THE BACTERICIDAL EFFICIENCY OF IODINE SOLUTIONS.*

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INTRODUCTION.

The antiseptic action of iodine was discovered by Davaine in 1873. Perhaps the earliest reference to the antiseptic use of iodine in surgery is to be found in the fourth edition of "The Practice of Surgery" by T. Bryant, published in 1884. He recommends an antiseptic lotion for wound irrigation which is made by adding 10 drops of Liquor Iodi to the ounce of water. Willard in his "Annals of Surgery," published in 1896, Nicholas Senn in his "Surgery, Gynecology and Obstetrics," published in 1905, and several other prominent surgeons refer to iodine as the safest and most potent of all antiseptics. As a disinfectant for the skin, particularly for the treatment of injuries and for the field of operation, iodine came prominently to the attention of every one during the year 1905. Considerable discussion has resulted in an attempt to definitely determine who introduced iodine for this purpose. Among the claimants for the honor are to be found Cannaday, Woodbury, Dannreuther and Grossich. The latter is credited by many workers as having been the first one to write comprehensively on the subject and his article, in "Zentralblatt für Chirurgie," No. 44, page 1289, Oct. 31, 1908, is frequently quoted by later writers.

As a local application for the purpose of destroying microörganisms present on the applied area, iodine has been and is being constantly employed by surgeons throughout the world as one of the safest of skin disinfectants. Free iodine (and in some instances iodine vapor and nascent iodine) has been and is being employed as a bactericidal agent for the treatment of skin affections, in obstetrics and gynecology, in general surgery as a wound wash, as a vaginal douche, as a mouth wash, for the disinfection of small quantities of water and even in general disinfection where this chemical will not be inactivated or attack the material to be treated.

More recently and especially since the beginning of the Great World War numerous antiseptics and bactericidal agents have been introduced, each bearing claims as the nearest approach to the ideal germicide. Reports by different workers have revealed wide variations in the bactericidal efficiency of these different chemicals. With the thought of determining the disinfecting qualities of iodine, its limitations, its value as compared to other antiseptics and bactericidal agents frequently advocated, an extensive program of research was inaugurated. Herewith are recorded the data completed to date. The germicidal agents used for comparison were of the concentrations commonly marketed or recommended for use.

DETERMINATION OF PHENOL COEFFICIENT AGAINST B. TYPHOSUS.

The Hopkins strain of *B. typhosus* was used as the test organism in these experiments. Three additional cultures of *B. typhosus* were obtained from laboratories employing this as their test organism (typhoid bacillus) in performing the phenol coefficient technique. The Reddish method, as published in the issue of April 1927, of the *American Journal of Public Health*, was employed using these

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four cultures of *B. typhosus* separately. Check determinations were made in each case so that in all eight phenol coefficient tests were performed on each sample. The phenol coefficient recorded for each preparation in Table I is the average of the findings in these eight tests.

Controls on the solvents revealed the following: Dilute alcohol kills cultures of *Staphylococcus aureus* and typhoid bacillus within 5 minutes when mixed in the proportion of 5 cc. of chemical to 0.5 cc. of culture (the same proportion as employed in the Reddish method). Dilute alcohol, mixed with equal parts of water, does not kill these organisms within 15 minutes when employed in the same proportion.

Alcohol–acetone–water (undiluted) employed as a solvent for E2[1] kills cultures

A. Proprietary compound cresol solution.
B. Proprietary stabilized sodium hypochlorite solution.
C. Proprietary cresylic acid solution.
D. Proprietary organic mercurial solution, 1:500.
E1. Proprietary organic mercurial, 2% aqueous solution unless otherwise designated.
E2. Proprietary organic mercurial, 2% solution in 10% acetone, 55% alcohol, water q. s. 100%.
F. Proprietary polyphenol derivative, 1:1000 solution.

of *Staphylococcus aureus* and typhoid bacillus within 5 minutes, but, if diluted with an equal quantity of water, it will not kill these organisms within 15 minutes, when 5 cc. of the solvent is mixed with 0.5 cc. of the respective cultures.

The aqueous solution of iodides employed as a solvent for the iodine in the 3% special aqueous solution of iodine (Karns' Formula[2]), THIS JOURNAL, 21, 785 when

Iodine	3.00 Gm.
Calcium iodide hexahydrate	0.132 Gm.
Potassium iodide	0.144 Gm.
Sodium iodide	3.312 Gm.
Water, q. s.	100.00 cc.

undiluted does not kill either *Staphylococcus aureus* or the typhoid bacillus within 15 minutes.

TABLE I.—PHENOL COEFFICIENT TEST.

(Reddish Technique.)

B. typhosus (as the test organism—temperature at 20° C.)

	Phenol Coefficient.	Variations in Coefficient.
1. 2% Alcoholic Iodine Solution (with dilute alcohol)	4.7	4.1 5.2
2. 3% Alcoholic Iodine Solution (with dilute alcohol)	6.6	5.5 7.5
3. 2% Alcoholic Iodine Solution (U. S. P. tincture diluted with alcohol)	3.6	3.2 4.1
4. 3% Alcoholic Iodine Solution (U. S. P. tincture diluted with alcohol)	5.8	5.3 6.1
5. 2% Isotonic Iodine Solution	4.7	4.4 5.5
6. 3% Special Aqueous Iodine Solution (Karns' Formula)	7.2	6.5 7.5

[1] The proprietary germicidal agents used in this investigation are as follows.

