 missing, 1 with calicoed leaves, 1 with calicoed sprouts. Calicoed, 1st exam., 20%, last exam., 40%.

Exp. 65. Same treatment as in No. 59, except calicoed tomato leaves were used. Aug. 6 and 24, none calicoed. Sept. 16, 4 free, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 66. Checks to Nos. 55-65, 5 plants, no treatment. Aug. 6 and 24, none calicoed. Sept. 16, 4 free, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 67. July 24, vines cut off rather close to the ground from (a) 16 hills of potatoes, and (b) several large tomato vines. Aug. 16, no signs of chlorosis in new growth. Sept. 15, while potato vines did not re-sprout very well, the growth that did appear showed no signs of chlorosis, neither did that of the tomatoes.

Exp. 68. July 31, unbruised calicoed tobacco leaves wrapped around young upper leaves of 15 tobacco plants. Aug. 7, no signs of calico except on one plant. Sept. 4, 8 free, 3 slightly calicoed on main leaves, and 4 on sprouts. Calicoed, 1st exam., 7%, last exam., 47%.

Exp. 69. July 31, same as in No. 68, except that calicoed leaves were cut with knife. Aug. 7, no signs of calico. Sept. 4, 1 missing, 4 free, 3 calicoed on main leaves, and 7 on sprouts. Calicoed, 1st exam., 0%, last exam., 67%.

Exp. 70. July 31, a calicoed leaf (not crushed so as to get juice on hands), was touched each time before touching young leaves of 15 tobacco plants. Aug. 7, no signs of calico. Sept. 4, 2 free, 13 calicoed in sprouts. Calicoed, 1st exam., 0%, last exam., 87%.

Exp. 71. July 31, fresh calicoed tomato leaves were crushed in hands, and juice and fragments transferred to young leaves of 15 tobacco plants. Aug. 7, no signs of calico. Sept. 4, all calicoed in sprouts, some showing rust spots. Calicoed, 1st exam., 0%, last exam., 100%.

Exp. 72. July 31, young calicoed tobacco leaves were crushed in the hands, staining fingers with juice, and then 40 tobacco plants were touched one after another, without renewing juice on hands. Aug. 7, no signs of calico; Sept. 4, none free, 4 calicoed in main leaves and 36 in sprouts. Calicoed, 1st exam., 0%, last exam., 100%.

Exp. 73. After Exper. No. 72, next 5 plants in same row were touched, after washing hands thoroughly with soap and water. Aug. 7, no signs of calico; Sept. 4, all 5 plants free. Calicoed, 1st and last exams., 0%.

Exp. 74. Check plants for Nos. 68-73, no treatment, 9 plants. Aug. 7, no signs of calico; Sept. 4, 7 free, 2 calicoed in sprouts; calicoed, 1st exam., 0%, last exam., 22%.

Exp. 75. Aug. 6, 15 healthy plants were tied carefully near the top with string to 15 calicoed plants. Two healthy plants left not tied as checks. Sept. 4, 5 free, 2 with calicoed main leaves, 8 with calicoed sprouts; Sept. 16, 1 free, 2 with calicoed main leaves, 12 with calicoed sprouts. The two check plants were free. Calicoed, 1st exam., 67%, last exam., 93%.

Exp. 76. Aug. 6, each alternate (even numbers) of 118 plants was topped by cutting off with a knife which was passed through a calicoed leaf each time before using. Sept. 4, all of the 58 plants showed calico in sprouts (one dead plant not counted), or 100%.

Exp. 77. Check to No. 76, each alternate (odd numbers) of the 118 plants was topped, being careful to convey no tobacco juice during the topping. For the first 20, knife was wiped with paper and sterilized in flame before each topping, and for the remainder, top was broken off by hand, touching only the part of the plant removed. Sept. 4, of the first 20, 16 were free, and 4 calicoed in sprouts; of the remaining 39, 30 were free, 1 dead, and 8 showed calicoed sprouts. Altogether only 20% were calicoed, as against 100% in Experiment 76.

Exp. 78. Aug. 7, check to No. 80, 14 plants cut off close to ground with knife sterilized as in Experiment 77. Sept. 4, 6 plants failed to sucker, the other 8 all grew suckers free from calico, or 0% calicoed.

Exp. 79. Check to No. 80, 14 healthy plants cut off close to the ground but without cleaning knife each time. Sept. 4, 9 plants failed to grow suckers, and the other 5 grew suckers free of calico, or 0% calicoed.

Exp. 80. Aug. 7, 15 healthy plants cut off close to the ground, with knife passed through calicoed plants each time before using. Sept. 6, all died without producing suckers. Probably cut too close to the ground.

Exp. 81. Checks to Nos. 48-80 no treatment given during the season, 24 plants. Aug. 6, all free from calico except possibly one. Sept. 4, 18 free from calico, 6 showing calico in sprouts only. Calicoed, 1st exam., 0%(?); last exam., 25%.

In 1908, Experiment Station Grounds, New Haven.

Exps. 82-85. This tobacco was the same as that used that year at the Centerville Farm, and was set out about the same time, the middle of June. The seedlings in both cases were obtained from Mr. Hale's bed at Portland, and this may account for the few calicoed plants that appeared on the land used for this experiment, where tobacco had never been grown previously, and no other tobacco grew in the vicinity. It was planted here to see if it would be entirely free from calico, and to act as a check on the experiments at the Mount Carmel farm. July 28, examined tobacco carefully, and found two apparently calicoed plants,

which were pulled up before topping experiments were made. Another calicoed plant was pulled up August 1st. All calico that developed later in the sprouts of eight plants was on plants near these originally calicoed ones.

Exp. 82. July 28, 19 healthy plants topped with knife sterilized as in No. 77. Aug. 24 and Sept. 15, 18 plants free, 1 with calico only on small leaves of sprout (next to suspicious plant removed July 28). Calicoed, 1st and last exam., 5%.

Exp. 83. July 28, 17 healthy plants topped, but knife not cleaned after each topping. Aug. 24 and Sept. 15, 15 free, 1 with sprout prominently calicoed, 1 with sucker slightly calicoed. (Both near suspicious plant removed July 28.) Calicoed, 1st and last exam., 12%.

Exp. 84. July 28, 20 plants topped with sterilized knife, as in No. 77. One plant showed calico in sprout at top. This was topped, but removed Aug. 1st. Aug. 24, 16 free, 3 with calico on sprouts (these were next to calicoed plant removed). Sept. 15, 14 free, 5 with calicoed sprouts. Calicoed, 1st exam., 16%, last exam. 26%.

Exp. 85. Checks, no topping, 9 plants. Aug. 24 and Sept. 15, no calico. Calicoed, 0%.

Exp. 86. Aug. 1, leaves of tobacco plant touched with hands containing juice and fragments from leaves of Golden variety of Sambucus. Sept. 15, no calico resulted.

Exps. 87-91. July 23, leaves and stems of dried "yellows" asters, kept in-doors since previous fall, were soaked in water over night and this material used on asters, as indicated below. At the time of treatment, at least two of these asters showed yellows, so that the few plants that developed it later probably had latent yellows when treated.

Exp. 87. Roots of 7 plants (one already showing yellows) were uncovered and after placing on them "yellows" leaves macerated in water, they were re-covered. Sept. 15, no further yellows developed.

Exp. 88. "Yellows" water containing tissue was poured liberally over leaves of 7 plants (one already showing yellows). Sept. 15, no further yellows developed.

Exp. 89. Two rows of check plants, not treated. No yellows showing except in one plant. Sept. 15, there had developed a few probable cases of yellows in these check plants.

Exp. 90. Leaves of 7 plants were touched after crushing fresh "yellows" leaves in hands, leaving part of the crushed tissues on them. Sept. 15, one plant developed yellows.

Exp. 91. Leaves of 7 plants were touched after crushing calicoed tobacco leaves so as to get juice on the hands. (One plant already showed probable yellows.) Sept. 15, besides the original yellowed plant, 1 developed yellows, 1 doubtful yellows, 4 remained free.

In Winter of 1908-09, Station Greenhouse, New Haven.

Exp. 92. Dec. 17, pure juice of calicoed tobacco (extracted from calicoed leaves by hydraulic press in September, and preserved by film of toluol) was used on leaves of a small tobacco plant. Jan. 4, younger

leaves showing calico in fine mottling. Jan. 15, calico prominent on four or five additional leaves. Jan. 22, whole plant prominently calicoed.

Exp. 93. Dec. 17, same as No. 92, but before extracting juice from calicoed leaves, these were wet thoroughly. Jan. 4, 15 and 22, showed calico the same as in No. 92.

Exp. 94. Dec. 17, crushed dried calicoed tobacco leaves, kept indoors since fall were soaked one-half hour in water, and used immediately on small tobacco plant. Jan. 4, showed faint traces of calico. Jan. 15, calico about the same as in No. 92, but not so prominent on worst leaves. Feb. 18, plant in seed, leaves yellowed, and therefore calico not so conspicuous. The same experiment on other plants showed very similar results.

Exp. 95. Dec. 17, check to Nos. 92-94. Jan. 4 and 15, Feb. 1 and 18, no calico showing at any time, though on Feb. 18 the plant was in fruit.

Exp. 96. Dec. 17, treatment same as in No. 92, except young tomato plant was used for infection. Jan. 4, no calico, but top killed by Fusarium wilt. Jan. 15, cut off dead top. No sure signs of calico below. Feb. 18, new growth showed calico.

Exp. 97. Dec. 17, treatment same as in No. 93, except young tomato plant was used for infection. Jan. 4, calico just showing on young leaves. Feb. 5, calico very evident on new leaves. Feb. 18 and Mar. 6, all new growth badly calicoed.

Exp. 98. Dec. 17, same treatment as in No. 94, except young tomato plant was used for infection. Jan. 4 and 15, slight indications of calico. Feb. 5, calico very evident on new leaves. Feb. 18, all new growth calicoed. Feb. 23, leaves showed some of the peculiar bacterial-like burn noticed last year. Mar. 6, all new growth badly calicoed. The same experiment on other tomato plants failed to produce calico, though at first they seemed to show signs of it.

Exp. 99. Dec. 17, check to Nos. 96-98. Jan. 4 and 15, Feb. 5 and 18, Mar. 6, examinations showed no signs of calico.

Exp. 100. Dec. 17, same treatment as in No. 94, except liquid was filtered through filter paper before using on tobacco plant. Jan. 4, calico beginning to show. Jan. 15, two leaves with calico evident. Jan. 27, calico very evident. Feb. 18, plant badly calicoed and somewhat stunted.

Exp. 101. Dec. 17, same treatment as in No. 100, except filtered juice was used on tomato. Jan. 4, 15 and 27, Feb. 5 and 18, examinations showed no calico; reason for failure not apparent.

Exp. 102. Dec. 18, same treatment as in No. 94, except tobacco water was twenty-four hours old when used on tobacco plant. Jan. 4, calico evident. Jan. 15, calico more prominent on young leaves. Jan. 27, calico very evident, especially on six leaves. Feb. 18, badly calicoed and somewhat stunted.

Exp. 103. Dec. 18, same as No. 102, except tomato plant was used. Jan. 4, calico apparently present. Jan. 15, faint but sure signs of calico. Jan. 27, calico very evident on new leaves. Feb. 18, new growth continued to calico.

Exp. 104. Dec. 19, same as No. 94, except tobacco water was two days old when used on tobacco plant. Jan. 4, 15 and 27, Feb. 5, 18 and 23, Mar. 13, examinations showed absolutely no signs of calico.

Exp. 105. Dec. 21, same as No. 94, except tobacco water was four days old when used on tobacco plant. Jan. 4 and 15, no calico. Jan. 27, faint signs of calico on two young leaves. Feb. 5, calico not so evident. Feb. 18, calico only moderate, plant stunted.

Exp. 106. Dec. 21, same as No. 105, except tomato plant was used. Jan. 4, possibly some slight signs of calico. Jan. 5, plant severely injured by escaped guinea pig. Jan. 15 and 27, calico not surely present. Feb. 11, plant had made poor growth, but calico now showed in younger leaves. Feb. 18, calico moderately prominent.

Exp. 107. Dec. 21, same treatment as in No. 100, except water was evaporated over radiator, and four days later crystalline residue was dissolved in small amount of water before placing on tobacco plant. Jan. 4, 15 and 27, Feb. 5 and 18, Mar. 13, no calico.

Exp. 108. Dec. 21, same treatment as in No. 107, except tomato plant was used. Jan. 4, 15 and 27, Feb. 5 and 18, Mar. 24, no calico.

Exp. 109. Dec. 21, check tobacco plants (a, b) to Nos. 94, 100, 102, 104, 105, 107, 111. Jan. 4, 15 and 27, no calico. Feb. 5, (a) not calicoed, but (b) suspicious. Feb. 18, (a) no calico, but (b) with younger leaves prominently calicoed (possibly infected by guinea pig which injured plant, as mentioned above). Feb. 23, (a) no calico, cut off close to ground with sterilized knife. Mar. 13, (a) no calico in new growth.

Exp. 110. Dec. 21, check tomato plant, for Nos. 98, 101, 103, 106, 108, 112. Jan. 4, no calico. Jan. 15, dead from injury by guinea pig on Jan. 5.

Exp. 111. Jan. 4, treatment same as in No. 94, except tobacco water was eighteen days old when used on tobacco plants (a, b). Jan. 15 and 29, Feb. 5 and 18, no calico. Feb. 23, (b) free, (a) with calico showing on young growth. Mar. 13, (b) free, (a) with upper leaves badly calicoed.

Exp. 112. Jan. 4, treatment same as in No. 107, except crystalline residue was dissolved eighteen days after evaporation, and used on tobacco plants (a, b). Jan. 15 and 27, no calico. Feb. 5, (a) no calico, (b) showing first stages on young leaves. Feb. 18, (a) no calico, (b) badly calicoed in new growth. Mar. 13, (a) now showed calico on new growth.

Exp. 113. Jan. 16, treatment same as in No. 94, except fresh tobacco water was used on young (a) Lima bean and (b) string bean. Feb. 1 and 18, no calico. Mar. 6, (a) no calico, cut off plant near ground with sterilized knife. Apr. 7 and 28, (a) no sure signs of chlorosis in new growth.

Exp. 114. Jan. 16, treatment same as in No. 92, except preserved calicoed juice was used on young (a) Lima and (b) string bean. Feb. 1 and 18, no calico. Apr. 1, (a) no calico, cut off plant near ground. Apr. 28, (a) no signs of calico in new growth.

Exp. 115. Jan. 16, check (a) Lima and (b) string beans, for Nos. 113-114. Feb. 1 and 18, Apr. 18, no calico.

Exp. 116. Jan. 18, (a) Lima and (b) string beans cut off close to ground with sterilized knife. Feb. 18, no chlorosis. Mar. 6, slight yellowish mottling on (b); both plants cut off again down to lowest branch. Apr. 28, no very evident chlorosis on new growth of either plant.

Exp. 117. Jan. 16, treatment same as in No. 94, but fresh calicoed water placed on all eight leaves of young tobacco plant. Feb. 1, no calico. Feb. 11, calico just showing on young leaves. Feb. 18, calico prominent on upper ten leaves and bracts. Feb. 23, plant cut off near ground. Mar. 13, calico just showing in suckers. Apr. 28, all new growth strongly calicoed.

Exp. 118. Jan. 23, same treatment as in No. 117, except same tobacco water was preserved seven days with film of toluol before using. Feb. 1, no calico. Feb. 5, calico just showing on younger leaves. Feb. 11, calico now more prominent than in No. 117, probably because plant grew faster. Feb. 18, calico very evident, especially on middle leaves. Feb. 23, plant in bud, cut off near ground. Apr. 28, new growth calicoed, and with bacterial-like burn.

Exp. 119. Jan. 16, check tobacco plant for Nos. 117, 118. No treatment. Feb. 1 and 18, no calico. Feb. 23, no calico, plant in flower.

Exp. 120. Jan. 20, juice from calicoed leaf of plant in No. 92 used on another tobacco plant. Feb. 1, calico appearing on young leaves. Feb. 18, calico prominent on eleven leaves and bracts. Feb. 23, plant in bud, cut off near ground. Mar. 13, calico just showing in suckers.

Exp. 121. Jan. 20, same as No. 120, except juice from plant in No. 94 was used. Feb. 1, 18 and 23, Mar. 13, treatment and calico same as in No. 120. Apr. 28, all new growth of suckers strongly calicoed.

Exp. 122. Jan. 20, same as No. 120, except juice from plant in greenhouse calicoed from unknown cause before experiments started (not quite typical, leaves lighter green), was used. Feb. 1, no calico. Feb. 5, calico showing on younger leaves. Feb. 18, calico similar to that on original plant. Mar. 6, upper leaves free from calico; cut off near ground. Mar. 13, no calico. Apr. 28, badly calicoed, running toward albino type, leaves misshapen.

Exp. 123. Jan. 10, check for Nos. 120-122. Feb. 1, no calico. Feb. 11, calico just beginning to appear on young leaves, but as these leaves touched calicoed plants of Nos. 120 and 121, they probably became infected from these. Feb. 18, calico showing only on upper leaves. Feb. 23, cut off near ground. Mar. 13, calico appearing in suckers. Apr. 28, all new growth calicoed.

Exp. 124. Jan. 21, juice from uncalicoed lower leaf of calicoed tobacco plant in No. 94 was used. Feb. 1 and 18, no calico. Feb. 23, no calico; cut off near ground with sterilized knife. Mar. 13, Apr. 28, no calico in suckers.

Exp. 125. Jan. 21, check to No. 124. Same treatment, but juice from plant showing no calico was used. Feb. 1 and 18, no calico. Mar. 6, no calico; plant cut off near ground with sterilized knife. Apr. 28, no calico in resulting suckers.

Exp. 126. Jan. 21, similar to No. 94, but 6 grams crushed calicoed leaves were soaked one hour in 150 cc. of distilled water and filtered through cloth before using on tobacco plants (a, b). Feb. 1, (a) no calico, but (b) calico showed on younger leaves. Feb. 5, (a) calico now appearing. Feb. 18, (a, b) calico on all new leaves since first appearance. Feb. 23, (a) plant cut off near ground; (b) now badly calicoed. Mar. 13, (a) sucker calicoed. Apr. 28, (a) sucker wholly calicoed.

