a dark room it assumed an erect position in a few days. Placed back into the greenhouse it gradually became prostrate again. The seeds from this plant produced seedlings which responded to light in a similar way; they were prostrate in the sunlight and erect in weak light or in darkness. The growth habit could be changed at will by changing the light conditions.

Recently experiments were conducted at the Instituto Experimental de Agricultura, Caracas, Venezuela, to study the effect of light on *Panicum purpurascens,* Raddi.; *Alternanthera ficoidea,* Moq.; *Eleusine indica* (L.) Gaertn.; *Commelina cayennensis,* Rich.; *Portulaca oleracea,* L.; *Mimosa sensitiva,* L.; *Cynodon dactylon* (L.) Pers.; *Plantago major,* L.; *Echinochloa colonum* (L.) Link and others, which normally have a prostrate habit of growth under field conditions. Several plants of each genus which were prostrate in an open field were covered with a low roof of burlap bags or of cardboard boxes. In a few days they started to raise themselves and gradually became erect. When the protective coverings were removed, the plants became prostrate again. Then some of the shoots of each plant were covered and some left exposed to the sunlight. In every case the covered shoots became erect while the exposed ones remained prostrate.

Cuttings were made from prostrate plants and potted in an erect position. After they had taken root, some were placed toward the back of a box $24'' \times 18'' \times 18''$ which was open only to the south, and others were placed in the front of the box. Those in the back received diffuse light, while those near the entrance received direct sunlight from one side only. Plants in the back of the box bent south toward the light, while those in the front bent north away from the light. In other words, the plants in the back row showed positive phototropism, while similar plants in the front row showed negative phototropism.

The experiment was repeated several times, using cuttings of most of the genera mentioned above and similar results were obtained. Young *Commelina* plants reacted quickly to changes in light conditions. The front and back rows curved toward each other as in the previous experiments; but a third row between the other two rows bent forward in the early morning while shaded from the sun by the east side of the box, and bent backward during the middle of the day while exposed to direct sunlight. In late afternoon the west edge of the box shaded the center row again and the plants straightened up. This pattern of growth was followed every clear day. On cloudy days the plants bent forward in early morning and stayed forward all day.

By means of a special apparatus, it was shown that direct sunlight is not necessary to produce negative curvatures; reflected light of high intensity will give similar results but not as quickly.

From these experiments and others which will be described in detail in another publication the author has concluded that certain plants which normally have a prostrate growth habit under field conditions are probably negatively phototropic to intense light. A possible explanation will be given later.

D. G. LANGHAM
INSTITUTO EXPERIMENTAL DE AGRICULTURA,
EL VALLE, CARACAS, VENEZUELA

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A TECHNIQUE FOR CONTINUOUS MICROSCOPIC OBSERVATIONS

THE literature on anaerobic cultivation contains numerous descriptions[1] of apparatuses for the microscopic observation of the developmental processes of organisms requiring a low oxygen tension. The glaring defect in these techniques lies, not in their inadequacy, but in their relatively elaborate and complicated schemes of preparation and utilization.

In the course of the study of the morphology of the butyl alcohol-acetone organism, Mr. Eugene Gaughran, a graduate student in our laboratories, developed a method which, because of its simplicity and effectiveness, we have adopted as a standard technique.

The Gaughran method may be described succinctly as a simple hanging drop preparation in which the air has been replaced by a very inert oil of low viscosity and marked clarity. The oil preferred is a D.T.E. light turbine oil. This completely saturated oil is colorless in thin layers. It may be obtained from any of the large oil companies.

The procedure, which involves no meticulous care and takes less time than an ordinary fixed preparation, is as follows: The cavity of a depression-slide is filled with an excess of freshly heated (sterile) oil. A small portion of a semi-solid culture of the organism to be studied is transferred by pipette from the bottom of the culture tube to the center of a sterilized cover-slip. The cover-slip is inverted over the depression of the objective slide in a manner that will eliminate all

