to bending or impact for instance, can be readily replaced by brushing with the dissolved wax or with the solvent.

The softer waxes generally impart a yellowish or brownish color, are prone to stick but are more pliable and being amorphous give a better protection from attack by air or moisture. The harder waxes, such as the above noted, impart no color, do not stick even under considerable pressure and rather high temperatures. They are more apt to yield cracks or breaks under rough handling. On standing, as can be observed under a microscope, the whole film tends to crystallize into a matter mass. It is reasonable to infer that such a film can not give as good protection from the atmospheric attacks as the softer films. Perhaps a satisfactory compromise may be obtained by mixing two or more waxes. Our experiments, however, favor the use of a hard wax as stated.

Due to the rapid evaporation of the carbon tetrachloride and benzene, the solutions become more concentrated when allowed to stand in the air. For this reason the solution should never be allowed to stand in the open except when being used. If the solution becomes too concentrated more of the carbon tetrachloride-benzene mixture should be added. If a hydrometer is at hand, it is a good idea to take the specific gravity of the solution at the beginning and on evaporation of the solvent more of it should be added to bring the specific gravity down to that of the initial solution.

If previous cleaning of the manuscripts is desirable, the procedure described by J. C. Fitzpatrick is suggested.[1] After waxing the manuscript can be conveniently cleaned or washed, although care should be exercised to carefully remove any excess water, especially when hard wax has been used.

No ink has yet been encountered which dissolves or "runs" in the wax or the solution, and the dried film produces no appreciable diminution of legibility.

The fire hazard is generally decreased by the wax. Treatment with insecticides, fungicides or even rodent repellents is not made more difficult. In fact, the use of some of these may be facilitated by dissolving them in the wax solvent.

Further work with protecting films is in progress. The easy application and apparently great usefulness of the procedure described impels us to call it to immediate notice of interested parties.

The halowax used was obtained from Halowax Corporation, 247 Park Avenue, New York City.

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[1] "Notes on the Care, Cataloging, Calendaring, and Arranging of Manuscripts," 3rd Edition, U. S. Government Printing Office, 1928.

THE USE OF LIVE NEMAS (METONCHOLAIMUS PRISTIURUS) IN ZOOLOGICAL COURSES IN SCHOOLS AND COLLEGES

ANSWERING very numerous requests for a free-living nema suitable for school and college class work, attention is called to *Metoncholaimus pristiurus*, a slender, five-millimeter species common in European and North American stagnant marine mud, below low tide—for example, in the harbors at Woods Hole, Massachusetts, and Naples, Italy—a nema suitable for study alive with moderate and high powers of the microscope. It is a well-differentiated, bisexual nema that can be sent by post or express long distances in a living condition, and there seems no reason why the usual collecting agencies should not supply it alive to any inland laboratory at moderate cost. It withstands journeys of thousands of miles; *e.g.*, it has been successfully shipped (both summer and winter) from Woods Hole, Mass., to Washington, D. C.; Durham, N. C.; and Salt Lake City, Utah; and successfully used in class work. One laboratory director reports a "very interesting and exciting two-hour period."

This nema may be ordered from the Supply Department of the Marine Biological Laboratory at Woods Hole, Massachusetts, and no doubt could be supplied from Naples, and many other harbors. Laboratory instructors will find readiest guidance to the anatomy, etc., of this and very similar nemas in *Jour. Washington Acad. Sci.*, vol. 20, No. 12, 1930. Experienced nematologists consider free-living marine nemas the best teaching material for entrance to nematology. *Metoncholaimus pristiurus* belongs to a large marine group, the *Oncholaiminae*—type genus *Oncholaimus*,—abundant in all oceans, and hence may perhaps be considered as nearly "a representative species" as one is likely to obtain from such an immense and varied phylum.

(1) *Collecting.* *Metoncholaimus pristiurus* may be successfully dredged with a metallic, one to two-liter cylindrical vessel, one to two decimeters in diameter and two to three kilograms in weight, cast several yards from shore, allowed to sink to the bottom, and slowly pulled in by means of 25 meters of $\frac{3}{8}$ inch limber rope, firmly linked at a single point on its rim. This dredge, cheaply made from iron pipe, should sink through any bottom growth of eel-grass, etc., so as afterward to bite into the top layer of mud in which the oncholaims live.