Exp. 127. Jan. 21, same treatment as in No. 126, except part of the tobacco water was filtered through Berkefeld filter, and then used on young tobacco plants (a, b). Feb. 1, (a) no calico; (b) just showing calico on younger leaves. Feb. 5, (a) no calico; (b) calico evident. Feb. 18, (a) showed suppressed calico; plant cut off near base; (b) calico very evident. Mar. 6, (b) badly calicoed, with bacterial-like burn. Apr. 28, (a) sucker wholly calicoed.

Exp. 128. Jan. 21, same treatment as in No. 127, but tobacco water was sterilized in autoclave before using on young tobacco plants (a, b). Feb. 1, 5 and 18, no calico. Feb. 23, no calico, cut off (a) with sterilized knife. Mar. 6, (b) calicoed in upper six leaves; cut off with sterilized knife. Mar. 13, (a) no calico in sucker. Apr. 28, (a, b) suckers of both showed calico, (a) the worst (probably an accidental infection; see Nos. 141 and 150).

Exp. 129. Jan. 21, check tobacco plants (a, b) for Nos. 126-128. Feb. 1, and 18, no calico. Mar. 6, no calico; plants cut off near ground with sterilized knife. Apr. 28, (a) dead; (b) suckers showing no sure signs of calico.

Exp. 130. Jan. 22 and 30, Feb. 24, preserved calicoed juice (see No. 92) used on these dates on all leaves of three tobacco plants. Feb. 1, no calico. Feb. 18, calico showed on young leaves. Apr. 28, plants grew poorly; all calicoed, one an albino.

Exp. 131. Jan. 22 and 30, Feb. 24, same as in No. 130, but young tomato used. Feb. 1 and 18, no calico. Feb. 23, calico on youngest leaves. Apr. 28, whole plant calicoed, but not albino.

Exp. 132. Jan. 22, calicoed plant of No. 93 was placed in diffused light under bench. Feb. 18, plant not so strongly calicoed, leaves turning yellowish.

Exp. 133. Jan. 22, same as No. 132, but calicoed plant, No. 92, placed in dark room. Feb. 18, calico not so evident; leaves turning yellowish, then brown, and dying. Calicoed spots usually first affected.

Exp. 134. Jan. 22, preserved calicoed juice, same as in No. 92, used on leaves of young green-leaved geranium. Feb. 1 and 18, no signs of calico on this or the check plant.

Exp. 135. Jan. 25. Uninjured end of fresh calicoed tobacco leaf was soaked for three hours in a small amount of water, then this water poured on tobacco plant. Feb. 1 and 18, no calico. Apr. 28, failed to grow properly, as plant was shaded; no sure signs of calico, though one or two leaves suspicious.

Exp. 136. Jan. 25, several glandular hairs, removed by forceps from fresh calicoed tobacco, were soaked three hours in a few drops of water,

then placed on tobacco plant. Feb. 1 and 18, Mar. 13, no calico, but plant made poor growth because shaded. Apr. 28, no calico except in a few young upper leaves.

Exp. 137. Jan. 26, crushed dried leaves of pole Lima beans, gathered in September, and showing chlorosis which looked like calico, were soaked in small amount of water, filtered, and then used on young (a) Lima bean, and (b) tobacco plant. Feb. 1 and 18, Mar. 13, Apr. 1 (cut off (a), Apr. 28), no calico or chlorosis showing on either (a) or (b) except that on last date (b) showed a few leaves with apparently accidental infection.

Exp. 138. Jan. 26, same treatment, etc., as in No. 137, except calico-like chlorosis of string beans, gathered in the same place, was used on young (a) string bean, and (b) tobacco plant. Feb. 1, 8 and 18, Mar. 13, Apr. 28, no calico showed on either (a) or (b).

Exp. 139. Jan. 27, same as No. 126, except tobacco water six days old was used. Feb. 1, no calico. Feb. 11, calico just showing. Feb. 18, calico evident on all new growth. Mar. 13, Apr. 28, all new growth since inoculation badly calicoed.

Exp. 140. Jan. 27, same as No. 127, except tobacco water was used six days after filtering through Berkefeld filter, on young tobacco plant. Feb. 1, no calico; plant cut off near ground with sterilized knife. Feb. 18, no calico. Mar. 6, slight signs of calico on new sucker. Mar. 13, calico more evident. Apr. 28, all new growth calicoed.

Exp. 141. Jan. 27, same as No. 128, except sterilized tobacco water was used six days after sterilization on young tobacco plant. Feb. 1 and 18, Mar. 6, no calico; cut off plant near ground with sterilized knife. Apr. 28, plant dead.

Exp. 142. Jan. 27, check to Nos. 139-141, no treatment. Feb. 1 and 18, no calico. Apr. 28, a few upper leaves calicoed.

Exp. 143. Jan. 27, two healthy tomato plants about two feet high were cut off near the ground, using hot sterilized knife. Feb. 1 and 18, Mar. 6, no calico; most of new growth cut off on last date, as before. Apr. 28, dead, but no calico observed up to this date.

Exp. 144. Feb. 1, same treatment as in No. 143, except instead of sterilizing knife, it was used each time to cut through calicoed tomato leaf before cutting off healthy plants (a, b). Feb. 18, (a) doubtful signs of calico; (b) no calico in new growth. Mar. 6, (a) still doubtful, but (b) calicoed without question.

Exp. 145. Feb. 1, same as No. 143, but healthy tobacco plant was cut off instead. Feb. 18 and 23, Mar. 13, Apr. 28, no calico showed on sucker, though on Feb. 23d a mottling of some leaves due to shading appeared, but later disappeared entirely.

Exp. 146. Feb. 1, same as in No. 144, but before cutting off tobacco plants (a, b) calicoed tobacco leaf was cut through. Feb. 18, (a) all new growth calicoed; (b) little new growth made on account of shading by other plants, and this not calicoed. Feb. 23, Mar. 6, (a) prominently; and (b) evidently calicoed, shade having been removed. Apr. 28, (a, b) all new growth prominently calicoed.

Exp. 147. Feb. 1, Calyx of healthy tobacco plant, just flowering (see

No. 95) was slit with knife, and preserved calicoed tobacco juice (that used in No. 92) was injected into ovaries with hypodermic syringe, as follows: (a) ovaries with ovules not yet fertilized; (b) ovaries with ovules just fertilized. Feb. 18, seed maturing, but ovaries often split open at point of inoculation, and pods wrinkled on this account; no signs of calico on flower parts. Mar. 8, seed ripe, that from pods most promising saved. No signs of calico on plant.

Exp. 148. Feb. 1, same as in No. 147 (a, b), except calicoed plant was used for injection, and floral parts were not slit. Feb. 18, seed maturing; no signs of calico on pods. Mar. 8, seed from two most promising pods saved.

Exp. 149. Mar. 5, same as in No. 126, except tobacco water was forty-three days old when used on young tobacco plants (a, b, c). Mar. 20, (a) just showing calico, (b, c) free. Apr. 28, (a) slightly calicoed; (b, c) free.

Exp. 150. Mar. 5, same as in No. 128, except sterilized tobacco water was forty-three days old when used on young tobacco plants (a, b, c). Apr. 28, all free from calico; (a) badly sunburned.

Exp. 151. Mar. 5, same as in No. 127, except tobacco water which had been filtered through Berkefeld filter into sterilized test tubes forty-three days before was now used on young tobacco plants (a, b, c). Apr. 28, (a, b) calicoed, but (c) apparently free.

Exp. 152. Mar. 5, same preserved juice as in No. 92 used on two young tobacco plants. Mar. 29, both plants showing signs of calico. Apr. 28, both badly calicoed.

Exp. 153. Mar. 5, juice from fresh calicoed tobacco leaves (from plant in No. 102) used on young tobacco plants (a, b). Mar. 13, (a) calico showed only on youngest leaves. Mar. 29, calico now showed on young leaves of (b). Apr. 28, (a, b) both badly calicoed.

Exp. 154. Mar. 5, checks to Exps. 149-153, no treatment, tobacco plants (a, b). Apr. 8, (a) seemed to be just developing calico; (b) free. Apr. 28, (a) calicoed (probably accidental infection by white fly); (b) free.

Exp. 155. Mar. 5, same as No. 149, except on young petunia. Apr. 28, no calico.

Exp. 156. Mar. 5, same as No. 150, except on young petunia. Apr. 28, no calico.

Exp. 157. Mar. 5, same as No. 151, except on two young petunias. Apr. 28, both apparently free, or very faintly calicoed.

Exp. 158. Mar. 5, same as No. 152, except preserved juice was used on young petunias (a, b). Apr. 3, (a) apparently free, but (b) for first time showed lighter colored, somewhat mottled foliage, like calico of tobacco, but not so prominent. Apr. 28, (a, b) showed distinct signs of calico.

Exp. 159. Mar. 5, same as No. 153, except fresh calicoed juice was used on young petunias (a, b). Apr. 28, (b) showed evident signs of calico, but (a) very faint, if any.

Exp. 160. Mar. 5, two petunias, checks for Nos. 155-159, no treatment. Apr. 28, both free.

Exp. 161. Mar. 5, same as No. 149, except on young tomato. Apr. 28, no calico.

Exp. 162. Mar. 5, same as No. 150, except on young tomato. Apr. 28, no calico.

Exp. 163. Mar. 5, same as No. 151, except on young tomato. Apr. 28, apparently free.

Exp. 164. Mar. 5, same as No. 152, except on young tomato. Apr. 28, considerably calicoed.

Exp. 165. Mar. 5, same as No. 153, except on young tomato. Mar. 27, showed calico on young leaves. Apr. 28, calicoed considerably.

Exp. 166. Mar. 5, tomato, check to Nos. 161-165. Mar. 24, no calico; cut off near base, but no further growth.

Exp. 167. Mar. 5, same as No. 152, except on young pokeweed. Apr. 28, no calico on this or the check plant.

Exp. 168. Apr. 3, juice of crushed leaves of petunia (No. 158-b) transferred by hand to young petunia. Apr. 28, leaves not typically calicoed, but probably so, as more yellowish than check plant.

Exp. 169. Apr. 28, juice from fresh calicoed tobacco (*Nicotiana Tabacum*) transferred by hand to five plants of *Nicotiana Sandrae*. July 29, two dead, three plainly calicoed, or 60%, while none of the check plants showed any sure signs of calico.

Exp. 170. Apr. 28, same as No. 169, except on five plants of Giant Red tobacco. July 29, all five plants calicoed, or 100%. Two of the five checks also showed calico, or 40%.

Exp. 171. Apr. 28, same as No. 169, except on five plants of *Nicotiana affinis*. July 29, no signs of calico on any of these or the five check plants.

Exp. 172. Apr. 28, same as No. 169, except on two plants of *Nicotiana tomentosa*. July 29, one plant certainly calicoed, but the other probably not. No checks.

Exp. 173. Apr. 28, same as No. 169, except on two small seedling potatoes. July 29, one dead, but the other showing positive signs of calico.

In 1910, Experiment Station Farm, Centerville.

Exp. 174. June 28, tobacco seedlings grown from seed saved in injection experiment No. 147 were set out, using (a) plants from seedpod a-1, and (b) plants from seedpod a-2. Aug. 30, (a) 11 plants free, 12 calicoed, or 52%; (b) 23 plants free, none calicoed. Totals, free 34, calicoed 12, or 26%.

Exp. 175. June 28, same as in No. 174, but seed from No. 147 used, as follows: plants from (a) seedpod b-1; (b) seedpod b-2; (c) seedpod b-3; (d) seedpod b-4. Aug. 30, (a) 13 plants free, 10 calicoed, or 43%; (b) 42 free, 2 calicoed, or 5%; (c) 36 free, 11 calicoed, or 23%; (d) 36 free, 5 calicoed, or 12%. Total, free, 127; calicoed, 28, or 18%.

Exp. 176. June 28, same as No. 174, but seed from No. 148, using plants from (a) seedpod a-1, (b) seedpod a-2. Aug. 30, (a) 36 plants free, 5 calicoed, or 12%; (b) 45 plants free, 1 calicoed, or 2%. Totals, 81 free, 6 calicoed, or 7%.

Exp. 177. June 28, same as No. 174, but seed from No. 148, using plants from (a) seedpod b-1, and (b) seedpod b-2. Aug. 30, (a) 31 plants free, 2 calicoed, or 6%; (b) 23 free, none calicoed. Total, 54 free, 2 calicoed, or 4%.

Exp. 178. June 28, checks for Nos. 174-177, no treatment, 45 plants. Aug. 30, 43 free, 2 calicoed, or 4%.

Exp. 179. July 29, dried crushed calicoed tobacco leaves (gathered in October, 1907) were soaked for two hours in a small amount of water, and then water and fragments were placed on alternate (odd-number) plants (a) in row of 54 plants, leaving even-number plants (b) for checks. Aug. 9, calico hardly evident as yet on (a), not at all on (b). Aug. 12, (a) 9 out of 27 plants calicoed; (b) all 27 plants free. Aug. 30, (a) 17 calicoed, 10 free; (b) all free. Calicoed, 1st exam., (a) ?%, (b) 0%; last exam., (a) 63%, (b) 0%.

Exp. 180. July 29, treatment same as in No. 179, except fresh calicoed tobacco leaves soaked in water and used on (a) each alternate (odd-numbered) of 87 plants, with alternate even numbers untreated (b) for checks. Aug. 9, (a) calico hardly evident as yet; (b) no signs of calico. Aug. 12, (a) 27 of the 44 plants calicoed; (b) all of the 43 plants free. Aug. 30, (a) 36 calicoed, 8 free; (b) one calicoed in top, 42 free. Calicoed, 1st exam., (a) ?%; (b) 0%; last exam., (a) 82%, (b) 2%.

Exp. 181. July 29, each alternate (odd-numbered) plant in row of 85 touched with (a) juice from fresh calicoed leaf, renewing on hand each time before touching; (b) even-numbered plants left untouched for checks. Aug. 9, (a) calico just beginning to show on practically every plant; (b) all free. Aug. 12, (a) all 43 plants plainly calicoed; (b) no calico in the 42 plants. Aug. 30, (a) all badly calicoed; (b) 2 calicoed in upper leaves only, 40 free. Calicoed, 1st exam., (a) 100% (?), (b) 0%; last exam., (a) 100%, (b) 5%.

Exp. 182. July 29, each alternate (odd-numbered) plant in row of 60 touched as in No. 181, but juice on hand not renewed (a); even numbers left untouched (b) as checks; after washing hands thoroughly with soap and water, 14 additional plants (c) were touched in same row. Aug. 9, calico just beginning to show in practically every plant in (a), but not at all on (b) and (c). Aug. 12, (a) all plants plainly calicoed, (b) all 30 plants free, (c) all 14 plants free. Aug. 30, (a) all badly calicoed; (b) 2 calicoed in top only, 28 free; (c) all free. Calicoed, 1st exam., (a) 100%; (b) 0%, (c) 0%; last exam., (a) 100%, (b) 7%, (c) 0%.

Exp. 183. July 29, same as No. 181-a, except five muskmelon vines were touched. Aug. 10, no signs of calico or chlorosis showed on this date or later.

Exp. 184. July 29, same as No. 179, except five young muskmelon vines were used. Aug. 10, no signs of calico or chlorosis appeared on this date or later.

Exp. 185. Aug. 30, 88 plants cut off close to ground, as in No. 186. (a) alternate odd-numbered plants cut off with knife used on calicoed leaf before each cutting; (b) alternate even numbered plants cut off with knife cleaned each time before using with soap and water, and

wiped dry with fresh paper; 5 odd and 5 even numbered plants showed calico when cut off. Sept. 30, (a) 8 with suckers free, 5 (plants calicoed when cut off) with calicoed suckers, 31 (plants apparently free when cut off) with calicoed suckers; (b) 37 with suckers free, 5 (plants calicoed when cut off) with calicoed suckers, 2 (plants apparently free when cut off) with calicoed suckers. Calicoed (a) 82%, (b) 16% (including the five originally calicoed, or only 5% without these).

Exp. 186. Aug. 30, same as No. 185, but 76 healthy plants merely topped, using (a) calicoed knife on alternate odd-numbered, and (b) cleaned knife on even-numbered plants. Oct. 10, the topping was made too late for sufficient growth of suckers to determine certainly whether calicoed or not, so results show a small percentage of calico on this date, as follows: (a) 28 free, 10 calicoed, or 26%; (b) 36 free, 2 calicoed, or 5%.

In 1911, Experiment Station Farm, Centerville.

Exp. 187. Aug. 2, juice from fresh calicoed leaves used on hands, touching each alternate (even-numbered) (a) of 40 plants, the odd-numbered (b) being left untouched as checks. Sept. 12, (a) 20 plants badly calicoed, none free; (b) 14 free, 3 doubtful, 2 with calicoed shoots, 1 with main leaf calicoed. Calicoed, (a) 100%, (b) 15%.

Exp. 188. Aug. 2, juice was used from peculiar malformed leaves of "string leaf" disease, received from Tariffville, where trouble was had in field. These plants had the color of suppressed calico, but other similar plants kept in crocks in the greenhouse for a time regained their normal color. Each alternate (a) (odd-numbered) of 30 plants was touched with juice on hands, while even-numbered (b) were left untouched as checks. Sept. 12, (a) 1 calicoed (probably from original unknown infection), 14 free; (b) all 15 plants free.

Exp. 189. Aug. 15, upper leaves of each alternate (odd-numbered) of 38 plants (a) touched with hands containing fresh calicoed juice (not renewed after each touching); while alternate even-numbered plants (b) were left untouched as checks. Most of the plants in Nos. 187-189 were too nearly grown to admit of infection except in sprouts or suckers. Sept. 12, (a) 1 plant with main leaves badly calicoed, 14 with upper leaves and sprouts calicoed, 4 with sprouts only calicoed, none free; (b) all 19 plants free. Calicoed, (a) 100%, (b) 0%.

Exp. 190. Aug. 15, dried crushed calicoed tobacco leaves (kept indoors since October, 1907), were soaked in water, and the material used (a) on upper leaves of alternate (odd-numbered) plants in row of 41, leaving the even numbers (b) untreated as checks. Sept. 12, (a) 1 plant with main leaves calicoed, 20 with upper leaves and sprouts calicoed, none free; (b) 19 free, 1 with sprout calicoed. Calicoed, (a) 100%, (b) 5%.