[1] Among the methods tried were those described by the following: M. A. Barber, *Jour. Exp. Med.,* 32: 295, 1920. H. Buchner, *Centbl. Bakt.* (etc.), 4: 149–151, 1888. J. Fortner, *Centbl. Bakt.* (etc.), 1 Abt. Orig. 108: 155–159, 1928. J. Fortner, *Centbl. Bakt.* (etc.), 1 Abt. Orig. 115: 96–99, 1929–1930. A. Itano and J. Neill, *Jour. Infect. Diseases,* 29: 78–81, 1921. H. Neumann, *Centbl. Bakt.* (etc.), 1 Abt. Orig. 114: 228–232, 1929. M. van Riemsdijk, *Centbl. Bakt.* (etc.), 1 Abt. Orig. 143: 265–270, 1939. L. Wamoscher and J. Vasarhelyi, *Centbl. Bakt.* (etc.), 1 Abt. Orig. 123: 250–255, 1932.

bubbles of air. The excess oil will be displaced to form a perfect seal. Immediately, the liquid portion of the medium spreads out between the oil and the cover-slip and the more solid portion of the medium is held firmly in place. The reason for this is apparent when one considers the free surface energy of the system in the light of the high surface tension and low adhesion tension of the oil and the relatively low surface tension and high adhesion tension of the solution in preferentially wetting the glass.

The practice of placing the chamber on the microscope stage and then placing the whole apparatus in an incubator was found to be objectionable. In a prolonged observation of a specific germinating spore or a dividing cell, any movement of the microscope will cause the organism to be carried from the field by the fluid flow or to gravitate. The many warm stages previously described in the literature were found to be unnecessary. In this method, the substage mirror is removed and a standard frosted 40-watt electric light bulb resting on a sheet of asbestos is inserted into the horseshoe base of the microscope. This is capable of providing the optimum temperature ($37 \pm 2°$ C.) for the germination of the spores of the butyl alcohol-acetone group of anaerobes. For other organisms the required temperature can be obtained by changing the distance between the bulb and the stage or by using bulbs of varying intensities.

STANLEY THOMAS

LEHIGH UNIVERSITY

ATTEMPTS AT TAGGING SMALL SALAMANDERS IN LIFE HISTORY STUDIES

AMONG the vertebrates, with the exception of small salamanders, fairly satisfactory methods of marking individuals for ready future identification are known. Jaw-tags probably will be satisfactory for tagging larger individuals of such species as *Cryptobranchus* and *Necturus* as they have proved to be with frogs.[1] However, the writer is not aware of any satisfactory tag, commercial or otherwise, which may be used to encircle the jaw of such small salamanders as *Triturus, Desmognathus, Plethodon, Eurycea,* etc. The failure of another method is recorded here, namely, that of inserting a clip through the musculature of the back or tail.

On July 28, 1939, at the Edmund Niles Huyck Preserve, Rensselaerville, New York, a number of adult newts, *Triturus viridescens viridescens,* averaging 95 mm in total length, were tagged with small surgeon's suture clips. These clips are smaller and considerably lighter than any of the commercial types of strap tags which are now on the market. However, they can not be bent over and locked at the tip. Clips were placed on the newts at various points such as through the musculature of the lower hind leg and about the jaw. They appeared at once to be much too large and heavy and when the newts were liberated in an aquarium they were quickly carried to the bottom and were able to reach the surface again only by great effort. The most satisfactory point to attach them appeared to be through the dorsal part of the tail muscles back of the anus. A few were also marked by inserting a clip through the musculature of the back just anterior of the anus. Several tagged specimens were placed in an aquarium and 17 were liberated in a small pond in a bed of emergent grasses near shore where they had originally been obtained.

After five days this grassy area was seined and several specimens were recovered very close to the spot where they had been liberated. Only one newt which had been tagged through the muscles of the tail was holding the clip securely. In five other recovered newts it had either pulled out, leaving a large hole in the tail or back, or was very loose, and the nearby flesh had a putrid appearance. The entire tail, posterior to the point of attachment of the suture clip, had dropped off in one newt. The tagged specimens placed in aquaria had lost their tags.

Dr. William C. Senning tagged over 500 *Necturus maculosus maculosus* in a limited area in Cayuga Lake near Ithaca, New York, by inserting strap-tags through the muscles of the tail near its base. These tags held well for at least two weeks, the period over which the actual tagging was done. After a lapse of two years the area was collected again, but no tagged *Necturus* were recovered, although many specimens were taken. It can not be assumed that the *Necturus* lost their tags since the marked specimens may have moved out of the area. However, in the absence of evidence to the contrary the success of this method of tagging must be viewed as questionable with *Necturus.*

EDWARD C. RANEY

CORNELL UNIVERSITY

[1] E. C. Raney, *Amer. Midl. Nat.,* 23: 733–745, 1940.

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