was shaken frequently each day and after forty days there seemed to be still a few particles of iodine undissolved. The supernatant solution was assayed, however, and found to contain 1.038 percent iodine. The iodine added was 1.055 percent. Six months later 1.025 percent iodine was found.

To 5.1832 Gm. of iodine was added 199.5 Gm. liquid petrolatum. The mixture was heated to 100° C. for four hours shaking frequently. The iodine was in perfect solution. The percent iodine would then be 4.95. Upon cooling, iodine in abundance crystallized out. After standing a few hours, with frequent shaking, the iodine in solution was determined. This was found to be 1.425 percent.

These two experiments indicate: First, that the previous findings of the A. M. A. Chemical Laboratory are correct in that only about 1.4 percent free iodine is retained in solution in liquid petrolatum at room temperature. Second, that the quantity of iodine absorbed by liquid petrolatum at room temperature, in seven months at least, is practically none. Third, that iodine dissolves rather slowly in liquid petrolatum at room temperature.

In the experiments, the results of which are tabulated below, the iodine and liquid petrolatum were heated at 100° for about four hours, shaking frequently to hasten solution. After cooling they were assayed, and again assayed at intervals as indicated in the table.

Kind of liquid petrolatum used.	Date of manufacture and first assay.	Iodine weighed.	Petrolatum weighed.	Percent iodine used.	Percent iodine found.	Percent iodine Nov. 17, 1918.	Percent† iodine May 19, 1919.
Stanolind.....	10, 17, 18	2.089	188.4	1.096	1.085	1.068	1.067
Squibb.....	10, 14, 18	1.9569	186.78	1.0306	1.0232	1.013	1.009
Unknown, bulk*...	10, 28, 18	1.9497	158.2	1.225	1.133	1.075	1.095
Parke, Davis & Co.	10, 24, 18	2.0869	167.43	1.241	1.2488	1.191	1.180

* Considerable dark sediment formed in this sample during the heating process.

† It should be pointed out here that while every sample showed some absorption, the amount, with the exception of the unknown bulk, is so small that it might even be accounted for on the basis of "experimental error." Every ordinary precaution was taken to insure accuracy, but since about 15 Gm. of the solution was used for each determination, it is seen that an error of 0.3 Cc. in the titration would indicate a greater absorption of iodine than that noted.

Conclusions: These experiments show:

A solution of iodine in liquid petrolatum is saturated when it contains about 1.4 percent iodine.

The amount of iodine absorbed (disappearing as free iodine) by liquid petrolatum, when in contact at room temperature for as long as seven months, or in contact at 100° C. for four hours, or both, is relatively insignificant. Also all the absorption seems to take place during the heating and in the first month of contact.

DICHLORAMIN-T AND PETROLATUM DRESSING FOR BURNS.*

BY TORALD SOLLMANN, M.D.

Dichloramin-T as a wound antiseptic has the very real advantage of furnishing a continuous supply of the antiseptic agent, securing a continuous action over

* From the pharmacologic laboratory of the Western Reserve University School of Medicine. Reprinted from *Journal A. M. A.*, April 5, 1919.

[1] This investigation was supported by a grant from the Therapeutic Research Committee of the Council on Pharmacy and Chemistry of the American Medical Association.

long periods of time, and this with the simplest forms of dressings. A continuous supply of antiseptic is very important in the treatment of infected tissues when it is out of the question to kill all the bacteria at once. The simplest technic is at least an important convenience.

On the other hand, dichloramin-T has some material disadvantages. The solutions must be prepared with some care, and must be fairly fresh, or else tested for the presence of available chlorine. The application causes considerable smarting and burning. This, however, disappears promptly, and can generally be tolerated. On repeated application, it is liable to irritate the skin.

TABLE 1.—TWO PERCENT DICHLORAMIN-T IN LIQUID SOLVENTS: PERCENTAGE OF THE ADDED DICHLORAMIN-T THAT REMAINS UNDECOMPOSED AT THE TIMES STATED.