Exp. 191. Aug. 15, pure calicoed juice preserved in toluol since September, 1908 (same as used in No. 92), used on upper leaves of (a) alternate odd-numbered plants in row of 30, keeping (b) the even-numbered untreated as checks. Sept. 12, (a) 2 with main leaves calicoed,

4 with upper leaves and sprouts calicoed, 6 with sprouts only calicoed, 2 doubtful, 1 free; (b) all 15 free. Calicoed, (a) 80 to 93%, (b) 0%.

Exp. 192. Aug. 23, upper leaves of 6 young tobacco plants (set out late) were touched with juice on hands from fresh calicoed tobacco. Sept. 12, all 6 plants badly calicoed, or 100%.

Exp. 193. Aug. 23, same as No. 192, but only lower mature leaves were touched. Sept. 12, all 6 plants badly calicoed above, but old leaves not showing calico. Calicoed, 100%.

Exp. 194. Aug. 23, same as No. 190, but calicoed tobacco water, etc., seven to eight days old was used on 6 plants. Sept. 12, 4 plants free, 2 calicoed, or 33%.

Exp. 195. Aug. 28, same as No. 194, but infusion freshly made, on 6 plants. Sept. 12, all 6 plants calicoed, or 100%.

Exp. 196. Aug. 23, same preserved calicoed juice was used as in No. 191, on 12 young plants. Sept. 12, for some undetermined reason this treatment did not act as before, and none of the plants showed calico on this date. Were not examined later.

Exp. 197. Aug. 23, 12 young tobacco plants were touched with juice on hands from fresh leaves of healthy tobacco. Sept. 12, all plants free, or 0% calicoed.

Exp. 198. Plants set out late, July 5, same as in Nos. 192-197. These plants were grown from seed taken from calicoed plants Nos. 174-177, which in turn came from seed from plants injected with calicoed juice. Sept. 12, 1 calicoed, 174 free. Sept. 30, 8 calicoed, 6 doubtful, 161 free; plants hardly mature yet. Calicoed, 1st exam., $\frac{1}{2}$ %, last exam. 5%.

Exp. 199. Sept. 12, 38 plants used in No. 189 were topped with knife which was washed with soap and water and wiped with fresh paper each time before topping. At this time 19 of the topped plants showed signs of calico, and 19 showed no signs of it. Sept. 30, all the 19 calicoed plants showed calicoed sprouts, while of those apparently free, only 2 produced calicoed sprouts, or 11%.

In 1912, Experiment Station Farm, Mount Carmel.

Exp. 200. June 8, just before transplanting, roots of 21 tobacco plants were dipped in pure juice from fresh calicoed tobacco leaves. Care was used not to get any of the juice on any other part of the plant. July 10, 2 dead, 2 apparently free, 17 plants plainly calicoed. Sept. 10, 2 missing, 19 calicoed badly, so as to stunt their growth. Calicoed, 1st exam., 81-90%, last exam., 90-100%.

Exp. 201. June 8, part of same calico juice used in No. 200 placed on leaves of 10 plants after setting. July 10, 3 apparently free, 7 plainly calicoed. Sept. 10, 9 badly calicoed and stunted in their growth, 1 stunted, but apparently not calicoed. Calicoed, 1st exam., 70%, last exam., 90%.

Exp. 202. June 8, tap root, with most of rootlets, cut off from 25 plants just before setting out. July 10, 1 plant dead, 1 calicoed, 23 free. Sept. 10, 1 missing, 2 calicoed, 22 free. Calicoed, 1st exam., 4%, last exam., 8%.

Exp. 203. June 8, tap root of 15 plants bent back before setting out. July 10, none calicoed. Sept. 10, 1 calicoed, 14 free. Calicoed, 1st exam., 0%, last exam., 7%.

Exp. 204. June 8, checks to Nos. 200-203, no treatment, 20 plants. July 10, 1 dead, 1 calicoed, 2 doubtful, 16 free. Sept. 10, 1 missing, 2 calicoed, 17 free. Calicoed, 1st exam., 5% (?), last exam., 10%.

Exp. 205. July 10, crushed dried calicoed tobacco leaves (herbarium specimens obtained from Southington in July, 1902) soaked in small amount of water for about four hours, and used on leaves of (a) 6 young tobacco plants, leaving (b) 4 similar plants as checks. Sept. 10, (a) all 6 plants free from calico; (b) 3 free, 1 calicoed. Calicoed, (a) 0%, (b) 25%.

Exp. 206. July 10, same as No. 205, except calicoed and rusted tobacco leaves gathered in September, 1907, at Centerville, were used on 6 young plants (a), leaving 4 plants (b) as checks. Sept. 10, (a) 4 free, 2 calicoed, (b) 3 free, 1 calicoed in upper leaves. Calicoed, (a) 33%, (b) 25%.

Exp. 207. July 10, same as No. 205, except calicoed and rusted leaves gathered in August, 1911, in Middletown, were used on 6 young plants. (Check plants were the same as in Nos. 205-206.) Sept. 10, 2 free, 1 calicoed in upper leaves, 3 calicoed all over. Calicoed, 67%.

Exp. 208. Aug. 28, fresh calicoed and rusted mature leaves from No. 201 were gathered, washed, and cut into bits, and the juice extracted in hydraulic press, part of this filtered through Berkefeld filter into flasks, and used on leaves of 19 half-grown Havana tobacco plants about eighteen hours later. Sept. 10, 18 free, 1 calicoed in upper leaves. Sept. 27, 1 with main leaves calicoed, 3 with calicoed sprouts, 15 free. Calicoed, 1st exam., 5%, last exam., 21%.

Exp. 209. Aug. 23, same treatment as in No. 208, except that after filtering, juice was sterilized in autoclave one-half hour, and used at same time on leaves of 19 similar tobacco plants. Sept. 10, all 19 plants free. Sept. 27, 16 free, 2 doubtful, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 5% (?).

Exp. 210. Aug. 23, same treatment as in No. 208, except juice was neither filtered nor sterilized before using on 18 similar tobacco plants. Sept. 10, 16 plants free, 2 calicoed in upper leaves. Sept. 27, 14 free, 2 doubtful, 2 calicoed in upper leaves. Calicoed, 1st exam., 11%, last exam., 11-22%.

Exp. 211. Aug. 23, checks for Nos. 208-210, no treatment, 13 plants. Sept. 10, all 13 free. Sept. 27, 12 free, 1 calicoed. Calicoed, 1st exam., 0%, last exam., 8%.

Exp. 212. Aug. 23, same treatment as in No. 208, except young calicoed, but not rusted leaves, from same source, were used on 18 Havana tobacco plants nearly in bloom. Sept. 10 and 27, all free. Calicoed, 0%.

Exp. 213. Aug. 23, same treatment as in No. 209, except juice from leaves as in No. 212 was used on 18 similar plants. Sept. 10 and 27, all free. Calicoed, 0%.

Exp. 214. Aug. 23, same treatment as in No. 210, except juice from

leaves as in No. 212 was used on 18 similar plants. Sept. 10, all free. Sept. 27, 15 free, 3 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 17%.

Exp. 215. Aug. 23, checks to Nos. 212-214, no treatment on 18 plants. Sept. 10 and 27, all free. Calicoed, 0%.

Exps. 208-215. In these experiments Havana instead of Broadleaf tobacco was used, and yet this does not explain why calico failed to appear where naturally expected in Nos. 208, 210, 212 and 214, because before treatment some of the Havana plants not used in the experiments showed calico. The plants when treated were a little old, and this may have made some difference, but to overcome this, all of those showing blossoms were topped on September 10, using a knife washed with soap and water and wiped dry after each topping, yet the suckers from these did not develop calico. It looks as if the trouble might be due to the use of calicoed juice which may have lost its power of infection from standing eighteen hours, without any preservative to prevent bacterial fermentation; or because the juice was not rubbed in but merely dropped on the plants.

In 1913, Experiment Station Farm, Mount Carmel.

Exp. 216. June 25, juice on hands from fresh calicoed leaves was used in touching, with considerable pressure, single leaf on 20 young tobacco plants just starting to grow, renewing juice on hands before each touching. June 27, leaves more or less injured where touched, looking like burn. July 8, calico showing on young leaves of apparently all the plants. July 28, 19 prominently calicoed, 1 doubtful. Aug. 21, all badly calicoed, and somewhat stunted. Calicoed, 100%.

Exp. 217. June 25, same as No. 216, but two leaves of 20 plants were touched, and juice on hands was not renewed after touching first plant. June 27, same injury as in No. 216. July 8, all plants apparently calicoed. July 28, all plants prominently calicoed. Aug. 21 and Sept. 11, all badly calicoed. Calicoed, 100%.

Exp. 218. June 25, checks for Nos. 216-217, no treatment, 15 plants. July 8 and 28, all 15 plants free. Aug. 21, Sept. 11, 2 plants calicoed slightly in upper leaves, 13 free. Calicoed, 1st exam., 0%, last exam., 13%.

Exp. 219. June 27, fresh calicoed tobacco leaf tissue was crushed in very small amount of water, juice poured off, and two drops used on each of three leaves of 20 young tobacco plants. July 8, 6 plants apparently calicoed, 14 free. July 28, same as before, except calico evident in all 6 plants. Aug. 21, 9 with calicoed main leaves, 4 with upper leaves, 7 free. Sept. 11, 9 with main leaves badly calicoed, 5 with upper leaves only, 1 calicoed in sprouts, 5 free. Calicoed, 1st exam., 30%, last exam., 75%.

Exp. 220. June 27, same as No. 219, except juice was mixed half and half with similar juice from *Coprinus* sps., obtained by soaking crushed tissue in small amount of water and then filtering through filter paper. Two drops of this juice was used immediately after mixing on three leaves each of 20 young tobacco plants. July 8, 4 plants doubtful, 16 free.

July 28, all 20 apparently free. Aug. 21 and Sept. 11, 1 calicoed in upper leaves only, 19 free. Calicoed, 1st exam., 0% (?), last exam., 5%.

Exp. 221. June 27, same as No. 220, except juice from tobacco and Coprinus was mixed three hours before using on 20 young tobacco plants. July 8, 3 plants apparently calicoed, 17 free. July 28, 5 plants apparently calicoed, 15 free. Aug. 21, 5 with main leaves calicoed, 4 calicoed in upper leaves only, 11 free. Sept. 15, 5 with main leaves calicoed, 4 calicoed in upper leaves only, 6 with calicoed sprouts, 5 free. Calicoed, 1st exam., 15%, last exam., 75%.

Exp. 222. June 27, same as No. 220, except juice of Coprinus only was used without adding the calicoed tobacco juice, on 15 young tobacco plants. July 8 and 28, all free. Aug. 21 and Sept. 11, 1 calicoed in upper leaves only, 14 free. Oct. 3, 2 plants with calicoed sprouts, 12 free. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 223. June 27, checks for Nos. 219-222, no treatment, 14 plants. July 8 and 28, all plants free. Aug. 21, 1 calicoed, 13 free. Sept. 11, 1 calicoed in main leaves, 1 in sprouts, 12 free. Oct. 3, 2 with calicoed sprouts, leaving 11 free. Calicoed, 1st exam., 0%, last exam., 21%.

Exp. 224. July 9, fresh leaves of "yellows" raspberries from Benham's, Highwood, crushed in hands and two upper leaves of 10 tobacco plants touched, renewing juice on hands each time before touching. July 23 and 28, all plants free. Aug. 24, 5 free, 4 calicoed in upper leaves only, 1 with main leaves calicoed. Sept. 11, same as before, except one additional plant with calicoed sucker. (Probably some infection carried from a latent calicoed tobacco plant in touching, was responsible, rather than the "yellows" of the raspberry, for the late infection.) Calicoed, 1st exam., 0%, last exam., 60%.

Exp. 225. July 9, same as No. 224, except juice from fresh calicoed tomato leaves from same farm, was used on 10 tobacco plants. July 23, all plants calicoed. July 28, all badly calicoed. Aug. 24 and Sept. 11, all plants very badly calicoed on main leaves, and somewhat stunted. Calicoed, 1st and last exam., 100%.

Exp. 226. July 28, fresh specimens of Coprinus were crushed in small amount of water, then tissue and juice were placed on three or four leaves of 5 calicoed tobacco plants used in No. 216. Sept. 11, these calicoed plants showed no recovery from calico as compared with adjacent calicoed plants.

Exp. 227. July 29, fresh calicoed tobacco leaves of No. 216 were washed with small amount of water, cut in strips, and juice pressed out in hydraulic press (9.00 A. M.) and used (3.00 P. M.) by pouring a few drops on three leaves each of 10 tobacco plants. Aug. 24, 2 free, 1 doubtful, 7 calicoed in upper leaves. Sept. 11, 8 calicoed in upper leaves, 2 with calicoed sprouts. Calicoed, 1st exam., 70-80%, last exam., 100%.

Exp. 228. July 29, same treatment as in No. 227, except juice was sterilized in autoclave before pouring it on the leaves of 10 tobacco plants. Aug. 24, 9 free, 1 calicoed in upper leaves only. Sept. 11, 8 free, 1 calicoed in upper leaves, 1 calicoed in sprouts. Oct. 3, same as before, but one more plant showing calicoed sprouts. Calicoed, 1st exam., 10%, last exam., 30%.

Exp. 229. July 29, same treatment as in No. 227, except juice was filtered through Berkefeld filter into sterilized test tubes before pouring on leaves of 10 tobacco plants, as follows: (a) 5 plants with juice rubbed in after pouring, with fresh piece of paper for each plant; (b) 5 plants with juice not so rubbed in. Aug. 24, (a) all 5 plants with upper leaves calicoed; (b) all 5 plants free. Sept. 11, Oct. 3, same, except (b) 1 plant showing calicoed sprout. Calicoed, 1st exam., (a) 100%, (b) 0%; last exam., (a) 100%, (b) 20%.

Exp. 230. July 29, same leaves as in No. 227, after pressing, were thoroughly ground in mortar with small amount of water added, and this juice dropped on 10 tobacco plants. Aug. 24 and Sept. 11, all 10 plants with upper leaves calicoed. Calicoed, 100%.

Exp. 231. July 29 same as No. 230, except juice was sterilized in autoclave before pouring it on 10 tobacco plants. Aug. 24, all 10 plants free. Sept. 11, 9 free, 1 calicoed in sprout. Oct. 3, 8 free, 2 calicoed in sprouts. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 232. July 30, same treatment as in No. 227, except juice twenty-four hours older, not preserved, used on 10 plants (a) and (b) as in No. 229. Aug. 24, (a) all 5 plants calicoed in upper leaves; (b) 4 free, 1 calicoed in upper leaves. Sept. 11, same as before, except (b) with 3 free, 1 calicoed in upper leaves, 1 calicoed in sprouts. Oct. 3, same as before, except (b) with 2 now calicoed in sprouts. Calicoed, 1st exam., (a) 100%, (b) 20%; last exam., (a) 100%, (b) 60%.

Exp. 233. July 30, same treatment as in No. 228, except sterilized juice twenty-four hours older, not preserved, used on 10 plants. Aug. 24, Sept. 11, all 10 plants free. Oct. 3, 8 free, 2 calicoed slightly in sprouts. Calicoed, 1st exam., 0%, last exam., 20%.

Exp. 234. July 30, same treatment as in No. 229, except filtered juice twenty-four hours older, in sterilized tube, was used on 10 plants (a) and (b) as in No. 229. Aug. 24, (a) 4 plants with upper leaves calicoed, 1 with main leaves calicoed; (b) all 5 plants free. Sept. 11, same as before, except (b) 1 plant with a few upper leaves calicoed. Calicoed, 1st exam., (a) 100%, (b) 0%, last exam., (a) 100%, (b) 20%.

Exp. 235. July 30, same treatment as in No. 227, except juice preserved with film of toluol after extraction, and now twenty-four hours older, was used, on 10 plants (a) and (b) as in No. 229. Aug. 24 and Sept. 11, (a) all 5 plants with upper leaves calicoed; (b) 2 free, 2 with upper leaves calicoed, 1 with calicoed sprouts. Oct. 3, (b) one additional plant with calicoed sprouts. Calicoed, 1st exam., (a) 100%, (b) 60%, last exam., (a) 100%, (b) 80%.

Exp. 236. July 30, same treatment as in No. 230, except juice preserved with film of toluol and used twenty-four hours later on 10 plants. Aug. 24, Sept. 11, all 10 plants with upper leaves calicoed. Calicoed, 100%.

Exp. 237. July 30, checks for Nos. 224-236, no treatment, 10 plants. Aug. 24, Sept. 11, 9 plants free, 1 calicoed in upper leaves only. Calicoed, 10%.

Exp. 238. Aug. 7, same treatment as in No. 227, except juice now

nine days older, not preserved, used on 10 plants. Aug. 24, 7 free, 3 calicoed in upper leaves only. Sept. 11, 4 free, 3 calicoed in upper leaves, 3 in sprouts only. Oct. 3, 1 more calicoed in sprouts, leaving 3 free. Calicoed, 1st exam., 30%, last exam., 70%.

Exp. 239. Aug. 7, same treatment as in No. 228, except sterilized juice nine days older, not preserved, used on 10 plants. Sept. 11, 5 free, 2 calicoed in upper leaves, 3 calicoed in sprouts. Oct. 3, 1 more calicoed in sprouts, leaving 4 free. Calicoed, 1st exam., 50%, last exam., 60%.

Exp. 240. Aug. 7, same treatment as in No. 229, except filtered juice nine days older, not preserved, used on 10 plants. Sept. 11, 8 free, 2 calicoed in upper leaves only. Oct. 3, 5 free, 2 calicoed in upper leaves, 3 calicoed in sprouts only. Calicoed, 1st exam., 20%, last exam., 50%.

Exp. 241. Aug. 7, same treatment as in No. 227, except juice preserved in toluol after pressing out, and now nine days older used on 10 plants. Sept. 11, 4 free, 1 calicoed in upper leaves, 5 calicoed in sprouts only. Oct. 3, 2 free, 1 calicoed in upper leaves, 7 in sprouts. Calicoed, 1st exam., 60%, last exam., 80%.

