disease as is insulin to diabetes or diphtheria antitoxin to diphtheria, but it is widely applicable to the relief of that distressing symptom—pain—in all kinds of conditions. As a matter of fact there is hardly a branch of medicine which is not indebted to Sertürner's discovery for making it possible to serve mankind. This beneficence extends even to animals of the lower orders. Considering that this discovery led directly to the discovery of such important alkaloids as quinine, cocaine, emetine, ephedrine and others, it is not too much to say that Sertürner promoted not only the conquest of pain, but also of disease prevention, and thus facilitated the conquest of continents and of uncivilized peoples. Thus, Sertürner's discovery stands well alongside of the greatest discoveries which have benefited the human race. No wonder that it was hailed as an important one.

Now, on the 125th anniversary of this important discovery, we reaffirm our gratefulness for the timely effort and native talent of the once obscure pharmacist of Paderborn. There is indeed a lesson in his achievement. In it we have an example of drug store research 125 years ago. Would it be too much to expect of American Pharmacy to draw a fresh inspiration for higher and better things from Sertürner and his discovery? Could this happen, it would contribute to her a life element of inestimable worth.

AUTHOR'S NOTE: My acknowledgments are due to the University of Wisconsin Library, Madison, Wisconsin, for a loan of the journals containing the papers by Sertürner; and to Prof. Dr. H. Freund of the University of Münster, Germany, for certain cuts, which have been used in this paper, and a pamphlet by Dr. Krömeke, previously unknown to me, all of which were received after completion of this paper.

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SYRUP OF FERROUS IODIDE AND THE OFFICIAL HYDRIODIC PREPARATIONS.

BY H. V. ARNY, BENJAMIN VENER AND LESLIE C. JAYNE.

(*Concluded from p. 268, March Issue*).

Part II.

SYRUP OF FERROUS IODIDE.

(Work performed with Leslie C. Jayne, Ph.Ch., B.S.)

Three samples of this syrup were prepared:

A. Exactly as directed by U. S. P. X. The fresh sample assayed 5.1793 per cent ferrous iodide.

B. As directed by U. S. P. X with omission, however, of the hypophosphorous acid. The fresh sample assayed 5.4116 per cent ferrous iodide.

C. As directed by U. S. P. X except that the sugar is replaced by the same

amount of invert sugar.[1] The fresh sample assayed 5.0942 per cent, of ferrous iodide.

TABLE VII.

SAMPLE A. SUCCESSIVE ASSAYS OF SAME SAMPLE STORED IN 2 ONE-PINT BOTTLES. UNDER "REMARKS" MENTION IS MADE AS TO WHETHER THE ASSAYED SAMPLE WAS TAKEN FROM THE FULL OR PARTLY FULL BOTTLE.

Date.	Age.	Color.	Scum.	Free iodine.	% FeI_2.	Remarks.
10-26-26	....	Green	.....	...	5.1793	Partly filled pint bottle
11-27-26	1 mo.	Green	.....	...	5.1793	Full pint bottle
12-28-26	2 mos.	Green	.....	...	5.1793	Full pint bottle
2- 1-27	3 mos.	Green	.....	...	5.1407	Full pint bottle
3- 3-27	4 mos.	Green	.....	...	5.1793	Full pint bottle
4- 9-27	5 mos.	Green	.....	...	5.1793	Full pint bottle
5-23-27	6 mos.	Green (cloudy)	Present	...	5.249	Full pint bottle
6-25-27	7 mos.	Green (cloudy)	.....	...	5.1793	Full pint bottle
9-20-27	10 mos.	Green (cloudy)	.....	...	5.2181	Partly filled pint bottle
10-28-27	11 mos.	Green (cloudy)	.....	...	5.1793	Partly filled pint bottle
11-28-27	1 year	Green (cloudy)	.....	...	5.1793	Partly filled pint bottle
1-15-28	14 mos.	Green (cloudy)	.....	...	5.1019	Partly filled pint bottle
3-19-28	16 mos.	Green (cloudy)	.....	...	5.2640	Partly filled pint bottle
7-16-28	20 mos.	Brown	.....	...	5.218	Partly filled pint bottle

TABLE VIII.

