the sulfate precipitated as the barium salt. The precipitate was collected following the usual method.[3]

Measurements of radioactivity were made with a well-shielded G.M. counter tube provided with a thin mica window of the type described by Copp and Greenberg[4] regulated with a Neber-Haper circuit. Counts were registered by a scale of eight circuit energized by a stable 115 volt A.C. line.

Typical results obtained with the three compounds mentioned above are shown in Table 1. All values are

TABLE 1

DISTRIBUTION OF S^{35} IN RAT TISSUES

	Heptyl-aldehyde bisulfite	Cinnamal-dehyde bisulfite	Sodium sulfate
Total S^{35} injected, counts /min. $\times 10^{-3}$	8.5	110	118
Body weight, gms	115	165	175
Tissue	Counts / min. / 100 mgm		
Bone marrow	218	280	208
Bone matrix	10	14	45
Lymph nodes	4	23	36
Spleen	4	11	18
Thymus	2	7	33
Lymphosarcoma*	4	...	...
Liver	3	18	10
Kidney	6	15	39
Brain	3	45	8
Hair	11	130	26

* We wish to thank Dr. J. B. Murphy, of the Rockefeller Institute for Medical Research, for the rats bearing lymphosarcoma tumors used in these experiments.

corrected for radioactive decay and for beta ray absorption in the samples.

It is evident from the table that the highest concentration of radioactive sulfur occurs in the bone marrow irrespective of the sulfur compound used. Though comparison between animals can not be readily made, the data show, nevertheless, that the relative distribution of sulfur in some tissues is somewhat dependent upon the chemical structure of the compound.

Preliminary chemical analysis of the marrow indicates an unexpectedly high sulfur content. The nature of the substances responsible for this high sulfur value are, at present, unknown.[5]

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EXPERIMENTAL VERRUCOUS ENDOCARDITIS[1]

ON June 11, 1943, we received from Dr. Jacob Werne, of St. Johns Hospital, Long Island City, a specimen of fluid removed from the pericardial sac of a woman who had died of active rheumatic carditis. This fluid was passed through a Mandler filter and the filtrate was introduced into culture media (aerobic) with negative result. Some of this filtrate was injected intravenously into rabbits in which there were subsequently found scattered foci of inflammation in the myocardium, in one or more of the valves of the heart and in the pulmonary arterioles. The changes in the valves of the heart could be distinguished from those seen in experimental bacterial endocarditis because of the absence of bacteria, the more diffuse dissemination of the lesions, their curious edematous verrucous character and especially by the remarkable hyperplastic and reparative activity of the endothelium and connective tissue.

During the subsequent eighteen months the pericardial exudate from two more rheumatic patients and the blood from seven others with clinical evidence of rheumatic carditis have been injected into rabbits, guinea pigs and mice, with somewhat inconstant results. It has been possible to recognize damage of endocardial endothelium and connective tissue in most of these animals. The experimental disease has ordinarily not been lethal and the animals have been sacrificed at various intervals after inoculation.

The disease has been propagated in series through fifteen successive animals by injection of blood. In embryonated eggs, inoculation with small amounts of blood from the experimental mammals has given rise to a non-lethal infection which has been propagated in series in the eggs. Allantoic fluid of the eggs has been in turn injected intravenously into rabbits with the production of even more pronounced lesions in the heart, apparently because of a greater concentration of the pathogenic agent in the egg as compared with the mammalian blood.

In addition to the many rabbits examined in our studies of experimental bacterial endocarditis there have been animals injected with normal rabbit blood, blood of animals dead of various spontaneous disorders, animals injected with normal human blood, normal egg fluids, vaccinia virus, Theiler virus, influenza virus and with the blood of rabbits in which there was evidence of spontaneous disease of the heart. The changes produced in these animals require much further study. At present, however, it appears that they are not identical with the changes seen in the animals of the "rheumatic" series. The distinction between these various disorders of the rabbit's

[3] We wish to thank Dr. J. R. Rachele, of the Department of Biochemistry of Cornell Medical College, for assistance in setting up a method to collect the radioactive precipitates.

[4] D. Harold Copp and David M. Greenberg, *Rev. Scientific Instruments*, 14: 205–206, July, 1943.

[5] We wish to thank G. Horiuchi and H. Levy for technical assistance.

