Alcoholic Extract of the Drug XI		13.323
Resinoid (Precipitated with HCl) XI, A	4.300	
Alcoholic Residue XI, B	9.020	
	13.320	
XII, See above		
Volatile Matter (From steam distilling) XIII		0.024
Fat (From Petroleum ether extraction of the drug) XIV		0.644
XV, Alkaloids, See above		

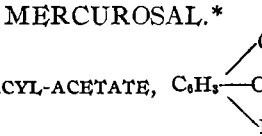
CONCLUSION.

The investigation, such as the writer has endeavored to make, has aimed to isolate the proximate principle or principles upon which the drug seems to depend for its alleged medicinal properties. The separation of the various constituents, as detailed in the accompanying outline, seems to indicate that the medicinal properties are contained in aromatic resinous bodies. The presence of volatile oil is evident as will be observed in the record of the analysis. Preparations of the drug for catarrhal conditions, such as a tincture or a syrup, are blended with other expectorants and sedatives affecting the irritated mucous membrane either locally or remotely. The tincture which has a deep olive-green color has a decided characteristic herby taste, having a rather soothing sensation to the mucous surfaces of the mouth and throat, leaving a slight tingling sensation not very unlike a mild local anaesthetic. It should be stated that the high percentage of fat and oil, it seems to the writer, can be accounted for only by the presence of fat soluble coloring matter and the presence of considerable seed in the powder.

Our investigation seems to indicate that the statement made in King's Dispensatory—"that the medicinal principles may be extracted with aqueous menstrua" should be corrected, as they seem to the writer to be misleading since the resinous bodies, in which the virtues seem to reside are only soluble in an alcoholic, hydroalcoholic, or similar menstrua.

UNIVERSITY OF KANSAS,
LAWRENCE, KANSAS,
JUNE 1, 1924.

THE ELIMINATION OF MERCURIALS WITH PARTICULAR REFERENCE TO MERCUROSAL.*

(DI-SODIUM-HYDROXYMERCURI-SALICYL-ACETATE, )

BY L. W. ROWE.

In a previous article[1] the relatively low toxicity of mercurosal was demonstrated by experiments upon animals. Its comparative freedom from corrosive action upon the wall of a vein was also determined by intravenous injections into animals.

The present article will deal first, with the study of the excretion of mercurosal both from a qualitative and quantitative standpoint, and second, with its

* Scientific Section, A PH. A., Buffalo meeting, 1924.

lack of corrosive action upon the organs of excretion. Other mercurials have been included for the purpose of comparison.

The following is a brief statement of the chemical method[1] used by A. G. Flieger in the analysis for mercury content of samples of excreta submitted to him:

To a liter of dog urine or 50 grams of feces, is added 50 to 100 cc. of concentrated hydrochloric acid; the organic matter is destroyed by heating on a sand-bath at 70° to 80° C. for three hours, adding gradually 5 to 6 grams potassium chlorate. The chlorine is blown out by air (approximately 3 hours). Filter through a Buchner funnel and pass hydrogen sulphide into the filtrate. Filter off the sulphide residue. Again decompose this sulphide residue with 10 cc. concentrated hydrochloric acid and 0.5 Gm. potassium chlorate in an Erlenmeyer flask under a reflux condenser. Dilute with water and blow out the chlorine. Filter, make slightly alkaline with ammonium hydroxide and pass in hydrogen sulphide. Mercuric sulphide will come down free from sulphur as a black ppt. Filter on tared filter papers. The following table gives data on samples of urine to which a known amount of mercury bichloride was added, in order to test the method.

Weight of mercury. Added to one liter, calculated to Hg.	Weight of mercury. Found in one liter, calculated to Hg.
0.0012 Gm.	0.0017 Gm.
0.0027 Gm.	0.0033 Gm.
0.0065 Gm.	0.0060 Gm.
0.0094 Gm.	0.0090 Gm.
0.0127 Gm.	0.0115 Gm.

It shows that there is an average error of about 15% in the results.

A search of the literature reveals the fact that while a good many articles deal with renal elimination of mercury, very little quantitative data has been published relative to intestinal elimination.

The chief reason for this is easily discerned when one attempts to collect such experimental data and is confronted with the difficulties incidental to such work. The pharmacological work is in some respects disagreeable and tedious, but the chemical isolation of minute amounts of a volatile substance such as mercury from large amounts of organic materials such as feces is very difficult.