[2] Iodine Solution, Karns, has the following composition.

7.	A	2.7	
8.	B	1.8	1.6
			2.1
9.	C	9.3	
10.	Mercuric chloride (1-1000)	2	
11.	D	1.1	
12.	E1	0.16	
13.	E2	0.16	
14.	F	0.055	

The phenol coefficients as recorded in Table I, are for the solutions as they are marketed or as mentioned therein. Thus the coefficients for A, B, C, D and F, are for the solutions as they are marketed. Solutions of E were all prepared freshly from the commercial powder (original sample). The phenol coefficients for the iodine solutions are for those solutions, the strengths and methods of preparation of which are given. The 2% isotonic iodine solution contains 20 Gm. of iodine, 24 Gm. of potassium iodide and dilute alcohol, a quantity sufficient to make 1000 cc.

It is to be noted that in obtaining the phenol coefficient of the solutions mentioned (average of eight determinations), variations were observed only in the iodine solutions and B. The other disinfectants tested and the phenol employed yielded practically the same results on each of the eight examinations. In the case of B, the variations were from 1.6 to 2.1. The variations of the iodine solutions were:

No. 1—from 4.1 to 5.2	No. 4—from 5.3 to 6.1
No. 2—from 5.5 to 7.5	No. 5—from 4.4 to 5.5
No. 3—from 3.2 to 4.1	No. 6—from 6.5 to 7.5

This variation in results with the iodine solutions is apparent not only with the different strains of typhoid bacilli but may occur with the same strain of organism (but grown in two different tubes of media and these employed separately in the test). For instance, it was noted that if to each of 0.5 cc. of several cultures of organisms, the same dilution of iodine is added and these kept under identical conditions, there will be a variation in the length of time required for the disappearance of free iodine. This was determined not only by the disappearance of color from the solutions but by bringing loopfuls of the latter in contact with starch indicator.

TABLE II.—PHENOL COEFFICIENT TEST.

(Reddish Technique.)

Staphylococcus aureus (as the test organism—temperatures at 20° C. and 37° C.)

	At 20° C.	At 37° C.
3% Special Aqueous Iodine Solution (Karns' Formula)	7.5	5.6
3% Alcoholic Iodine (with dilute alcohol)	6.3	5.1
E1	0.013	0.011
E2	0.024	0.037

The disappearance of free iodine, in these solutions, seems to depend upon the amount of organic substances and in particular upon the quantity of protein matter present. This probably accounts for the variable end results displayed by iodine in bactericidal efficiency tests. It is probable that the iodine reacts with protein matter producing a compound which in itself displays bactericidal efficiency. Of course, we are also to take into consideration the fact that some of these iodine solu-

tions may reveal slight losses in strength, depending upon the methods employed in keeping them, resulting in the same solution yielding a lower phenol coefficient at a later date. But with these variations due to whatever cause, even if we take the low points and not the average, we find that the iodine solutions are decidedly more efficient as bactericidal agents in their recommended formulas than the other substances tested.

It is to be noted that the iodine solutions do not reveal a marked decrease in bactericidal efficiency for the *Staphylococcus aureus* at 20° C. as compared with the typhoid bacillus at the same temperature. An attempt was made to determine the reason for this. Unless this chemical displays specificity, it is to be expected that it would not be as effective against the staphylococcus as it would be against the typhoid bacillus, the latter an organism much weaker in resistance. In the standard methods as advocated in the Reddish technique which were carried out, it was found that the cultures of staphylococci when ready for the test contained 100,000,000 less organisms per cc. than were present in the cultures of typhoid bacilli employed in the test. This means less organic and protein matter with a corresponding increase in the prolonged action of free iodine.

It is also to be noted that in the case of the iodine solutions, there is a decrease in the bactericidal efficiency at 37° C. as compared with results obtained at 20° C. Titrations made of weak iodine solutions at 5-, 10- and 15-minute intervals while kept at 20° C. and 37° C., revealed a loss of free iodine at the higher temperature and an almost negligible loss at 20° C. Such losses are not as marked with concentrated iodine solutions.

The phenol coefficients with *Staphylococcus aureus* at 37° C. as given in this table were obtained by comparing the unknowns with phenol at 37° C. This will give a coefficient less than that obtainable if the comparison is made with phenol at 20° C., a practice employed by some workers. We found that a 1:80 phenol kills *Staphylococcus aureus* in 10 minutes but not in 5 and 1:90 does not kill in 15 minutes at 37° C. whereas 1:60 phenol will kill in 10 minutes but not in 5 and 1:70 will not kill in 15 minutes at 20° C. Take for instance the 3% Aqueous Special Iodine Solution (Karns' Formula): A 1:450 dilution kills *Staphylococcus aureus* at 20° C. and also at 37° C. within 10 minutes but not within 5 minutes. If we compare this dilution with the 1:80 phenol dilution at 37° C., the resulting coefficient will be as recorded, 5.6. If our comparison should be made with the standard resistance of *Staphylococcus aureus* at 20° C., even though the actual work with this organism was performed at 37° C., a practice established by some workers, the phenol coefficient will be $\frac{450}{60}$ or 7.5. In like manner the phenol coefficients (*Staphylococcus aureus*) at 37° C. of the solutions mentioned in Table II will be as follows if comparisons were made with the standard resistance to phenol at 20° C. instead of at 37° C.:

3% Alcoholic Iodine (with dilute alcohol).	Average.
	6.8
E1	0.013
E2	0.05

MODIFIED BACTERICIDAL EFFICIENCY TESTS.