SAMPLE A. KEPT IN SMALL COMPLETELY FILLED, TIGHTLY CORKED ONE-OUNCE BOTTLES; EACH OPENED ONLY AT THE TIME OF THE SPECIFIC ASSAY.

Date.	Age.	Color.	Scum.	Free iodine.	% FeI_2.	Remarks.
10-26-26	....	Green	...	...	5.2531	....
11-27-26	1 mo.	Green	...	...	5.2181	....
12-28-26	2 mos.	Green	...	...	5.178	....
2- 1-27	3 mos.	Green	...	...	5.2181	....
3- 3-27	4 mos.	Green	...	...	5.2181	....
4- 9-27	5 mos.	Green	...	...	5.1793	....
5-23-27	6 mos.	Green	...	...	5.1793	....
6-25-27	7 mos.	Green	...	...	5.1793	....
9-20-27	10 mos.	Green	...	...	5.2181	....
10-28-27	11 mos.	Green	...	...	5.1406	....
11-28-27	1 year	Green	...	...	5.1019	....
1-15-28	14 mos.	Green	...	...	5.1793	....
3-19-28	16 mos.	Green	...	...	5.2645	....
7-16-28	20 mos.	Brownish green	...	...	5.1793	....

These three samples were stored as in the case of those used in Part I; that is (*a*) a filled pint bottle; (*b*) a partly filled pint bottle; (*c*) the rest in completely filled well-stoppered one-ounce bottles which were opened only as they were as-

[1] The invert sugar used was the "Nulomoline" brand, the amount used corresponding to 850 Gm. of 100% material to 1000 cc. of finished syrup.

sayed. Samples A and B were prepared October 20, 1926, and Sample C two days later. As in Part I the color, presence of scum, presence of free iodine and the iodide assay was carefully studied with results noted in the tables:

TABLE IX.

SAMPLE B. SUCCESSIVE ASSAYS OF SAME SAMPLE STORED IN 2 ONE-PINT BOTTLES. UNDER "REMARKS," MENTION IS MADE AS TO WHETHER THE ASSAYED SAMPLE WAS TAKEN FROM THE FULL OR PARTLY FULL BOTTLE.

Date.	Age.	Color.	Scum.	Free iodine.	% FeI_2.	Remarks.
10-26-26	....	Green	...	...	5.4116	Partly filled pint bottle
11-27-26	1 mo.	Green	...	...	5.3419	Full pint bottle
12-28-26	2 mos.	Green	...	...	5.403	Full pint bottle
2- 1-27	3 mos.	Green	...	...	5.4115	Full pint bottle
3- 3-27	4 mos.	Green	...	...	5.45036	Full pint bottle
4- 9-27	5 mos.	Green	...	...	5.45036	Full pint bottle
5-23-27	6 mos.	Dull green	...	...	5.45036	Full pint bottle
6-25-27	7 mos.	Dull green	...	...	5.45036	Full pint bottle
9-20-27	10 mos.	Dull green	...	...	5.4503	Partly filled pint bottle
10-28-27	11 mos.	Dull green	...	...	5.4503	Partly filled pint bottle
11-28-27	1 year	Dull green	...	...	5.5277	Partly filled pint bottle
1-15-28	14 mos.	Dull green	...	...	5.4890	Partly filled pint bottle
3-19-28	16 mos.	Dull green	...	...	5.4968	Partly filled pint bottle
7-16-28	20 mos.	Dull green	...	...	5.4890	Partly filled pint bottle

TABLE X.

SAMPLE B. KEPT IN SMALL, COMPLETELY FILLED, TIGHTLY CORKED ONE-OUNCE BOTTLES; EACH OPENED ONLY AT THE TIME OF THE SPECIFIC ASSAY.

