student and a familiarity with analytical geometry and calculus is assumed.

Subjects treated include mechanics, thermodynamics, electricity and magnetism, together with a short discussion of the special or restricted theory of relativity. Mechanics is emphasized not only because it furnishes fundamental concepts for all other branches of physics, but also because its development provides examples of a number of important mathematical methods. The treatment of Hamilton's principle and the discussion of Gibbs's statistical mechanics, in particular, although not elaborate, are very satisfactory. On the other hand, more space could well be devoted to thermodynamics, and the same is true to a less extent in connection with the portions of electricity and magnetism dealing with material media.

In addition to the above, chapters are devoted to differential equations, calculus of variations and vector analysis. The treatment of these subjects, although compact, is clear and should be very useful to the student of physics with only the average preparation in mathematics. No attempt is made to develop any of the various subjects in great detail, much being left to the student in the form of problems, of which there are a large number. For those interested in collateral reading an excellent list of references is appended to each chapter.

The most serious defect in the book is the almost entire lack of figures. There are but three altogether, although at many points a figure would undoubtedly be an aid to the student's comprehension of the analysis.

"Principles of Mathematical Physics" should prove satisfactory as a basic text in a lecture course introducing mathematical physics and also should be of value as an auxiliary in more advanced courses, particularly in the field of mechanics, as there are a number of items included here which are often omitted from other texts. The book is not well suited, however, to independent study by the average student, as supplementary physical background should be supplied in many places.

N. I. ADAMS, JR.

YALE UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

INTRATRACHEAL INOCULATIONS IN THE RAT[1]

As a preliminary step in the study of lobar pneumonia in the rat, the following method of intratracheal inoculation has been developed.

The anesthetized animal is placed on its back with the head at the edge of the table and held by an assistant, who grasps the tongue with a hemostat. Traction is applied to the tongue so that it is held firmly to the side of the mouth and against the lower teeth. The root of the tongue is raised by spreading the blades of a curved hemostat inserted far back in the pharynx and held by the operator. The field is illuminated by reflected light from a head mirror. Under direct vision a specially devised cannula may then be inserted into the trachea.

The cannula is made of brass tubing 7 cm long, 2.5 mm outside diameter and 1.6 mm inside diameter. The tube is bent upward at an angle of 15°, 0.5 cm from the distal end. The tip is beveled on the upper surface, care being taken to avoid sharp edges. Near the proximal end of the tube a brass rod 5 cm long and 3 mm in diameter is soldered at right angles to serve as a handle.

To enter the trachea, the beveled tip of the cannula is placed just under the epiglottis, which is then raised slightly. The handle of the instrument is depressed and the cannula passed gently into the trachea. When the cannula is in the trachea a drop of soap solution placed over the proximal end will form soap bubbles which break explosively. If the cannula has entered the esophagus bubbles may form but do not break with expiration. This test is important.

In the final step of the procedure a No. 5 French ureteral catheter (1.5 mm in diameter) is passed through the lumen of the cannula and withdrawn 0.5 cm at the first sense of resistance. This serves to free the tip of the catheter. Up to 0.5 cc of material may be injected from an attached syringe.

After an experience of over 300 inoculations made by this method, it is believed that with limited practise one should be able to make successful inoculation in at least 95 per cent. of the trials. Guinea pigs may also be inoculated by this method, although greater difficulty is encountered in passing the cannula into the trachea.

L. JOURDONAIS

W. J. NUNGESTER

[1] From the Department of Bacteriology, Northwestern University Medical School, Chicago, Illinois. Aided by a grant from the American Medical Association.

THE PRESERVATION OF CARTILAGE

THIS technique was evolved to obviate certain difficulties in handling the cartilaginous structure of a chimaeroid fish, *Hydrolagus colliei* (Lay and Bennett). In this case the cleaned cranium was dehydrated by ordinary histological methods. After it had been placed in paraffin, the temperature of the

paraffin was raised until it was quite liquid, and then the cranium was removed and wiped clean. At the present the cranium has been exposed to such desiccation as would occur on my desk for quite some time, and there is absolutely no sign of shrinkage or alteration. This process would be applicable to the cartilaginous structure of any of the smaller elasmobranchian fishes, for there is an evident limit in the size of the cartilage to be impregnated; although the degree of infiltration necessary to preserve the cartilage would be below the standard required in microtechnical work. The cranium is in a condition for study far superior to cartilaginous material in liquid preservatives.