From many sources, including the latest edition of "Sollmann's[2] Manual of Pharmacology," the opinion is obtained that soluble compounds of mercury are largely excreted by the kidney.

However, Cushny[3] in his short discussion on the elimination of mercury states that, "No accurate estimation of the mercury excreted in the feces has been made, but it is believed that less is excreted here than in the urine at first, but that later the greater part may pass out by the intestine."

Ramsay and Groebner[4] find that the bichloride, when given hypodermically in single small doses, continues to be eliminated for six or seven days through the kidney.

Beinhauer[5] reports that there is an appreciable renal elimination of mercury following small internal doses of calomel.

MacNider[6] who has done a great deal of work on the kidney injury caused by elimination of mercury, finds that dogs dosed internally with lethal amounts of the bichloride often die from delayed kidney injury, and that this action on

[1] This method is a modification of one published in *Chem. Zentral Blatt.* 2, 60 (1921) (Fabre). The original article is in *Jour. de. Phar. et. Chim.*, 7, 22 (1920), pp. 81–85.

the kidney is due to the development of a severe acid intoxication, rather than to irritant action of mercury itself.

Schamberg, Kolmer and Raiziss[7] who have also done considerable work on kidney injury due to the better known mercury compounds, report that mercury has a great affinity for the cells of the kidney, and that the nephritis produced by mercury is primarily tubular in variety. When given intravenously they report that mercury salicylate produces 100% severe tubular nephritis, the succinimide 71% and the bichloride but 25%.

The first experiments conducted were of a qualitative nature and were concerned only with the mercury excreted by the kidneys of animals injected with large doses of mercurosal since it was assumed that the kidney would be the chief organ of excretion and that the elimination would be comparatively rapid, due to the great solubility of the preparation.

The following table gives a brief summary of the results of the first series of experiments:

TABLE I.—PRELIMINARY QUALITATIVE SERIES.

Urine sample.	Dose of mercurosal.	Injected.	Sample collected after.	Hg. test.
No. 1	0.025 Gm.	Intravenously	1/2 Hour	Negative
No. 2	0.025 Gm.	Intravenously	6 Hours	Negative
No. 3	0.100 Gm.	Intramuscularly	5 Hours	Positive
No. 4	0.050 Gm.	Intramuscularly	1/2 Hour	Negative
No. 5	0.050 Gm.	Intravenously	1/4 Hour	Negative
No. 6	0.050 Gm.	Intramuscularly	4 Hours	Negative
No. 7	0.050 Gm.	Intravenously	4 Hours	Negative
No. 8	0.100 Gm.	Subcutaneously	4 Hours	Negative
No. 9	0.050 Gm.	Intramuscularly	4 1/2 Hours	Negative

These results indicate that mercurosal is not very rapidly eliminated by the kidney even following large doses intravenously. The one positive result was obtained five hours after a very large dose was administered intramuscularly.

QUANTITATIVE EXPERIMENTS.

In a preliminary quantitative experiment a normal, female dog, weighing 9.6 Kgs. was injected intravenously with 200 mgs. (approximately 20 mgs. per Kg. body weight) of mercurosal. A 2% solution was used, and injection of the 10 cc. was accomplished in five minutes.

The dog did not vomit but defecated once within ten minutes after injection of this very large dose. The dog was placed in a metabolism cage, and exactly 25 hours after injection was anesthetized and bled to death. The total urine and feces were collected (this included the contents of the bladder and the intestines at the time of death), and submitted for chemical assay. Also the blood, kidneys, lungs, and liver were submitted for tests. The reports showed 0.0263 Gm. mercury or 0.060 Gm. mercurosal in the urine; 0.0072 Gm. mercury or 0.016 Gm. mercurosal in the feces and very small amounts in the other organs submitted. The amounts in the urine and feces account for about 40% of the mercurosal injected.

In another preliminary experiment a dog weighing 13 Kgs. which received 800 mgs. of mercurosal intravenously in a period of four days (200 mgs. per day) excreted mercury corresponding to 120 mgs. of mercurosal in the urine during this

time. This was 15% of the total injected. The amount in the feces was lost in the chemical manipulation.

A third dog, weight 22 Kgs., received 1.25 Gms. (1250 mgs.) of mercurosal intravenously within a period of four weeks, and a total of 550 mgs. was recovered in the urine in the period which included one week after the last injection. This amounted to 44% of the total, and again the feces determination was a failure.

