B. Jewett, president of the National Academy of Sciences; Alfred N. Richards, professor of pharmacology, University of Pennsylvania; William J. Robbins, director of the New York Botanical Garden; Harlow Shapley, director of the Harvard College Observatory, and Tom K. Smith, president, the Boatmen's National Bank, St. Louis. Members of the executive committee are Winthrop W. Aldrich, Albert F. Blakeslee, Frank B. Jewett, William J. Robbins and Harlow Shapley.

THE Carnegie Corporation has renewed the grant to finance the Committee of Private Research of Western Reserve University for another year. Established a year ago as the outgrowth of the work of the late Dr. Robert C. Binkley, the committee encourages research and private scholarship. Dr. Harold A. Blaine will continue as director of the committee, and William S. Dicks as research associate.

AN Associated Press dispatch reports that the building of the Royal College of Surgeons in London was among the places damaged in recent air raids. It reads: "Valuable museum specimens were lost when the structure, twice slightly damaged in earlier raids, was hit by high explosive and fire bombs. The bulk of the famous Hunterian collection made by Dr. John Hunter, known as the founder of modern surgery, was buried under a pile of fire-swept débris. This collection was bought by the Government for £15,000 two years after Dr. Hunter's death in 1793."

Nature writes: "Owing to the generosity of the Rockefeller Foundation, which has provided a grant for the purpose, the Royal Society is in a position to give some assistance to scientific societies and associations which, as a result of war conditions, are experiencing financial difficulties in the publication of scientific journals."

THE Pharmaceutical Society of Great Britain celebrated in London on May 15 the centenary of its foundation. A thanksgiving service was held in the morning in the parish church of St. Pancras, and a commemoration meeting at Conway Hall was followed by a play, "Jacob Bell and Some Others," which recalled scenes surrounding the actual foundation of the society. The society received congratulations on its century of useful work from many medical associations, learned bodies, manufacturing and trading organizations in Great Britain and from pharmaceutical societies in all parts of the Empire and in the United States.

THE general meetings of the Linnean Society of London, according to *Nature,* were resumed, beginning on March 6. The centenary of the Royal Botanic Gardens, Kew, as a Government institution, occurred on April 1, and at the meeting on April 3, Sir Arthur W. Hill, director of the Royal Gardens, gave some account of the work of Kew during the past hundred years. At the meeting on May 1, the society observed the tercentenary of the birth of Nehemiah Grew, when Dr. Agnes Arber gave an account of his work and that of Marcellus Malpighi. The anniversary meeting was held on May 24, when the president addressed the society. The council is considering the possibility of prolonging the session into July.

DISCUSSION

IS EVOLUTION INSCRUTABLE?

THE undeniable importance of Professor Goldschmidt's recent volume on evolution,[1] and the weight which its author's name justly carries, make it doubly needful that certain of its implications be fully recognized. Dobzhansky's assertion[2] that the acceptance of Goldschmidt's central theory demands a "belief in miracles" seems to me to be literally true, though the statement deserves some amplification.

The difficulties which beset the Darwinian theory of evolution through the natural selection of small variations were recognized by many of Darwin's contemporaries, and were discussed at great length by Darwin himself. Alternative theories of "saltation" or progress through large, discontinuous "jumps" were proposed by contemporary critics, notably by St. George Mivart.[3] Indeed, the rudiments of this idea long antedated Darwin, as witness Geoffroy St. Hilaire.

Mivart's evolutionism, as is well known, was strongly tinged with theology. The continuous intervention of the Creator in the evolutionary drama was fundamental in his world outlook. There was nothing disturbing to him in the notion that complex, adaptive structures could arise abruptly, since all this happened under divine guidance. The "innate tendency" to vary he conceived to be "an harmonious one, calculated to simultaneously adjust the various parts of the organism to their new relations."

It is needless to say that Professor Goldschmidt entertains no such theological interpretation of natural phenomena. Nor can we suspect him of sympathy with "vitalism," "teleology," "innate tendencies" or other forms of biological mysticism. Indeed, Goldschmidt's position would perhaps be more understand-

[1] "The Material Basis of Evolution." Yale University Press, 1940.

[2] SCIENCE, October 18, 1940.

