lated psychopharmacological interest by means of the Aminco-Bowman scanning spectrophotofluorometer. The instrument was calibrated to an activation reading of 350 mμ and a fluorescence reading of 450 mμ for quinine at a concentration of 0.1 μg/ml dissolved in 0.1*N* H_2SO_4. Data obtained were (i) activation and fluorescent maxima, (ii) the widest optimal range for measurement of concentrations in which these maxima were constant, and (iii) that range of concentrations (within the afore-mentioned range) that gave a linear response curve as measured by fluorescence intensity. Standard linear calibration curves for each of the compounds tested could then be plotted. Calculations revealed that the 5-hydroxyindoles absorb less energy for activation and emit more fluorescent energy in the activated state than the parent indole compounds.

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Photoscanning Detection of Radioactive Tracers in vivo

Previously described scanning methods that provide a graphic representation of the distribution of radioactive materials within the human body have an arithmetic relationship between the gamma flux detected by the scintillation counter and the density of the resulting image (*1*). When the difference in radioactivity between the target and nontarget tissues is small, as in the case of brain-tumor localizations with iodinated human serum albumin, this type of equipment fails to delineate clearly the areas of abnormal concentration.

This preliminary report describes apparatus that was designed to give maximum contrast for a minimum difference in activity. This apparatus provides good definition with small dosages and an absence of background fogging without loss of significant data. It differs from the apparatus described by Kuhl *et al.* (*2*) in that even higher contrast can be obtained with equipment readily available in the average isotope laboratory, without the necessity for manufacturing a special electronic amplifier. The examples of clinical studies shown are representative of many such studies that have been performed with this instrument in the course of the past 18 months.

In this system, the signal from the scanning scintillation probe was fed into a single-channel pulse-height analyzer in which scattered radiation was discriminated against and by which the primary gamma emission was passed on as a signal to a count-rate meter. The output of the count-rate meter was then fed to a potentiometer-type recorder (*3*). A 20-ohm wire-wound potentiometer was mechanically coupled to the pen drive wheel of the recorder in such a fashion that maximum deflection of the recorder gave minimum resistance through the potentiometer. This potentiometer was in series with a small, tungsten-filament light source (*4*) that was mechanically fixed to the scanning probe so that the physical relationships of the two were constant. The electric supply for the tungsten filament was provided by a 6.3-v filament transformer. The light source was focused into a narrow slit by a 0.5-in. diameter Lucite rod acting as a cylindrical lens. Screen type x-ray film in an x-ray film cassette was placed beneath the light. The opaque face of the cassette was replaced by transparent red plastic 1/16 in. thick. The red plastic prevented fogging of the film from external light sources if the room lights were off, but allowed exposure of the film by the concentrated light source of the instrument. This obviated the need for a lightproof film holder.

As the probe passes over the patient's body and detects an increased gamma flux, the count-rate meter drives the recorder, which in turn removes resistance from the light circuit. In consequence, the light increases in brilliance and the film is exposed. Because of the marked dependence of light emission from a tungsten filament on changes in current, extremely high contrast is obtained, so that the net result can be a 95 percent increase in film density for a 10 percent increase in count rate.

Figure 1*A* is a photoscan of a normal thyroid with 4.5 μc of I^{131} in the gland; Fig. 1*B* is the image of a metastatic carcinoma of the thyroid with 10.3 μc in its substance, superimposed over an x-ray of the region involved; Fig. 1*C* is a lateral scan; Fig. 1*D* is an anteroposterior scan of a patient with a 2- by 1.5- by 1-cm