A fourth dog, weight 10 Kgs., was injected intramuscularly and intravenously with 500 mgs. of mercurosal in a period of three days. This dog died from the effect of this dosage. The urine during this period contained 86 mgs. or 17%, and the feces contained 93 mgs. or 19%.

These four preliminary quantitative experiments each bring out certain points relative to mercurosal elimination after intensive dosage. In the first experiment less than 40% of the mercurosal injected was present in the total feces and urine 25 hours later, showing the distribution of the remaining 60% throughout the body.

Experiments No. 2 and No. 4 show the relatively small amount which is eliminated by the kidneys within a few days after injection of large doses.

Experiment No. 3 shows the higher proportion which is eliminated by the kidneys over a much longer period.

Following this preliminary qualitative and quantitative work with mercurosal, a more complete series of experiments was begun on about ten dogs using mercuric chloride, mercurosal, mercury salicylate and mercury succinimide. Two dogs were used with each salt to act as duplicates and in the case of the bichloride four were used, because the dosage proved fatal too early in the first series of experiments. In every case, the largest possible dosage was used in order to aid the chemists in their attempts to find weighable amounts in each day's urine and feces.

The tables containing the detailed data obtained in each experiment follow:

TABLE II.—MERCURIC CHLORIDE INTRAVENOUSLY.

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in feces.
1	25 mgs. 8/14	8/14 to 15	0.0026 Gm.	None
1		8/15 to 16	0.0041 Gm.	0.0014 Gm.
1	25 mgs. 8/16	8/16 to 17	0.0020 Gm.	
1		8/17 to 18	0.0008 Gm.	
1		8/18 to 20	0.0021 Gm.	
	50 mgs.		0.0116 Gm.	0.0014 Gm.

This dog, weighing 17 Kgs., died at noon 8/20/23 from acute mercury poisoning (two doses of 1.5 mgs. per Kg. of mercuric chloride).

Dog no.	Dose and date.	Date of sample	Hg. in urine.	Hg. in feces.
2	25 mgs. 8/14	8/14 to 15	0.002 Gm.	
2		8/15 to 16	None	0.0045 Gm.
2	25 mgs. 8/16	8/16 to 17	0.0035 Gm.	0.0009 Gm.
2		8/17 to 18	0.0147 Gm.	
2		8/18 to 20	0.0019 Gm.	
	50 mgs.		0.0203 Gm.	0.0054 Gm.

This dog, weighing 15 Kgs. died about 10 A.M. 8/20/23 from acute mercury poisoning (total dose of bichloride was 50 mgs. in five days).

In the experiment with dog No. 1 a total of 13.0 mgs. of mercury, corresponding to 17.6 mgs. of bichloride, was found in the urine and feces. This is 35% of the total amount injected, and was excreted within six days after the first injection. Since three of the feces samples were not successfully analyzed, this shows a relatively rapid rate of excretion. Dog No. 2 excreted the bichloride still more rapidly, since 25.7 mgs. mercury, corresponding to 34.8 of bichloride were excreted within six days after the first injection, and two feces assays were not made. The amount found in this case represents practically 70% of the total amount injected.

TABLE III.—MERCURIC CHLORIDE INTRAVENOUSLY—SECOND SERIES.

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in feces.
3	10 mgs. 9/13/23	9/13 to 14	0.0021 Gm.	
3		9/14 to 15	0.0008 Gm.	
3	10 mgs. 9/15	9/15 to 17	0.0032 Gm.	
3	10 mgs. 9/17	9/17 to 18	0.0036 Gm.	
3	10 mgs. 9/19	9/18 to 21		
3		9/21 to 22	0.0006 Gm.	
3	10 mgs. 9/22	9/22 to 24	0.0020 Gm.	0.0001
3	Sixth injection	9/24 to 26	0.0017	
	was not given	9/26 to 29		
	because both	9/29 to 30	0.0001 Gm.	
	femoral veins	9/30 to 10/3		
	were so badly	10/3 to 10/23	None	None
	necrosed			
	50 mgs.		14.1 mg.	

This dog, No. 3, weighing 13 Kgs. was rather seriously affected by this amount of bichloride, showing that a larger dose could not be given. Bloody diarrhoea and obliterated veins at the sites of injection resulted from this dosage.

