IDENTITY OF AN IODINE-STORING TISSUE IN AN ASCIDIAN

THE thyroid gland, engaged in the fabrication of its hormone, is the only organ in vertebrates capable of withdrawing considerable amounts of iodine from the blood stream and storing it within itself in relatively high concentration. Recently, by the use of iodine which has been made radioactive, and which will therefore affect a photographic plate, it has become possible to provide a graphic demonstration of this property of iodine-accumulation of thyroid tissue.

With this simple test available, it was of interest to determine whether a protochordate, lacking a thyroid gland, but possessing an organ which is considered its morphological homologue, the endostyle, is capable of storage of iodine. For this purpose about 100 of the small littoral tunicate *Perophora annectens* Ritter were kept for two days at 10° C. in 800 cc of sea-water to which had been added an amount of radio-iodine[1] having a total activity of 150 μ-curies. The mass of iodine involved, as the sodium salt, was less than 0.1 mg. The half life of this preparation is eight days.

After exposure to the radio-iodine some of the animals were dried on glass slides, and some were fixed in formalin and sectioned serially. The slides, bearing either the whole-mounts or serial sections, were placed in close contact with a sensitive "no-screen" x-ray film. After having obtained a satisfactory radio-autograph of the serial sections, they were stained in haematoxylin-eosin.

Contrary to expectation, the radio-autographs of the whole mounts showed that no tissue within the body proper of the tunicates stored iodine. It was clear, however, that the stolon was capable of iodine accumulation to a degree fully as great as the vertebrate thyroid. Matching of the serial-sections with their radio-autographs demonstrated that the endostyle stored no iodine whatsoever and that the tissue within the stolon responsible for the remarkably strong iodine storage was the stolonic septum.

The stolonic septum, in most of those ascidians possessing this structure, is a reproductive organ, contributing to the formation of buds. The usual source of the stolonic septum is the pharynx in the region of the endostyle (see discussion by Garstang[2]). In *Perophora,* however, the endodermal origin of the septum is not clear, although it is well established that it is the direct source of all endodermal tissue of the bud.[3,4]

It must be remembered that the iodine which produced the radio-autographs of the serially sectioned animals had remained in the 8 μ sections after passing through aqueous and alcoholic solutions, alcohol-ether and xylene, and was, therefore, probably organically bound. This activity by the stolonic septum of *Perophora,* resembling that of the thyroid in its ability to remove iodine from the blood stream, bind it organically, and store it in high concentration, would seem to indicate that the endostyle in this animal may not be the homologue of the thyroid, especially when it is noted that the endostyle displayed no such properties. Indeed, Marine[5] has shown that only a small part of the rather complex endostyle in the ammocoetes of cyclostomes is involved in the formation of the thyroid tissue of the adult. The pharyngeal derivation of the stolonic septum in tunicates as well as its demonstrated iodine-storing activity invite the re-examination by modern workers, with improved techniques, of the protochordate homologue of the vertebrate thyroid gland.

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THE POLARIZATION OF ATMOSPHERIC HAZE[1]

THE partial plane polarization of skylight was discovered by Arago in 1811. The theory of this phenomenon was later developed by Lord Rayleigh and is described in his papers on the more general subject of the scattering of light by small particles. An equally interesting and more important phenomenon is the polarization of atmospheric haze or air-light, the luminous veil which obscures distant landscape objects. Like skylight, the air-light is most strongly polarized in a direction at right angles to the sun, and if $F_{max.}$ is the fraction of light polarized in this direction, the fraction F_θ polarized in a direction making an angle θ with the direction of the sun is given approximately by the equation

$$F_\theta = F_{max.} \frac{\sin^2 \theta}{1 + \cos^2 \theta}$$

provided that θ does not depart greatly from 90°. On clear days when the scattering particles are very small, $F_{max.}$ usually has values between 0.5 and 0.7

[1] The writer is indebted to the Radiation Laboratory of the University of California, and especially to Dr. J. G. Hamilton, for the radioactive iodine used in this work.

[2] W. Garstang, *Quart. Jour. Micr. Sci.,* 72: 51, 1928.

[3] A. Kowalevsky, *Rev. Sci. Nat. Montpell.,* 1874.

[4] W. E. Ritter, *Jour. Morph.,* 12: 149, 1896.

[5] D. Marine, *Jour. Exper. Med.,* 17: 379, 1913.

