of the foundation, 1211 Cathedral Street, Baltimore, by January 1. Applications received after that date can not be considered for 1943 awards, which will be made the first of March, 1943. This foundation was provided for in the will of the late Dr. George Walker, of Baltimore, for the support of "research work into the cause or causes and the treatment of cancer." The will directed that the surplus income from the assets of the foundation together with the principal sum should be expended within a period of ten years to support a number of fellowships in cancer research, each with an annual stipend of two thousand dollars, "in such universities, laboratories and other institutions, wherever situated, as may be approved by the Board of Directors." Fellowships carrying an annual stipend of $2,000 are awarded for the period of one year, with the possibility of renewal up to three years. Special grants of limited sums may be made to support the work carried on under a fellowship.

ORIGINAL specimens of some of the crude stone tools of the "Peking man" and casts of others have been placed on display in a new exhibit devoted to China's Old Stone Age in the department of anthropology at Field Museum of Natural History, Chicago. The exhibit shows typical stone tools from six Paleolithic sites in China, and explains their presumed chronological sequences; there is also a series of photographs to show the various methods of use of the stone tools.

Nature states that on the invitation of the president and council of the Royal Astronomical Society, the British Astronomical Association is to be accommodated in future in the rooms of the former at Burlington House, London. Negotiations have been proceeding for some months and the final arrangements were completed in time for the British Astronomical Association to hold its first meeting in the new premises on September 30. A large part of the proceedings was devoted to a survey of the history of the association since it was founded in 1890, special mention being made of its founder, Edward Walter Maunder. A number of members spoke about the progress of the association during the fifty-two years of its existence and about the influence of many of its past members in shaping its policy and assisting with its remarkable development. It is worth noticing that the present international crisis has not affected its membership adversely—an indication of the interest which the amateur possesses in various astronomical branches. The new premises provide more adequate accommodation for the library and in other ways supply greater facilities for the members to whom the change has given considerable satisfaction.

DISCUSSION

CATALYSIS AS A BIOLOGICAL FACTOR

IF we apply to biology the extensive knowledge of catalysts and their influence, reinforced as it is by wide experience in the use of catalysts in large-scale organic and inorganic chemical industry, we envisage a factor capable of giving a rational explanation of many obscure and diverse biological processes.

Even before Berzelius coined the word "catalysis" over a century ago (1836), the specificity of action of catalysts had been known, appearing later in Emil Fischer's analogy that enzyme and substrate are related as lock and key. Since specificity, as well as time, is of the essence of all biological happenings, the text-book notion that catalysts merely speed up reactions which would occur spontaneously over indefinite time, has been superseded by the view that catalysts are also *directors* of chemical change, and therefore directors of those biochemical changes which underlie all morphology, physiology and function.

Much of the success attending the industrial use of catalysts is due to recognition and control of the fact that very small changes in the structure or composition of a catalyst may result in great and permanent change in the quantity and chemical nature of the chemical output. To give a concrete case, Sir Gilbert T. Morgan found that a certain concentration of carbon monoxide and hydrogen passed at certain temperature and pressure over a catalyst composed of equimolecular proportions of chromium oxide and manganese oxide gave an effluent containing 80½ per cent. methanol. On adding 15 per cent. rubidium to the catalyst, the effluent under like operative conditions contained only 46 per cent. methanol; but large percentages of higher branching chain alcohols appeared. Where cobalt was added to the catalyst, the formation of higher straight chain alcohols was favored. Since enormous outputs of chemical substances may be determined by small amounts of catalysts prepared in laboratory secrecy and used in factory isolation, the patent literature fails fully to reflect the use of tiny amounts of "promotors," added to catalysts to make them direct the formation of wanted compounds.

While the importance and specificity of catalysts, especially enzymes, as directors of biochemical change had long been recognized,[1] the collateral importance

[1] L. T. Troland, *Monist*, January, 1914; *Cleveland Med. Jour.*, 15: 377–89, 1916; *Am. Nat.*, 15: 321–5, 1917. J.

of the consequences of changes in the biocatalysts themselves was unknown or insufficiently appreciated. Knowledge gained from the industrial use of catalysts, which demonstrated the enormous effects that may result from the addition even of traces of specific promotor substances to catalysts, led the writer to the view[2] that an analogous situation must exist with biocatalysts.