Solvent.	Carbon tetrachloride.	Chlorcosane.	Liquid petrolatum.	Kerosene.	Olive oil.
No. of samples tried.....	1	2	4	1	1
Period after mixing:					
At once.....	98	100	50 to 100	47	48
1 hour.....	..	86	.....	..	..
1 day.....	97	81 to 94	50 to 78	13	25
3 days.....	..	85 to 96	.....	10	17
1 week.....	94	65 to 85	32 to 50	8	8
1 month.....	86	60	33	..	7
Later.....	7 weeks:79	2 mo.:34 4 mo. : 16 to 19	2 mo.:29	..	4 mo.:4

These disadvanatges are rather minor, in most cases. Certain physical limitations are more serious in connection with burns. The large, open surfaces require protection against mechanical irritation and access of air, and this the dichloramin-T-chlorcosane solution fails to furnish. On the contrary, this solution is absorbed by the dressings, which are then glued by the wound secretions, producing pain and injury when the dressings are changed. Paraffined lace-mesh gauze does not avoid this effectively.

TABLE 2.—TWO PERCENT DICHLORAMIN-T IN PETROLATUM AND IN PARAFFIN OINTMENT: PERCENTAGE OF THE ADDED DICHLORAMIN-T THAT REMAINS UNDECOMPOSED AT THE TIMES STATED.

Color of petrolatum:	"Superla white."	"Ivory white."	"Onyx."	"Topaz."	"Amber."	"Yellow."	Paraffin ointment 3:7 (2 series).
Period after mixing:							
At once.....	15	16 : 12	10	12	13	20	61–71
1 day.....	10	11 : 8	5	6	7	13	68
1 week.....	7	8 : 4	3	6	6	7	50–61
1 month.....	..	....	..	..	..	5	....

These drawbacks were especially conspicuous in the case of the very painful and slowly healing "mustard gas" (dichlorethylsulphide) burns that came under my observation. When these burns reach the ulcerative stage, they become so sensitive that they have to be protected by thick petrolatum dressings, especially at night. These are undesirable, since they furnish protection to the bacteria as well as to the tissues. Superficial infection therefore flourishes, and the healing must be delayed. It was attempted to compromise the matter, either by alternating the antiseptic and protective dressings or by applying a petrolatum dress-

ing to the wound after it had been painted with dichloramin-T-chlorcosane solution (generally of 2 percent strength).

It was known, of course, that dichloramin-T is gradually destroyed by ordinary petrolatum; but it was hoped that the destruction would be slow enough so that some of the antiseptic would last from one dressing to the next. Subsequent chemical study of the problem showed that this expectation is not realized, and that the application of ordinary petrolatum over dichloramin-T really amounts merely to alternation of antiseptic and protective treatment.

This prompted a more detailed study of the destruction of dichloramin-T by petrolatum and various solvents. This resulted in the working out of a special petrolatum medium which was found to be sufficiently compatible with dichloramin-T for surgical purposes, so that it may be applied either mixed directly with the dichloramin-T or as a protective dressing over the dichloramin-T.

Attention may be called to the fact that liquid and semi-liquid mixtures of petrolatum with active drugs are not subject to the same limitations as is the incorporation of these drugs into solid paraffin. Solid paraffin prevents adequate contact of the mass of the antiseptic with the wound. On the other hand, the layers of liquid and semi-liquid mediums in contact with the wounds are continuously changed, so that good contact is secured.

RATE OF DESTRUCTION OF DICHLORAMIN-T IN VARIOUS SOLVENTS.

The deterioration was estimated by the changes in the "available chlorine," occurring at successive periods in solutions or mixtures containing originally 2 percent of dichloramin-T. I am indebted to Miss J. R. Collacott for these determinations.