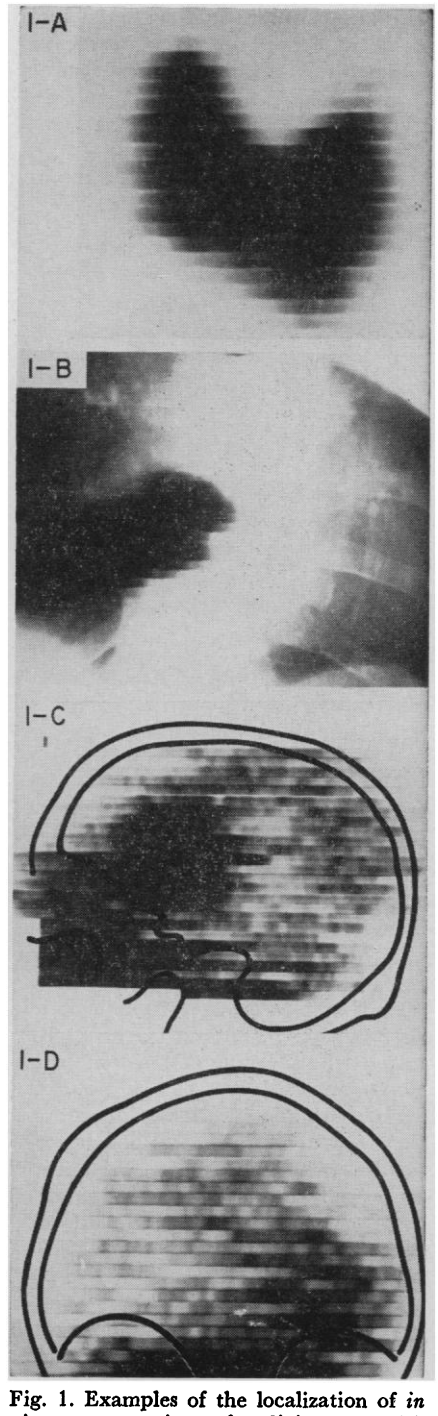

Fig. 1. Examples of the localization of *in vivo* concentrations of radioisotopes with photoscanning techniques.

cerebral metastasis to the left temporal lobe from a primary carcinoma of the breast. This patient received an intravenous administration of 300 μc of I^{131}-labeled human serum albumin 24 hours before the scan (*5*). It is important to note that the count rate over the site of the lesion was only 14 percent higher than the expected normal count rate for this position.

These studies were performed with a 1- by 1-in. sodium iodide (thallium activated) crystal having a lead collimator

with an aperture 2 in. long and 1 in. in diameter. It is hoped that a focusing collimator as described by Francis *et al.* (*6*) will increase "see-ability" and definition. Work is in progress with this type of equipment (*7*).

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4 October 1956

Nutrition of Plant-Sucking Hemiptera

The technical difficulties of culturing a plant-sucking insect apart from its host have hampered, if not effectively prevented, detailed studies of the biological relationships between sucking insects and their host plants. Many problems of importance to both agricultural and theoretical biology lie in this difficult and complex area of interest. Such problems include the breeding of resistant plants, transmission of plant pathogens, toxicogenesis, host plant specificity, insect nutrition, and many others. Although a few plant-chewing insects have been reared successfully through their life cycles on aseptic purified diets (*1*), no plant-sucking forms (aphids, leafhoppers, plant bugs, and so forth) have been so reared.

Carter (*2*) was apparently the first to devise a technique for maintaining adult leafhoppers apart from a host plant for several days. His method involved offering insects a liquid diet covered with a membrane. The leafhoppers obtained the nutrient by penetrating the membrane with their piercing-sucking mouth parts. This membrane technique has been used by a number of workers to investigate insect transmission of plant viruses, and a number of modifications have been tried. However, as far as is known to us, neither the original technique nor any of its modifications has permitted the successful rearing of the immature stages of any species of plant-sucking insect.

At the beginning of the study reported here (*3*), nymphs of a number of species of aphids, leafhoppers, and plant bugs were used in attempts to rear the insects on liquid diets covered with a large variety of membranes under a number of different environmental conditions. Although some of the insects survived such conditions for 2 or more weeks, no growth or development was observed. At least some feeding occurred, as indicated by intestinal recovery of vital dyes that had been added to some of the liquid diets. The amount of feeding was distinctly suboptimal in all cases, however. The preliminary trials showed that two hemipterous insects were well suited for further investigation, for they were hardy and could be maintained easily in stock cultures on natural food plants. These two species were the large milkweed bug, *Oncopeltus fasciatus* (Dallas) (Lygaeidae), and the one-spot stink bug, *Euschistus variolarius* (P. de B.) (Pentatomidae). Neither of these insects fed successfully under conditions in which the membrane technique or any of its numerous modifications was employed.

