nine animals injected, four showed after thirty-seven, nineteen, twelve and five days, respectively, fever of 40 C. and a purple-red eruption of the face, followed by a marked desquamation. Two of the positive results were obtained through the subcutaneous injection of the blood of one patient sick with scarlet fever, who had shown the eruption for only a few hours. Of the remaining two monkeys that developed symptoms, the first was injected subcutaneously with pericardial exudate, the other with an emulsion of the tracheobronchial glands. The blood and exudate were free from any demonstrable microorganisms.

About two months later Bernhardt¹⁹ gave an account of experiments in the same direction. He injected an emulsion of the coatings from the tongue in the early stages of scarlet fever into the groin of his monkeys. Some of this material he rubbed over their tonsils and tongue. This inoculation was followed by a rise in temperature and swelling of the lymph-nodes in the inguinal region and on the fifth day the animals were quite sick. The inguinal glands were now extirpated and an emulsion of them injected into the groins of another series of monkeys. After three such passages this material was free from streptococci, yet it was still virulent for the animals. The symptoms developed were similar to those of scarlatinal fever, a punctiform exanthem on face, neck, shoulders and chest, and the characteristic strawberry tongue. This was followed by a lamellate desquamation. These symptoms appeared whether the material injected was freed from streptococci by filtration through a Berkefeld filter or not. But streptococci alone did not produce the characteristic symptom-complex.

While Bernhardt used for his experiments the lower monkeys (*Macacus cercopithecus*), Landsteiner and Levaditi²⁰ used chimpanzees, the same species as Metchnikoff and Roux had first used successfully in the experimental transmission of syphilis. They took the coating of the tonsil and the blood of children sick with scarlet fever as material. By introducing this into the throat and by inoculation under the skin, they produced a disease in one chimpanzee, characterized by fever, an angina, with redness and swelling of the mucous membranes of pharynx and tonsils, and the formation of a grayish-yellow deposit on the latter, and swelling of the papillae of the tongue. A general eruption followed resembling closely the scarlet fever rash in children. This ape died and the post-mortem findings showed lesions in the kidneys and the skin and a tumefaction of the lymph-nodes which Landsteiner and Levaditi consider as identical with the changes found in human beings. With streptococci isolated from scarlet fever patients they were unable to produce the disease picture.

Hektoen and Weaver²¹ reported some experiments made during the time from December, 1909, to September, 1910, in which they fed monkeys with milk which was infected with material from the throat and mouths of children sick with scarlet fever. From thirteen monkeys (*Macacus*) fed in this way, ten remained well and three died. No streptococci or other microorganisms could be demonstrated by microscopic or cultural methods. The sterile blood taken from the heart of the third monkey immediately after death was mixed with

sterile milk and fed to a healthy monkey for three days. This one became sick four days after the milk was first fed, and refused food, the temperature rising to 104.1 F.; the leukocyte count was 52,000. The leukocytosis persisted for five days and disappeared as the temperature subsided and the appetite returned. This sickness was suggestive, as it came on four days after feeding and ran a short course with fever and leukocytosis; but there was no cutaneous eruption.

These are, in brief, the advances made in the last five years in our knowledge of scarlet fever. Though the etiologic agent has not been found and is yet to be discovered, the place to be attributed to the streptococcus has been more clearly recognized. The streptococcus almost constantly present leads to a systemic reaction of the organism which finds its expression in the presence of antibodies against it. The streptococcus, however, can no longer be identified with the virus of scarlet fever, whose existence and presence in the lymph-nodes in a high concentration must be assumed from the presence of specific antibodies in the blood. The experimental transmission of scarlet fever to apes and monkeys substantiates this statement and points to new possibilities for the closer study of the nature of this virus.

32 North State Street.

THE ARTIFICIAL CULTURE OF FILARIAL EMBRYOS

A PRELIMINARY NOTE *

CREIGHTON WELLMAN, M.D.

Professor and Head of the Department of Tropical Medicine, Hygiene and Preventive Medicine, Director of the Laboratories of Hygiene and Tropical Medicine, Medical Department, Tulane University of Louisiana; Visiting Physician to the Charity Hospital, New Orleans

AND

FOSTER MATHIEW JOHNS, M.D.