The phenol coefficient methods are used as a means of comparing the efficiency of different disinfectants against the same organism under identical test conditions.

There are several objections, however, to certain features of the phenol coefficient techniques. At times one may find that the coefficient obtained, though consistent with the maximum of accuracy possible in a laboratory test, may not be comparable to the actual results in practice, as here conditions may be entirely different from that possible in a laboratory test. Experiments were therefore conducted employing more rigid laboratory methods. The latter, having the advantage of more closely simulating actual conditions found in practical disinfection, may serve as a more satisfactory means of determining the practical value of various disinfectants as bactericidal agents.

Transplant tubes held ten cc. of sterile bouillon (containing 1% peptone, 0.5% salt, 0.5% beef extract and possessing a p_H of 6.6).

The inoculating loop employed was 4 mm. in diameter.

The test organisms were *B. typhosus* and *Staphylococcus aureus* and in each case four separate cultures were employed, the latter being the strains of these organisms used for phenol coefficient and other bactericidal efficiency tests by different workers. Stock cultures of these organisms transplanted once a month were kept on beef extract agar slants at room temperature. The cultures used in the test were unfiltered 24-hour old bouillon growths obtainable after transplanting on 5 successive days and employing a standard loopful of the previous 24-hour growth for inoculation. These cultures were capable of resisting dilutions of phenol as given in the Reddish method.

The following Alcoholic Iodine Solutions were tested:

	% Iodine.	% KI.	% Alcohol.
I	1	0.65	64
II	2	1.32	64
III	4	2.70	64
IV	6	4.00	64
V	A 3% Special Aqueous Iodine Solution (Karns' Formula)		
VI	1%, 2%, 4% and 6% Aqueous Iodine Solutions (containing twice as much potassium iodide as iodine) were also tested		

Technique:

Equal quantities (5 cc.) of these alcoholic and aqueous solutions of iodine were mixed separately with (5 cc. of) the unfiltered 24-hour old culture of *B. typhosus* and *Staphylococcus aureus*. Transplants with a standard loop were made every two minutes for the first ten minutes and every ten minutes thereafter until one hour had elapsed. These subculture tubes were incubated at 37° C. for 48 hours and the results were read. The tests were repeated with each of the four strains of these two organisms and a check test performed with each strain. In all 8 tests each were conducted with *B. typhosus* and *Staphylococcus aureus* as the test organisms. In every instance these bacteria were killed by the iodine solutions within two minutes.

To be assured that during transplanting an amount of iodine was not being carried over which might exert a bacteriostatic action, $^1/_{10}$ cc. and 1 cc. of the subculture tubes showing no growth were transplanted into 10 cc. of bouillon. No growth was obtained. To further verify the fact that no bacteriostatic action was exerted, several 10-cc. tubes of bouillon were each inoculated with a loopful of organisms, and immediately a loopful of the various iodine solutions was added.

These tubes showed growth after incubation at 37° C. for 24 hours, thus revealing that the amount of iodine carried over is not bacteriostatic.

In the case of the 3% Special Aqueous Iodine Solution (Karns' Formula) 5 cc. of a 1:20 dilution of this solution were effective in killing within two minutes the organisms present in 5 cc. of a 24-hour old broth culture of *B. typhosus*, and a similar effect was observed when mixed in the same proportions with a 24-hour old culture of *Staphylococcus aureus*.

These tests were repeated employing 1 cc. of each of the iodine solutions and 3 cc. of the 24-hour old unfiltered broth culture of *B. typhosus*, and again with 3 cc. of the culture of *Staphylococcus aureus*. At the designated intervals as previously mentioned, transplants were made. The findings made after reading the transplants which were incubated for 48 hours at 37° C. revealed that all of the solutions killed the organisms within two minutes.

ANOTHER METHOD AND COMPARATIVE RESULTS WITH OTHER ANTISEPTICS.

A representative group of antiseptics was selected including phenol and chemicals representing the coal-tar disinfectants, the mercurials, sodium hypochlorite, etc. The solutions of iodine employed in this test were:

	Iodine.	KI.	Dilute Alcohol.	% Free I.
1.	20 Gm.	24 Gm.	qs. 1000 cc.	2%
2.	30 Gm.	36 Gm.	qs. 1000 cc.	3%

3. Tincture of Iodine, U. S. P. diluted with 95% Alcohol to a 2% titratable free iodine solution
4. Same as C except that the titratable free iodine was 3%
5. 3% Special Aqueous Iodine (Karns' Formula).