In this experiment, 14.2 mgs. of mercury, corresponding to 19.2 mgs. of bichloride were recovered in the urine and feces. This amounted to 38% of the total injected. Since only two samples of feces were analyzed, partly due to inability to separate the liquid feces from the urine, practically all of the excretion is shown to be through the kidneys. Forty per cent of the total bichloride injected was recovered by analysis.

TABLE III (Continued).

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in feces.
4	15 mgs. 9/13	9/13 to 14	0.0034 Gm.	0.0015 Gm.
4	15 mgs. 9/15	9/14 to 21		
4	15 mgs. 9/17	9/21 to 23	0.0015 Gm.	0.0016 Gm.
4	15 mgs. 9/19	9/23 to 24	0.0100 Gm.	0.0008 Gm.
4	15 mgs. 9/22	9/25 to 26	0.0034	
4	15 mgs. 9/24	9/26 to 10/3		
4		10/3 to 23	0.0031 Gm.	0.0003 Gm.
	90 mgs.		0.0214 Gm.	0.0042 Gm.

This dog, No. 4, weighing 22 Kgs. was not so seriously affected by the larger dose as was dog No. 3. There was some diarrhoea, but the veins were not obliterated.

In this experiment, 25.6 mgs. of mercury, corresponding to 34.6 mgs. of bichloride were recovered in the urine and feces. This amounted to 38% of the total injected, and considering that analyses for two periods of one week each are missing

from the total period of observation of nearly six weeks, it is not surprising that more mercury was not recovered. Of the total amount recovered, 29 mgs. was excreted by the kidneys and this amounted to about 84%, while 16% was excreted by the intestinal tract.

TABLE IV.—MERCUROSAL INTRAVENOUSLY.

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in feces.
5	200 mgs. 7/23	7/23 to 24	0.01026 Gm.	0.0009 Gm.
5		7/24 to 25	0.0021 Gm.	
5	150 mgs. 7/25	7/25 to 26	0.0447 Gm.	0.0032 Gm.
5		7/26 to 27	0.0028 Gm.	0.0009 Gm.
5	150 mgs. 7/27	7/27 to 28	None	None
5		7/28 to 30	0.0064 Gm.	None
5		7/30 to 31	0.0220 Gm.	
5	150 mgs. 7/31	7/31 to 8/1	0.0344 Gm.	
5		8/1 to 2	0.0028 Gm.	None
5		8/2 to 3	0.0184 Gm.	0.0005 Gm.
5	150 mgs. 8/3	8/3 to 4	0.0076 Gm.	
	800 mgs.		0.15146 Gm.	0.0055 Gm.

Kidney contained 0.006 Gm.

This dog, weighing 13 Kgs., died on the night of August 3 from the effects of the 800 mgs. of mercurosal. The vein at the site of injection was in good condition.

In this experiment, 151.46 mgs. of mercury, corresponding to 344 mgs. of mercurosal, were excreted by the kidneys. This is 43% of the total amount injected.

Only 5.5 mgs. of mercury, corresponding to 12.5 mgs. of mercurosal, were found in the feces and this was 1.5% of the total injected. The kidneys excreted 96% of the total excreted.

Gross and histological examination of this dog's kidney showed no abnormalities.

TABLE IV (Continued).

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in feces.
6	200 mgs. 7/23	7/23 to 24	0.0341 Gm.	0.0026 Gm.
6		7/24 to 25	0.0061 Gm.	0.0141 Gm.
6	200 mgs. 7/25	7/25 to 26	0.0693 Gm.	0.0025 Gm.
6		7/26 to 27	0.0018 Gm.	None
6	200 mgs. 7/27	7/27 to 28	None	
6		7/28 to 30	0.0552 Gm.	0.0047 Gm.
6	200 mgs. 7/30	7/30 to 31	0.0140 Gm.	None
6	200 mgs. 7/31	7/31 to 8/1	0.0139 Gm.	0.0020 Gm.
6		8/1 to 2	0.0016 Gm.	
6	200 mgs. 8/3	8/2 to 3	0.0803 Gm.	0.0003 Gm.
6		8/3 to 13	None	None
	1200 mgs.		0.2763 Gm.	0.0262 Gm.

This dog, weighing 17 Kgs., was in fairly good condition about two weeks after the last dose was injected. A total of 276.3 mgs. metallic mercury, corresponding to 628 mgs. mercurosal, was found in the urine. This was 52% of the total amount injected. Only 26.2 mgs., corresponding to 60 mgs. mercurosal, were found in the feces. Two feces samples were not successfully analyzed, but these would

not have added much to the total. The amount found in the feces was 5% of the total injected. The kidneys excreted 91% of the total excreted in the urine and feces.

