shown the dry weights obtained by varying both the iron and the manganese concentration in a series of 42 solution cultures of bean plants (*2*), while Fig. 2 is made up of photographs of the same plants. Extreme toxicity of manganese in the absence of insufficient iron and the antidoting effect of iron are clearly shown.

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Penicillin as an Agent for Sterilization of Protozoan Cultures

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Cleveland (*1*) attempted to obtain sterile cultures of *Trichomonas* using bactericidal agents. He states that the search for efficient chemical agents for the sterilization of protozoan cultures "appears to be almost a hopeless undertaking" (p. 256). However, various chemicals have been used successfully upon protozoan cysts. Morgan's (*3*) success in obtaining sterile cultures of *Trichomonas* with the use of penicillin and streptomycin suggested the possibility of using these antibiotics as agents for the sterilization of free-living protozoa.

In the present investigation *Colpidium campylum* was used. Organisms from a wild culture were concentrated by centrifugation and were washed three times with sterile Hahnert's solution (*2*). A few drops of the washed concentrate were then added to a solution of sterile 3 per cent Difco proteose-peptone containing 5,000 units of penicillin[2]/cc. After being in the penicillin solution for 12 hours, the organisms were transferred through three successive washes of 3 per cent proteose-peptone. A drop containing organisms and culture fluid from the third wash was plated on nutrient agar. No bacterial growth was observed on any of the agar slants used in the 8 tests conducted. The colpidia were apparently uninjured by exposure for 12 hours to solutions containing 5,000 units of penicillin/cc.

It appears that this method may be used with success in obtaining sterile cultures of most protozoa. However, with each different species used, preliminary tests must be made to ascertain the length of time the organism will survive in a given concentration of penicillin. If the survival time is extremely short, lower concentrations should be used. Preliminary observations indicate that *Paramecium nucleatum* is killed in 12 hours in solutions containing 5,000 units of penicillin/cc., but remains in a vigorous condition for 5 hours in the same concentration.

The process described above does not require constant attention of the investigator, large numbers of organisms are recovered after the final wash, and the number of transfers is reduced to a minimum, thus reducing the possibility of contamination.

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[2] The penicillin used was supplied by Merck & Co., Inc.

A Monitoring Probe for Radiochemistry Laboratories[1]

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In order to detect contamination of equipment and to protect the health of workers in laboratories handling radioactive materials, it is necessary to have instruments capable of indicating small amounts of radiation at the working space and on the person and clothing of workers. Several excellent portable radiation meters are now on the market, but only the most recent ones are effective in detecting weak radiation, the older ones generally being designed for monitoring X-rays.

As Libby (*1*) points out, the isotopes emitting the least energetic radiation are among the most useful. By substituting a more sensitive GM tube for the one ordinarily furnished, older instruments easily may be changed to permit them to detect a fraction of these weak radiations large enough so that they may be of service in monitoring laboratories. Moreover, the housing for the GM tube described here permits using the tube at some distance from the meter, allowing more flexibility in monitoring and incidentally permitting any scaler to be used as a detector of contamination.

A thin-walled, silvered, self-quenching tube is mounted in a stainless-steel housing, provided with mesh-covered windows over the sensitive area of the tube. The use of stainless steel permits ready decontamination of the probe itself in case of contamination, a nitric acid wash being sufficient in most cases. Fig. 1 shows some of the constructional details of the

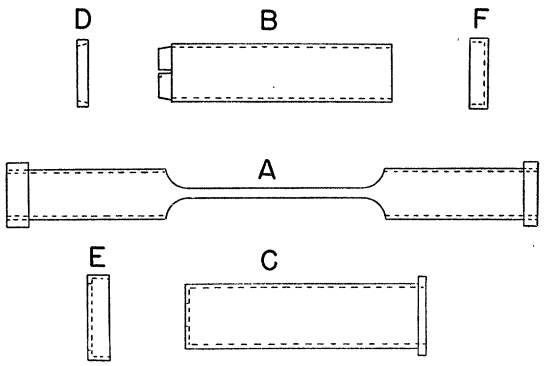

FIG. 1

probes used in this Laboratory. A, the body of the probe, is tubing, 10 inches long and 1 inch in diameter, which is attached to handle C by means of collar E. Tube B slides over A and can be secured in a position over the windows by tapered collar D. When not required in this position to protect the GM tube or to distinguish gamma from beta radiation, it is pushed back toward handle C. By making slide B $\frac{1}{16}$ inch thick, the original calibration (in R's/8-hour day) of a Herbach and Rademan Model GLR-200 Radiation Meter is sensibly unchanged when B covers the windows. With the slide open, the sensitivity of this meter is increased more than 10-fold for energetic radia-

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tion, and the detection of weak radiation is made possible. Traces of C^{14}, for example, are distinctly indicated, although weaker radiation (*1*) is not detected.