The technique employed was the same as mentioned in the previous test with the exception that one cc. of the antiseptic solution or a dilution of the latter was added to 5 cc. of the 24-hour old unfiltered culture of the respective test organisms. Transplants were made after 1, 3, 5, 10, 15, 30, 45 and 60 minutes. This proportion of culture to antiseptic is more rigid than one finds under practical conditions, there being present not only a large quantity of organic matter but an exceedingly large number of organisms. In fact, a laboratory test as performed here exaggerates the exact conditions found in practice so that antiseptics showing favorable results in a procedure as outlined will be found, in most instances, to be efficacious, when used in practice. The same four different strains of the *B. typhosus* and *Staphylococcus aureus* were employed separately. A check test was performed each time so that eight separate tests were made with each dilution on each of the two organisms (*B. typhosus* and *Staphylococcus aureus*). 1, 4, 5, 9, 14 and 19 in the table refer to the parts of sterile water added. Table III gives the results obtained.

TABLE III.

(*B. typhosus*.)

	Solution.	Strength.	(At 20° C.) 1.	3.	5.	10.	15.	30.	45.	60 Minutes.
1.	Iodine in dilute alcohol	2%	−	−	−	−	−	−	−	−
	Iodine	2% (1 + 1)	−	−	−	−	−	−	−	−
	Iodine	2% (1 + 4)	−	−	−	−	−	−	−	−
	Iodine	2% (1 + 9)	+	+	+	+	+	+	+	+
2.	Iodine in dilute alcohol	3% (1 + 9)	−	−	−	−	−	−	−	−

	Iodine	3% (1 + 14)	−	−	−	−	−	−	−	−
	Iodine	3% (1 + 19)	+	+	+	+	+	+	+	+
3.	Tincture of Iodine U. S. P. diluted with 95% alcohol to	2% (1 + 9)	+	+	+	+	+	+	+	+
4.	Tincture of Iodine U. S. P. diluted with 95% alcohol to	3% (1 + 9)	+	+	+	+	+	+	+	+
5.	Iodine (Special Aqueous Karns' Formula)	3%	−	−	−	−	−	−	−	−
	Iodine (Special Aqueous Karns' Formula)	3% (1 + 14)	−	−	−	−	−	−	−	−
	Iodine (Special Aqueous Karns' Formula)	3% (1 + 19)	+	+	+	+	+	+	+	+
	E1	2% (in dil. alcohol)	+	+	+	+	+	−	−	−
	E1	3% (aqueous)	+	+	+	+	−	−	−	−
	E1	4% (aqueous)	+	+	+	−	−	−	−	−
	E1	5% (aqueous)	+	+	−	−	−	−	−	−
	E2		−	−	−	−	−	−	−	−
	Bichloride of Mercury	1–1000	−	−	−	−	−	−	−	−
	D	1 + 1 or (1:1000)	+	+	−	−	−	−	−	−
	B	Undiluted	−	−	−	−	−	−	−	−
	B	1 + 1	−	−	−	−	−	−	−	−
	B	1 + 4	+	+	+	+	−	−	−	−
	B	1 + 5	+	+	+	+	+	−	−	−
	Phenol	2% (aqueous)	+	+	+	+	+	+	+	+
	Phenol	5% (aqueous)	+	−	−	−	−	−	−	−
	A	1%	+	+	+	+	+	+	+	+
	A	2%	+	+	+	+	−	−	−	−
	A	3%	−	−	−	−	−	−	−	−
	C	0.5%	+	+	+	+	+	+	+	+
	C	1%	+	−	−	−	−	−	−	−
	F	Undiluted	+	+	+	+	+	+	+	+
	Liquor Cresolis Comp.	1%	+	+	+	+	+	+	+	+

Staphylococcus aureus.

Solution.	Strength.	(At 20° C.) 1.	3.	5.	10.	15.	30.	45.	60 Minutes.
1. Iodine in dilute alcohol	2%	−	−	−	−	−	−	−	−
Iodine	2% (1 + 1)	−	−	−	−	−	−	−	−
Iodine	2% (1 + 4)	−	−	−	−	−	−	−	−
Iodine	2% (1 + 9)	+	+	+	+	+	+	+	+
2. Iodine in dilute alcohol	3% (1 + 9)	−	−	−	−	−	−	−	−
Iodine in dilute alcohol	3% (1 + 14)	−	−	−	−	−	−	−	−
Iodine in dilute alcohol	3% (1 + 19)	+	+	+	+	+	+	+	+
3. Tincture of Iodine U. S. P. diluted with 95% alcohol to	2% (1 + 9)	+	+	+	+	+	+	+	+
4. Tincture of Iodine U. S. P. diluted with 95% alcohol to	3% (1 + 9)	+	+	+	+	+	+	+	+
5. Special Aqueous Iodine (Karns' Formula)	3% (1 + 14)	−	−	−	−	−	−	−	−
Special Aqueous Iodine (Karns' Formula)	3% (1 + 19)	+	+	+	+	+	+	+	+
E1	2% in dil. alcohol	+	+	+	+	+	+	+	+