Assistant in the Laboratories of Tropical Medicine and Hygiene
NEW ORLEANS

The earliest success of Bass¹ in the cultivation of certain parasitic protozoa (plasmodia) *in vitro* led one of us (Wellman) to attempt the nurture in artificial mediums of the embryos of *Filaria immitis* Leidy. At that time a considerable number of positive cultures was obtained, using defibrinated dog's blood inactivated for long periods of time at comparatively low temperatures. Since the return of the malarial expedition of the Tulane University Department of Tropical Medicine from Central America additional work has been completed, employing their technic² and comparing results with ordinary blood-cultures. A fuller statement of the work thus far accomplished and the details of future progress will be presented later.

Experiments were devised to determine the influence of various whole bloods, serums and diverse mediums, and also the effects of temperature, air, etc., on the cultures.

The embryos live for ten or twelve days in some specimens of sterile defibrinated dog's blood at room temperature (28 C.), and considerable increase in size occurs, the parasites growing to 1 $\frac{2}{3}$ their former

19. Bernhardt: Deutsch. med. Wchnschr. 1911, xxxvii, 792.

20. Landsteiner and Levaditi: Compt. rend. Soc. de Biol., 1911, lxx, 641; Gaz. d. hôp., 1911, p. 784. Landsteiner, Levaditi and Praeck: Ann. de l'Inst. Pasteur, 1911.

21. Hektoen, L. and Weaver, G. H.: THE JOURNAL A. M. A., June 17, 1911, p. 1705.

* Study 24, from the Laboratories of Hygiene and Tropical Medicine under the direction of Creighton Wellman, Medical Department, Tulane University of Louisiana.

1. Bass, C. C.: THE JOURNAL A. M. A., Nov. 4, 1911, p. 1534.

2. Bass, C. C., and Johns, Foster M.: The Cultivation of Malarial Plasmodia (*Plasmodium Vivax* and *Plasmodium Falciparum*) in Vitro, Jour. Exper. Med., October, 1912, p. 567.

dimensions. At 37 C. the cultures die out in from three or four to eight days and little or no increase in the size of the embryos can be seen. It may be noted here that the adult worms, both male and female, will live from three to five days in sterile defibrinated dog's blood at 37 C., but, even if fecund females, or both males and females, are included in the same tube no increase in the number of embryos in the medium can be noted. Dog's blood containing embryos, if added to dog-serum, to human serum or to guinea-pig serum, shows little increase in the size of the contained parasites either at room temperature or at 37 C.

Other mediums, such as hemoglobin agar, bouillon, citrated dog and human blood, were less successful than defibrinated blood.

Our best results were obtained with dextrose dog-serum at low temperatures. The cultures were prepared by adding 0.1 c.c. of filarated dog's blood to 1 c.c. of dog-serum which contained 0.01 per cent. of dextrose. These were placed in the ice-chest at 12 C. Such cultures live from twelve days to two weeks and the parasites become from 2 to 2½ times as long as when planted. The addition of fresh serum after removal of the old (on the eighth day) seemed to aid the growth and vitality somewhat, as such cultures have remained alive over two weeks and the embryos have increased to 2½ times their original length.

It is rather curious that, after the low temperature, the next best temperature for producing growth of the parasites is as high as 40 C. At this temperature, in the medium last mentioned, an increase of growth to 1¾ times the original length of the embryos is seen after eight or nine days.

Cultures which are contaminated with bacteria in many instances give quite as good results as those which are sterile, especially at low temperatures. When incubated at high temperatures such cultures become rapidly overgrown with bacteria and the embryos die, while at low temperatures (12 C.) and even at room temperature (28 C.) they seem to thrive in the presence of certain bacteria. Possibly the low temperature, by allowing the presence of certain bacteria and their products while preventing the excessive development of such organisms, approximates in a degree the conditions found in the mosquito's stomach.