V. BROCK

STANFORD UNIVERSITY

PERMANENT ACETO-CARMINE PREPARATIONS

THE following method has proven useful in accurately and permanently preserving the cytological details in aceto-carmine preparations. It is rapid and convenient and has been found more satisfactory for our purposes than previous techniques.[1]

The preparation is made in the usual way[2] and sealed with vaseline or preferably paraffin. When the stain is satisfactory the slide is supported face down by two thin glass rods in a petri dish of a mixture of equal parts of xylol, absolute alcohol and glacial acetic acid until the cover soaks loose. The action of the reagent is hastened by first cracking off most of the paraffin seal with a needle and also by gentle agitation of the slide.

When the cover comes off (5 minutes to ½ hour) the slide is rinsed in the solution for 5 minutes, drained carefully and wiped free from mounting medium. It is then passed through two changes of a mixture of equal parts of xylol and absolute alcohol (5 to 10 minutes each), then through xylol (10 to 15 minutes) and mounted in balsam. The xylol stage may be omitted with minute objects such as pollen-mother cells. Occasionally part of the preparation adheres to the cover slip in which case cover and slide are run up separately and recombined in balsam. Preparations in the balsam improve in clarity for a week or more. Smears of pollen-mother cells (*Lilium, Podophyllum, Hyacinthus, Tulipa*) made in this way are unaltered 10 months after preparation. The method has been used successfully on smear preparations of Dipteran salivary glands (*Drosophila, Sciara,* blowfly).

Professor C. W. Metz and Miss Elizabeth Gay find the following modification equally as good as the above for paraffin-sealed smears of *Sciara* salivary glands: Soak off the cover in equal parts of 95 per cent. alcohol, clove oil and glacial acetic acid; 2 changes of 95 per cent. alcohol up to ½ hour; absolute alcohol 5 minutes; clove oil 10 minutes; xylol 5 minutes; balsam.

JOHN B. BUCK

ZOOLOGICAL LABORATORY
THE JOHNS HOPKINS UNIVERSITY

SPECIAL ARTICLES

THE SIMILARITY BETWEEN FASCIATIONS IN PLANTS AND TUMORS IN ANIMALS AND THEIR GENETIC BASIS

A COMMONLY recurring abnormality in plants is the irregular development of the growing points of the main stem or branches called fasciations. These peculiar formations occur in many plant families and are particularly noticeable in species having an indeterminate type of growth. In some cases fasciated plants are able to reproduce and all the progeny show the same abnormality. In these cases the teratological development is due to one or more specific genes for abnormal growth and is definitely inherited. In many other cases fasciations occur only in one part of a plant. Such variations occur so sporadically both in seed and vegetatively propagated plants that they seem not to have any basis in inheritance, yet they appear more frequently in some germinal lines than in others. Gall formations occur in plants, and many of these are clearly due to insect, fungus and bacterial parasitism. In some galls no infection can be found and these seem to be a form of unregulated growth for which no adequate explanation has been made.

The tumors in animals that assume many different forms and occur in many parts of the body are also a form of unregulated growth. This abnormal development frequently starts in traumatic tissue. In both plants and animals the injurious nature of unregulated growth comes mainly in later stages from a breaking down of cells due either to pressure or to a failure of normal metabolism, resulting in secondary infections in necrotic tissue. Plants differ from animals in that there is no migration of abnormal cells to other parts of the organism starting new centers of growth. In plants there is no circulatory system whereby this transfer could be brought about. Fasciations and galls in plants do not show the malignant features characteristic of many tumors in animals.

[1] B. McClintock, *Stain Tech.*, IV: 53, 1929; W. C. Steere, *Stain Tech.*, VI: 107, 1931.

[2] Lee, "Microtomist's Vade-Mecum," p. 142, 9th ed., 1928; J. Belling, *Am. Nat.*, 55: 573, 1921; *Biol. Bull.*, 50: 160, 1926.