E1	3% aqueous	+	+	+	+	+	+	+	+
E1	4% aqueous	+	+	+	+	+	+	+	+
E1	5% aqueous	+	+	+	+	+	+	+	+
E2		+	+	+	+	+	+	+	+
Bichloride of Mercury	1-1000	+	+	+	+	+	+	+	+
D	1 + 1 or (1:1000)	+	+	+	+	+	+	−	−
B	Undiluted	−	−	−	−	−	−	−	−
B	1 + 1	−	−	−	−	−	−	−	−
B	1 + 4	+	+	+	+	−	−	−	−
B	1 + 5	+	+	+	+	+	+	+	+
Phenol	2% (aqueous)	+	+	+	+	+	+	+	+
Phenol	5% (aqueous)	+	+	+	+	+	+	+	−
A	1%	+	+	+	+	+	+	+	+
A	2%	+	+	+	+	+	+	+	−
A	3%	+	+	+	−	−	−	−	−
C	0.5%	+	+	+	+	+	+	+	+
C	1.0%	+	+	+	+	+	+	+	+
F	Undiluted	+	+	+	+	−	−	−	−
Liquor Cresolis Comp.	1%	+	+	+	+	+	+	+	+

REDDISH METHOD WITHOUT ORGANIC MATTER.

Tests were conducted employing the Reddish method as used in determining the phenol coefficient, but the following variations were made: Five-tenths cc. of the 24-hour old culture of the test organism to be used was centrifuged in a sterile centrifuge tube at a high rate of speed. The supernatant fluid was discarded. Five cc. of the various dilutions of the disinfectant to be tested were added separately to the same amount of sediment in each of the several centrifuge tubes. Thin sterile glass rods were employed to mix the organisms and the dilutions of the disinfectant and these suspensions were kept in a water-bath at the standard temperature for the designated length of time. Other than this variation, wherein most of the culture medium was removed, the technique of the Reddish method was carried out in detail.

With this modification it is possible to observe the action of the disinfectants tested, the two iodine solutions and the E1 and E2 solutions under standard methods of testing and in the presence of a minimum amount of organic matter.

TABLE IV.

B. typhosus (as the test organism—at 20° C.)

Solution.	Dilution Killing in Five Minutes.	Dilution Not Killing in Five Minutes.
3% Special Aqueous Iodine (Karns' Formula)	1:3000	1:4000
3% Iodine in dilute alcohol	1:3000	1:4000
E1	1:40	1:50
E2	1:40	1:50

Staphylococcus aureus (as the test organism—at 20° C. and 37° C.)

3% Special Aqueous Iodine (Karns' Formula)	1:1000	1:2000
3% Iodine in dilute alcohol	1:1000	1:2000
E1	Undiluted	1:2
E2	1:2	1:3

These tests were performed separately on the four strains of the standard *B. typhosus* and on the four strains of the *Staphylococcus aureus*.

The solvents, dilute alcohol and alcohol–acetone–water, killed both of the test organisms within five minutes. The solution of iodides used as the solvent for the 3% aqueous iodine solution (Karns' Formula) did not kill either of these two organisms within fifteen minutes.

BACTERICIDAL EFFICIENCY TEST WITHOUT ORGANIC MATTER.

The bactericidal efficiency test, the results of which are given in Table III, was repeated and modified as was the test, the results of which are given in Table IV. Five cc. of a twenty-four hour old culture of each of the two test organisms employed were centrifuged separately in sterile centrifuge tubes. The supernatant fluid was discarded and one cc. of the dilutions of the disinfectant tested (as given in Table V) was mixed with the test organism in the centrifuge tube. The technique from here on was identical with that mentioned previously, the results of which are recorded in Table III, except that only three transplants were made—one minute, three minutes and five minutes after contact of organisms and dilution of antiseptic.

TABLE V.

Solution.	Dilution Killing in One Minute.	Dilution Not Killing in One Minute.
B. typhosus (at 20° C.)		
3% Aqueous Special Iodine (Karns' Formula)	1:200	1:300
3% Iodine in dilute alcohol	1:200	1:300
E1	1:3	1:4
E2	1:15	1:20
Staphylococcus aureus (at 20° C.).		
3% Aqueous Special Iodine (Karns' Formula)	1:100	1:200
3% Iodine in dilute alcohol	1:100	1:200
E1	+	Undiluted
E2	Undiluted	1:2

It was thought that by this technique it would be possible not only to observe the bactericidal efficiency of the antiseptics tested, employing a large quantity of bacteria and a minimum amount of other organic material but that it would also be possible to observe whether the solvents employed interfere or modify the bactericidal efficiency of the disinfectant when the latter is employed in an environment devoid of moisture or where a minimum amount of water is present. Unfortunately the latter comparison could not be made with this technique as the undiluted solvents, dilute alcohol and acetone–alcohol–water killed the organisms, so that it was not practical to employ the solvents themselves as diluents when the antiseptic was to be diluted.

SUMMARY.