In all previous work on the feeding of sucking insects, it was assumed that a liquid diet and a penetrable membrane were necessary conditions for artificial feeding, and the assumption was never subjected to experimental test. Our uniform lack of success with this method led us to test the hypothesis that a liquid diet and a penetrable membrane are not necessary. Using newly hatched nymphs of *Oncopeltus* and *Euschistus*, we tried a number of different diet forms, including gels, powders, and semisolid diets. Nymphs of both species fed and grew slowly on a powdered diet that had been moistened and rolled into small pellets. Under these feeding conditions, a supplementary water source was found to be necessary; it was provided in the form of a moistened cotton wick protruding from the floor of the rearing chamber. The food material was renewed every day to minimize the effect of contamination by microorganisms and because the diets tended to harden as they dried.

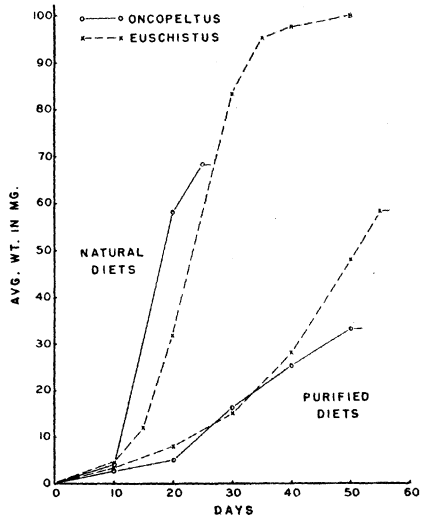

Fig. 1. Growth of *Oncopeltus fasciatus* and *Euschistus variolarus* on natural and purified diets.

Table 1. Components of a purified diet used in studies of the nutritional requirements of *Oncopeltus fasciatus* (Dallas) and *Euschistus variolarius* (P. de B.).

Constituent	Amount used	
	Wt. (g)	Percentage of dry diet
Glucose	6.25	24.3
Soluble starch	6.25	24.3
Sodium caseinate	6.25	24.3
Corn oil	1.25	4.9
Cholesterol	0.25	0.9
Mineral salt mix	0.50	1.9
Brewers yeast powder	5.00	19.4
Distilled water	15.00	0.0
Total	40.75	100.0

Several dozen different dietary formulations were tested, and the diet shown in Table 1 was the most nearly satisfactory. Both species have been reared from egg to adult on this diet. The growth obtained (Fig. 1) was suboptimal, the insects on the purified diets growing at half the rate of the controls on natural diet and attaining but about half the normal body weight. The importance of these results does not lie in the nutritional efficacy of the diets employed, but in the finding that a liquid diet and membrane barrier are not necessary conditions for feeding.

During the course of the investigation, a number of observations were made on factors that influenced the feeding behavior of the two insect species. Feeding appears to be greatly influenced by the physical and chemical conditions imposed by the diet and the rearing chambers employed. Feeding was very poor on the purified diet if the yeast powder was replaced by a mixture of B vitamins. This effect was found to be caused by (i) an unidentified attractant contained in yeast and (ii) a possible repellent effect of choline chloride. Starch stimulated feeding, whereas glucose, fructose, and sucrose did not.

Difficulty was encountered in inducing newly hatched nymphs of *Oncopeltus* to feed on the purified diets. The nymphs would feed readily on eggs of their own species and on milkweed seeds. Nymphal mortality was very high on the purified diet, except in cases where the insects were allowed to feed on eggs or seed for a day or so immediately after hatching. This difficulty was not encountered with *Euschistus*.

The suboptimal growth obtained with the purified diets is not necessarily indicative of nutritional deficiencies.