By means of a suitable connector at the end of handle C the probe is attached to the meter or scaler with co-axial cable, up to 20 feet long. In the authors' experience, the high potential supplied by an AC-operated type radiation meter requires very little change in value to enable the new tube to work on its plateau (ca. 800 volts for commercial tubes of this type).

In one application, this probe was attached to a Herbach and Rademan meter to which, in turn, had been added a simple audioamplifier and loud-speaker, obviating the necessity of looking at the meter while testing for stray radioactivity. The frequency of occurrence of the audible clicks is a measure of the intensity of the radiation passing through the probe. In another application, the described probe was attached to a standard scaler of 64, where it worked equally well.

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Use of the Hydra for Pharmacological Study

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The hydra responds to touch by a withdrawal of its tentacle from the point of contact. This process presumably involves its primitive nervous system, which consists of a simple nerve network without a central organization such as a brain. The hydra, therefore, should have possibilities as a test object for the study of certain drugs which act on nerve mechanisms. For instance, local anesthetics, which act on the peripheral portions of the nervous system, would be expected to abolish the tactile response, whereas central depressants, such as hypnotics, would not. These ideas were confirmed in the following experiments.

Individual specimens of *Hydra oligactis* were placed in glass dishes containing 5 ml. of glass-distilled water. Within 15 minutes, the hydra attached itself to the bottom of the dish. The drug to be tested was then added to the water, and changes in shape, in spontaneous movements, and in response to vigorous tactile stimulations with a glass rod were noted at 1-minute intervals.

In agreement with the above postulates, it was found that each of the three local anesthetics tested (cocaine, procaine, and pontocaine) abolished the response to tactile stimulation; and, as was expected, the general hypnotics, Dial and Evipal, failed to inhibit this reaction. The local anesthetics also frequently caused the hydra to become detached from the dish. Perhaps this was a further manifestation of peripheral nerve depression. The abolition of tactile response by the local anesthetic was not due to the death of the hydra, for it was possible to restore the sense of touch by replacing the local anesthetic solution with fresh water.

Certain quantitative relationships were also observed for the local anesthetics. The minimum effective dilutions for pontocaine, cocaine, and procaine were, respectively, 1:25,000, 1:5,000, and 1:1,000. The drugs were therefore effective in the ratio 25:5:1, which is similar to that recorded for higher animals. Table 1 shows that the time required for the onset of tactile anesthesia increased as the concentration of cocaine decreased. A similar relationship was found for procaine. These results are again comparable to those obtained on common laboratory animals.

TABLE 1

EFFECT OF VARYING CONCENTRATIONS OF COCAINE ON TIME OF ONSET OF ANESTHESIA IN THE HYDRA

Concentration (mg./ml.)	Onset of anesthesia (min.)
0.2	Partial anesthesia
0.25	20
0.4	25
0.4	30
0.4	28
0.4	37
0.4	11
0.5	3
0.5	8
1.0	2
1.0	2
1.0	11
1.0	4
2.0	Disintegration

All of the drugs mentioned produced changes in the size and shape of the hydra. The local anesthetics regularly caused an initial contraction which was soon followed by a return to the original size. The only effect of the barbiturates was to produce a persistently shortened and thickened hydra.

The actions of certain other drugs on the hydra were also observed. The analgesic, morphine, which is believed to act centrally, produced no visible effect. Curare, after an initial contraction, produced great elongation, often to two or three times the original length. A tendency to form spirals or curls was noted. There was no loss of tactile sense or of spontaneous movements. Papaverine-treated hydrae first contracted and then regained normal size, but became rigid with complete loss of spontaneous movements, of response to touch, and of response to acetylcholine. The action of the latter drug by itself was limited to an initial contraction and was difficult to assess, since many things, *i.e.* salt solutions, cold, water movement, etc., caused brief contractions of the hydra. Although these may be qualitatively similar, the possibility remains that different drugs may produce contractions differing quantitatively in extent and duration.

The hydra also appears to have interesting potentialities for the analysis of the toxic actions of certain drugs. Protoplasmic poisons such as strong cocaine solutions were quite destructive to the hydra. A series of amidines, which were known to produce necrosis in higher animals, actually disintegrated the hydra within a matter of minutes. On the other hand, drugs which exert their lethal actions in higher organisms by affecting such organizations as the respiratory center, were relatively harmless. For example, neither morphine nor the very toxic curare killed the hydra, even in high concentrations.