M. pristiurus is about the largest nema in its native mud, and hence is readily assembled for shipment, with the aid of appropriate sieves (1st, 1/8 inch mesh to remove coarse débris; 2nd, 1/24 inch mesh to catch the nemas while permitting silt to pass through). Preferably the nemas should defecate in clean, cool sea water for a day or two before examination, since

at the time of collection they may contain considerable ingested mud that would interfere somewhat with the microscopic examination—although the nemas can be profitably examined immediately on collecting.

It is very important to the student of nemas that he *study living material.* For examination alive, *M. pristiurus* may be placed in a drop of tap water for from 10 to 60 seconds until it quiets down, and then mounted at once in a droplet of clear sea water under a thin cover-glass with sufficient pressure to keep the nema from moving more than a very little. This pressure can be applied by drawing the extra sea water from under the round cover-glass with a sliver of filter-paper until the nema can barely move, and then sealing in at once on a turntable with a modicum of smoking hot wax (formula, 1 of beeswax plus 3 of 45° paraffin), best applied from the wick of an ignited, narrow 5-millimeter-gauge taper made of the wax, somewhat like a Christmas-tree candle;—but boiling hot wax and a No. 2 water color brush will answer. A small amount of movement of the nema during microscopic examination is very desirable because the various nemic organs reveal their contours more readily when sliding slightly one on another. Mounting direct into 5 per cent. KOH solution displays various cuticularized organs—mouth parts, spicula, etc., more distinctly.

(2) *Advantages.* There are many marine nemas obtainable at seaside stations more suitable for class use than *M. pristiurus,* but none of them is yet known to bear transportation so well. The drawbacks of *Metoncholaimus pristiurus* are: (1) Its amphids (very important characteristic organs, universal in nemas) though well developed, are rather difficult to see; (2) the sensory setae so prevalent on aquatic nemas are here not very well developed; (3) there are no eyespots; (4) the tissues are not quite as transparent, and hence not quite as readily studied, as in some other forms.

Its advantages are: (1) It is relatively large, and is available at any season; (2) it can be shipped long distances alive, and be kept alive for weeks in cool laboratory storage; (3) it presents the demanian system of organs—indicative of the fact that nemas possess whole systems of organs as yet comparatively unexplored; (4) it presents all the numerous advantages which well-developed free-living forms possess over the parasitic forms commonly used as teaching material, such as, among other things, (a) distinctly developed mouth parts, and salivary glands, (b) caudal glands and spinneret, (c) well-developed amphids, (d) sensory setae, (e) readily visible central nervous system, parts of the peripheral system being easily demonstrable by using sea water-methylene blue (over night), (f) a more or less visible renette, (g) well-developed longitudinal cords and associated organs, (h) visibly differentiated intestinal cells (among them the "birefringent" cells), (i) a double gonadic system in the male, *the primitive and normal condition* (although, here, as it happens, single in the female and thus atypical), (j) growth, fertilization, etc., of the living ova can be observed *in situ;*—all these more or less readily observable without dissection.

(3) *Shipping.* It is recommended that in transportation for laboratory use *M. pristiurus* be shipped with half a liter or so of sea water in a separate container, since additional pure sea water is necessary as a mounting medium for the living nema, and permits renewal during lengthy laboratory storage of the sea water containing the nemas; also, that it be put into the mail or express immediately before closing time, that it be packed with ice or solid insulated CO_2 so as to remain cool in transit, and that it be shipped under cool conditions. The nema is so small that hundreds can be packed in the small space suitable to air mail, and this method of shipping is very desirable, especially as air mail temperatures are not likely to be excessively warm. These nemas stand freezing temperatures.

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SPECIAL ARTICLES

A CHART OF RADIOACTIVE ELEMENTS INDICATING THEIR STRUCTURE

THE terminology and some of the data of this chart are based upon the recent report of the International Radium-Standards Commission.[1] The purpose of the chart is to indicate the structure of the nucleus as well as that of the electron shell of all radioactive isotopes.

[1] Curie, Debierne, Eve, Geiger, Hahn, Lind, St. Meyer, Rutherford and Schweidler, *J. Am. Chem. Soc.*, vol. 53, p. 2437, July, 1931.

The lower part contains the familiar disintegration series: double circles for the uranium-radium family; single circles for the uranium-actinium family, and squares for the thorium family. The position of AcU and UY is doubtful and indicated by the broken circle. The average life of the atomic species is indicated by bold type—those having a period of over one year; Roman characters—those from one hour to one year, and italics—those existing less than one hour.

Nuclear structure is indicated by the number of