It is probable that we have by the above methods nurtured the microfilariae to a point which corresponds with the limit of their development in the digestive tract of the mosquito, and that a modification or change of the medium in order to approximate their surroundings in the malpighian tubules of the same insect (wherein their subsequent development occurs) will be necessary to carry the parasites to sufficient maturity to make possible the infection of animals from cultures. Further research along these lines is in progress and will be published later.

We wish to acknowledge the help of Mr. Percy L. Querens, student assistant in the Laboratories of Tropical Medicine, in the routine work of planting and examining the series of cultures studied in the course of the work.

Tongue Sign of Cancer of the Esophagus.—Guarnaccia calls attention in the *Archives Int. de Laryngologie*, 1912, xxxix, 88, to the information to be derived from progressive retrofixation of the tongue with cancer of the esophagus. He has never encountered this sign in other affections in the region but has found it constant even with incipient cancer of the upper third of the esophagus. The patient cannot put out his tongue except with difficulty and pain, and it is almost impossible to draw out the tongue.

SURGERY OF INTRAMEDULLARY AFFECTIONS OF THE SPINAL CORD: ANATOMIC BASIS AND TECHNIC

WITH REPORTS OF CASES *

CHARLES A. ELSBERG, M.D.

Surgeon to the Neurological Institute

NEW YORK

In the course of more than sixty spinal operations I have had occasion to observe a number of lesions within the substance of the cord which seemed amenable to surgical treatment. This led me to investigate the subject in order to determine the frequency of localized intramedullary disease, and the part of the cord into which an incision can be made with a minimum amount of injury to the delicate cord tissue. In addition, I have attempted to develop a special technic for intramedullary spinal surgery, and have made use of this technic in a number of spinal operations in which the cord itself was invaded during the operative manipulations.

The results of my investigations have convinced me that under the proper conditions and with the proper technic it is perfectly feasible and safe to incise the cord substance in order to allow of the extrusion of localized intramedullary growths, to drain cysts in the substance of the cord, etc. I am at present investigating experimentally on animals the subject of intramedullary operations, and hope in the near future to report my experiences and the results of the histologic studies of spinal cords in which incisions at various levels had been made.

Intramedullary tumors are not by any means so rare as ordinarily they are believed to be. Thus Allen Starr,¹ quoting from Schlesinger, states that among 302 tumors of the cord, 125 were within the cord substance. These included sarcoma, tuberculous tumors, gumma, glioma, lipoma, cysticercus, neuroma, cholesteatoma, myxoma, teratoma, adenoma (Benda), endothelioma, etc. Many of these intramedullary growths infiltrate the cord substance and increase in size by extending upward and downward, but some enlarge in their transverse diameter, are encapsulated and of small size. Gowers² says that "these tumors in some cases blend with the substance of the cord, but in other instances they are bounded by an area of softening which often isolates even invading growths. Some tumors are sharply limited." According to Flatau,³ the comparative frequency of extramedullary and intramedullary tumors is as 2.6 to 1 (fifty-seven intramedullary tumors in 213 cases). Although one cannot estimate from the reports the frequency of localized and encapsulated intramedullary tumors, the fact that one frequently finds illustrations and descriptions of such growths in the literature shows that they are not so very rare. Localized tumors have been found at operation by Krause,⁴ Ropke,⁵ von Eiselsberg,⁶ Elsberg and Beer,⁷ and many others. Localized cysts have been found by Krause⁴ and by myself. That localized collections of fluid do occur in syringomyelia and hematomyelia is well known. Foreign bodies (bullets) have been found lodged in the cord substance.

* Read in the Section on Nervous and Mental Diseases of the American Medical Association, at the Sixty-Third Annual Session, held at Atlantic City, June, 1912.

1. Starr, Allen: Text-Book of Nervous Diseases, 1909, p. 442.

2. Gowers: Diseases of the Nervous System, 1899, p. 609.

3. Flatau: Handbuch der Neurologie, II, 640.

4. Krause: Chirurgie des Gehirns und Rückenmarks, II.

5. Ropke: Arch. f. klin. Chir. (Langenbeck's), 1911, xvi, No. 4, p. 903.

6. Von Eiselsberg: Mentioned by Ropke (Footnote 5).

7. Elsberg and Beer: Am. Jour. Med. Sc., November, 1911