Date.	Age.	Color.	Scum.	Free iodine.	% FeI_2.	Remarks.
10-26-26	....	Green	....	....	5.4116	....
11-27-26	1 mo.	Green	....	....	5.4116	....
12-28-26	2 mos.	Green	....	....	5.334	....
2- 1-27	3 mos.	Green	....	....	5.4503	....
3- 3-27	4 mos.	Green	....	....	5.4503	....
4- 9-27	5 mos.	Green	....	....	5.3729	....
5-23-27	6 mos.	Green	....	....	5.3679	....
6-25-27	7 mos.	Green	....	....	5.4503	....
9-20-27	10 mos.	Green	....	....	5.4890	....
10-28-27	11 mos.	Green	....	....	5.4116	....
11-28-27	1 year	Green	....	....	5.3729	....
1-15-28	14 mos.	Green	....	....	5.4116	....
3-19-28	16 mos.	Green	....	....	5.4194	....
7-16-28	20 mos.	Green	....	....	5.4194	....

TABLE XI.

SAMPLE C. SUCCESSIVE ASSAYS OF THE SAME SAMPLE STORED IN 2 ONE-PINT BOTTLES. UNDER "REMARKS," MENTION IS MADE WHETHER THE ASSAYED SAMPLE WAS TAKEN FROM THE FULL OR PARTLY FULL BOTTLE.

Date.	Age.	Color.	Scum.	Free iodine.	% FeI_2.	Remarks.
10-26-26	....	Bright green	....	....	5.0942	Partly filled pint bottle
11-27-26	1 mo.	Bright green	....	....	5.0942	Full pint bottle
12-28-26	2 mos.	Bright green	....	....	4.978	Full pint bottle
2- 1-27	3 mos.	Bright green	....	....	5.0555	Full pint bottle
3- 3-27	4 mos.	Bright green	....	....	5.0555	Full pint bottle
4- 9-27	5 mos.	Bright green	....	....	5.0942	Full pint bottle

5–23–27	6 mos.	Bright green	....	....	5.0555	Full pint bottle
6–25–27	7 mos.	Bright green	....	....	5.0942	Full pint bottle
9–20–27	10 mos.	Bright green	....	....	5.0168	Partly filled pint bottle
10–28–27	11 mos.	Bright green	....	....	5.0168	Partly filled pint bottle
11–28–27	1 year	Bright green	....	....	5.0477	Partly filled pint bottle
1–15–28	14 mos.	Bright green	....	....	5.0942	Partly filled pint bottle
3–19–28	16 mos.	Bright green	....	....	5.1984	Partly filled pint bottle
7–20–28	20 mos.	Bright green	....	....	5.0168	Partly filled pint bottle

TABLE XII.

SAMPLE C. KEPT IN SMALL, COMPLETELY FILLED, TIGHTLY CORKED ONE-OUNCE BOTTLES; EACH OPENED ONLY AT THE TIME OF THE SPECIFIC ASSAY.

Date.	Age.	Color.	Scum.	Free iodine.	% FeI_2.	Remarks.
10–26–26	....	Bright green	....	....	5.0942	....
11–27–26	1 mo.	Bright green	....	....	5.0942	....
10–28–26	2 mos.	Bright green	....	....	5.016	....
2– 1–27	3 mos.	Bright green	....	....	5.0555	....
3– 3–27	4 mos.	Bright green	....	....	5.0555	....
4– 9–27	5 mos.	Bright green	....	....	5.0166	....
5–23–27	6 mos.	Bright green	....	....	5.0555	....
6–25–27	7 mos.	Bright green	....	....	5.0492	....
9–20–27	10 mos.	Bright green	....	....	5.0555	....
10–28–27	11 mos.	Bright green	....	....	5.0169	....
11–28–27	1 year	Bright green	....	....	5.1019	....
1–15–28	14 mos.	Bright green	....	....	5.1019	....
3–19–28	16 mos.	Bright green	....	....	5.1484	....
7–16–28	20 mos.	Bright green	....	....	5.0942	....