[1] Aided in part by the United Hospital Fund of New York; Grants No. 522 and No. 523 of the Committee on Therapeutic Research, Council on Pharmacy and Chemistry, American Medical Association; and by the Virus Research Fund of the Lambert Pharmacal Company. This paper was presented in part, together with demonstration of specimens, at the meeting of the New York Pathological Society, New York Academy of Medicine, March 22, 1945.

heart has been very difficult and rather unconvincing when only morphological evidence has been used, as, for example, in the early work of De Vecchi[2] and the later studies of Andrei and Ravenna.[3] In our own studies these difficulties have not been entirely overcome. We have been able to use the more modern method of perfusion fixation to demonstrate more clearly the changes in the valves and in the endothelium of the mural endocardium and aortic intima. The propagation of the supposed pathogenic agent in embryonated eggs and its subsequent passage back to small mammals would appear to have confirmatory value and would seem to open the field for application of the newer technical procedures of virus study to the agent or agents which may be concerned in the causation of the rheumatic diseases.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

GRAPEVINE INJECTION APPARATUS[1]

THE plant-injection procedure for diagnosis of mineral deficiencies causing leaf abnormalities seems preferable in many instances over other types of treatments. Injection into the plant circumvents soil fixation of various ions, requires only a minimum of materials, and also gives assurance that the element in question is at least within the plant. The treatment of single branches provides closely comparable checks and reduces the number of plants necessary for diagnosis. Although foliage sprays have proved useful, there is less assurance of penetration and distribution, particularly in the case of the "nonmobile" elements. For instance, foliage sprays with zinc compounds on zinc-deficient grapevines have given transient and far less marked recovery than that from injections or from daubing the fresh pruning wounds with zinc solutions. The daubing procedure has generally given unsatisfactory results with cane-pruned vines. Injection of 5 ml of 25 per cent. zinc sulfate solution into the trunk has resulted in outstanding improvement in the appearance of zinc-deficient, cane-pruned Thompson Seedless (*Vitis vinifera*) vines. Various injection procedures have been used by Collison *et al.*,[2] Roach,[3] Rumbold[4] and Wallace,[5] who refer in turn to many other investigations.

Fig. 1 illustrates the apparatus. The screw is used to force the flat-faced, circular injection point into the wood until the taper at the back end forms a seal with the plant tissue. The solution is then pumped into the tracheal system of the xylem through a hole in the neck of the injection point.

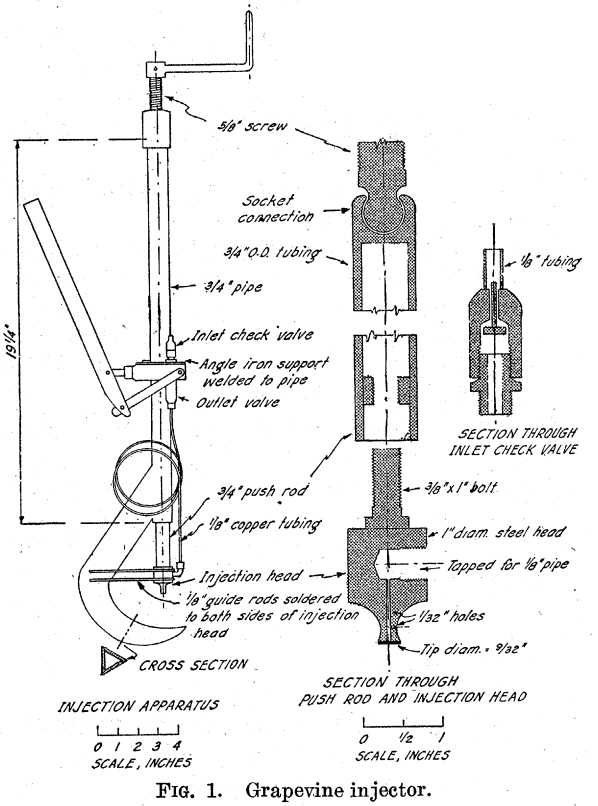

FIG. 1. Grapevine injector.

The injection head was turned from 1-inch soft round steel. The end face of the point is 9/32-inch diameter and is decreased at the neck to 8/32 inch. The neck and sealing face are turned on approximately a ¼-inch radius. This design allows the solution to flow freely around the neck of the point, and the sheared tracheal ends are not under mechanical pressure which would tend to keep them closed. The

[2] Bindo De Vecchi, *Arch. de Méd. Expérimentale et d'Anat. Pathol.*, 24: 352–420, May, 1912.

[3] Guiseppe Andrei and Paolo Ravenna (translated by Richard Kemel), *Arch. Int. Med.*, 62: 377–387, September, 1938.

[1] Thanks are due to Mr. P. E. Symens for the design and construction of the hook and pump mounting.

[2] R. C. Collison, J. D. Harlan and M. P. Sweeney, *New York Agr. Exp. Sta. (Geneva) Tech. Bul.*, 192: 1–36, 1932.

[3] W. A. Roach, *Ann. Bot.*, n.s., 3: 156–222, 1939.

[4] Caroline Rumbold, *Am. Jour. Bot.*, 7: 1–18, 1920.

[5] T. Wallace, *Jour. Pom. and Hort. Sci.*, 13: 54–67, 1935.