Estimation of "Available Chlorine."—This was carried out essentially by the method described in New and Non-official Remedies, 1918, p. 158. To duplicate 5 Cc. or 5 Gm. samples of the mixtures to be tested, there are added 5 Cc. of glacial acetic acid, 10 Cc. of 10 percent potassium iodide, and sufficient carbon tetrachloride or chloroform to thin the material (usually about 5 Cc.); then a few drops of starch test-solution, and finally, from a buret, sufficient tenth-normal sodium thiosulphate solution to discharge the color.

Each cubic centimeter of tenth-normal sodium thiosulphate solution corresponds to 0.0177 Gm. of available chlorine.

The results are presented in terms of percentage of the amount of available chlorine that should have been liberated, according to the quantity of dichloramin-T originally added.

Three samples of dichloramin-T (Abbott and Squibb), two samples of chlorcosane (Abbott and Squibb) and two samples of liquid petrolatum (Squibb and Stanolind), and five samples of petrolatum (Stanolind) and one of unknown manufacture were used, with practically identical results for each instance.

Liquid Solvents.—The rate of deterioration is shown by Table 1. Carbon tetrachloride gives the most stable solutions. Chlorcosane solutions keep practically perfect for three days, and are fairly active for a month. Liquid petrolatum solutions show some loss at once, but would preserve a fair efficiency for a month. Kerosene is surprisingly destructive, even more so than olive oil.

Petrolatum.—Commercial petrolatums are highly destructive for dichloramin-T: so much so that the efficiency is at once practically completely destroyed.

This is equally true for a series of six samples representing different depth of colors, so that the coloring impurities are not concerned. This is shown in Table 2.

The last column contrasts this with a "paraffin ointment 3 : 7" prepared by mixing 30 parts of melted surgical paraffin wax with 70 parts of liquid petrolatum (the Stanolind brands were used). There is considerable deterioration in mixing, but a practical efficiency is maintained for a week.

The physical properties of the paraffin ointment are fairly satisfactory, although it is rather more solid and damp than the commercial petrolatums.

Chlorcosane Solution Overlaid with Petrolatum, Etc.—In order to imitate somewhat the application of a petrolatum dressing over a dichloramin-T dressing, 5 Cc. of chlorcosane containing 2 percent of dichloramin-T were placed in bottles with 20 Gm. of petrolatum, etc., without mixing. After definite periods, these mixtures were thinned with carbon tetrachloride or chloroform, and titrated.

TABLE 3.—TWO PERCENT DICHLORAMIN-T IN CHLORCOSANE, OVERLAID WITH 20 GM. OF PETROLATUM, ETC.: PERCENTAGE OF THE ADDED DICHLORAMIN-T THAT REMAINS UNDECOMPOSED AT THE TIMES STATED.

	Liquid petrolatum.	White petrolatum (2 brands).	Yellow petrolatum.	Paraffin ointment 3:7
At once	100	46–68	98	100
1 hour	95	13–62	42	99
1 day	101	38		
3 days	...	2–7	14	
1 week	87	3	8	60

The results, reproduced in Table 3, again show the inferiority of petrolatum, which may destroy most of the dichloramin-T in an hour. Both the paraffin ointment 3 : 7 and the liquid petrolatum were satisfactory.

CONCLUSIONS.

An ointment of 3 parts of surgical paraffin and 7 parts of liquid petrolatum has relatively little detructive action on dichloramin-T and can be used as a protective dressing on wounds (burns) treated with dichloramin-T-chlorcosane solution, and even as a basis for a dichloramin-T ointment.

Ordinary petrolatum, irrespective of its color, is very destructive of dichloramin-T, and cannot be used effectively in connection with it.

Liquid petrolatum can be used in emergencies as a vehicle for dichloramin-T, although it is inferior to chlorcosane.

Solutions of dichloramin-T in carbon tetrachloride are very stable, while those in kerosene or in olive oil deteriorate very rapidly.

NOTES FROM THE RESEARCH LABORATORY, GENERAL ELECTRIC COMPANY.*

X-RAY CHEMICAL ANALYSIS.

BY A. W. HULL.

The method of X-ray crystal analysis, developed in the Research Laboratory of the General Electric Company just before the war, is being further developed

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