Exp. 242. Aug. 7, fresh calicoed tobacco leaves from No. 225 (originally calicoed from tomato leaves) were crushed in the hands and, without renewing, one leaf each of 25 tobacco plants were touched in succession. Sept. 11, none free, 8 calicoed in upper leaves, 17 calicoed in sprouts only. Calicoed, 100%.

Exp. 243. Aug. 7, same as in No. 242, except after touching these plants, hands were washed thoroughly with soap and water, and 25 plants were touched as before. Sept. 11, 24 free, 1 doubtful. Oct. 3, 23 free, 2 calicoed in sprouts only. Calicoed, 1st exam., 0% (?), last exam., 8%.

Exp. 247. Aug. 7, checks for Nos. 238-243, no treatment, 20 plants. Sept. 11, all free. Oct. 3, 19 free, 1 with calicoed sprouts. Calicoed, 1st exam., 0%, last exam., 5%.

Exps. 244-255. Aug. 14-21, these were experiments made with a fresh lot of crushed juice from calicoed tobacco leaves, and many of the experiments Nos. 227-241 were repeated. The experiments were started too late in the season to obtain full results, but as far as shown, they confirmed those previously made.

In 1914, Experiment Station Farm, Mt. Carmel.

Exp. 256. July 10, chlorosis pokeweed leaves, recently collected at Meriden, were thoroughly mashed in a small amount of water, and after standing two and one-half hours, juice and pulp were poured on leaves of 20 young tobacco plants, and rubbed in, using fresh piece of paper each time. None showed calico at this date. Aug. 7, 1 calicoed, 19 free; Sept. 10, 3 calicoed, 2 calicoed in sprouts only, 15 free. Calicoed, 1st exam., 5%, last exam., 25%.

Exp. 257. July 10, fresh calicoed tobacco leaves were thoroughly mashed in small amount of water, and after standing for two and one-half hours, the greenish liquid was poured off and mixed with equal parts of blackish liquid from fresh *Coprinus micaceus* similarly treated; five

minutes after mixing, several drops were placed on a leaf of each of 10 small tobacco plants, and rubbed in, using fresh paper each time, without touching the plants with the hands. Only one showed calico at the time, or 10%. Aug. 7, 9 calicoed, 1 free; Sept. 10, all 10 calicoed. Calicoed, 1st exam., 90%, last exam., 100%.

Exp. 258. July 10, check to No. 257. Same treatment, except instead of mixing with *Coprinus micaceus* juice, an equal amount of water was added, on 10 young plants, 3 of which showed calico. Aug. 7 and Sept. 10, all 10 calicoed. Calicoed, 1st and last exam., 100%.

Exp. 259. July 10, used only the Coprinus liquid, same as in No. 257, which was not rubbed in, after placing on 3 calicoed plants and 2 previously touched with calicoed juice on hands. Aug. 7, Sept. 10, all 5 calicoed. Calicoed, 1st and last exam., 100%.

Exp. 260. July 10, checks to Nos. 256-9, 261-2, no treatment, but of the 15 plants, 2 already showed calico at this time. Aug. 7 and Sept. 10, 3 calicoed, 12 free. Calicoed, 1st exam., 13%, last exam., 20%; therefore we would naturally expect at least 13-20% of the plants in the experiments this year to show calico without treatment of any kind. See Nos. 264-266 for data regarding source of infection.

Exp. 261. July 14, one or more leaves of 24 tobacco plants (2 of which showed calico at the time) were touched with fresh calico juice on the hands, and same treatment repeated on July 28th. Aug. 7 and Sept. 10, all 24 plants calicoed. Calicoed, 1st and last exam., 100%.

Exp. 262. July 21, slaked lime, about one pound per plant, was placed around 19 small tobacco plants, which on July 10th showed no signs of calico. Aug. 7, 2 calicoed, 17 free; Sept. 10, 4 calicoed (1 only in upper shoots), 15 free. Calicoed, 1st exam., 11%; last exam., 21%.

Exp. 263. July 21, about one-third pound of acid phosphate was placed around each of 19 small tobacco plants, of which only one showed calico on July 10th. Aug. 7, only one calicoed; Sept. 10, 14 free, 2 completely calicoed, 2 calicoed in upper leaves only, and 1 in sprouts only. Calicoed, 1st exam., 11%, last exam., 26%.

Exp. 264. All plants in Nos. 256-265 were raised as seedlings in our greenhouse in sterilized soil, carefully reset in trays of 100, and when set out in the field, were set about six feet apart so that they would not touch each other. These precautions were taken so that there would be little or no calico in the plants except as due to the experiments. Unfortunately, in the same greenhouse but in another room, old calicoed tobacco had been grown all winter, and the white fly was more or less abundant there. Without question these flies carried the calico to some of the young seedlings, and it may have been further spread by handling in resetting, since when we started to set these plants out in the field, on June 3d, we found one or more plants in each tray showing the first signs of calico. These and the surrounding plants were all discarded, and in order to prevent further infection, care was taken to wash the hands frequently with soap and water, and to touch the leaves of the plants as little as possible. Most of these plants, the 156 Broadleaf of this experiment and the Havana plants of No. 265, were left without

further treatment, and the amount of calico determined from time to time. This amount would have been greater had we not taken the above precautions at the time of transplanting.

July 10, 26 wholly calicoed, 3 doubtful or missing, 127 free; Aug. 7, 35 wholly calicoed, 8 doubtful or missing, 113 free; Sept. 10, 39 wholly calicoed, 15 calicoed in upper leaves only, 3 calicoed in sprouts only, 4 doubtful or missing, 95 free. Calicoed, 1st exam., 17%, 2d exam., 23%, last exam., 37%. The first and second examinations probably show about the percentage of calico due to infection in the greenhouse and handling in transplanting to the field, while the increase in the third examination shows that due to secondary field infection.

Exp. 265. Same as No. 264, except that 125 plants of Havana were used. July 10, 4 wholly calicoed, 1 doubtful or missing, 120 free; Aug. 7, 9 wholly calicoed, 4 doubtful or missing, 112 free; Sept. 10, 12 wholly calicoed, 10 calicoed in upper leaves only, 16 calicoed in sprouts only, 22 doubtful or missing, 65 free. Calicoed, 1st exam., 3%, 2d exam., 7%, last exam., 30%. It was more difficult to determine calico positively on the Havana than on the Broadleaf.

Exp. 266. Other seedlings grown in the same greenhouse, and therefore subject to infection, were planted elsewhere for plant breeding experiments, and an examination of these on July 10th showed 155 calicoed plants out of 1,452 counted, or 11%. No doubt later counts would have shown the same proportional increase as in our experimental plots. This percentage of calico was much larger than we have usually had in the field at this time of year. Young tomato plants grown in the same greenhouse, when set out in the field, showed a very unusual amount of calico early in the season.

Exp. 267. July 14, *Nicotiana rustica scabra*, (a) leaves of 7 plants were touched with juice on hands from fresh calicoed Broadleaf tobacco; (b) 7 plants with juice from fresh calicoed tomato leaves; (c) checks, 5 plants, no treatment. All the plants in Nos. 267-277 were kindly furnished by Dr. E. M. East, and were grown at the greenhouses of the Bussey Institution, Boston, Mass., and planted out-of-doors at Mt. Carmel on June 17th. Dr. East wrote that some of these seedlings did not grow well, due to cold or poor soil, and showed indications of chlorosis. This may explain the yellowish mottling of the foliage, not typical calico, on some of the plots, including the checks, later in the season.

Sept. 3, (a) all 7 plants *decidedly dwarfed*, six to twelve inches high, much branched; *leaves very much reduced, irregular, crinkled*, somewhat mottled with yellow, but not typical calico variegation (see photo); (b) all 7 plants similar to *a*; (c) checks with normal foliage, and two to two and one-half feet high, except one undersized normal plant and one large plant with foliage a little off color.

Exp. 268. Same as No. 267, but on *Nicotiana alata grandiflora*. (a) Calicoed tobacco juice on 4 plants; (b) calicoed tomato juice on 4 plants; (c) checks, 2 plants. Sept. 3, (a) 2 with upper leaves showing rather typical calico chlorosis and some of them irregular in shape; 1

plant dead; 1 plant apparently normal; (b) 2 plants calicoed, 1 doubtful, 1 normal; (c) both checks apparently normal, but a little off color.

Exp. 269. Same as No. 267, but on *Nicotiana attenuata*. (a) Calicoed tobacco juice on 6 plants; (b) calicoed tomato juice on 6 plants; (c) checks, 6 plants. Sept. 3, (a) all 6 plants decidedly smaller than the checks, and with foliage more slender and showing more yellowing, but not typical calico chlorosis; (b) similar to *a*; (c) checks apparently normal in growth and color of foliage.

Exp. 270. Same as No. 267, but on *Nicotiana plumbaginifolia*. (a) Calicoed tobacco juice on 8 plants; (b) calicoed tomato juice on 8 plants; (c) checks, 4 plants. Sept. 3, (a) and (b) similar, all living plants *decidedly dwarfed*, averaging less than one foot high, not much branched, with foliage scanty, small, and more or less yellowish and crinkled; one plant in each lot dead; (c) all check plants alive, apparently healthy, good color, plants bushy and averaging two feet high.

Exp. 271. Same as No. 267, but on *Nicotiana quadrivalis*. (a) Calicoed tobacco juice on 4 plants; (b) calicoed tomato juice on 4 plants; (c) checks, 3 plants. Sept. 3, (a) and (b) similar, all living plants *very small, stunted*, about three or four inches high, with foliage narrow and yellowish; only 4 of the 8 plants alive; (c) one check dead, but the other two normal green in color and about ten inches high.

Exp. 272. Same as No. 267, but on *Nicotiana alata* var. (a) Calicoed tobacco juice on 4 plants; (b) calicoed tomato juice on 4 plants; (c) checks, 4 plants. Sept. 3, (a) and (b), 4 out of the 8 plants dead, the others failed to show calico in leaves on main stem, but those of the shoots showed typical mottling, and all plants were shorter (about one to one and one-half feet high) and less bushy than the checks; (c) 1 plant dead, the other 3 normal height (three feet) and bushy, color of leaves normal except one, which had a little calico mottling on the sprouts.

Exp. 273. Same as No. 267, but on *Nicotiana forgetiana*. (a) Calicoed tobacco juice on 2 plants; (b) calicoed tomato juice on 1 plant; (c) check, 1 plant. Sept. 3, not so much difference between infected plants and checks as in some other species, as plants were apparently too old when infected. Chief differences seen were that the infected plants were slightly smaller (two feet high as compared with three feet for check), with some leaves having typical mottling and with blossoms a deeper red color.

Exp. 274. Same as No. 267, but on *Nicotiana vincaeflora*. (a) Calicoed tobacco juice on 5 plants; (b) calicoed tomato juice on 5 plants; (c) checks, 4 plants. Sept. 3, (a) 2 plants dead, the other 3 somewhat smaller and less thrifty than the checks, with no typical calico, but some yellowish chlorosis of leaves, which also showed somewhat on the checks; (b) plants similar to checks, but slightly smaller, hard to recognize as calicoed; (c) plants all alive and apparently normal, except for some yellowing of foliage.

Exp. 275. Same as No. 267, but on *Nicotiana paniculata*. (a) Calicoed tobacco juice on 7 plants; (b) calicoed tomato juice on 7 plants; (c) checks, 6 plants. Sept. 3, (a) and (b) most plants of each lot show-

ing calico through smaller size (some quite dwarfed), with some of the main stem leaves merely yellowed, and others showing true calico mottling; remaining plants not surely calicoed, though somewhat irregular in size; (c) checks normal, except some having leaves yellow-spotted, not typical of calico.

Exp. 276. Same as No. 267, but on *Nicotiana rustica humilis*. (a) Calicoed tobacco juice on 2 plants; (b) calicoed tomato juice on 2 plants; (c) check, 1 plant. Sept. 3, (a) and (b) all plants showing calico through dwarfed size, poor foliage, some with typical calico mottling; (c) check vigorous, height, branching, and color of foliage normal.

Exp. 277. Same as No. 267, but on a mixture of the preceding species of tobacco and their crosses. (a) Calicoed tobacco juice on 10 plants; (b) calicoed tomato juice on 9 plants; (c) checks, 8 plants. Sept. 3, (a) 8 plants certainly showing signs of calico, as indicated by size, mottling, etc., and 2 doubtful; (b) 8 showing calico, 1 free; (c) 1 doubtful, signs of calico in sprouts, 7 free.

Exp. 278. July 10, fresh calicoed tobacco leaves were crushed in the hands, and leaves of (a) 7 plants of wild ground cherry, *Physalis* sp., were touched, leaving (b) 3 check plants. Sept. 10, (a) 2 plants showed faint signs of calico mottling and wrinkling of foliage, like suppressed calico; other plants normal, except that one was much smaller; (b) all 3 plants normal size and color, except one with some leaves of yellow cast, not like calico.

Exp. 279. Same as No. 278, except that (a) 7 egg plants, *Solanum melongena*, were treated, leaving (b) 3 for checks. Sept. 10, (a) and (b) no signs of calico could be found on any of the plants, treated or untreated.

Exp. 280. Same as No. 278, except that (a) 7 pimento pepper plants *Capsicum annuum* var., were treated, leaving (b) 3 for checks. Sept. 10, (a) 5 plants dead (2 of these were alive Aug. 7th, and showed some signs of calico then), the other 2 smaller than the checks, but showing no sure signs of typical mottling of foliage; (b) checks all alive and normal.

Exp. 281. Same as No. 278, except that (a) 7 petunia plants, *Petunia* sp., were treated, leaving (b) 3 for checks. Sept. 10, (a) 5 plants with some leaves showing typical mottling, but not very evident on whole plant; 2 plants doubtful; (b) all 3 plants free.

Exp. 282. Same as No. 278, except that (a) 7 tomato plants, *Lycopersicon esculentum*, of different varieties were treated, leaving (b) 3 for checks. Sept. 10, (a) 5 plants evidently calicoed, as shown by typical mottling of leaves, 2 plants of Dwarf Champion doubtfully calicoed, as mottling was not so evident, though crinkling of leaves was more prominent than usual; (b) checks free, except sprout of one possibly calicoed.

Exp. 283. July 14, (a) young cucumber vine, *Cucumis sativus*, touched with juice from fresh calicoed tobacco leaves on hands; (b), same, but with juice from fresh calicoed tomato. Aug. 7, no signs of calico on either vine.

Exp. 284. Same as No. 283 (a) and (b), but young musk melon vines, *Cucumis melo*, 3 in each case, were touched. Aug. 7, no signs of calico on any of the vines.

Exp. 285. Same as No. 283, but tops of potato plants, *Solanum*

tuberosum, were cut off in part before leaves were touched, in order to start new growth, and then three each were touched, as in (a) and (b). Aug. 7, plants made new growth, but no positive signs of calico appeared on this or on the old leaves of any of the plants.

Exp. 286. Same as No. 283, but on ordinary cultivated peppers, *Capsicum annuum*, (a) on 3 plants; (b) on 3 plants; (c) several check plants. Sept. 10, (a) and (b) 2 plants dead, 2 with no mottling, but plants somewhat smaller than checks, 1 plant with evident mottling on a few leaves, and 1 with faint typical calico mottling; (c) checks normal.

Experiments to Lessen Calico by Removing Calicoed Plants.

Some farmers, who believe that calico is contagious, pull up the calicoed plants they see when going through their fields. Often they do not know that calico can be transmitted by handling calicoed and then healthy plants, and so they are likely to do more harm than good through thoughtless handling or bugging of the plants at this time.

In order to gain some idea as to whether calico could be lessened in a field by the removal of calicoed plants at regular intervals, experiments along this line were undertaken in 1909 in the fields at Windsor belonging to Elias F. Aldrich and James H. Smith. These fields eventually showed considerable calico, and so quite a number of plants were removed from certain selected rows, while in other check rows they were not removed, but the number was determined in each case. The calicoed plants were first removed on July 16th, care being taken at all times not to spread the disease in any way by contact of calicoed plants with healthy or by handling healthy plants. As the calico first began to show in the fields a week or ten days previously, it would have been better if the first removal of calicoed plants had been made at that time. The particular data for each field are given under the following headings. The figures in case of the calicoed plants indicate that calico showed on the leaves of the main stem. Where it occurred only on sprouts, additional figures are sometimes given in parentheses.

Field of Elias F. Aldrich.

The plants were set out June 20th; but many had to be reset on account of cut worms. On July 16th they were quite unequal in height, but averaged about one foot. The seed bed had been used for four years, and the tobacco field for about the same length of time, previous to which it had not been in tobacco for

ten years. Some calico showed last year, but more showed this year. In Row 8, calicoed plants regularly alternated with healthy ones for a considerable distance and then gradually disappeared. Evidently these were set out by the same man, and were infected by juice from his hands. The plants were topped August 14th, shortly before the last count, but too early to show any calico in the young sprouts at that time. Rust was abundant on this date. September 25th, some time after cutting, we examined the stubs, but the suckers were not far enough developed in most cases to determine accurately the percentage of calico. See Tables I and II.

TABLE I. ROWS FROM WHICH CALICOED PLANTS WERE REMOVED.

Row No.	Total plants	July 16 removed	Aug. 2 removed	Aug. 19 counted but not removed	Total calicoed
1	296	11	6	3 (1)**	20 (1)
2	299	27	11	11 (3)	49 (3)
3	299	7	19	6	32
4	283	1	1	2	4
5	297	6	5	5 (3)	16 (3)
6	298	5	5	8 (1)	18 (1)
7	304	12	12	4 (4)	28 (4)
8	287	65	17*	7 (2)	89 (2)
9	305	4	5*	3 (3)	12 (3)
10	291	1	4*	5 (4)	10 (4)
11	327	2	1*	0 (3)	3 (3)
12	305	5	5*	7 (4)	17 (4)
13	289	39	9*	1 (1)	49 (1)
14	308	11	11*	4	26
Totals	4188	196	111	66 (29)	373 (29)
Per cent.	100	4.7	2.6	1.6	8.9

* Not removed, but on Aug. 19 only additional calicoed ones counted.

** Figures in parentheses indicate additional plants showing calico in axillary sprouts only.

TABLE II. ROWS FROM WHICH CALICOED PLANTS WERE NOT REMOVED.