In applying this "promotor" notion to biology, the term "modification" is preferable, since here human choice does not control. We must also recognize that a limiting case of catalyst modification arises where a new active catalyst area is brought into being by union of appropriate substructures, for example, by the fixation of a prosthetic group by a carrier.

There are here epitomized three basic biological events which seem to be clarified by the concept of catalyst modification:

(1) *Differentiation and the Orderly Course of Life:* At definite stages in the development of a zygote, specific molecules or other particles, carried in the zygote cytoplasm or formed by genic or other biocatalysts, apparently modify existing catalysts so that their chemical output is changed in nature or in relative proportions. The fixation of these modifiers may follow, for example, ionic changes which must develop as a consequence of differential diffusion when the blastula mass increases in size, and must become more marked as it assumes the gastrula form. Apart from the heavy responsibilities carried by the genes, we see here a factor that may modify both genic and non-genic catalysts in a specific and orderly manner; and the tiny amounts of the original or "templet" modifier particles could readily be carried in the zygote cytoplasm.

The fact that fully differentiated cells can continue to duplicate themselves, as such, even in tissue culture, proves that a mechanism exists for the heritable continuance of modified catalysts or of catalyst areas produced de novo. This fact has been successfully demonstrated by the work of geneticists with the self-duplicating (autocatalytic) genes, and seems probable with some other biocatalysts.

(2) *Evolution:* Any heritable catalyst change may have as a consequence changes in the biont (plant or animal) which make it structurally and/or functionally different from its progenitors. This would give a physico-chemical basis for evolution, since natural selection, operating on these differences, could result in the establishment of any new species thus originated.

(3) *Cancer:* Here there seems to be a heritable change in cellular catalysts, due to modification or following the introduction of a virus (Rous), with the consequence that the cells continuously duplicate themselves and invade healthy tissue. Non-invasive growth would constitute a benign tumor. Cancers may result from radiation (known also to produce heritable chromosomal or genic changes); or from the introduction of ultrafiltrable particles or viruses, or of definite chemical substances, for example, methylcholanthrene, or 3,4-benzpyrene; or from less defined causes, such as trauma and burns (kangri cancer). Many cancer cells have been grown as such by transplantation or in tissue culture. The main difference between cancerous and other heritable catalyst changes seems, therefore, to lie in the diagnostic consequences of the catalyst change. Other diseases may be considered from this point of view; for it must be stressed that catalyst modification may in some cases be reversible and is not necessarily heritable.

A more extended consideration of these and allied questions will be given in a paper to appear in Volume V of the international series on colloid chemistry, now in preparation.[3]

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THE INFLUENCE OF SEX ON NUTRITIONAL ACHROMOTRICHIA IN MICE

A DIFFERENCE in the response between male and female mice to nutritional achromotrichia was observed with 39 male and 55 female mice of the C-57 strain kept on a diet similar to that employed by Unna and coworkers.[1] The following observations were made.

On the 30th day of the experiment 16 of the 29 or 55 per cent. of the surviving males showed various degrees of graying, while but 3 out of 50 or 6 per cent. of the living females grayed and this was not so marked. Within 75 days all but one of the males had become gray, while 13 per cent. of the surviving females only revealed slight changes.

Three additional groups each of 8 male and 7 female C-57 mice were fed the same basic diet, but each mouse of the first group also received 0.75 mg para-aminobenzoic acid daily and each of the second group 100 gamma calcium pantothenate daily and

Alexander and C. B. Bridges, in Vol. II, "Colloid Chemistry, Theoretical and Applied," N. Y., 1928. Alwin Mittasch, "Ueber katalytische Verurschachen in biologischen Geschehen" (1935); "Ueber Katalyse und Katalysatoren in Chemie und Biologie" (1936); "Katalyse und Determinisimus" (1938), all publications by Julius Springer, Berlin.

[2] J. Alexander, *Protoplasma,* 14: 296–306, 1931; "Colloid Chemistry," 4th ed. D. Van Nostrand Company, 1937; *Biodynamica,* December, 1939.

[3] To appear in 1943, Reinhold Publishing Company, N. Y.

[1] K. Unna, G. V. Richards and W. L. Sampson, *Jour. Nutrit.,* 22: 553, 1941.