TABLE V.—MERCURY SALICYLATE, INTRAVENOUSLY.

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in feces.
7	25 mgs. 8/21	8/20 to 21	None	None
7		8/21 to 22	0.0017 Gm.	None
7	15 mgs. 8/23	8/22 to 23	0.0009 Gm.	None
7		8/23 to 24	0.0078 Gm.	None
7	15 mgs. 8/25	8/24 to 25	None	None
7		8/25 to 27	0.0085 Gm.	None
7	20 mgs. 8/27	8/27 to 28	None	0.0016 Gm.
7		8/28 to 29	None	None
7	20 mgs. 8/29	8/29 to 30	None	0.0027 Gm.
7		8/30 to 31	0.0043 Gm.	0.0006 Gm.
7		8/31 ot 9/1	0.0026 Gm.	None
7		9/1 to 5	None	None
7		9/5 to 7		0.0033 Gm.
7		9/7 to 10	None	
	95 mgs.		0.0258 Gm.	0.0082 Gm.

This dog, weighing 12 Kgs., given a total of 95 mgs., excreted 25.8 mgs. of metallic mercury, corresponding to 43.7 mgs. of salicylate, in the urine. This was 46% of the total injected. Eight and two tenths mgs. of metallic mercury, corresponding to 13.7 mgs. of salicylate, were excreted in the feces and this was 14.4% of the total injected. Altogether about 60% of the total injected was recovered in the urine and feces, and 75% of this was excreted by the kidney.

TABLE V (Continued).

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in feces.
8	25 mgs. 8/21	8/21 to 22	0.0004 Gm.	No sample
8		8/22 to 23	None	0.0030 Gm.
8	25 mgs. 8/23	8/23 to 24	No Sample	No sample
8		8/24 to 25	No sample	0.0016 Gm.
8	25 mgs. 8/25	8/25 to 27	0.0020 Gm.	0.0001 Gm.
8	25 mgs. 8/27	8/27 to 28	0.0067 Gm.	None
8		8/28 to 30	0.0029 Gm.	No sample
8	25 mgs. 8/29	8/30 to 9/1	0.0041 Gm.	None
8		9/1 to 5	None	None
8		9/5 to 7	0.0017 Gm.	0.0028 Gm.
8		9/7 to 10	0.0035 Gm.	0.0004 Gm.
	125 mgs.		**0.0223 Gm.**	**0.0079 Gm.**

This dog, weighing 22 Kgs., and given a total of 125 mgs. of mercury salicylate, excreted 22.3 mgs. in the urine. This was 30% of the total injected. Seven and nine tenths mgs., corresponding to 13.2 mgs. of salicylate, were excreted in the feces and this was 10.5% of the total injected. In this experiment, only about 40% of the total injected was recovered in the urine and feces, but here, as with dog No. 7, 75% of the total recovered was excreted by the kidneys.

TABLE VI.—MERCURY SUCCINIMIDE INTRAVENOUSLY.

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in feces.
9	22 mgs. 10/8	10/9 to 10		0.0015 Gm.
9	22 mgs. 10/10	10/10 to 11	0.0016 Gm.	0.0013 Gm.
9		10/11 to 12	0.0017 Gm.	0.0038 Gm.
9	22 mgs. 10/12	10/12 to 15	0.0001 Gm.	0.0017 Gm.
9	22 mgs. 10/15	10/15 to 16	0.0036 Gm.	0.0030 Gm.
9		10/17 to 19	0.0030 Gm.	0.0014 Gm.
9		10/19 to 20	0.0042 Gm.	
9		10/20 to 23	0.0020 Gm.	0.0027 Gm.
9		10/23 to 24		0.0013 Gm.
9		10/24 to 25	0.0030 Gm.	
9		10/25 to 26	0.0052 Gm.	0.0016 Gm.
	88 mgs.		0.0244 Gm.	0.0183 Gm.

This dog weighing 25 Kgs. stood the treatment very well, and was in good condition two weeks after the injection ceased. A total of 88 mgs. of mercury succinimide were injected into this dog, and 42.7 mgs. of mercury, corresponding to 83.7 mgs. of succinimide, were recovered in the urine and feces. This was 95% of the total injected and shows how rapidly and completely the succinimide is eliminated when administered intravenously. Fifty-seven per cent of the total recovered by analysis was excreted by the kidneys, and the remaining 43% by the intestinal route.