Row No.	Total plants	Calicoed on July 16	Calicoed on Aug. 2	Calicoed on Aug. 19
15	307	5	9	12 (3)
16	300	18	25	26 (4)
17	287	3	7	22 (2)
18	295	49	64	76 (4)
19	311	26	29	44 (7)
20	292	17	25	31 (3)
21	307	15	17	26 (4)
22	301	1	1	12 (3)
23	292	1	2	5 (2)
24	255	1	1	7 (3)
Totals	2947	136	180	261 (35)
Per cent.	100	4.6	6.1	8.9

Field of James H. Smith.

This field was across the street from Mr. Aldrich's, and the plants on July 16th were somewhat larger and more even in height. They came from a new seed bed, and the field had been in tobacco for only three years recently. There was little calico last year. The plants were topped a short time before those of Aldrich, so that on August 19th the suckers were more advanced, but these had been removed on most of the plants in Rows 1 to 34. In Rows 35 to 51 the suckers had not been removed, and the numbers in parentheses show those plants that had developed calico in the sprouts only. As the plants were harvested earlier than those of Aldrich, the suckers from the stubs on September 25th had mostly developed far enough to determine whether or not they were calicoed; so their condition is also indicated in the table. The details of the examinations are given in tables III and IV.

TABLE III. ROWS FROM WHICH CALICOED PLANTS WERE REMOVED.

Row No.	Total plants	July 16 removed	Aug. 2 removed	Aug. 19 counted but not removed	Total calicoed	Sept. 25 suckers**	Calicoed	Free
1	76	0	0	1	1	17	30	
2	73	0	1	0	1	12	41	
3	76	2	2	0	4	17	48	
4	81	4	1	0	5	23	42	
5	80	3	1	1	5	23	32	
6	80	7	2	1	10	21	33	
7	81	4	2	3	9	26	34	
8	81	2	0	2	4	29	38	
9	81	1	1	4	6	24	39	
10	82	1	3	2	6	26	37	
11	79	2	5 (4)*	4	11	26	38	
12	81	6	0	2	8	30	42	
13	81	2	5	2	9	26	40	
14	81	1	2	1	4	27	39	
15	80	3	1 (2)	4	8	28	35	
16	81	8	2 (1)	2	12	26	35	
17	78	4	1 (7)	12	17	31	42	
18	80	4	6	3	13	20	35	
19	84	7	1 (1)	5	13	28	37	
20	81	4	8	1	13	19	20	
21	79	7	0 (7)	9	16	26	28	
22	80	4	7	3	14	20	29	
23	78	4	2 (3)	5	11	24	33	
24	85	5	3 (5)	8	16	34	30	
25	81	3	1 (2)	4	8	24	40	
26	81	6	2 (2)	2	10	20	37	
Totals	2081	94	59 (34)	81	234	627	934	
Per cent.	100	4.5	2.8	3.9	11.2	40	60	

* The figures in parentheses under Aug. 2d give the number of additional plants showing very little calico which were not actually removed, but were topped to prevent spread by handling when other plants were topped. They are included in count of Aug. 19th.

** As not all the sprouts had developed far enough to show whether calicoed or not, the percentage of calico finally developed was probably somewhat greater for all the rows (1-51) than indicated here.

TABLE IV. ROWS FROM WHICH CALICOED PLANTS WERE NOT REMOVED.

Row No.	Total plants	Calicoed July 16	Calicoed Aug. 2	Calicoed Aug. 19	Sept. 25 suckers**	Free
27	84	5	8	9	23	36
28	82	15	28	40	29	28
29	80	5	7	9	40	29
30	82	4	6	6	28	30
31	80	4	6	12	33	25
32	83	2	7	11	20	32
33	80	4	5	14	25	25
34	85	3	7	10	26	38
35	83	3	3	5 (25)*	43	30
36	84	6	9	24 (44)	31	43
37	86	2	3	6 (18)	40	26
38	89	1	3	8 (36)	31	31
39	86	1	3	6 (10)	44	24
40	83	4	7	9 (26)	39	20
41	83	1	1	3 (8)	42	26
42	87	0	5	12 (29)	28	32
43	87	0	0	1 (8)	38	39
44	86	0	5	9 (25)	33	29
45	86	3	5	8 (11)	36	17
46	86	2	5	8 (32)	42	20
47	89	2	3	4 (6)	35	26
48	89	0	1	3 (20)	27	30
49	87	0	0	1 (2)	42	35
50	89	0	1	2 (7)	14	40
51	57	0	0	1 (1)	12	33
Totals	2093	67	128	221 (308)	801	744
Per cent.	100	3.2	6.1	10.6	52.	48.

* Figures in parentheses, Rows 35 to 51, give additional plants that showed calico only in the sprouts which had been left, those in plants in Rows 1 to 34 having been removed, so that data could not be obtained.

An examination of the results given in the preceding tables shows that the removal of the calicoed plants did not lessen to any extent the calico appearing on the main leaves of the plants during the season. In the Aldrich field, where the calicoed plants were removed they averaged 8.9 per cent. for the season, while this was exactly the percentage developed where they were not removed. In the Smith field, where the calicoed plants were removed the number calicoed even averaged 11.2 per cent., as against 10.6 per cent. where they were not removed.

These results indicate to us that the calico that develops on the main, or commercial leaves, appears chiefly on plants that were infected in the seed bed or at the time of transplanting, and that the time when especial care is needed to prevent calico in

the field is when transplanting is done. Our data, however, also indicate what our observation further confirms, that the removal of the calicoed plants lessens somewhat the amount of calico that appears in the sprouts and suckers. It would not, however, be profitable to remove calicoed plants for this purpose.

Effect of Planting from a Seed Bed Containing Calicoed Plants.

Near the experiment fields in Windsor previously referred to was another tobacco farm where the owner had been troubled by calico in recent years, and where this year he had noticed calicoed plants in his seed bed when transplanting. On July 16th, when examined by us, the plants remaining in the seed bed showed considerable calico, especially in those beds that had been covered with glass. We examined the field set out from these plants on the same dates as we did the other two fields, with the following results:

TABLE V. EFFECT OF CALICO IN SEED BED.

Rows	Total plants	Calicoed July 16	Calicoed Aug. 2	Calicoed Aug. 19
1-10	522	81	116	163
11-20	711	193	224	286
21-32	867	140	173	228
Total	2100	414	513	677
Per cent.	100	19.7	24.4	32.2

These figures clearly show that it does not pay to set plants from a seed bed where calico is undoubtedly present at the time of setting out, at least not unless especial care is taken not to spread the disease. They also indicate that most of the infection is spread at the time the plants are set out, as on July 16th the percentage of calicoed plants was 19.7, as against 32.2 per cent. on August 19th.

Percentage of Calico in Connecticut Fields.

The percentage of calicoed plants in the Connecticut tobacco fields varies greatly with the care of the growers (especially in recent years, when sterilizing the seed beds seems to lessen the amount), the season, the varieties grown, and the time of year when observations are made.

In 1906 we examined many fields in both the Connecticut and the Housatonic Valleys, and on the whole we found less in the latter valley, where comparatively less commercial fertilizer and more horse manure is used. The growers there also seem to think they suffer less from it than the growers in the other valley. We do not know whether the method of fertilization has anything to do with this, however.

We have seen some fields where practically all the suckers produced after the tobacco was cut showed calico. As the calico on these suckers, or even on shoots from the main stem, does little harm, we give in the following counts, made from time to time, only the plants with calico showing on the leaves of the main stem. As a usual thing, the counts were made in different parts of the fields, to get a fair average.

TABLE VI. PERCENTAGES OF CALICO IN CONNECTICUT FIELDS.

No.	Date	Town	Total count	Calicoed	Per cent calicoed	Remarks
1	June 10, 1906	Portland	500	235	47.	Used tobacco water.
2	" 10, 1906	"	500	3	.5	
3	Sept. 10, 1907	Centerville	152	111	73.	Used tobacco water.
4	Aug. 3, 1908	Rainbow	400	8	2.	
5	" 3, 1908	"	400	13	3.	
6	" 3, 1908	"	400	26	6.	
7	" 3, 1908	"	500	18	4.	
8	" 3, 1908	"	400	8	2.	
9	Aug. 10, 1908	Tariffville	500	51	10.	
10	" 10, 1908	"	500	54	11.	Hand picked
11	" 10, 1908	"	500	19	4.	" "
12	" 10, 1908	"	500	11	2.	
13	" 10, 1908	"	500	68	14.	
14	" 10, 1908	"	500	4	1.	Sumatra
15	" 10, 1908	"	500	82	16.	
16	" 10, 1908	"	500	17	3.	
17	" 10, 1908	"	500	136	27.	
18	" 10, 1908	"	500	7	1.	Not topped
19	" 10, 1908	"	500	2	.5	" "
20	July 16, 1909	Windsor	700	156	22.	Seed bed infected.
21	Aug. 19, 1909	"	2,100	677	32.	Seed bed infected.
22	" 19, 1909	"	2,947	261	9.	
23	" 19, 1909	"	2,093	221	11.	
24	July 10, 1914	Mt. Carmel	1,452	155	11.	Seedlings infected
		Total.....	18,044	2,343	13.	

Effect of Calico on Size of Plants.

We have made no especial studies of the effect of calico on the number of leaves or their relative size and shape. Ordinarily calico does not seem to misshape them or even alter their relative length and breadth to any evident degree, though of course they are occasionally more or less irregular in outline. They are probably somewhat smaller in size than healthy leaves, though we have no measurements to prove this. It has, however, been very evident in our experiments that the calicoed plants are not so tall as the healthy plants adjacent to them. The effect of calico in reducing the height depended somewhat on its severity, and especially on how early in its life the plant became infected. Plate XXXII a shows in the first row a number of plants artificially calicoed which were much lower in height at the time the photograph was taken than the healthy plants of the same age at the end of the row.

In 1910 we artificially infected every other plant in two rows by touching them, when young, with calicoed juice on the hands. On October 21st, when fully grown, they were all measured. These measurements show that the 29 calicoed plants in the outer row averaged only 5 ft. 4.1 inches, as against 6 ft. 9.7 inches for those free from calico, or 1 ft. 5.6 inches shorter. In the inner row the difference was not quite so marked, possibly on account of more shade, as the 41 calicoed plants averaged 4 ft. 3.7 inches as against 5 ft. 8.4 inches for the healthy plants, or 1 ft. 4.7 inches shorter. The whole 70 calicoed plants averaged 1 ft. 5 inches shorter than the 70 healthy. The details of the measurements of the plants in the outer row are given in Table VII, where it can be seen that in only two cases did the calicoed plants grow taller than the adjacent free plants, and then only slightly taller, while very often the calicoed plants were decidedly shorter than the adjacent free plants.

TABLE VII. EFFECT OF CALICO ON HEIGHT OF PLANTS.

No.	Condition	Height		No.	Condition	Height		No.	Condition	Height	
		Ft.	In.			Ft.	In.			Ft.	In.
1	Calicoed.	3	6	21	Calicoed.	5	11	41	Calicoed.	6	0
2	Free.....	6	2	22	Free.....	6	9	42	Free.....	6	10
3	Calicoed.	4	2	23	Calicoed.	6	2	43	Calicoed.	5	4
4	Free.....	7	7	24	Free.....	7	0	44	Free.....	6	6
5	Calicoed.	4	8	25	Calicoed.	5	10	45	Calicoed.	6	0
6	Free.....	7	4	26	Free.....	7	7	46	Free.....	7	7
7	Calicoed.	4	11	27	Calicoed.	6	0	47	Calicoed.	4	9
8	Free.....	6	10	28	Free.....	7	6	48	Free.....	6	7
9	Calicoed.	6	5	29	Calicoed.	5	2	49	Calicoed.	4	1
10	Free.....	6	9	30	Free.....	7	1	50	Free.....	6	9
11	Calicoed.	6	4	31	Calicoed.	5	8	51	Calicoed.	4	0
12	Free.....	6	10	32	Free.....	7	3	52	Free.....	7	2
13	Calicoed.	6	6	33	Calicoed.	6	6	53	Calicoed.	5	9
14	Free.....	6	2	34	Free.....	7	3	54	Free.....	5	6
15	Calicoed.	2	6	35	Calicoed.	5	3	55	Calicoed.	3	1
16	Free.....	7	2	36	Free.....	5	8	56	Free.....	4	9
17	Calicoed.	6	3	37	Calicoed.	6	2	57	Calicoed.	6	3
18	Free.....	6	9	38	Free.....	7	5	58	Free.....	6	10
19	Calicoed.	5	10	39	Calicoed.	6	0				
20	Free.....	7	3	40	Free.....	6	10				

CONCLUSIONS.

(1) Calico is primarily a disease of the chlorophyll or green coloring matter of the infected plants. As this substance largely controls the manufacture of the food products, calico is a trouble that disturbs the nutrition of the plant. This means that calicoed plants average smaller (Table VII) than the healthy, and the leaves, besides having a mottled yellow and green appearance, sometimes are more or less wrinkled and even misshapen through uneven growth.

(2) Calico is an infectious and to a certain extent a contagious disease. Its infectious nature is shown by the following miscellaneous experiments, and also by many others: Nos. 27, 201, 210, 214, 227, 238. In the experiments noted here there were employed 71 plants, which showed 28 per cent. infected on the first, and 48 per cent. on the last examination, a rather low average when compared with many of the other experiments. Its contagious nature is shown by experiments noted under conclusions No. 6, also in various other experiments, as Nos. 264-6.

(3) Calico can be communicated to the leaves through root infection under certain conditions. See Exper. No. 200.

(4) Old calicoed stems and leaves, while a possible source of infection through the roots, can be neglected in the field, but are a serious menace in the seedbed. Exper. No. 51 a-b showed comparatively little infection through the roots by the moist calicoed leaves and water placed around them. This explains why a field may be seriously calicoed one year and not the next, since the rotting of the calicoed tissues in the soil affords little chance for re-infection another year (see Conclusion No. 27). In the seed bed, however, when dried stems are used as fertilizer, or where old decayed stems remain in the soil, even if only one seedling becomes infected, it can, through handling, etc., be the source of subsequent infection to many plants, as will be shown later.

(5) Tobacco water used on seed beds, either as a fertilizer or as a remedy for worms, etc., is a possible source of infection that often proves very serious. Experiment No. 5 shows a final infection of 111 out of 152 plants, or 73 per cent., due to such treatment with water from selected calicoed stems, and the use of ordinary tobacco water by growers has frequently given similar results.

(6) Calico can be communicated at least in some cases by mere contact of calicoed plants with the healthy, as shown by Experiments Nos. 15, 16, 17, 54, 68, 69, 70 and 75, where out of 115 plants used 28 per cent. were calicoed on the first, and 77 per cent. on the last examination (see also notes under No. 49 and Nos. 82-84). In our field experiments we observed that the first or second check in a row next to calicoed plants, especially if touching one, sometimes became calicoed, and that the first check was sometimes badly calicoed and the second slightly, as if infected later.

(7) Juice on the hands from calicoed plants when handling healthy growing plants is certain to spread the disease to a very large percentage, if not to all, of those touched. This is shown by Experiments Nos. 1, 7, 9, 40, 48, 50, 122, 153, 181-a, 187-a, 192, 216 and 261, where juice on the hands was renewed each time before touching the healthy plants, with the result that the first examination showed over 95 per cent. calicoed and the last examination 100 per cent. In Experiments Nos. 72, 182-a, 189-a, 217, 242, where the juice was not renewed on the hands after touching the first plant (from twenty to forty plants each being

used in the different experiments), the infection was just as effective, since of the 134 plants used 100 per cent. of infection showed on both the first and final examinations. Our experiments, therefore, show that this is the most effective way of spreading the disease.

(8) This infection was due to the calicoed juice on the hands, and not to handling, since plants touched at the same time, as checks, without juice on the hands, did not develop calico to any great extent (shown by Experiments Nos. 4, 8, 10, 49, 73, 182-c, 243), as out of 95 plants used only 2 per cent. showed infection on the first examination, and 32 per cent. on the last examination, and this latter percentage was undoubtedly largely due to accidental outside infection which occurred in several of the experiments, as explained in the notes under Nos. 8 and 49.

(9) Washing the hands thoroughly with soap and water entirely removes the possibility of infection from any calicoed juice that may have been on them, as shown by Experiments Nos. 73, 182-c, 243, where of 44 plants touched only 5 per cent. showed calico at any time later.

(10) Destroying all the calicoed plants as soon as they appeared in the field did not in our experiments (Tables I-IV) lessen appreciably the percentage of calico as compared with that part of the field where they were not removed. As ordinarily carried on by growers, this practice of removal may even result in spreading the disease, since they are not usually careful about touching healthy plants after handling the calicoed. However, in some cases it possibly might pay to go over the field three or four weeks after transplanting, and if only occasional calicoed plants occur, to remove these, being careful not to spread the disease in any manner as already indicated.

(11) The calico "virus" is not carried over in the seed of calicoed plants to any great extent, as shown by Experiments Nos. 147, 148, 174, 175, 176, 177, 198, where of 519 plants from seed of calicoed plants or from calicoed injected seed pods only 11 per cent. were calicoed. However, that calico might in some cases be carried over in the seed in a small way is suggested by the injection experiments Nos. 174-a, 175-a, 175-c, which gave 35 per cent. calicoed. If this is true, it explains the calicoed plants of unknown origin that appear occasionally in the check plots.

(12) Methods of fertilization, injury to the roots, weather con-

ditions, etc. have not been definitely shown by experimentation to be primarily responsible for the appearance of calico in tobacco, etc., though some writers and growers claim one or the other as causal agents. It is not easy to experiment along these lines, but such miscellaneous experiments as we made (Nos. 36-tomato, 37, 132, 133, 202, 203, 262, 263) gave no increased or decreased percentages of calicoed plants as a result.

(13) True calico is not developed even by severe pruning if not already present or latent in the plant or accidentally introduced in the pruning process, though repeated cutting back sometimes develops more or less of a chlorosis condition in the new tissues. See Experiments Nos. 42, 43, 67 a-b, 78, 79, 116, 143, 185-b, which included among other plants 66 apparently free tobacco plants that after pruning developed only 2 with calicoed growth, or 3 per cent.; also see Conclusion No. 16, topping experiments, where 219 plants showed only 10 per cent. calico after topping, etc. On the other hand, if the plants are already calicoed, even if not yet apparent, the new growth following cutting off will almost certainly be calicoed. (Nos. 117, 118, 120-3, 126-a, 127-a, 128, 185-a, b in part, 199.)