Several methods of testing the bactericidal efficiency of various antiseptic preparations are given. In addition to the Reddish technique (the most rigid technique of the Phenol Coefficient Methods) which was employed, the other procedures were exaggerated tests as compared with conditions found during practical disinfection. If the chemicals tested reveal antiseptic properties by these techniques, there is every reason to believe that they will be just as efficient when used in practice.

From the standpoint of bactericidal action, 3% solutions of iodine were found to be superior to any of the other commonly used bactericidal agents in the dilutions most frequently employed.

CONTRIBUTION FROM THE IODINE SCHOLARSHIP OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE, WITH THE COÖPERATION OF THE IODINE EDUCATIONAL BUREAU'S INDUSTRIAL FELLOWSHIP AT MELLON INSTITUTE.

RESOLUTIONS ADOPTED BY THE AMERICAN PHARMACEUTICAL ASSOCIATION AT ITS EIGHTIETH ANNUAL MEETING AT TORONTO, CANADA, AUGUST 23 TO 27, 1932, UPON RECOMMENDATION OF THE HOUSE OF DELEGATES, THROUGH ITS COMMITTEE ON RESOLUTIONS.

ADDRESS OF PRESIDENT WALTER D. ADAMS, A. PH. A.

The Committee on Resolutions desires to express its appreciation of President Adam's well-prepared and comprehensive address. His carefully worded and singularly thoughtful observations clearly evidence his fundamental grasp of present problems as well as his understanding of the difficulties involved in their proper solution.

No. 1. St. Louis Drug Survey.

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION express its appreciation to the Department of Commerce and to all those agencies and individuals who coöperated in bringing to completion the fact-finding aspects of this work.

Resolved, that the ASSOCIATION express its thanks to the Committee on Use of this Survey who are charged with the duty of establishing ways and means to apply the findings of the Survey.

No. 2. Headquarters Building.

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION express its thanks to the Headquarters Building Committee for its excellent work in completing the final details for the site and in awarding of the contract for the erection of the Headquarters Building.

No. 3. Pharmacy Week.

Resolved, that the observance of Pharmacy Week be continued with undiminished enthusiasm to the end of directing increased public attention to the distinctly professional aspects of Pharmacy.

No. 4. Membership.

Resolved, that the Membership Campaign initiated during the year and wholeheartedly supported by the pharmaceutical press be continued, and that the rank and file of the membership be urged to lend their best efforts in this important work.

No. 5. Pharmaceutical Syllabus.

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION express its appreciation to the Committee on Pharmaceutical Syllabus for its constructive work in getting the Fourth Edition, covering the four-year course into final form.

No. 6. World's Fair Exhibit.

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION commend the work of the Committee on World Fair Exhibit in completing plans for this demonstration of the professional value of pharmaceutical service, in medical progress and medical care.

No. 7. Leaflet No. 14—Pharmacy as a Career.

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION commend the Office of Education of the Department of the Interior for the splendid work it has done in preparing and issuing Leaflet No. 14, in which authoritative publication is set forth the requirements for entering

Pharmacy, the standards to be maintained in Pharmacy and the many opportunities offered to those entering the field.

No. 8. The Show Globe as a Professional Symbol.

WHEREAS, the Show Globe has come back into its rightful place as the universal emblem of Pharmacy, and

WHEREAS, its distinctively professional significance should never be subordinated to a desire for commercial gain,

Resolved, that this ASSOCIATION bring to the attention of all groups of Pharmacy the necessity for avoiding any semblance of commercially utilizing this universal professional heritage.

No. 9. Costs of Medical Care.

WHEREAS, the Committee on the Costs of Medical Care has carried out an extensive and thorough study of the economic aspects of the Prevention and Care of Sickness, including adequacy, availability and compensation of the persons and agencies involved, and

WHEREAS, the study of the services of Pharmacy in Medical Care conducted by the Committee has emphasized the importance of Pharmacy in the general scheme of public health,

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION endorse and approve the general scope and purpose of this study and that pharmacists be urged to carefully study the conclusions and recommendations of the Committee regarding the adequate use of the professional knowledge and skill of Pharmacists, the distribution and control of drugs and medicines and public health information, to the end that the professional services of Pharmacy may be more effectively directed toward the trends in medical practice and public health work.

No. 10. Vocational Opportunities.

WHEREAS, pharmacists in common with other professional groups have suffered greatly on account of the present distressing economic conditions, and

WHEREAS, the AMERICAN PHARMACEUTICAL ASSOCIATION feels impelled to do its share in setting into motion any proper agency that may be helpful in relieving the suffering,

Resolved, that a special committee be appointed to study carefully the vocational opportunities in the field of Pharmacy to the end of helping local and state groups in the attempts to relieve this unhappy condition.

No. 11. Practical Drug Store Experience and the Four-Year Course.

WHEREAS, the Colleges of Pharmacy of the United States have for the most part, established four years of standard university training as a minimum requirement for a degree in pharmacy, and

WHEREAS, such training is especially devoted to the preparation of those engaged in the practice of Pharmacy with special regard to training in the laboratory and practical phase of pharmaceutical work,

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION recommend that practical drug store experience as a legal requirement for registration as a pharmacist, be restricted to one calendar year,

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION be urged to coöperate in establishing this standard so that requirements for registration may be definite and uniform throughout the country.