The following comments on the three Samples A to C, supplement the tables just given:

The 1926–1928 samples kept much better than the samples of 1924–1926. This is possibly due to the use of absolutely new bottles, just as they came from the factory. Perhaps these fresh containers were in a more sterile condition than the old but well-cleaned bottles used in the first set of experiments.

The puzzling behavior as to question of presence or absence of free iodine shown in Tables I and II (the real cause of repeating the work), may be due to the fact that the 1924 experiments were carried on in a room where artificial light was necessary most of the time whereas the 1926–1928 experiments were conducted in a room receiving an abundance of sunshine.

The "scum" noted in the 1924 experiments was noted only in Sample A of 1926–1928 and in a lesser amount; possibly due to the influence of sunlight; in fact, the amount available was too small to repeat the chemical examinations of 1924.

The darkening of the silver iodide precipitate during the assay of Sample A was as noticeable as it was in the 1924 experiments. No mention is made of it, however, in the tables.

Sample C kept more satisfactorily than the other two, suggesting the possible value of invert sugar as a sweetener and preservative of this official syrup.

Part III.—THE HYDRIODIC PREPARATIONS.

(Work performed with Benjamin Vener, Ph.G., B.S.)

While our main object was to study the stability of syrup of hydriodic acid,

since this pharmaceutical is made from the diluted acid, the latter product had to be given consideration. Only one sample of the diluted acid was prepared, since that sample proved entirely satisfactory. From this sample (which we will call Sample E) three samples of the syrup were prepared; Sample F made with an old sample of simple syrup giving a positive reaction for reducing sugar; Sample G made with a freshly prepared simple syrup giving a negative reaction for reducing sugar; and Sample H made by diluting 125 cc. of the diluted acid with a mixture of 375 Gm. syrup and 400 Gm. glycerin followed by enough water to make the finished product measure 1000 cc. Samples E and F were assayed over a period of 20 weeks under conditions described in the discussion of the samples of syrup of ferrous iodide A and B. Syrup of hydriodic acid, Sample G, was assayed when fresh and when 16 weeks and when 21 months old, while Sample H was assayed when fresh and when 12 weeks and 19 months old. Incidentally it might be stated that the main objects in preparing the three samples of the syrup were (*a*) to study the effect of an old simple syrup (containing reducing sugars) on the stability and the titration of the preparation; (*b*) to find if the presence of glycerin would improve the product.

The following are the tabulated results of our experiments with the hydriodic preparations:

TABLE XIII.

SAMPLE E (DILUTED HYDRIODIC ACID). SUCCESSIVE ASSAYS OF SAME SAMPLE CONTAINED IN AN INCOMPLETELY FILLED BOTTLE.

Age.	Color.	Titration. % HI.	AgI ppt.
Fresh	Colorless	9.645	Reduced
1 week	Colorless	9.78	Reduced
2 weeks	Colorless	9.78	Reduced
3 weeks	Colorless	9.78	Reduced
4 weeks	Colorless	9.78	Reduced
8 weeks	Colorless	9.633	Reduced
12 weeks	Colorless	9.633	Reduced
16 weeks	Colorless	9.751	Reduced
20 weeks	Colorless	9.751	Reduced
22 months	Colorless	9.841	Reduced

TABLE XIV.

SAMPLE E (DILUTED HYDRIODIC ACID). KEPT IN SMALL, COMPLETELY FILLED, TIGHTLY CORKED BOTTLES EACH OPENED ONLY AT THE TIME OF THE SPECIFIC ASSAY.

Age.	Color.	Titration. % HI.	AgI ppt.
Fresh	Colorless	9.645	Reduced
1 week	Colorless	9.78	Reduced
2 weeks	Colorless	9.78	Reduced
3 weeks	Colorless	9.78	Reduced
4 weeks	Colorless	9.71	Reduced
8 weeks	Colorless	9.633	Reduced
12 weeks	Colorless	9.633	Reduced
16 weeks	Colorless	9.751	Reduced
20 weeks	Colorless	9.751	Reduced

TABLE XV.

SAMPLE F (SYRUP OF HYDRIODIC ACID). SUCCESSIVE ASSAYS OF SAME SAMPLE CONTAINED IN AN INCOMPLETELY FILLED BOTTLE.