(14) While insects apparently can spread infection somewhat from calicoed to healthy plants, especially in the greenhouse, we doubt if they are a common source of general infection in the Connecticut fields. We have made no special experiments along this line (except No. 24), but in our greenhouse experiments the white fly was very common, and it seemed to us a probable agent in the accidental infection of some of our checks and of our young seedlings grown there for field work in 1914 (Nos. 264-6).

(15) Infected plants in the seed bed are probably primarily responsible for most of the calico in the fields. See Experiments Nos. 5 and 264.

(16) These calicoed seedlings furnish the means for a subsequent general infection through their handling (see Conclusion 7) at transplanting time, and from the resulting infected plants further infections take place through the operations of "bugging," topping, suckering, etc., so that the percentage of calico in the field continually increases until not infrequently, after the plants are harvested, the suckers from a majority of the stubs are calicoed. For the effect of topping, etc., with a calicoed knife, see Experiments Nos. 25, 76, 80, 185-a, 186-a, where of the 135 ap-

parently free plants topped or cut off 80 per cent. developed calicoed sprouts or suckers; while Experiments Nos. 26, 77, 78, 79, 82, 83, 84, 185-b, 186-b, 199, where 219 similar plants were cut off with a clean or sterile knife, gave only 10 per cent.

(17) Calico usually takes from ten to fourteen days to make its appearance after infection. See various experiments giving dates of inoculation and of first examination showing infection. However, the appearance of calico really depends on the rate of growth of the new leaves. As, for instance, in our greenhouse experiments, where conditions were more or less unfavorable for normal growth, infection lagged correspondingly; also, in the field, when tobacco is first set out, it takes a week or two to recover before starting to grow, and the appearance of calico is likewise retarded; and in mature plants calico fails to show at all unless new suckers are developed, which may be hastened by topping, etc.

(18) Whether or not calico shows on all or a part of the plant depends primarily upon its age at the time of infection; that is, it may show on all the main leaves and stunt the growth more or less conspicuously, or it may be limited to the upper new leaves, the axillary shoots, or even to the basal sprouts. This is shown by the following experiments in 1913: No. 216, where the plants were infected when young, June 25th, with the result that all permanent main leaves were fully calicoed and the plants somewhat stunted; No. 230, July 29th, where calico was confined to the upper leaves and subsequent growth; No. 242, Aug. 7th, where calico appeared on the upper leaves in a few cases, but in most plants showed first in the sprouts; and Nos. 244-255, where the treatments of Aug. 14-21 were too late to show full results.

(19) While mature leaves are not visibly affected by inoculation, they may serve as carriers for infection of the younger growing leaves. In other words, calico is a disease of the chlorophyll of the nascent tissues. Experiments Nos. 3, 14-b, 50, 193, show that while the old leaves only were touched and did not calico, yet the results of infection were 100 per cent. (omitting No. 3, where later growth was not observed). Such infection, while as successful, is perhaps not quite as responsive as where the young leaves are touched (see Nos. 14-a and 48).

(20) A plant which once becomes infected remains so, and all subsequent new growth (at least that above the lowest infected

leaf)* usually, if not always, becomes calicoed. See various experiments comparing the data of first observation with that of the last. Shading (Nos. 132, 133), or the aging of leaves often dims or obscures, but apparently does not entirely obliterate the calico or destroy its virus.

(21) "Rust," at least in Connecticut, is associated with calico as a frequent, though not a necessary, later development, and so usually occurs only on the fully grown leaves. It seems to be merely a physiological injury, usually due to the action of the sun in "burning" the weakened tissues, this burning being favored by water on the leaves, or by bright, hot weather following rain storms. Its appearance, therefore, is largely a matter of weather conditions. So far as we have observed, rust occurs here only, or at least almost entirely, on calicoed leaves, though sometimes the calico is of the suppressed type. The relation of sun and water to the rust is indicated in certain greenhouse experiments (Nos. 28, 29, 30, 34, 41, 98, 127-b), where burning took place (Plate XXIX a), especially when the foliage had been intentionally sprinkled with water at the time of infection. In Nos. 216, 217, where some pressure was made on the tissues by fingering at the time of inoculation, there also developed a "burn" type of injury.

(22) "String Leaf" (Plate XXX a) is a malformation of the leaves that sometimes accompanies calico, but is not dependent upon a calicoed condition of the plant for its development. See Experiment No. 188, also Rept. 1914, p. 27.

(23) Chlorosis or calico of tomato is the same as calico of tobacco, and these troubles can be as easily transferred from one host to the other (Plate XXIX b) as calico is transferred from one tobacco plant to another, and in the same ways. For

* We placed the above clause in parentheses because we are not sure whether the calico virus is carried downward in the stem as far or as readily as it is carried upward. If not, it stands to reason that if plants were calicoed late in life by touching and infecting the upper leaves only, and some time later were cut off at the base with a sterile knife, the resulting suckers would not so surely calico as those from plants whose basal leaves were calicoed. Some evidence along this line is shown by Experiment No. 124, where the juice from an apparently healthy leaf at the base of a plant calicoed above failed to infect another plant when applied to it.

transfer from calicoed tomato to healthy tomato see Nos. 29, 30, 31, 144; calicoed tobacco to healthy tomato, Nos. 28, 33, 34, 41, 52b, 96, 97, 98, 101, 103, 108, 131, 161, 163, 164, 165, 282-a; calicoed tomato to healthy tobacco, Nos. 32, 71, 225. Checks, Nos. 45, 99, 110, 166, 282-b, etc.

(24) Calico of tobacco (*Nicotiana Tabacum*) and of tomato (*Lycopersicum esculentum*), besides being inter-transferable, can also be transferred to a number of other species of *Nicotiana*. On some of these it produces the typical calico mottling of the leaves, and on others this character is not so evident, being sometimes largely suppressed, or showing as a yellowish mottling found on plants not calicoed, but the disease manifests itself largely in the dwarfing of the plants and sometimes the misshaping of the leaves, etc. There seems to be considerable difference in susceptibility in the various species. Among those apparently little affected were: *N. affinis*, No. 171; (failed in 1909; possibly same species as *N. alata-grandiflora*, successful in 1914); *N. vincaeflora*, No. 274. Others not always showing typical mottling of leaves, but dwarfing and other symptoms, were: *N. rustica scabra*, No. 267; *N. attenuata*, No. 269; *N. plumbaginifolia*, No. 270; *N. quadrivalis*, No. 271. Those showing at least some true calico mottling on the foliage were: *N. tomentosa*, No. 172; *N. Sandrae*, No. 169; *N. alata grandiflora*, No. 268; *N. alata* var., No. 272; *N. forgetiana*, No. 273; *N. paniculata*, No. 275; *N. rustica humilis*, No. 276; miscellaneous crosses, No. 277; Giant Red Tobacco, No. 170.

(25) Besides various species of *Nicotiana*, calico of tobacco can be transferred to a number of related genera belonging to the same family, Solanaceae. Some of these it is rather difficult to infect, as for instance the potato, *Solanum tuberosum*, with which we partially succeeded in only one case, where seedlings were used (No. 173), while experiments on vines from tubers failed (Nos. 52-a, 285, et al.). On egg plant, *Solanum melongena*, the calico apparently entirely failed to infect (No. 279). On peppers, *Capsicum annum*, etc., a few of the plants showed leaves with typical calico mottling (Nos. 280, 286). On *Physalis* sp., two plants out of seven showed a few leaves with typical mottling (No. 278). On *Petunia* sp., we succeeded in producing the typical calico on several plants (Nos. 155-9, 281), and in one case apparently re-transferred calico from *petunia* to a healthy *petunia* (No. 168).

(26) While there are a number of plants not members of the family Solanaceae which have chlorosis troubles more or less similar in appearance to the calico of tobacco, we have not been able so far to surely infect healthy plants of these species with juice from calicoed tobacco leaves, nor have we been able to infect them with juice from their own chlorosis leaves, or transfer their disease to tobacco or other plants. The following experiments were along these lines:—Calicoed tobacco juice on cultivated geranium, *Pelargonium* sp., No. 134; on pokeweed, *Phytolacca decandra*, No. 167; on Lima bean, *Phaseolus lunatus*, Nos. 113-a, 114-a; on string bean, *Phaseolus vulgaris*, Nos. 113-b, 114-b; on cultivated aster *Callistephus hortensis*, No. 91; on musk melon, *Cucumis Melo*, Nos. 183, 184, 284-a; on cucumber, *Cucumis sativus*, No. 283-a: calicoed tomato juice on musk melon, No. 284-b; on cucumber, No. 283-b: juice of "yellows" of raspberry, on tobacco, No. 224: juice of "yellows" of asters, on asters, Nos. 87, 88, 90; on tobacco, No. 53-a, b: juice of calico-like chlorosis of string bean, on string bean, No. 138-a; on tobacco, No. 138-b: juice of calico-like chlorosis of Lima bean, on Lima bean, No. 137-a; on tobacco, No. 137-b: juice of "golden" elderberry, *Sambucus* sp., on tobacco, No. 86: juice of chlorosis of pokeweed, on tobacco, No. 256: juice of "yellows" of peach on leaves and roots of peach, miscellaneous experiments not reported here.

(27) The dried leaves of calicoed tobacco retain their power of infection for some time (at least a year or two in some degree), but these, and even fresh leaves, seem to lose this power much sooner if kept wet. This explains in part why the wintering over in the fields destroys the infecting power of calicoed tissues, so that the amount of calico each year has little or no relation to the amount the preceding year. Infection experiments with dried calicoed leaves one or more years old, crushed in water and then soaked for a short time before using, were as follows: Nos. 51-c, 94, 100, 117, 126, 179-a, 190, 195, 205, 206, 207. Of 98 plants used in these experiments 76, or 78 per cent., calicoed. Similar experiments with old dried leaves soaked for a longer time, twenty-four hours or more, before using, were as follows: Nos. 102, 104, 105, 107, 111, 112, 139, 149, 194; on tomatoes Nos. 103, 106; and gave 11 out of 20 calicoed, or 55 per cent. Experiments with fresh leaves crushed in water and used im-

mediately, Nos. 12, 180-a, 219, 230, gave 68 out of 81 calicoed, or 84 per cent.; while those left twenty-four hours or more before using, Nos. 22, 23, 57, 232, gave 13 out of 24 calicoed, or 54 per cent.

(28) The purer the calico juice the surer its power of infection; that is, pure juice expressed from calicoed leaves is more effective than the same diluted many times with water; but whether the former affects plants any more strongly than the latter, in the cases where infection does take place, is not so certain. The determining factor as to the amount of injury caused seems to be the age of the plant when infected. We believe, however, that early infection with a large amount of pure calico juice (No. 200 on roots), especially if applications were repeated (Nos. 130, 261), would cause the plants to be more stunted and nearer an albino type than a single application of diluted juice.

(29) However, an exceedingly small amount of the pure juice is capable of infecting a plant. This is shown in our various experiments, where with merely the juice adhering to the fingers, and without renewing it, we were able to infect in some cases as many as forty plants in succession (No. 72).

(30) The "virus" of this juice appears to renew itself or be renewed in some manner in the tissues of the living plants, as shown by the infection of numerous plants by a very small amount of juice on the hands, and the possibility of repeated infection from generation to generation in the same way. Without such increase through renewal in the plants, the ultimate amount of the original "virus" would through dilution become so infinitesimally small as to be eventually incapable of infection, yet, so far as our experience goes, it is just as easy to infect plants repeatedly in this way, and the percentage of infection is just as large and the results as conspicuous as at first.

(31) The "virus" of calico juice is destroyed by heating, as shown by Experiments Nos. 21, 128, 141, 150, 209, 213, 228, 231, 233, 239, in which calicoed juice that had been sterilized to a greater or less degree by boiling was placed on the leaves of 91 plants, and only 16, or 18 per cent., became calicoed. All of these 16 calicoed plants became calicoed so late, that is, only in the upper leaves or sprouts, that there is little question but that they were accidental infections, and not due to the sterilized juice placed on them.

(32) The "virus" of calico is filterable, at least to some extent, through a Berkefeld filter, as shown by Nos. 127, 140, 151, 208, 212, 229, 234, 240, where of 73 plants used 26 were calicoed, or 36 per cent. Possibly some of these calicoed plants were the result of accidental outside infection, yet we believe that we could have obtained with such filtered juice, if used under our present method of rubbing in, a considerably higher percentage of infection.

(33) The "virus" can apparently be extracted from calicoed leaves, at least to some extent, without destroying its infectious qualities, by such liquids as ether, chloroform and alcohol, as shown by Nos. 18, 20, 55, 56, 58-61, 63-65, in which of the 55 plants used 11, or 20 per cent., showed infection on the first examination, and 24, or 44 per cent., on the last.

(34) This "virus" can be preserved for a long time by a small amount of toluol shaken for a short time through the pure calico juice, and then left to form a protective film on the surface, as shown by Experiments Nos. 92, 93, 118, 130, 152, 191-a, 196, 235, 236, 241, where 65 plants were used and 47 calicoed, or 72 per cent. The age of the preserved juice when used in these experiments ranged from one to nine days, three to six months, and in two cases about three years old (where the average infection was nearly 50 per cent.).

(35) Certain of our experiments (see Conclusions 30-34) indicate that the "virus" of calico of tobacco is of the nature of an enzym.

(36) Tests of the juice from both calicoed and non-calicoed tobacco and tomatoes with a tincture of guaiacum shows the presence of an oxidizing enzym; however, the juice from calicoed leaves shows a greater amount, as indicated by the intensity of the test. This suggests that the infectious enzym belongs to the general group of oxidizing enzymes, but whether it is a specific form peculiar to calicoed tobacco, or merely an unusual amount of oxidase, etc., as suggested by Woods, we have made no effort to determine, as this is a subject for investigation by a physiological chemist.

(37) The possibility of the cure or prevention of calico through the use of the auto-digestive enzym of *Coprinus* species (as possibly illustrated by the work of Baker, *Ann. of Bot.* 27:172, on the "Silver-Leaf" disease of plum) was tested in a number of experiments, Nos. 219-223, 257-9, but so far as we could judge

from these, it had no inhibitive or curative action on the infectious enzym of calicoed tobacco (except possibly in No. 220).

(38) So far as we could judge from our observations and the limited number of experiments along this line (Nos. 35, 46, 47), neither calico nor the so-called "rust" that often accompanies it is due to the action of bacteria, as claimed by some investigators. The objection made to the enzymic theory in favor of the bacterial theory, that an excessive effect is produced by an exceedingly small amount of the enzym, is removed by the supposition of the increase of this enzym within the plant tissues, a supposition which is just as allowable as the assumed increase of hypothetical filterable or ultra-microscopic bacteria within the same.

(39) There seems to be some connection between the bruising of the glandular hairs (No. 136) and the certainty of infection, since when the calicoed juice is rubbed in, infection takes place more certainly than by any other method; for instance, when a few drops of calicoed juice were placed on the leaves, infection did not take place so certainly as when these were rubbed in with paper (renewed each time to avoid carrying possible contagion from one plant to another). See Nos. 229, 232, 234, 235. Possibly this bruising of the glandular hairs allows the "virus" to be more readily and quickly absorbed into the circulation of the plant sap.

(40) There is a probability that with check plants more or less calico will develop, but the more careful the attempts to prevent any accidental spreading, the freer the checks. We have tried to use moderate care with our check plants, but more or less calico has developed, much of which we are sure from our later experience might have been prevented had extreme precautionary measures been taken. This percentage of accidental infection has varied from year to year with the varying conditions under which the plants were grown, set out, etc. In order to determine the value of an experiment in producing calico it is necessary to compare it with its immediate checks; yet the average amount of calico that may naturally be expected can be obtained by getting the average of all the checks in our experiments (omitting those of 1914) —Nos. 2, 6, 11, 13, 19, 44, 66, 74, 81, 85, 95, 109, 119, 123, 129, 142, 154, 178, 179-b, 180-b, 181-b, 182-b, 187-b, 189-b, 191-b, 204, 211, 215, 218, 223, 237, 247—which showed that out of 561 check plants 13, or 2 per cent., were calicoed on first examination, and 45, or 8 per cent., on last examination.

The checks of 1914, Nos. 260, 264, 265, because of known infection by white fly in the greenhouse, showed a much higher percentage, namely, out of 296 plants 32, or 11 per cent., were calicoed on first examination, and 98, or 33 per cent., on last examination.

PRECAUTIONARY MEASURES.

Any treatment for calico of tobacco must be preventive rather than curative, since when once a plant becomes calicoed it cannot be cured. The following precautionary measures should, if observed, help to lessen the amount of calico in the fields:

(1) **If for any reason the grower suspects that his old seed beds are responsible for calico, new beds should be made, or the old ones steam-sterilized. Yearly steaming also lessens expense of weeding.**

(2) **Beds should never be made on land that had tobacco grown on it the year previous, because of the possibility of infection of some of the seedlings from the old tobacco stalks, etc.**

(3) **Old tobacco stems, leaves, or tobacco water should never be used on the seed beds or seed plants in any way.**

(4) **If suspicious plants show in the seed bed, these and the surrounding plants should be carefully pulled up and destroyed. If the seed bed shows unmistakable signs of calicoed plants before transplanting, it is well to secure plants elsewhere.**

(5) **When setting out plants, wash the hands occasionally with soap and water to lessen the danger of spreading infection.**

(6) **Never touch healthy plants after touching calicoed ones without first washing the hands.**

(7) **While it may possibly pay to carefully remove calicoed plants in the field very early in the season, if few in number, it will not later.**

(8) **Care in bugging, topping and otherwise handling the plants in the fields, especially calicoed ones, helps to lessen the spreading of calico, though infection from these means usually makes its appearance too late to show on any but the upper leaves, and usually only in the sprouts and suckers.**

LITERATURE.

Under the authors' names, arranged alphabetically, are given below some of the more important references to the literature of calico of tobacco, etc., with a brief abstract of their contents.

