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SOME BIOLOGICAL APPLICATIONS OF ORGANOMETALLIC COMPOUNDS[1]

By Professor HENRY GILMAN

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ORGANOMETALLIC compounds are compounds which have a metal directly attached to carbon, and are conveniently designated by the formula RM where M is a metal. They fall into three broad groups: those which are highly reactive *chemically,* like organopotassium compounds; those of moderate reactivity, such as organolithium and organomagnesium compounds; and those of relatively low reactivity, like the organomercury and organobismuth types.

Only those organometallic compounds of low chemical reactivity find any immediate biological application. It is out of the question, for example, to use organopotassium compounds directly, for they are not only spontaneously inflammable but react violently with water and carbon dioxide; and both violently and indiscriminately with the organic materials that go to make up cells.

However, it is probable that reactive types like those of magnesium (the Grignard reagents) and those of lithium are of greatest biological significance not because of their effects on body cells and fluids but because of the uncommon service they give to an understanding of biologically active material. There is hardly a branch of biologically active organic compounds (like vitamins, hormones, carcinogens) wherein RM compounds have not been used in one way or another to throw light on reaction mechanisms and procedures concerned with the structure and preparation of such compounds. It is doubtful if any class of organic compounds exceeds the reactive

[1] Address of the retiring vice-president and chairman of the Section on Chemistry, American Association for the Advancement of Science, December 27, 1940.

and the uncontrollable escape of fibers. It is gradually transformed into perineural connective tissue and after several months can no longer be identified. Regenerating fibers traverse the wound in straight parallel courses instead of in the usual confusion following nerve suture.

It has recently been described[5] that good binding between severed nerve trunks can be obtained by applying clotting blood plasma to the apposed cut ends, and that regenerating fibers under these conditions take fairly straight courses in crossing the scar.[6] Whether this method provides the experimenter with as definite an insurance against undesirable stray fibers as tubulation does, remains to be seen.

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A METHOD FOR DETERMINING AND SPECIFYING LOCALITY BY COLLECTORS

WHILE engaged in studying the flora of Maryland the author devised a system for determining and specifying locality which may be of interest to collectors. The system employs the topographical maps published by the United States Geological Survey which are scaled one inch to the mile. These quadrangle maps are already divided by the coordinates of longitude and latitude into nine nearly equal and approximately rectangular divisions. The longitudinal meridians, of course, converge to the north so that the northern boundary of the quadrangle and the northern boundary of every primary division is, in each case, slightly smaller than the opposite or southern boundary. The nine primary divisions of each quadrangle are numbered .1 to .9 counting from left to right: top row, .1, .2, .3; middle row, .4, .5, .6, and bottom row, .7, .8, .9.

A transparent celluloid over-lay is cut the size of an average primary division for the area to be studied. Since no over-lay can be made to fit all the quadrangular divisions for an area as large as the United States, due to the northward convergence of the meridians of longitude, it is necessary to take the average primary division in a given area as the size of the over-lay to be used.

The over-lay may be prepared from either of two kinds of celluloid: (a) with one side frosted so that it may be ruled with India ink, or, (b) with both sides smooth so that lines may be etched or cut into one side and subsequently filled with colored wax or India ink. This over-lay is divided by coordinately ruled lines into nine equal and approximately rectangular divisions each of which represents a secondary division of the quadrangle. These secondary divisions are numbered .01 to .09, and in the manner indicated above for the primary divisions. Each secondary division is, in a similar way, divided into nine tertiary rectangles and numbered .001 to .009. Finally, each tertiary subdivision is divided into nine rectangles which are numbered .0001 to .0009. Thus, the preparation of the over-lay in the manner indicated provides four sizes of rectangular divisions.

By placing the celluloid over-lay on any one of the primary rectangular divisions of the quadrangle map, any point on the division can be read as a four point decimal. The fifth decimal can be estimated if desired and will locate the point to within approximately a 250 foot radius. Since each quadrangle already bears a name (printed on the map), this name precedes the decimal code in specifying locations, as, for example: "Ellicott .99887."

For field use, the author has found it convenient to cut each topographical map into its nine primary divisions and paste these into a loose-leaf notebook of appropriate size where each is labeled with the name of the quadrangle from which it was cut and the proper primary division number, as, for example: "Ellicott .9." Through the use of these maps in the field, specific locations are determined and recorded at the time of collecting each specimen.

Fortunately, the over-lay described above can be used on the soil maps which are published by the Bureau of Chemistry and Soils, United States Department of Agriculture, and which are scaled one inch to the mile. For field use, as well as for other kinds of uses, it is convenient to mount the soil maps in the same loose-leaf form referred to above, and with each map opposing the page on which the corresponding topographic map is mounted. The simultaneous use of both maps often brings to light very interesting ecological features.

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[5] J. Z. Young and P. B. Medawar, *Lancet*, 1940: 126.

[6] These experiments essentially reproduce conditions first established in tissue culture by the author (P. Weiss, *Jour. Exp. Zool.*, 68: 393, 1934) and confirm the guiding effect of an oriented fibrin matrix on nerve fiber growth.

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