With both vagi and stellates divided, the heart rate during the remaining occlusion period in the above experiment, remained between 156 and 162, which one would consider relatively constant. Whether the adrenals play any part in the maintenance of heart rate in the denervated heart under conditions of bulbar anaemia, is, at present, under investigation.

210 (2733)

Effect of dyes on the penetration of arsenic into the central nervous system and the spinal fluid.

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The study of the relation between the antiseptic action and the chemical constitution of synthetic dyes dates back to the period of Paul Ehrlich[1] who began with one group of dyes known as azo dyes, including trypan red, trypan blue and trypan violet. The other group of dyes consisted of basic tryphenyl-methane dyes, including parafuchsin, methyl violet, pyronin G and other similar substances, known as neurotrophic dyes because of their ability to stain nerve tissue.

McIntosh and Fildes[2] reported that arsenic could not be found in the brain tissue, due to a lack of affinity between the brain substances and the inability on the part of the drugs to penetrate into the brain. *In vitro* experiments show that this is purely a question of physical penetration. The same authors[3] classified the dyes as, (1) those which stain the central nervous system, and (2) those which do not stain the central nervous system. They conclude that these variations were dependent upon the

[1] Ehrlich, Paul, and Hata, S., The Experimental Chemotherapy of Spirilosses. London: Rebman Limited, 1911.

[2] McIntosh, James, The Fixation of Arsenic by the Brain after Intravenous Injections of Salvarsan, *Proc. Roy. Soc.*, London, 1914, lxxxviii, (B), 320.

[3] McIntosh, James, and Fildes, Paul, *Brain*, 1916, xxxix, 478.

question of solubility. The subject further resolved itself into the fact that neurotropic substances are lipotropic, and before a substance can penetrate into a cell it must be soluble in the cell membrane or possess a distinct osmosis.

Kalberlah[4] decided that there was a distinct increase in the arsenic content when dye was used.

Smith and Waddell[5] increased the permeability of the choroid plexus to arsphenamine with methyl violet. Their conclusion is that methyl violet when given intravenously does not increase the permeability.

Cornwall and Myers[6] showed that arsenic actually penetrated the cord and the brain. These experiments are being repeated with the idea of checking up the effect of transfusion just previous to the sacrificing of the animal.

Fordyce and Myers[7] studied the action of salvarsan, neosalvarsan, silver salvarsan and tryparsamide on penetration of arsenic into the central nervous system in general paresis and cerebrospinal syphilis. A small percentage of patients show no penetration whatever, and a maximum penetration of 192 mg. per 100 gm. of dried specimen has been found. It has been pointed out that there is a significant difference in the chemical physiology of arsenic in the various types of neurosyphilis. The detection of arsenic varies, depending upon whether the lesions are confined essentially to the mesodermal structures or ectodermal structures. The period at which the largest quantity of arsenic appears is likewise dependent upon this type of differentiation. Table I shows the average values for the arsenic present in the brain after intravenous injection of the drugs indicated at the top of the column. It should be noted that the amount of arsenic necessary to produce these values is given at the bottom of the table. Table II shows the composite results obtained with the

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[4] Kalberlah, Fritz, *Muenchen. Med. Wchschr.*, 1922, lxix, 114.

[5] Smith, Dudley C., and Waddell, J. A., *Am. N. of Syphilis*, 1924, viii, No. 2.

[6] Cornwall, L. H., and Myers, C. N., *Am. J. Syphilis*, 1923, vii, 287; *Am. J. of Syphilis*, 1923, vii, 629; *Am. J. of Syphilis*, 1924, viii, 726.

[7] Fordyce, John A., Rosen, I., and Myers, C. N., *Am. J. of Syphilis*, 1922-1925.

TABLE I.

Showing the average values for the brain after intravenous injection of salvarsan, neosalvarsan, silver-salvarsan, tryparsamide, and sulpharsphenamine at the intervals indicated in the left hand column.

Time	Salvarsan	Neo-salvarsan	Silver-salvarsan	Tryp-arsamide	Sulphar-sphenamine
0	39.12	4.53	3.44	2.47	5.76
5 min.	5.51	2.48	0.81	2.43	1.65
10 min.	3.85	0.77	0.66	1.07	1.30
15 min.					0.58
20 min.	1.90	1.80	0.39	1.49	
30 min.	4.90	3.95	1.02	0.17	0.71
40 min.	2.66	0.80	1.43	1.54	
60 min.	6.03	0.46	0.62	0.33	0.27
90 min.	9.15	2.18	2.55	2.05	1.80
120 min.	8.45	1.05	0.98	0.21	0.18
180 min.	1.22	1.40	0.68	1.35	
240 min.	0.56	0.77	1.04	0.46	0.34
300 min.	7.06	0.95	5.69	0.98	
400 min.	7.26	0.55	0.51		1.86
24 hr.	0.39	2.03	1.27	0.32	1.16
48 hr.	9.16	6.02	1.07		7.48
72 hr.	2.36	1.33	0.69	0.62	0.93
96 hr.	1.80	1.89	0.59		0.28
120 hr.	2.71	0.65	0.14	0.14	3.72
144 hr.	7.64	1.17	0.31		3.09
168 hr.	5.39	0.19	0.50	0.03	
Milligrams of drug injected	160	280	160	600	360
Milligrams of metallic arsenic injected	50	51	32	150	65

TABLE II—Average Arsenic Values.

