resemble the data reported by these investigators and suggest that in this respect the underlying genetic phenomenon may be similar. The exact nature of the defect in acatalasemia is at present not clear.

EDWIN T. NISHIMURA
HOWARD B. HAMILTON
THOMAS Y. KOBARA
Atomic Bomb Casualty Commission, Hiroshima and Nagasaki, Japan
SHIGEO TAKAHARA
YOSHIO OGURA
KATSUSABURO DOI
Department of Otorhinolaryngology, Okayama University Medical School, Okayama, Japan

References and Notes

1. S. Takahara and H. Miyamoto, *Jibi Inkoka (Otorhinolaryngol. Clin.)* 21, 53 (1949) (in Japanese).
2. S. Takahara, *Proc. Japan Acad.* 27, 295 (1951); ———, S. Mihara, K. Tsugawa, M. Doi, *ibid.* 28, 383 (1951).
3. S. Takahara, H. Sato, M. Doi, S. Mihara, *ibid.* 28, 585 (1952).
4. S. Takahara, *Lancet* 263, 1101 (1952).
5. S. Takahara, E. T. Nishimura, H. B. Hamilton, T. Y. Kobara, Y. Ogura, K. Doi, preliminary report, Japan Genetic Society meeting, 20 Oct. 1958, Nagoya.
6. S. Takahara and K. Doi, *Nihon Jibi Inkoka Gakkai Kaiho (Japan. J. Otolaryngol.)* 61, 1727 (1958) (in Japanese with English summary).
7. These data were collected under the auspices of (i) the Atomic Bomb Casualty Commission, a field research agency of the U.S. National Academy of Sciences–National Research Council, with financial support from the U.S. Atomic Energy Commission, administered in cooperation with the National Institute of Health of the Japanese Ministry of Health and Welfare, and (ii) the Department of Otorhinolaryngology of Okayama University Medical School, Okayama, Japan.
8. D. Herbert in *Methods in Enzymology*, S. P. Colowick and N. O. Kaplan, Eds. (Academic Press, New York, 1955–57), vol. 2, p. 784.
9. Determinations were performed on non-irradiated individuals over 11 years of age.
10. P. B. Sawin and D. Glick, *Proc. Natl. Acad. Sci. U.S.* 29, 55 (1943).

20 April 1959

Presence of Myoglobin in "Cartilage" of the Marine Snail Busycon

Abstract. The odontophore of the snail *Busycon* has been found to contain myoglobin. The red pigment is readily extracted with water, and spectrophotometric analysis shows the characteristic peaks of myoglobin at 575 and 539 mμ. Although the odontophore is considered to be cartilaginous, it contains, not a chondroitin sulfate, but a polyhexose sulfate. This unusual chemical composition may be responsible for the absorption of myoglobin by the odontophore.

The occurrence of myoglobin in the marine snail *Busycon caniculatum* was first noted by Ball and Meyerhof (*1*), who studied the myoglobin and respiratory enzymes of the muscles associated with the radula of this snail. Since the blood pigment of *Busycon* is hemocyanin, it is of interest to note the occurrence of an additional oxygen-carrying pigment. In recent studies on the cartilage-like tissues of some marine invertebrates it was noted that the odontophore (the supporting rod for the radula in the proboscis) of *Busycon* contained a bright red pigment. This pigment was readily extracted with water, and subsequent analysis of the aqueous solution of pigment in a Beckman model DU spectrophotometer proved it to be myoglobin. This solution of pigment gave an α peak at 574 mμ and a β peak at 538 to 539 mμ. These peaks are in agreement with the data of Ball and Meyerhof (*1*) for the muscle myoglobin of *Busycon*.

Myoglobins have a higher oxygen-carrying capacity and are more soluble than hemocyanin. Therefore, myoglobin would probably be a more efficient respiratory pigment in the comparatively active movements of the radular apparatus. The radular musculature is rich in myoglobin, and so is the odontophore, to which the muscles are attached. The fact that the odontophores of young snails do not contain myoglobin and that those of older snails do accumulate the pigment suggests that myoglobin is stored there and is not essential to the metabolism of the tissue.