Most of these have been prepared under my direction by my assistant Miss Whittlesey. For more complete bibliographies the reader is referred to articles by Melchers (23) and Allard (4).

1. **Allard, H. A.** The Mosaic Disease of Tobacco. *Science* **36**: 875-6. 20 D. 1912.
Preliminary to more detailed article (see No. 2). Transferred mosaic disease to other Solanaceous genera from tobacco. Notes effect in appearance of blossoms of tobacco. Thinks calico not produced by simply cutting back plants. Finds that aphids carry the disease. Results of writer's experiments suggest presence of living, active micro-organisms. Does not favor theory of transmission by pollen grains.
2. **Allard, H. A.** The Mosaic Disease of Tobacco. U. S. Dept. Agr. Bull. 40: 1-33. Ja. 1914.
The author considers this disease parasitic in origin. Can be carried by aphids. Description of appearance of affected plants, especially the blossoms. Susceptibility of various Solanaceous plants. Probably distinct from pokeweed mosaic. Was produced by the writer by root inoculation.
3. **Allard, H. A.** Effect of Dilution upon the Infectivity of the Virus of the Mosaic Disease of Tobacco. *Journ. Agr. Res.* **3**: 295-9. 1915.
Gives results of infection experiments with mosaic virus of different dilutions, from undiluted up to one part to one million of water. 1-1000 is quite as effective as when undiluted; 1-10,000 much less so. The author favors theory of parasitism, an organism gaining entrance to the plant, not an enzym already present.
4. **Allard, H. A.** A Review of Investigations of the Mosaic Disease of Tobacco, together with a bibliography of the more important contributions. *Bull. Torr. Bot. Club* **41**: 435-58. S. 1914.
Review of literature, giving brief resumé of experiments and conclusions. "Mosaikkrankheit" frequently used to cover two distinct diseases—true mosaic and "pockenkrankheit." Meyer first proved artificial inoculation, no transmission by seed, etc. He held the soil responsible for origin of disease. Prillieux and Delacroix (1894) and Marchal (1897) apparently do not treat of the true mosaic. Beijerinck (1898) proved that immature tissues only were infected. Sturgis (1899) concludes that "mottled top" is a less pronounced phase of calico in nearly mature plants; was the first to regard it as purely physiological. Raciborski gave results of tests to destroy virulence of sap. Van Bijlert (1899) considered coolies responsible for its spread. Woods and Heintzel set forth theory of oxidizing enzymes. This was opposed by Hunter (1902) and (1904). He treats (1907) of the effects of shade and advances a "toxin" theory. Clinton (1908) showed it transferable to tomato. Allard (1914) found it transferable by aphids.

5. **Baur, E.** Ueber die infektiöse Chlorose der Malvaceen. *Sitzungsber. Königl. Preuss. Akad. Wiss.* **1906**: 11-29.
Infectious chlorosis of the Malvaceae,—experiments with *Abutilon*, etc. Tobacco mosaic differs in being transmitted by other means than grafting. Is latent in the plants, only brought out when conditions are favorable for its development.
6. **Baur, E.** Ueber infektiöse Chlorosen bei *Ligustrum*, *Laburnum*, *Fraxinus*, *Sorbus* und *Ptelea*. *Ber. Deut. Bot. Ges.* **25**: 410-13. Au. 1907.
Finds that the variegated plants known as *Ligustrum vulgare fol. aureo-variegatis*, *Laburnum vulgare chrysophyllum*, *Laburnum vulgare fol. aureis*, *Fraxinus pubescens aucubifolia*, *Sorbus aucuparia fol. luteo-variegatis*, *Ptelea trifoliata fol. variegatis*, belong with the infectious chlorosis types, while *Sorbus aucuparia Dirkenii aurea* and *Ptelea trifoliata aurea* do not. The infectious nature was proved by grafting buds of the normally green plants on the chlorosis variety, when the resulting growth became variegated. The chlorosis of the *Laburnum* and *Ligustrum* was shown to be similar to the previously investigated chlorosis of *Abutilon* as regards action of light and failure to reproduce itself through the seed. Buds of *Cytisus hirsutus* grafted on *Laburnum vulgare chrysophyllum* even became variegated, but not in the case of *Laburnum alpinum* or *Cytisus purpureus* on this variety.
7. **Baur, E.** Ueber eine infektiöse Chlorose von *Euonymus japonicus*. *Ber. Deut. Bot. Ges.* **26**: 711-13. D. 1908.
Investigated two variegated varieties of this species and found one, *Euonymus japonicus argenteo-marginatus*, non-infectious, but perpetuated through seed; while the other, *E. japonicus fol. aureo-marginatus*, was infectious. When this latter was grafted on the normal green variety, or *vice versa*, the subsequent growth from the green plant was variegated but not of the same pattern, and this modified variegation remained constant through propagation by cuttings. He explains this by supposing that the variegated variety had a double chlorosis, one infectious and the other non-infectious, and of course only the infectious chlorosis is communicated to the growth from the normally green plant and so presents a different pattern from that on the variegated one, where both are present.
8. **Chapman, G. H.** "Mosaic" and Allied Diseases, with Especial Reference to Tobacco and Tomatoes. *Ann. Rept. Mass. Agr. Exp. Sta.* **25**: 94-104. Ja. 1913.
General appearance on both hosts; manner of occurrence, on tomato only in greenhouse and of little economic importance, on tobacco annual loss over one million dollars. Disease physiological, not fungous or bacterial, not a virus caused by retarded enzymes. Caused sometimes by improper sterilization of seed beds, laceration of roots in transplanting, etc. Shade-grown tobacco less liable to it. Plants from heavy seed also less sus-

ceptible. Infectious, but not contagious. Not caused by excess of mineral fertilizers.

9. **Clinton, G. P.** Chlorosis Troubles. Rept. Conn. Agr. Exp. Sta. 1903: 305 (aster, yellows); *Ibid.*: 341 (peach, yellows); *Ibid.*: 355 (raspberry, yellows); *Ibid.*: 363 (tobacco, calico); *Ibid.* 1907: 343 (Lima bean, chlorosis); *Ibid.*: 362 (tomato, calico); *Ibid.* 1908: 857 (tomato, calico); *Ibid.*: 859 (bean, Lima and string, chlorosis); *Ibid.*: 865 (musk melon, chlorosis); *Ibid.*: 872-78 (peach, yellows); *Ibid.* 1909-10: 735 (squash, chlorosis); *Ibid.* 1913: 27 (tobacco, string leaf); Bull. Conn. Agr. Exp. Sta. 166: 10 (tobacco, calico).
- Gives results of observations and experiments with these various chlorosis diseases.
10. **Delacroix, G.** La rouille blanche du tabac et la nielle ou maladie de la mosaïque. Compt. Rend. Acad. Sci. Paris 140: 678-80. 1905.
- The trouble reported by Prilleux and Delacroix in 1894 he concludes not to have been the true mosaic ("la nielle") but a bacterial disease called "rouille blanche." Gives detailed description of each, with distinctions. The "spotting" of Sturgis and "pockenkrankheit" of Iwanowsky, etc., may be the same as "rouille blanche."
11. **Delacroix, G.** Recherches sur quelques maladies du tabac en France. Extrait des Annales de l'Institut National Agronomique II, 5. 1906. La nielle du Tabac et la "maladie des taches blanches." pp. 18-63.
- Review of previous investigations. Points out the differences in experimental results and theories deduced from them, and impossibility of drawing positive conclusions. Recommends the use of fresh soil for seed beds, crop rotation, care in fertilizing, avoidance of too wet soil. Distinguishes "la maladie des taches blanches" from "la nielle," under which name the author and Prilleux mistakenly described it in 1894. The "mal del mosaico" of Comes and Pirazzoli he considers the same as his "maladie des taches blanches." Also mentions a third trouble, "rouille blanche," spots round and regular, with brown margin. The "taches blanches" appear on the mature foliage, thus differing from mosaic, "la nielle," and the writer succeeded in obtaining bacteria and reproducing the disease.
12. **Flexner, S.** Some Problems in Infection and its Control. Science 36: 685-702.
- An important paper on this subject which may throw some light on infection of plants by fungi. Notes mosaic disease of tobacco as caused by ultra-microscopic parasites or filterable viruses.
13. **Gallatin** (Rept. of J. R. Dodge, Statistician). Rept. U. S. Com. of Agr. 1874: 58.

Brief note on "Frenching" of tobacco, narrow, dagger-shaped leaves, formation caused by "too much wet weather after the plant starts to grow."

14. **Hasselbring, H., and Alsberg, C. L.** Studies upon Oxidases. Science 31: 637. 22 Ap. 1910.
- Extract of paper read before Sec. G., A. A. A. S., at Boston meeting. The study is a by-product of the investigation still in progress of a disease of cabbage and spinach resembling in some respects the mosaic disease of tobacco. Explanation may not necessarily be increase of oxidase, as suggested by Woods, but may be a decrease of anti-oxidase.
15. **Hunger, F. W. T.** Neue Theorie zur Ätiologie der Mosaikkrankheit des Tabaks. Ber. der Bot. Ges. 23: 415. N. 1905.
- Preliminary article (see No. 16) setting forth author's theory of "physiological-catalytic" action. Brief reference to theories of previous investigators. The author ascribes the mosaic to action of a toxin under certain conditions, producing a substance harmful to the cell development, which is capable of increasing and passing from cell to cell to the younger plant tissues.
16. **Hunger, F. W. T.** Untersuchungen und Betrachtungen über die Mosaikkrankheit der Tabakspflanze. Zeitschr. Pflanzenk. 15: 257-311. D. 1905.
- History and nomenclature, review of different theories of origin, (1) bacterial (Mayer, etc.), (2) "contagium vivum fluidum" (Beijerinck), (3) oxidizing enzymes (Wood) and (Heintzel), and (4) the author's theory, an unorganized ferment rather than oxidizing enzymes. Distinctions given between "mosaik-krankheit" and "pockenkrankheit."
17. **Iwanowski, D.** Die Mosaik- und die Pockenkrankheit der Tabakspflanze. Zeitschr. Pflanzenk. 12: 202. O. 1902.
- Calls attention to distinction made by him previously between the brown spot and the mosaic disease, which some later writers have not considered distinct, and thereby have brought about errors in their conclusions.
18. **Iwanowski, D.** Ueber die Mosaikkrankheit der Tabakspflanze. Zeitschr. Pflanzenk. 13: 2-41. Ap. 1903.
- Detailed description, giving various appearances produced on different plants, effect of light, etc. *Nicotiana rustica* immune. Found in coastal countries, e. g. Holland. Apparently originates in the seed beds. Differences noted between mosaic- and pockenkrankheit. Opposes Wood's theory. Gives histology, details of experiments in filtration of sap, cultivation of microbes, tabulated results of infection experiments. Favors bacterial theory.
19. **Jensen, H.** Mosaiek-Zeikta. Mededeelingen van "Het Proef Station voor Vorstenlandsche Tabak" No. 5: 61-67. 1913.
- Gives notes of Raciborski and Jensen for years 1898-1911. Contains also (p. 68) article on "string leaf," "Tjakar." This

occurs much less commonly than mosaic. Affected plants sent out healthy growth after transplanting into various soils such as river sand, etc.

20. **Kranzlin, G.** Untersuchungen an papaschierten Pflanzen. Zeitschr. Pflanzenkr. **18**: 193-203. O. 1908.

Found considerable difference in the spectroscopic examination of solutions from leaves of normally green and variegated varieties of the same species (both infectious and non-infectious kinds investigated by Baur).

21. **Loew, O.** Remarks on the Mosaic Disease of the Tobacco Plant. U. S. Dept. Agr. Rept. No. 65: 24-27. 1900.

Gives short description of the disease; notes that the calicoed leaves contain less acid but more of the enzymes oxidase and peroxidase than the normal leaves; and relates experience of growers and his own observations in which the fertilization of the field, the treatment of seed beds, etc., apparently affected the amount of calico finally present in the field.

22. **Mayer, A.** Ueber die Mosaikkrankheit des Tabaks. Landw. Vers. Stat. **32**: 450-467. 1886.

The author proved by experiment that calico could be transmitted to healthy plants by inoculating with juice from diseased ones. He considered it a bacterial disease, but was unable to isolate bacteria which would reproduce it. He found no infection from plant to plant, or by seed. Advised rotation of crops and removal of diseased plants and of refuse in the field.

23. **Melchers, L. E.** The Mosaic Disease of the Tomato and Related Plants. Ohio Nat. **13**: 149-173. Je. 1913.

Gives historical account, characteristics, histology, nomenclature, causes (various theories), prevention measures; chiefly a review of the work of others.

24. **Peters, L.** Krankheiten und Beschädigungen des Tabaks. Mitteil. Kais. Biol. Anst. Land. Forstrw. **13**. Mosaikkrankheit p 58. 1912. [Reprint.]

Description of appearance and development. Cause and nature uncertain, by some considered as caused by parasitic bacteria. Differs from "infectious chlorosis" of Malvaceae in being transmissible by infected sap. Author considers seed of infected plants likely to produce more susceptible seedlings, so advises the use of seed from sound plants. Also sterilizing or renewing seed beds infected the year previous; liming seed beds; care in handling; crop rotation. No original investigation work.

25. **Selby, A. D.** The Mosaic Disease. Ohio Agr. Exp. Stat. Bull. **156**: 88-95. N. 1904.

Gives general characteristics of the disease; a short but excellent account of results of previous investigations; results of an experiment conducted under his own supervision proving the communicability of the disease by touching plants after having

touched calicoed ones (those touched showed over 68 per cent. calico as compared with less than 5 per cent. among the untouched plants in the field); the percentage of calico in various Ohio tobacco fields; preventive measures; also reports failure to produce calico through seeds from a calicoed plant.

26. **Stone, G. E.** Tomato Diseases. Mass. Agr. Exp. Sta. Bull. **138**: 26. Je. 1911.

Brief note on mosaic of tomato. In all cases where seen was associated with too severe pruning. Apparently affects the yield. Reference to later report by G. H. Chapman (8).

27. **Sturgis, W. C.** Preliminary Notes on Two Diseases of Tobacco. Ann. Rept. Conn. Agr. Exp. Sta. **22**: 242-260. 1899.

"Calico" and "mottled top" probably symptoms of same disease, the former occurring early in the season, the latter only on topmost leaves later in the season. Abundant in some places, especially east of the Connecticut River. Not contagious, whether or not infectious no statement can yet be made. The observed facts are not favorable to bacterial theory. Probably physiological.

28. **Sturgis, W. C.** On the Effects on Tobacco of Shading and the Application of Lime. Ann. Rept. Conn. Agr. Exp. Sta. **23**: 252-261. 1900.

Refers to recent work of Woods on calico of tobacco, as favoring enzym theory. Gives results of experiments in liming the land to decrease amount of mosaic, on both shaded and unshaded plots. Results inconclusive, but suggest that the use of lime may not be deleterious, and may tend to decrease prevalence of calico.

29. **Taubenhaus, J. J.** Mosaic Disease of the Sweet Pea. Del. Coll. Agr. Ex. Sta. Bull. **106**: 53-61. N. 1914.

Brief review of work of former investigators in mosaic of tobacco. No previous mention of the disease on sweet pea, but it is an important disease. Can be transmitted by needle puncture from diseased to healthy leaves, also carried by aphids. The writer believes it to be bacterial or protozoic, not physiological and enzymic. Apparently not transmitted by soil or seed.

30. **Westerdijk, Joha.** Die Mosaikkrankheit der Tomaten. Mededeel. Phytopath. Lab. "Willie Commelin Scholten," **1**: 1-20. Mr. 1910.

General appearance, infection experiments, influence of light, hereditary nature, comparison with tobacco mosaic. Infectious in tomatoes, but not communicable to tobacco. Intensity increased by strong light. Could not infect tomato with tobacco mosaic. Disease carried over by seed. Sometimes causes monstrosities.

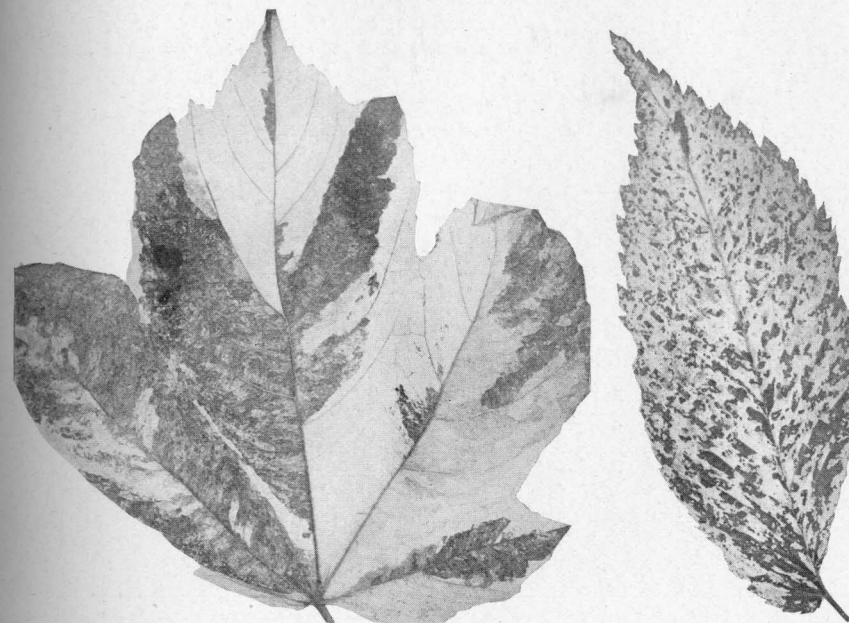
31. **Woods, A. F.** The Destruction of Chlorophyll by Oxidizing Enzymes. Centralb. Bakt. Abth. II. **5**: 745-754. N. 1899.

Treats of the author's observations on the oxidation of chlorophyll by enzymes, which he deems responsible for the autumnal

destruction of chlorophyll and for some forms of disease. Gives details of experiments with *Acer*, *Aesculus*, etc., using guaiac and other reagents to test enzymes. Produced mosaic on tobacco by cutting back rapidly growing plants. Oxidizing enzymes may occur in the soil through decay. His theory is that in rapid, poorly nourished growth many cells are unable to develop normal amounts of chlorophyll because of excessive development of oxidizing enzymes.