Dye	Interval	No. of rabbits	Spinal Fluid	Blood	Right Kidney	Left Kidney	Liver	Spleen	Brain	Heart	Lung	Cord	Gall bladder
(Neo salvarsan alone)	24 hrs.	1	.....	0.22	0.39	8.98	11.34	0.14	0.69	0.55	2.60	0.18	9.85
"	48 hrs.	1	Trace	0.08	3.27	7.27	0.47	0.35	0.09	2.68	9.03	0.13	4.30
"	72 hrs.	1	Not sufficient	4.40	1.76	3.79	2.69	0.36	0	1.91	0.85	0.13	12.58
Trypan Red	Immediate	1	16.13	8.06	2.69	6.61	2.32	Lost	0.08	2.62	11.36	0.19	7.12
"	48 hrs.	4	10.75	4.14	4.98	4.37	3.06	1.03	0.10	0.97	3.08	0.10	14.43
"	72 hrs.	3	37.78	0.84	3.99	4.33	8.95	0.53	0.07	0.29	1.82	.....	3.51
Bismark Brown R	Immediate	1	69.75	12.27	6.78	7.48	15.39	0.60	0.17	4.05	10.81	0.06	3.41
"	24 hrs.	1	6.39	1.61	5.63	7.94	0.72	1.29	0	2.10	3.51	0.18	3.77
"	48 hrs.	1	40.90	0.11	6.63	4.94	13.54	0.55	0.03	0.08	4.59	0.45	8.94
"	72 hrs.	1	12.85	0.87	1.85	1.82	3.62	0.39	0.39	0.69	3.84	0	8.78
Pyronine G	24 hrs.	1	.....	.....	8.53	3.28	6.45	0.19	0.08	4.50	5.15	0.34	11.31
Methylene Blue	Immediate	1	15.96	3.06	12.25	16.35	5.36	0	0.09	0.29	1.21	0.09	16.26
"	24 hrs.	1	24.09	2.29	5.37	6.42	0.86	1.08	0.11	0.07	2.85	0.20	3.81
"	48 hrs.	2	12.53	0.73	4.71	1.87	8.72	0.12	0.08	0.40	2.16	0.08	9.18
"	72 hrs.	2	36.11	1.07	3.76	4.35	8.13	0.58	0.15	1.68	1.25	0.46	15.95
Trypan Blue	24 hrs.	1	28.58	2.67	5.06	1.07	4.81	0.63	0.12	0.15	4.80	0.40	18.57
"	48 hrs.	2	23.84	4.15	2.47	10.88	12.15	0.32	0.06	0.12	1.27	0.23	18.54
"	96 hrs.	1	40.00	6.97	5.67	7.69	3.73	0.16	0.05	1.70	0.15	0.15	2.41

use of neosalvarsan and the dyes indicated in column 1. The general conclusion that may be drawn from this table is that the presence of dyes has not had any marked effect upon the penetration of arsenic from neosalvarsan into the brain and cord. On the other hand, the presence of the arsenic in the spinal fluid has been markedly increased. The therapeutic possibilities of a condition of this kind have not yet been satisfactorily worked out.

These investigations are being continued with the idea of showing that there are several factors that must be continuously considered in regard to the application of arsenicals in the treatment of various types of syphilis. In the first place, the *quality* of the arsenic which has penetrated, is more important than the *quantity* of arsenic which has penetrated. The physical condition of the arsenic which has reached the lesion is a factor that must be determined in order to evaluate the proper therapeutic index of a given drug. Furthermore, the antibody formation is a feature which is of equal importance in relation to the various types of treatment which are to be employed.

211 (2734)

The chemical composition of the vitreous humor of animal eyes.

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A survey of the literature revealed but incomplete data on the chemical composition of the vitreous humor. It was therefore deemed advisable to determine in this body fluid the concentration of some of the compounds known to occur in the blood and cerebrospinal fluid. This work represents a preliminary step in the study of the humors of normal and pathological human eyes. The use of the microchemical methods has made possible the more extensive analysis of the vitreous humors of individual eyes.

Analyses were made of the vitreous humors of the eyes of oxen, horses and pigs. The eyes were removed, without trauma,