of Devils Lake, and, lastly, the schistose and massive rhyolites exposed on the Lower Narrows of the Baraboo River, at which place the quartzite is in vertical position and likewise the original surface of the rhyolite on which deposition took place. No evidence of incorporation of rhyolite fragments in the quartzite was found.

The conference adjourned at 1 P. M. on Sunday, October 21.

W. H. TWENHOFEL

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A PHYSIOLOGICAL STROBOSCOPE

A NEW physiological stroboscope has been developed primarily for the study of the vocal cords during phonation. Stroboscopy, in this application, dates to a suggestion of Töpler[1] in 1866 and its first utilization by Oertel[2] in 1878. However, the instrumentation to date, although having seen much change in form, has shown little change in principle from that of original conception. These apparatus essentially consist of a light source of rapid quenching characteristic, some means for interrupting the light such as a shutter or switch, and a variable speed motor or actuator capable of covering the frequency range of the voice. A further elaboration provides for a tone source or loud speaker in conjunction with the interruptor, whereby the subject has established for him the tone frequency he is to take.

In contra-distinction, the authors' apparatus permits the subject to take any tone or series of tones arbitrarily, and the stroboscope automatically responds to the variation as it occurs. Inasmuch as no manual adjustment or compensation is necessary for the reestablishment of syntony upon a variation of frequency, either in the voice or the mechanism of interruption, it is possible to follow the cordal configuration throughout a tonal transition. Thus a limitation of large proportion has been lifted from this field of study.

A microphonic pick-up element, a series of band pass filters, a high gain amplifier, a set of phasing impedances and an oscillator with the output feeding a gaseous discharge lamp substantially comprise the instrument. The phasing circuit permits the study of the cords during any portion of the cycle from the fully closed to the fully opened positions. Entrance into the viewing position is accomplished with an endo-laryngoscopic device which has been fitted with the gas discharge lamp.

A series of investigations utilizing the instrument has been projected and reports will follow.

LEO A. KALLEN
H. S. POLIN

DISSECTION AS A METHOD OF EMBRYOLOGICAL STUDY

AT the meetings of the American Association for the Advancement of Science held in Berkeley in June of this year one of the demonstrations was an exhibit of most of the equipment for the dissection and stereoscopic photography of embryos, together with a display of stereoscopic photographs of various dissections of the developing rat. Although a detailed description is being prepared, the following summary is offered.

The chief pieces of apparatus consist of the following: A specially designed lamp, for using flashlight bulbs, by which light is concentrated to a small spot at a distance of 7 inches from the lamp; an electrically operated vibrating knife, made from a piece of safety razor blade, supported and controlled by racks and pinions; a dissecting needle fashioned from a hypodermic needle mounted on a system of levers so that the motion is reduced by about 4; ball and socket mounts for holding embryos during dissecting and during photographing. The camera bellows consists in part of a telescoping bellows and in part of boxes by which the total length can be increased to about 6 feet. It is supported on a long piece of steel tubing which in turn is so mounted vertically that it can be inclined to right and to left in order with the same lens to take in succession two different photographs of the same embryo, which give a stereoscopic effect. A support for the embryo so that it can be kept in the axis of inclination of the camera and also be illuminated from beneath as well as from above.

Other items include such things as fine-tipped forceps, brushes made of fine silk thread, turn table, etc.

J. A. LONG

UNIVERSITY OF CALIFORNIA

THE DEVELOPMENT OF THE PRINCIPAL ARTERIAL VESSELS IN THE RAT FROM 11 TO 16½ DAYS

THIS study traces the vascular changes through a critical period of development and determines the embryonic relationships of certain adult vessels. It also offers a reconciliation of inconsistent embryological terminology with the B.N.A. as used by Greene.[1]

The embryos were injected with diluted India ink, dehydrated, dissected in benzol, for which a method was devised, and finally cleared by Reagan's modified

[1] Topler, *Annalen d. Phys. u. Chem.*, p. 108, 1866.

[2] M. J. Oertel, "Uber eine Neue Laryngo-Stroboskopische," *Zentral. Med. Wiss.*, 1878.

[1] The writer wishes to gratefully acknowledge the generous cooperation of E. C. Greene in advancing information from her manuscript on the anatomy of the adult rat soon to be published.

Spalteholz technique.[2] Illustrations are stereoscopic photographs made as described by Long.[3]

The aortic arches exhibit the greatest development and remodeling during this interval, while the head vessels undergo extensive rearrangements. The major features of Tandler's[4] work is confirmed and extended to later stages. A summary of the development of the vessels to the limb buds and visceral organs is included.

The need for a standard and consistent nomenclature which takes into account both embryonic structures and their adult derivatives is discussed.