[1] Haze is sometimes defined as particles suspended in the atmosphere, but a definition which is more compatible with the usual meaning of the word and describes observed facts in a more satisfactory manner defines haze as a luminous condition of the atmosphere, which makes haze synonymous with air-light.

and is about the same for all wave-lengths throughout the visible range of the spectrum. When the haze is caused by larger particles suspended in the air, $F_{max.}$ may be considerably less than 0.5 and seems to be of a selective nature, having larger values for the longer wave-lengths. For haze resulting from particles large in comparison to the wave-length of light, such as those of fog, polarization due to scattering ceases.

The writer has conducted a series of experiments with colored polarizing screens which indicates that the polarization of the air-light may be of considerable importance in the detection of forest fire smokes from high mountain lookout points. When viewed through a combination polarizing screen and red filter, the visual range of distant objects may be considerably increased, because under favorable conditions this filter combination removes a large part (the polarized fraction) of the atmospheric haze. The light given off by smoke from fires spreading in fresh fuel is only slightly polarized; hence such smoke shows up plainly when the surrounding polarized air-light is removed. The light from thin blue smokes, such as are given off by some smoldering fires, is rather strongly polarized and not easily seen through a polarizing screen rotated so as to extinguish the polarized fraction of the light. The use of a polarizing filter is restricted to certain directions with respect to the sun and it can not be used on cloudy days. It is also ineffective for penetrating fog or removing haze caused by particles of condensed water vapor suspended in the air.

The combined phenomena of (1) selective transmission of red light through the atmosphere, (2) polarization of light of all wave-lengths scattered in directions approximately perpendicular to the sun's rays, and (3) for some types of haze the selective polarization of the longer wave-lengths, make the polarizing screen and red filter an effective haze cutting device. The best results have been obtained with this device in long-distance photography, although it is almost as effective for direct visual work. On rather clear days, distant mountain peaks photographed through the filter on panchromatic film show as much detail as is shown on infra-red film with a red filter. Photographed from Mt. Mitchell in North Carolina, high cirrus clouds almost 350 miles away in western Kentucky showed up plainly on panchromatic film, and only the curvature of the earth prevented a visual (or photographic) range greater than this. A neutral polarizing screen is equally effective for removing haze in color photography.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE TYPING OF HEMOLYTIC STREPTOCOCCI[1]

THE control of outbreaks of hemolytic streptococcal infection may depend on the prompt identification of the epidemic type of hemolytic streptococcus. Strains from human sources can be typed either by Lancefield's[2] precipitin test or by Griffith's[3] slide agglutination technic. The main difficulty in the typing by either method is the production of satisfactory rabbit antisera. Frequently effective rabbit antisera may be obscured by the existence of a pro-zone when the slide agglutination method is used. The purpose of this report is to call attention to this finding because failure to recognize it may cause good agglutinating serum to be discarded.

In the past we have made a 1:5 dilution of the serum to be tested as recommended by Griffith. Early this year, before discarding a sample of serum, out of curiosity we made serial dilutions of it and were surprised to find that it agglutinated the homologous organism strongly in a dilution of 1:80 in spite of the fact that it failed to do so either undiluted or when diluted 1:10. This experience has occurred frequently. Examples are shown in Table 1.

TABLE 1

EFFECT OF DILUTION OF 5 RABBIT ANTISERA ON AGGLUTINATION OF THEIR HOMOLOGOUS HEMOLYTIC STREPTOCOCCI

Dilutions of antiserum	Hemolytic streptococcus				
	Type 1	Type 6	Type 8	Type 11	Type 12
Undil.	−	−	−	−	−
1:10	±	±	−	±	−
1:20	1+	2+	2+	2+	±
1:40	1+	3+	3+	2+	±
1:60	2+	3+	3+	2+	1+
1:80	2+	2+	2+	2+	2+
1:160	1+	2+	2+	2+	2+
1:320				2+	1+
1:640				1+	

The dilution of typing serum has additional advantages which should be mentioned at this time. With an optimum antigen-antibody ratio specific agglutination is maximal and almost instantaneous. This helps to distinguish it from non-specific agglutination which may occur after several minutes when some strains of hemolytic streptococci are mixed with rabbit serum.

It has been pointed out by de Waal[4] that in the

[1] This work was aided by a grant from the Fluid Research Fund of the Yale University School of Medicine.

[2] R. C. Lancefield, *Jour. Exper. Med.*, 47: 91, 1928.

[3] F. Griffith, *Jour. Hyg.*, 34: 542, 1934; 25: 385, 1926.

[4] H. L. de Waal, *Jour. Hyg.*, 40: 172, 1940.