ture effects on organic processes, the contrasting action of acids and bases, gelation, coagulation, surface-tension and the structure of emulsions. This technique, therefore, makes possible in an introductory course of general biology the inclusion of experiments on biochemical subjects heretofore regarded as too difficult or impractical, and these subjects are the very ones most essential to any consideration of organisms as physicochemical mechanisms.

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MARKING LIVING FISHES FOR EXPERIMENTAL PURPOSES

IN experimental investigations with fishes it is frequently desirable to be able to distinguish individuals. When more than a half dozen are used at a time this becomes somewhat of a problem. Large fishes may be "tagged" by the methods in use in the Bureau of Fisheries, but these methods are inapplicable to small fishes, such as *Fundulus,* which are commonly used for experimental purposes. Clipping or punching the fins leaves an opening for infection and interferes with the normal movements of the fish. For experiments of brief duration, stains such as mercurochrome may be used, but these wash off in a very few days.

Using *Fundulus parvipinnis,* I tried marking with a fine hypodermic needle and india ink. Excellent results were obtained when the needle was inserted under a scale from behind, holding the syringe nearly parallel to the fish's body. The introduction of the needle must be carefully made; as soon as the point "takes hold," a delicate pressure is applied to the plunger and the needle withdrawn immediately. The needle should penetrate the scale pocket but must not break through the dermis. A little practice is all that is needed to rapidly mark large numbers of fishes without injuring them. When properly done the result is a round black spot from one to two millimeters in diameter which remains intensely black for several weeks and only begins to disappear after forty to sixty days. The mark seems to be absolutely permanent on specimens preserved in formalin.

In this laboratory over three hundred fishes have been thus marked and kept under various environmental conditions for periods ranging from two weeks to several months without showing the slightest harmful effect of the marking. Any part of the fish may be marked, but I have found the sides and venter most suitable, avoiding the head and the lateral line.

A number of other inks and stains were tried, but none of them proved satisfactory, some not holding their color and others causing a harmful local irritation. With a good grade of india ink, however, it was remarkable that not even a slight swelling or distortion of the scales was apparent and not a single case of infection was seen.

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SPECIAL ARTICLES

ASSOCIATION OF THE CAUSATIVE AGENT OF A CHICKEN TUMOR WITH A PROTEIN FRACTION OF THE TUMOR FILTRATE

SINCE 1911 when Rous reported on the transplantability of a chicken sarcoma a number of other fowl tumors have been transplanted and studied. The outstanding features of these sarcomata are that they can be transferred to no other species of fowls; that all, with the exception of two, differ from each other in their histology and general biological behavior on transplantation; and that the tumors in transmission from fowl to fowl retain all their finer characteristics and can be passed from fowl to fowl by filtrates and desiccates as well as by grafts of living tumor cells. While the filtrable agents obtained from the tumors have been generally referred to as viruses, their extreme specificity and the multiplicity of tumor types which are faithfully transmitted in each case by the agent seem to separate them from the virus class of disease producing agents as generally defined at the present time.

In our recent studies we have endeavored to determine more precisely the nature of the tumor-inducing agents, which possess the power to stimulate cells not only to grow but to undergo differentiation in specific ways. The present report deals with the results of the fractionation of the proteins contained in the extracts of Chicken Tumor 1 of the Rockefeller Institute series.

In the first tests differential precipitation was accomplished by dialyzing out the salts by means of the ingenious apparatus devised by Dr. J. J. Bronfenbrenner. After concentrating the Berkefeld filtrate of the tumor in Alumdun thimbles lined with soluble cotton membranes, the salt content of the concentrate was reduced by electrodialysis. In the very short time of three to seven minutes, a clear, mucoid material precipitated out, for the most part about the positive pole and in the bottom of the thimble. This precipitate injected into chickens proved active in the production of tumors; while the remaining fluid, though still containing considerable protein, proved inactive. Moreover the tumor agent may be precipitated in a highly active form by electrodialysis from