This is a preliminary note on an extensive study now in preparation for the press.

MARY SANFORD LEITCH

DEPARTMENT OF ZOOLOGY
UNIVERSITY OF CALIFORNIA

THE REMOVAL OF FLUORIDES FROM WATER BY SAND FILTRATION

SINCE it has been established that the dental disease in man known as "mottled enamel" is due to the drinking of water containing fluorine, the removal of fluorides by filtration has become an important problem.

I have found that a contact filter 15 cm high, made of river sand passing a screen 60 to the inch, to which has been added 2 per cent. by weight of powdered aluminium, will remove the fluoride from a solution containing 30 parts per million of sodium fluoride. The absence of fluoride in the filtrate was determined by the zirconium-alizarin colorimetric method.

S. P. KRAMER

FT. THOMAS, KY.

SPECIAL ARTICLES

RARE GASES NOT ESSENTIAL TO LIFE[1]

HERSHEY[2] reported that small animals such as rats could not survive more than a week approximately in an atmosphere of 21 per cent. oxygen and 79 per cent. nitrogen in which the rare gases were left out. He concluded that helium, argon, neon, krypton and carbon dioxide were vital to normal respiration and life. Fidlar,[3] accepting the results reported by Hershey, conceived of the rare gases playing a rôle in the atmosphere similar to the vitamins in foods. Previously, Ramsay[4] considered these gases inert biologically.

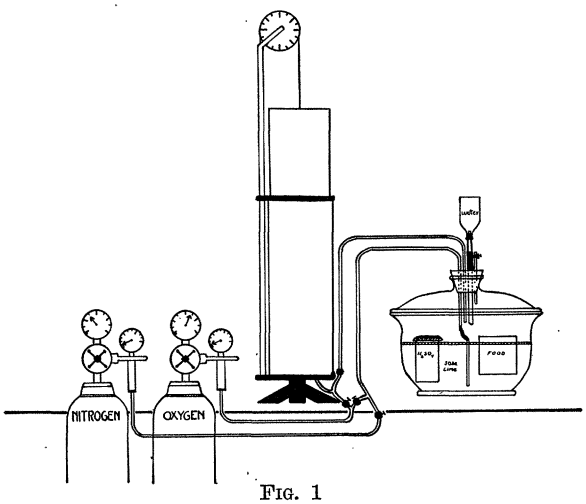

FIG. 1

Through the assistance of the engineering staff of the Linde Air Products Company, oxygen and nitrogen were especially prepared in order to exclude the rare gases. Oxygen was made from electrolytic dissociation of water. The nitrogen was produced by cracking ammonia and removing the hydrogen by control combustion with electrolytic oxygen. Both gases were prepared for the following purpose only, and every precaution exerted to secure pure oxygen and nitrogen. After the work was commenced, it was found that the nitrogen employed by Hershey was not free from rare gases. Nevertheless, it was thought desirable to determine whether these so-called inert gases had any detectable biological activity in the animal organism.

The problem presented the additional possibility of throwing a light on the cause of death in animals continuously exposed to from 80 to 100 per cent. oxygen for two to five days. Lorrain Smith[5] was the first to point out that fatal pulmonary lesions characterized by edema and finally consolidation took place when animals lived for periods exceeding two to three days in these high oxygen atmospheres. Although Hershey submitted no autopsy protocols of the animals who died presumably in the absence of rare gases, the hypothesis was apparent that perhaps the high oxygen atmospheres achieved a relative exclusion of rare gases. Smith's work was confirmed and amplified by many others[6-9] without affording

[2] F. Reagan, *Univ. Calif. Publ. Zool.*, 28: No. 18, 1926.
[3] J. A. Long, SCIENCE, this issue.
[4] J. Tandler, *Morph. Jahrb.*, 30: 275–373, 1902.
[1] From the Department of Medicine, College of Physicians and Surgeons, Columbia University, and the Presbyterian Hospital, New York City.
[2] J. Willard Hershey, *Trans. Kansas Academy of Science*, 32: 51, 1929; *ibid.*, 33: 133, 1930; *ibid.*, 34: 240, 1931; *ibid.*, 35: 141, 1932. SCIENCE, 71: 394, 1930.
[3] Edward Fidlar, SCIENCE, 72: 296, 1930.
[4] Ramsay, "The Gases of the Atmosphere."
[5] Lorrain Smith, *Jour. Physiol.*, 24: 19, 1899.
[6] L. Hill and J. J. R. Macleod, *Jour. Physiol.*, 29: 492, 1903.
[7] H. T. Karsner, *Jour. Exper. Med.*, 23: 149, 1917.