Age.	Color.	Titration. Gm. HI in 100 cc.	AgI ppt.
Fresh	Colorless	1.201	Reduced
1 week	Colorless	1.213	Reduced
2 weeks	Colorless	1.201	Reduced
3 weeks	Colorless	1.201	Reduced
4 weeks	Colorless	1.201	Reduced
8 weeks	Colorless	1.185	Reduced
12 weeks	Colorless	1.185	Reduced
16 weeks	Colorless	1.235	Reduced
20 weeks	Colorless	1.235	Reduced
22 months	Faint straw	1.379	No reduction

TABLE XVI.

SAMPLE F (SYRUP OF HYDRIODIC ACID). KEPT IN SMALL, COMPLETELY FILLED, TIGHTLY CORKED BOTTLES, EACH OPENED ONLY AT THE TIME OF THE SPECIFIC ASSAY.

Age.	Color.	Titration. Gm. HI in 100 cc.	AgI ppt.
Fresh	Colorless	1.201	Reduced
1 week	Colorless	1.213	Reduced
2 weeks	Colorless	1.227	Reduced
3 weeks	Colorless	1.227	Reduced
4 weeks	Colorless	1.227	Reduced
8 weeks	Colorless	1.173	Reduced
12 weeks	Colorless	1.173	Reduced
16 weeks	Colorless	1.259	Reduced
20 weeks	Colorless	1.259	Reduced

TABLE XVII.

SAMPLE G (SYRUP OF HYDRIODIC ACID). THREE ASSAYS OF SAME SAMPLE CONTAINED IN AN INCOMPLETELY FILLED BOTTLE.

Age.	Color.	Titration. Gm. HI in 100 cc.	AgI ppt.
Fresh	Colorless	1.319	No reduction
16 weeks	Colorless	1.367	No reduction
21 months	Faint straw	1.355	Reduction

TABLE XVIII.

SAMPLE H (SYRUP OF HYDRIODIC ACID). FOUR ASSAYS OF THE SAME SAMPLE CONTAINED IN AN INCOMPLETELY FILLED BOTTLE.

Age.	Color.	Titration. Gm. HI in 100 cc.	AgI ppt.
Fresh	Colorless	1.395	No reduction
1 week	Colorless	1.395	No reduction
12 weeks	Colorless	1.450	No reduction
19 months	Faint straw	1.438	Faint reduction

Commenting on Tables XIII to XVIII, it must be stated that the sample of diluted hydriodic acid and the three samples of syrup of hydriodic acid kept perfectly, there being during the 20 weeks no indication of darkening, of the presence of iodine, or the production of a sediment. In short, the stability of the U. S. P. diluted acid and the syrup is so satisfactory that there is no need of amending the

official recipe even to the extent of using glycerin as a preservative. In connection with the use of glycerin, it has been stated (9) that the addition of glycerin causes hydriodic preparations to develop a bad odor ("horrible odor," one observer states). Our samples containing glycerin that are almost two years old have nothing more than a slightly sour smell. The titration of the hydriodic preparations are not easy since the precipitated silver iodide not only darkens but frequently assumes a blue-purple tint that causes difficulty in determining the end-point of the titration.

In short there are a number of factors interfering with the sensitivity of the titration of syrup of hydriodic acid as directed by the U. S. P. "Blank titrations" of solutions containing sugar and potassium hypophosphite showed little or no reduction either visually or when expressed in terms of tenth-normal silver nitrate and thiocyanate, respectively. A solution containing sugar and diluted hypophosphorous acid, however, quickly reduced the silver solution. Old syrup diluted with water containing potassium hypophosphite had no more effect upon the silver solution than had a fresh syrup. So apparently the reduction of the silver salt in the titration of these preparations occurs primarily in the presence of silver iodide. The subject is one worthy of more study but is one which is hardly within the scope of this paper, hence we will close by merely stating that we obtained more satisfactory titration results by diluting the sample of the syrup (either ferrous iodide or hydriodic acid) with *warm* water and then adding the ferric alum solution followed by the nitric acid prior to titration with the thiocyanate solution. This, we found, usually obviates the warming on a water-bath in the presence of nitric acid, directed by the Pharmacopœia, as a means to reconverting the reduced silver precipitate to the yellow silver iodide.