[3] "The Genesis of Species." Macmillan and Company, 1871.

able if he did cherish such views. For he contends that "macroevolution" (*i.e., real* evolution) comes to pass through single, abrupt genetic changes ("macromutations"), capable of bringing about phenotypic alterations of specific, generic or even much greater magnitude. The role of selection is limited to the "immediate acceptance or rejection" of the finished product. Even St. Hilaire's suggested origin of the first bird from a reptile's egg, as repeated by a recent paleontologist, is cited by Goldschmidt with seeming approval.

We should surely need the guiding hand of an entelechy here, if not the direct intervention of the Creator himself. That a single, small, genetic change can produce varied and far-reaching somatic changes no one is better qualified to tell us than Professor Goldschmidt. That somatic changes produced in this way have any necessary tendency to be functionally integrated he has not, however, shown to be probable. Yet the most casual examination of any complex organ shows that it is made up of innumerable interrelated parts, harmoniously adjusted to one another. Consider the structure of even a bird's feather! Only the wave of a magician's wand could have transformed the scales of a reptile forthright into the plumage of a bird.

The trouble here is not so much that we are concerned with very great changes, structural and functional, but that these changes must involve the harmonious modification of parts which are to a large extent independent of one another genetically. Goldschmidt's assurance that "a simple shift in the velocity of one of the integrating processes relative to the others will account for the primary change with all the later unavoidable consequences during subsequent development" may suggest a partial solution of some of the difficulties. It can hardly apply, however, to cases involving the simultaneous though not necessarily parallel, modification of different organ-systems, and particularly to the appearance of fundamentally new structures in some of these. Mivart realized the difficulty of accounting for such functional integration in a theory of evolution by "jumps" and called in a supernatural agent to help him out.

Recent biology has sometimes shown itself so unsympathetic toward the conception of "adaptation" that it has even tended to overlook the facts to which this term is applied. Darwin was largely concerned with the endeavor to explain these facts. We can not, indeed, take them for granted, unless we are prepared to abandon the search for a naturalistic explanation.

It is significant that Goldschmidt's most voluminous line of evidence for the production of major bodily changes through single genetic steps is drawn from the field of rudimentation. Under this head, he has assembled a mass of highly interesting facts. It has long been known that even a single gene mutation may result in the degradation or loss of such important structures as an insect's wings or eyes. It is, however, easy to misinterpret such facts. May I repeat a doubtless unoriginal utterance of my own on this subject: "That a single and extremely simple alteration may effect a radical change in an object, even to its complete annihilation, proves nothing as to the degree of complexity of the object itself or of the processes necessary to bring it into existence."[4]

If Professor Goldschmidt can point to any one case in which a new, complex, adaptive structure has arisen through a single genetic change, and if this same genetic change is shown to have involved the necessary correlative changes in many other parts of the body, he will have gone a long way toward proving his main contention. But he will, at the same time, have left naturalistic biology in a most embarrassing position.

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THE ACTIVE PRINCIPLE OF MARIHUANA

FROM red oil distillates, Haagen-Smith *et al.*,[1] have reported the isolation of a crystalline product having marihuana activity. No other unmodified products possessing such activity have been isolated directly from the red oil, though it is known that synthetic tetrahydro-cannabinol possesses such activity,[2] that cannabidiol can be converted into active products by ring closure,[3] and that hydrogenated cannabinol acetate gives physiologically active products.[4]

We have subjected red oil distillates of high physiological activity to distribution between petroleum ether and methanol. This was followed by extraction repeatedly with alkali and distillation of the residues at 175–210° C (0.2 mm). Chromatographic adsorption on alumina gives a fraction (reddish-blue in ultra violet light) which yields about 30 per cent. of a crystalline 3,5-dinito-phenyl urethane. This urethane on hydrolysis gives an active product. Activities are expressed below in terms of a standard U.S.P. extract of cannabis, Parke Davis, according to procedures previously described.[5]

	Potency	Max. Dev.
Tetrahydro-cannabinol (synthetic)	10	± 3
Hydrolysate from urethane	25	± 10
A potent red oil fraction	85	± 10

[4] *American Naturalist*, March–April, 1934.
[1] Haagen-Smith *et al.*, SCIENCE, 91: 602, 1940.
[2] Adams and Baker, *Jour. Am. Chem. Soc.*, 62: 2405, 1940.
[3] Adams, Pease, Cain and Clark, *Jour. Am. Chem. Soc.*, 62: 2402, 1940.
[4] Bergel and Wagner, *Ann*, 482: 55, 1930.
[5] Walton, Martin and Keller, *Jour. Pharm. and Exp. Therap.*, 62: 239, 1938.