TABLE VI (Continued).

Dog no.	Dose and date.	Date of sample.	Hg. in urine.	Hg. in. feces.
10	22 mgs. 10/8	10/9 to 10	0.0029 Gm.	0.0007 Gm.
10	22 mgs. 10/10	10/10 to 11	0.0032 Gm.	0.0010 Gm.
10		10/11 to 12	0.0015 Gm.	0.0018 Gm.
10	22 mgs. 10/12	10/12 to 13		0.0009 Gm.
10		10/13 to 15	0.0062 Gm.	0.0015 Gm.
10	22 mgs. 10/15	10/15 to 16	0.0020 Gm.	0.0010 Gm.
10	22 mgs. 10/17	10/16 to 19	0.0027 Gm.	0.0016 Gm.
10		10/19 to 20	0.0022 Gm.	0.0010 Gm.
10		10/20 to 22	0.0022 Gm.	0.0006 Gm.
10		10/22 to 23	0.0019 Gm.	0.0042 Gm.
10		10/23 to 24	0.0017 Gm.	0.0021 Gm.
10		10/24 to 25	0.0019 Gm.	0.0045 Gm.
10		10/25 to 26	0.0040 Gm.	0.0004 Gm.
	110 mgs.		0.0324 Gm.	0.0213 Gm.

This dog, weighing 22 Kgs., received a total of 110 mgs., but the last two injections were made intramuscularly. The animal showed no evidence of a very marked reaction. A total of 0.0537 Gm. of mercury, corresponding to 0.105 Gm. was recovered by analysis from the urine and feces during a period lasting about 10 days after the last injection. This amounted to 95% of the total injected, and checks up with the other experiment with succinimide. Both these results must be a little high as the excretion would hardly be so complete in each case. Sixty per cent of the total recovered was excreted by the kidneys and 40% by the intestines.

CONCLUSIONS FROM EXPERIMENTAL DATA.

1. In the series of qualitative tests, no mercury was found in the urine six hours after the intravenous injection of a dose of 25 mgs. of mercurosal, showing that its elimination by the kidneys is not extremely rapid.

2. In one of the preliminary quantitative experiments, the total feces and urine excreted during a 25-hour period immediately following the injection of a single large dose of mercurosal were collected at autopsy. The mercury recovered by analysis amounted to 40% of the total injected, showing the distribution of the remaining 60% throughout the body.

3. In two other preliminary quantitative experiments, massive doses of mercurosal were injected, during a period of three and four days respectively, and the total excreted in the urine during these periods was 17% and 15%. This shows a reasonably slow excretion which permits the action of the drug and yet the excretion is rapid enough to prevent a serious cumulative action.

4. In the four quantitative experiments with the bichloride, the corrosive and systemic effects were very evident even with the smaller dosage. In all the four experiments, the rapidity of excretion by the kidneys was evident and in the two experiments where a few chemical analyses of feces samples were completed, it was apparent that not more than 20% of the total mercury eliminated would be by the intestines.

5. In the two quantitative experiments with mercurosal, the data obtained showed a total elimination of 43% and 52%. In each experiment, the kidneys excreted about 95% of the total. This indicates that mercurosal is very largely excreted by the kidneys. Also it is excreted rapidly enough to prevent any serious cumulative action from ordinary dosage. In several instances it was found by histological examination that mercurosal had no appreciable irritant action on the kidneys of animals but further studies would be necessary to prove definitely that the effect on the epithelial cells is negligible.

6. In the experiments with mercury salicylate intravenously, the mercury was eliminated fairly rapidly and in each case 75% of the total recovered by analysis was found in the urine. This shows that it corresponds more nearly with the bichloride in the nature of its elimination than with mercurosal. The kidney injury caused by the excretion of mercury salicylate is severe and is strongly emphasized by Schamberg.[7]

7. In the experiments with mercury succinimide, the rapidity and completeness of the excretion of the mercury is very noteworthy and also the fact that fully 40% of the total recovered was found in the feces. The succinimide shows the greatest percentage excreted by the intestines of any of the salts tested with the bichloride and salicylate next with about 25% intestinal excretion and mercurosal last with about 5%.

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