Part IV.—CONCLUSIONS.

1. The U. S. P. recipe for syrup of hydriodic acid is satisfactory, the resulting product being quite stable.
2. The U. S. P. recipe for syrup of ferrous iodide is less satisfactory, since the resulting product turns yellow and shows traces of precipitation.
3. In such deterioration, the decrease in iodide content is negligible and the amount of iodine liberated is insignificant.
4. The turbidity (or "scum") found in samples of the official syrup of ferrous iodide appears to be ferric hypophosphite. The formation of this "scum" is less noticeable in samples exposed to sunlight than in those kept in a dark place.
5. The syrup when free from a stabilizer does liberate iodine and the freed iodine may be returned into chemical combination by action of direct sunlight.
6. The U. S. P. syrup (containing hypophosphorous acid) suffered more decomposition on standing than the other samples.
7. The omission of hypophosphorous acid and the use of glycerin as a stabilizer does not yield a satisfactory product.
8. A sample of Syrup of Ferrous Iodide made with invert sugar was found practically perfect after standing 22 months.

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COLUMBIA UNIVERSITY,
COLLEGE OF PHARMACY,
July 1928.

A PHARMACEUTICAL STUDY OF MAGMÆ MAGNESIÆ—1900–1930.

BY A. J. LEHMAN, M.S.

(*Continued from p. 265, March Issue*).

5. SODIUM HYDROXIDE AS AN INGREDIENT.

Sodium hydroxide is prescribed by all three standards containing Magma Magnesia. The 1900 N. F. prescribed 81 Gm., the U. S. P. of 1910, 80 Gm. and the U. S. P. revision of 1920 increased the amount to 100 Gm., each for 1000 cc. of product. The purity rubric for the last three revisions reads "not less than 90 per cent of NaOH." Based upon this 81 Gm., 80 Gm. and 100 Gm. of sodium hydroxide represent 72.9 Gm., 72 Gm. and 90 Gm. of NaOH. Other alkalies were suggested in place of sodium hydroxide. An unsigned article (29) (1896) includes a formula for a "Fluid magnesia" in which sodium carbonate is prescribed. A second formula (30) (1904) prescribes "solution of potash—enough."

Raubenheimer (31) (1907) in commenting on this ingredient prefers NaOH to KOH in preparing milk of magnesia because of the greater solubility of the formed sodium sulphate which makes it easier to wash out. Terry and Davy (32) (1920) are also in favor of sodium hydroxide because of the cost. Ammonia should not be used they claim as magnesium hydroxide is soluble in ammonia. Grosh (33) (1913) contrary to this statement says that using stronger ammonia water, gives a more rapid precipitation and also eliminates filtering.

In respect to the quantity of sodium hydroxide used Bruden (34) (1909) suggests increasing the sodium hydroxide by one-half while Diehl (35) (1909) suggests a reduction to 72 Gm. Cloughy (36) (1913) increases the quantity to 81 Gm., Hilton (37) (1911) to 119 Gm. and Beringer (38) (1913) to 100 Gm. McNeery (39) (1916) for one gallon of magma uses 6259.08 grains or about 405 Gm., representing about 101 Gm. per 1000 cc. Mueller (40) (1917) offers an increase to 120 Gm., Boehm (41) (1908) to 125 Gm.

The following table summarizes the quantities of sodium hydroxide directed to be used by the official as well as by non-official formulas together with the respective absolute equivalents.

Formula.	Sodium hydroxide.	Purity rubric.	Absolute.
N. F. 1900	81	90%	72.9 Gm. NaOH
U. S. P. 1910	80	90	72.0 Gm. NaOH
U. S. P. 1920	100	90	90 Gm. NaOH