The odontophores of snails are frequently thought of as being cartilage tissue. With the advent of biochemical analysis, cartilage is currently defined as tissue which contains one or more of the chondroitin sulfates and which, upon hydrolysis, yields a hexosamine (D-galactosamine), a uronic acid, and sulfuric acid. Alkaline extracts of the odontophore extracted with potassium chloride and potassium carbonate (*2*) yielded a material which, upon ionophoresis (borate buffer, *p*H 10.0; potential gradient, 18 v/cm), produced a spot which stained metachromatically with alcoholic thionin (0.15 percent in 65-percent ethanol). This metachromatic material had an ionophoretic mobility (−12.2) slightly greater than that of chondroitin sulfate (−11.8). Pronounced streaking of the material during ionophoresis indicated that the extracted material was badly degraded. On improving the methods of extraction by use of trypsin digestion (*3*), an extract was obtained which gave no indication of being degraded. This extract was strongly metachromatic and had an ionophoretic mobility similar to that of the alkaline extract.

Upon acid hydrolysis (4.0*N* HCl for 18 hours or 1.0*N* H_2SO_4 for 4 hours in sealed glass tubes) and subsequent chromatography (butanol:acetic acid: water, 3:2:1), neither hexosamine nor uronic acid was detected. The only hydrolyzate product detected was glucose. Sulfate analysis (*4*) indicated that the extract contained ester sulfate. The polysaccharide of the odontophore is therefore a polyglucose sulfate and not one of the mucopolysaccharides normally found in cartilage (*5*). Since the odontophore does not contain the polysaccharides characteristic of cartilage, it cannot be considered normal cartilage. A further analysis of the apparently unique chemical composition of the odontophore may help to explain why the myoglobin is absorbed by the chondroid matrix (*6*).

JAMES W. LASH*
Department of Anatomy, School of Medicine, University of Pennsylvania, Philadelphia

References and Notes

1. E. G. Ball and B. Meyerhof, *J. Biol. Chem.* 134, 483 (1940).
2. J. Einbinder and M. Schubert, *ibid.* 185, 725 (1950).
3. S. Schiller, M. B. Mathews, H. Jefferson, J. Ludowieg, A. Dorfman, *ibid.* 211, 717 (1954).
4. R. J. Bertolacini and J. E. Barney, *Anal. Chem.* 29, 281 (1957).
5. A more detailed report on the identification of the polyglucose sulfate is in preparation.
6. This work was done while I was a Lalor Foundation fellow at Marine Biological Laboratory, Woods Hole, Mass.
* Helen Hay Whitney fellow.

27 March 1959

Notes on the Champlain Sea Episode in the St. Lawrence Lowlands, Quebec

Abstract. Palynological studies, coupled with geological investigations and radiocarbon dating, have shown that the Champlain Sea episode in the St. Lawrence lowlands is in part contemporaneous with the Two Creeks interstadial of the Wisconsin glaciation.

Recent studies made on Pleistocene deposits of the St. Lawrence lowlands, Quebec, involving stratigraphic studies by Gadd (*1*), Karrow (*2*), and McClintock (*3*), and palynological studies by Potzger (*4*), Potzger and Courtemanche (*5*), and me (*6*) have clarified the chronology of the late Pleistocene events in that area enough to warrant a reassessment of the previously accepted sequence of these events.

The palynological studies (Fig. 1) have indicated conclusively the regional presence of the postglacial pine period (Fig. 1, pollen zones III and IV), the hypsithermal interval (*7*), and the earlier spruce maximum (Fig. 1, pollen zone V) in post-Champlain Sea deposits of the St. Lawrence lowlands.

In sediments older than those showing the spruce maximum (zone V) the higher percentages of pine pollen (*Pinus banksiana*), accompanied by an increase of non-tree pollen, have been interpreted as evidence for a late-glacial episode (zone VI). The high percentages of pine pollen should, perhaps, be explained by over-representation due to the high pol-