No. 12. Recognition in Government Service.

WHEREAS, Pharmacy is not represented in the Government Services to the extent which its importance justifies, and

WHEREAS, the AMERICAN PHARMACEUTICAL ASSOCIATION has done much toward improving this condition,

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION continue to use its best efforts toward this end.

No. 13. The Capper-Kelly Bill.

Resolved, that AMERICAN PHARMACEUTICAL ASSOCIATION reaffirm its approval and endorsement of the Capper-Kelly Fair Trade Bill and that its officers and members lend their best efforts in advancing it toward a successful conclusion.

No. 14. Franklin M. Apple Fund.

Resolved, that the loyalty and devotion of the late Franklin M. Apple to American pharmacy and to the AMERICAN PHARMACEUTICAL ASSOCIATION be again commended and that the fund which now becomes available to the AMERICAN PHARMACEUTICAL ASSOCIATION through settlement of his estate, be gratefully acknowledged.

No. 15. Uniform Narcotic Legislation.

WHEREAS, there seems to be a belief that there is a need for the enactment of uniform state narcotic legislation, and

WHEREAS, this subject has been considered by the Commissioners of Uniform State Laws, and

WHEREAS the fifth tentative draft of the so-called "Uniform State Narcotic Act" is now available—

Resolved by the AMERICAN PHARMACEUTICAL ASSOCIATION that the commissioner of narcotics be urged to critically study and revise this measure, and that a conference of all groups concerned be called as promptly as possible to suggest changes and modifications which may be required so that the legislation may reasonably serve its purpose without the imposition of unnecessary and burdensome regulations.

No. 16. Prescription Tolerances.

WHEREAS, the Federal Food and Drug Administration has deemed it proper to establish reasonable tolerance for ampuls, tablets, pills, etc., and

WHEREAS such reasonable tolerances are not yet recognized for physicians' prescriptions,

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION through its president appoint a special committee to confer with the Food and Drug Administration on this matter, and that the Food and Drug Administration be urged to coöperate with this committee for working out reasonable and practical tolerances for physicians' prescriptions as compounded and dispensed by practicing pharmacists.

No. 17. Endowments for Pharmacy.

WHEREAS, many large fortunes have been built largely through sales in retail drug stores and through other pharmaceutical activities, and

WHEREAS, the possessors of many of these fortunes have not been made acquainted with the endowment needs of pharmacy at a time when they were planning the disposition of their wealth, with the result that the proportion devoted to pharmacy, as compared with other professions is not in keeping with its importance and with its services to humanity, and

WHEREAS, the needs of the AMERICAN INSTITUTE OF PHARMACY in Washington, of the many Schools and Colleges of Pharmacy throughout the land, of the necessary researches and surveys in the professional and economic phases of pharmacy, particularly in the improvement of standards and of proper publicity for pharmacy are very great and pressing, if the profession is to fully discharge its obligations, and

WHEREAS, such endowments would not only place pharmacy in a position conforming to its importance but would also enable it to increase its contributions to the comfort and safety of life, and

WHEREAS, it is necessary and timely that it be explained in a dignified but forceful manner, that a proper proportion of the means made in pharmacy should be devoted to its advancement,

Resolved that the AMERICAN PHARMACEUTICAL ASSOCIATION coöperate with other organizations in this important effort.

No. 18. Manufacturers' Excise Tax.

WHEREAS, the Pharmacists of the United States are deeply concerned with the fiscal policy of the Government, and

WHEREAS, the Manufacturers' Excise Tax has been imposed as a part of the Revenue Act of 1932, and

WHEREAS, it is recognized that changes in the taxes imposed may later become necessary and desirable,

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION strongly urge pharmacists to give close and earnest study to the effects of the Manufacturers' Excise Tax so that the fiscal and economic policies of the Government may be followed and that intelligent judgment may be passed on changes which may be suggested to meet conditions as they develop.

No. 19. Pharmacy Corps.

WHEREAS, it is amply established that the Committee on Pharmacy Corps has greatly advanced the cause of pharmacy in the United States army by directing attention to the unsatisfactory conditions which prevail and by pointing out the means whereby a responsible professional service might be provided, and

WHEREAS, the Surgeon General of the Army has recognized the need for a pharmaceutical service meeting the highest civilian standards, and

WHEREAS, the Surgeon General has expressed his desire to bring about the necessary improvement as promptly as possible,

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION express its appreciation of the Surgeon General's attitude and that the Committee be urged to continue its active coöperation and to take such other steps for the improvement of pharmaceutical service in the Army as may seem advisable under the circumstances which may come about.

No. 20. U. S. P. and N. F. Prescription Ingredient Survey.

WHEREAS, it is believed that professional pharmacy is essential to success in pharmacy, and

WHEREAS, a due appreciation of professional pharmacy must arise from a more intimate knowledge of the various facts and elements involved,

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION endorse surveys of prescription ingredients which have been made during the past year and that determined efforts be made to call the attention of pharmacists to this important work so that prescription stock may be more carefully controlled, that diversification be governed by recognized medical needs, and that prescription practice be placed on a sounder economic basis.