32. **Woods, A. F.** Observations on the Mosaic Disease of Tobacco. U. S. Dep. Agr. Bur. Pl. Ind. Bull. 18. My. 1902.

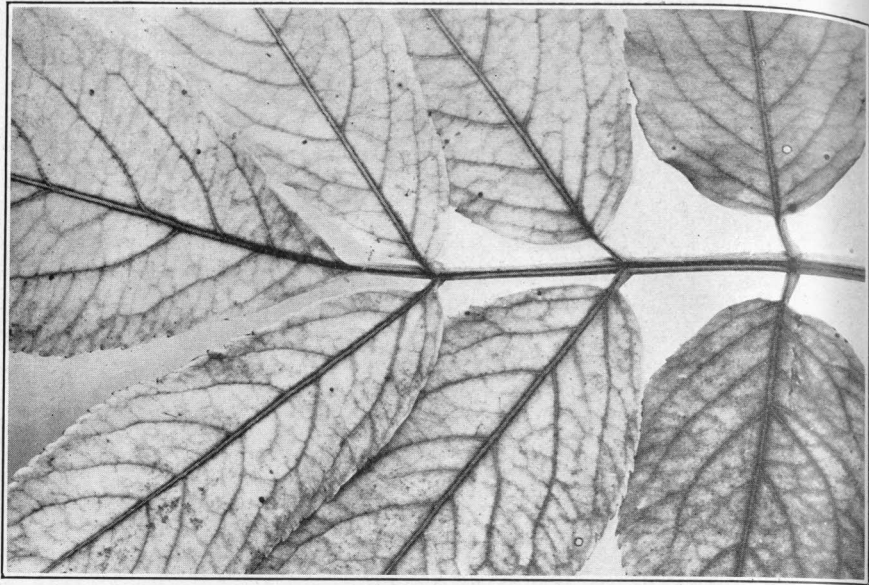
Gives general description, results obtained by Mayer, and subsequent investigators, Beijerinck, Sturgis and Koning, histology, artificial production, Suzuki's theory regarding cutting back of mulberry causing disease, infection experiments, theory of "oxidizing enzymes," preventive measures.



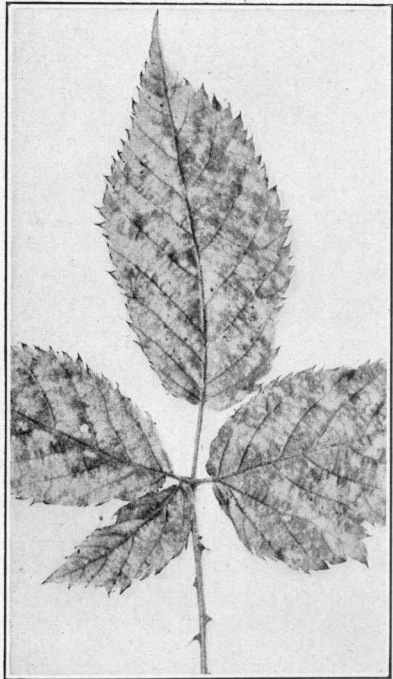
a. Variegated Sycamore Maple, p. 359, and b. European Elm, p. 359.



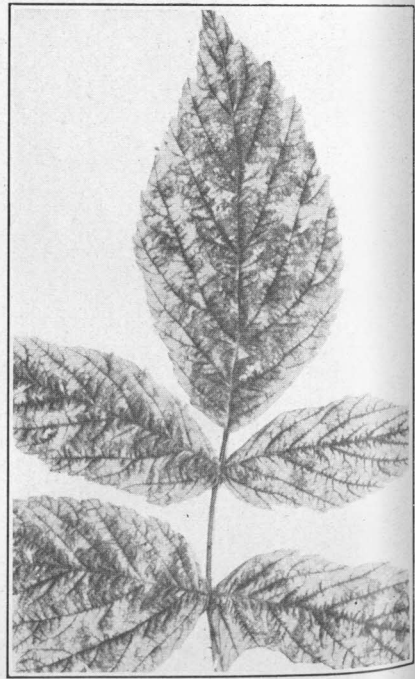
c. Variegated Box Elder, p. 359.



a. "Golden" Elderberry, p. 359.

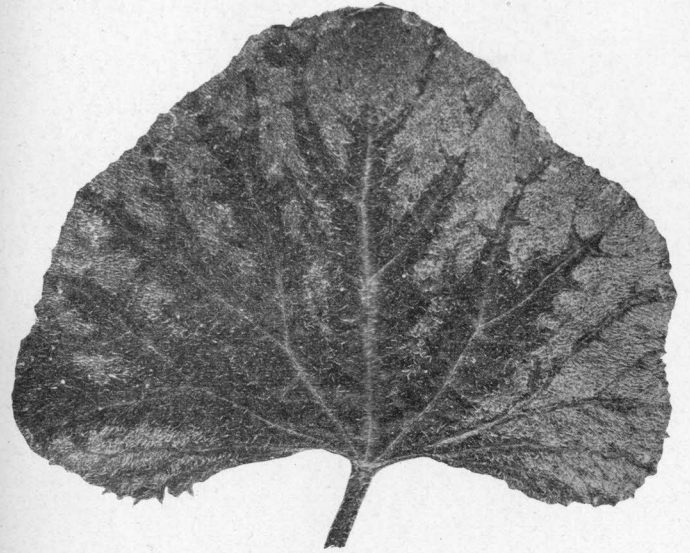


b. Chlorosis of Blackberry, p. 365.

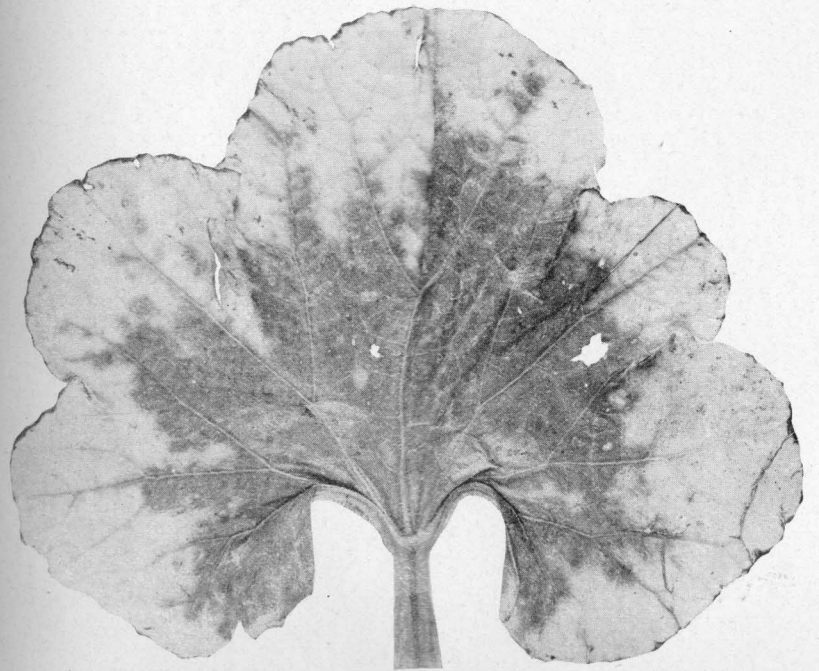


c. "Yellows" of Raspberry, p. 361.

CHLOROSIS OF CULTIVATED SHRUBS.



a. Natural Chlorosis, apparently non-infectious, p 362.

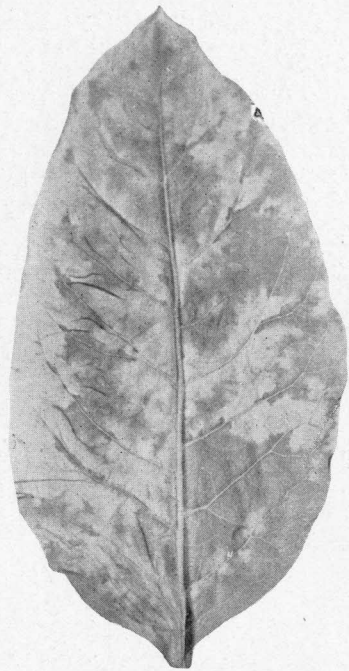


b. Chlorosis produced by Bordeaux Mixture, p. 365.

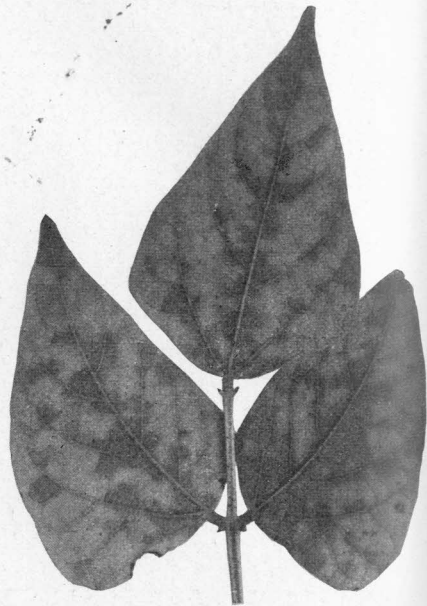
CHLOROSIS OF MUSK MELON.

Infectious.

Non-Infectious.

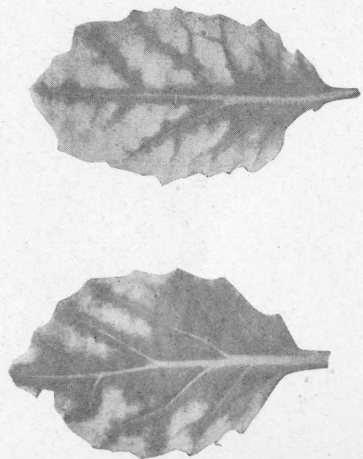


a. Of Pokeweed, p. 362.

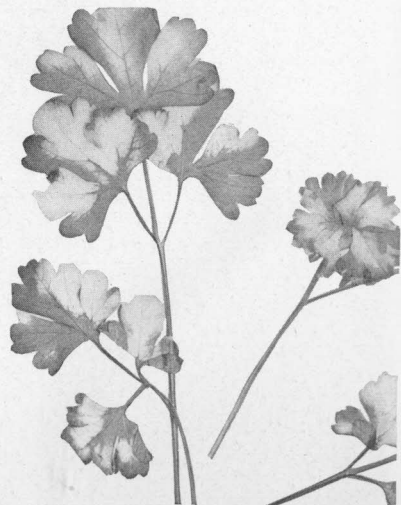


b. Of Lima Bean, p. 362.

Chlorosis resulting from frost injury.



c. Of Cabbage, p. 365.

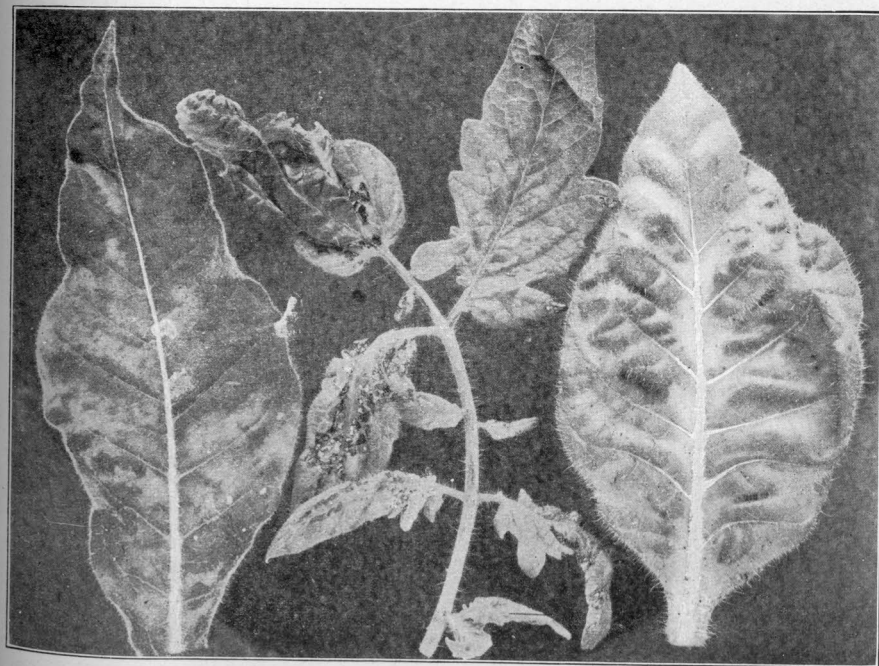


d. Of Parsley, p. 365.

CHLOROSIS OF VARIOUS HERBACEOUS PLANTS.



a. Burn on Artificially Calicoed Tomato Leaves, p. 373.



b. Calico from Tobacco on Tomato and then back to Tobacco, p. 373.

CALICO ON TOMATO PLANTS.



a. String Leaves, p. 366.

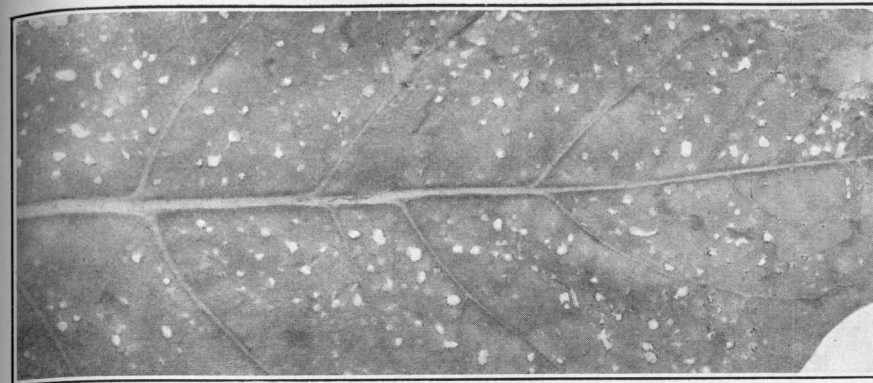


b. Showing relation to Veins, p. 365.

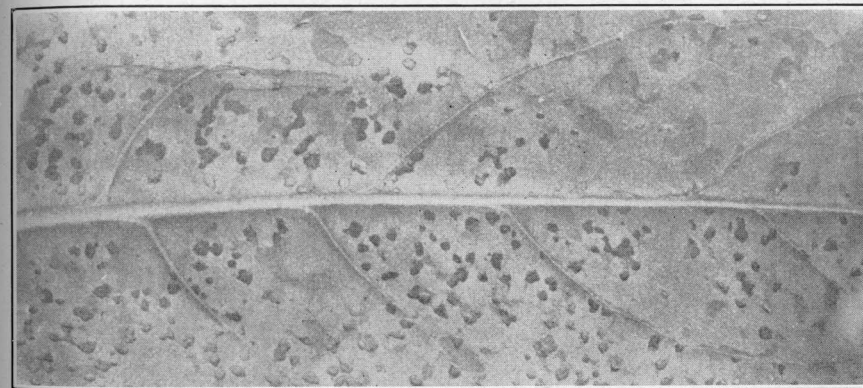


c. Calico Spots, almost White, p. 361.

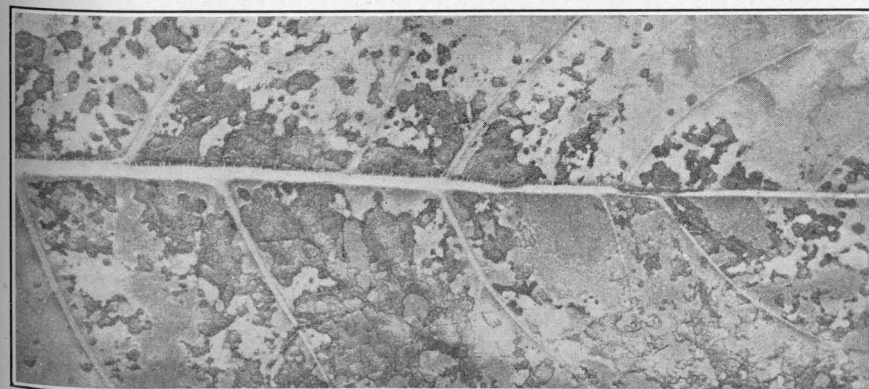
VARIATIONS OF CALICOED TOBACCO LEAVES.



a. White Spot (cause not known), p. 367.



b. Rust showing Spots isolated, p. 366.

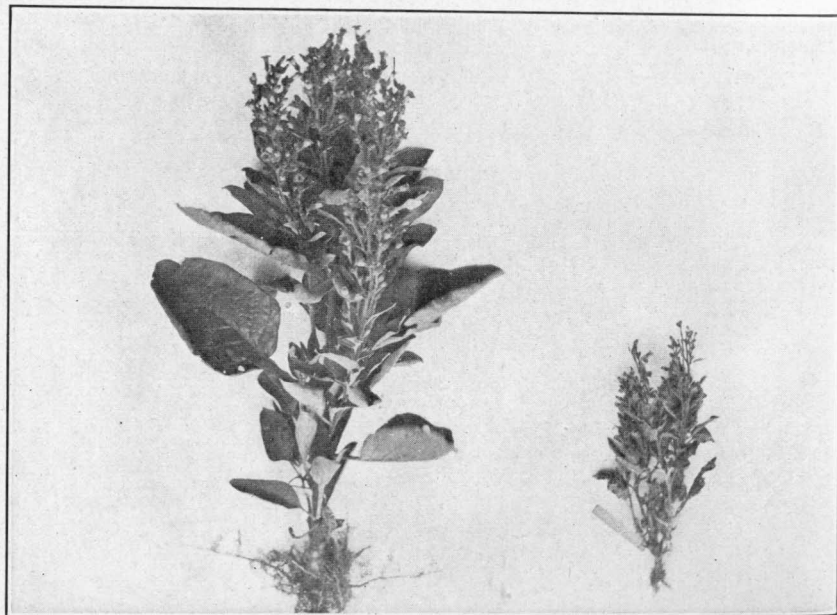


c. Rust showing Spots run together, p. 366.

INJURIES FOLLOWING CALICO.



a. Calicoed and healthy plants of same age in front row, p. 405.



b. Healthy and Calicoed plants of *Nicotiana rustica scabra*, p. 366.

EFFECT OF CALICO ON HEIGHT OF PLANTS.

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