No. 21. Narcotic Regulation and Enforcement.

WHEREAS, there has been marked improvement in the official attitude toward the professions in the enforcement of the federal narcotic act, and

WHEREAS, the commissioner of narcotics has shown a real and sincere desire to coöperate with the public health professions using and distributing narcotic drugs to the end that observance of the law may be brought about through amicable means,

Resolved, by the AMERICAN PHARMACEUTICAL ASSOCIATION that the commissioner of narcotics be commended for his enlightened policy and that an effort be made to have this cooperative attitude form the basis for future regulatory and enforcement programs of the state and national governments.

ADDRESS OF THE CHAIRMAN OF HOUSE OF DELEGATES.

While this address contained no specific recommendations the Committee desires to commend Chairman Thomas Roach for his tribute to the small independent Retail Merchant and recommend the thoughtful consideration of this address to the membership.

No. 22. Establishment of State and Local Sections on Practical Pharmacy and Dispensing.

Resolved, that the state and local pharmaceutical organizations be encouraged in every possible manner to establish sections on practical pharmacy and dispensing and other professional phases of pharmacy in their respective plans of operations, and that they further be encouraged to devote a definite period of time in their programs to these professional phases.

No. 23. Written Reports of National Conventions.

Resolved, that the delegates from the state and local pharmaceutical associations, to the annual meetings of the AMERICAN PHARMACEUTICAL ASSOCIATION be urged to prepare written reports to be presented to their respective organizations, as a means of acquainting the members of the latter with the scope and activities and importance of supporting the national organization through membership and the payment of dues.

No. 24. Pharmaceutical Service in Hospitals.

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION through the proper offices be instructed to continue its efforts to secure the coöperation of the Council on Medical Education and Hospitals of the American Medical Association in providing proper supervision over hospital pharmacies by the requirements covering approved hospitals.

No. 25. Coöperation with Other Professional Groups.

Resolved, that the action of the officers of the AMERICAN PHARMACEUTICAL ASSOCIATION in continuing its representation in and coöperation with the National Drug Trade Conference, the Metric Association, the American Association for the Advancement of Science, the National Conference on Pharmaceutical Research, the American Conference on Hospital Service, the Drug Trade Bureau of Public Information, the Committee of Pharmacy Exhibit at the Chicago World's Fair in 1933 and the International Pharmaceutical Federation, be commended and the said officers be instructed to continue such representation and coöperation.

No. 26. Sale and Distribution of Exempt Narcotics.

WHEREAS, a serious study is being given to the need for further control of narcotic drugs through the enactment of a Uniform State Narcotic Act, and

WHEREAS, the objective and purpose of this movement is to more adequately control and regulate the use and distribution of narcotic drugs, and

WHEREAS, the use and distribution of narcotic drugs is restricted to legitimate medical needs,

Resolved, by the AMERICAN PHARMACEUTICAL ASSOCIATION, upon recommendation of the Conference of Pharmaceutical Law Enforcement Officials, that the Uniform State Narcotic Act be written so as to restrict the retail sale and distribution of narcotic drugs and medicines containing any amount whatsoever of narcotic drugs to duly registered pharmacists in their respective states, so that the intent and purpose of the law may be achieved.

No. 27. Resolution of Thanks.

Resolved, that the AMERICAN PHARMACEUTICAL ASSOCIATION extend a vote of thanks and appreciation for the unfailing hospitality and courtesy of the Canadian Pharmaceutical Association, the Ontario Retail Druggists Association, the daily press of Toronto, Chairman C. O. Playter and Secretary F. A. Jacobs of the Local Committee, Local Secretary R. B. J. Stanbury, the Ladies' Committee, the visiting members of the British Pharmaceutical Society, the hotel and its staff, and all those associated with them who coöperated so effectively in making this meeting enjoyable and successful.

COMMITTEE ON RESOLUTIONS, HOUSE OF DELEGATES.

H. W. PARKER
J. W. DARGAVEL
W. B. DAY
R. P. FISCHELIS
R. L. SWAIN
W. HENRY RIVARD
A. L. I. WINNE
C. F. CLAYTON *Chairman*
C. LEONARD O'CONNELL, *Vice-Chairman*.

THE MARIANNE NORTH COLLECTION.

"It would amount almost to an act of injustice not to mention the remarkable gallery of botanical paintings by Miss Marianne North, now thrown open to the public at the Royal Botanic Gardens at Kew. . . . The liberality of the lady artist is as noteworthy as her inexhaustible perseverance and her skill. No less than 627 paintings are displayed. . . . The whole is a free gift to the nation by Miss North. The pictures were painted by herself on the spot, in the countries indicated, and were arranged by herself in their present positions. . . . Miss North has gone out into the world carrying with her the materials of her art, and has reproduced with absolute fidelity and with no little artistic feeling the flowers, fruits, vegetables, trees and shrubs she deemed of interest, surrounding them with whatever natural objects would serve to make the representation more thoroughly realistic."—From The *Chemist & Druggist* of July 15, 1882.