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.

F. B. SUMNER
SCRIPPS INSTITUTION OF OCEANOGRAPHY

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.

The urethane resembles the corresponding urethane of synthetic tetrahydro-cannabinol in solubilities, but was a higher melting point (about 216° C with reddening and gas evolution compared with that of tetrahydro-cannabinol at about 208° C with reddening and gas evolution). The analysis suggests a derivative of methyl cannabinol: C 65.12; H 6.00. The preparation could be repeated. A derivative of an active product which is possibly a tetrahydro-cannabinol has been obtained directly from the red oil.

G. POWELL
M. SALMON
T. H. BEMBRY

COLUMBIA UNIVERSITY
DEPARTMENT OF CHEMISTRY

R. P. WALTON

UNIVERSITY OF MISSISSIPPI,
DEPARTMENT OF PHARMACOLOGY

DESIGNATION OF LOCATIONS ON MAPS AND PHOTOGRAPHS

IN recent issues of SCIENCE, two methods of location designation have been described. One of these is a "gridiron" system,[1] the other employs "latitudes and departures."[2] Both are entirely workable within reasonable limits; neither is suitable, without some or much modification, for use with maps or photographs which are to be reproduced on a scale differing from that of the original.

A third method, which may be called a method of intersection, in which the designation remains unchanged regardless of the enlargement or reduction of the original, is here presented. Through the point to be designated and the lower left corner of the map, draw a line. Record the angle between this line and the lower margin of the map. Repeat the process with a line through the point and the lower right corner. A typical actual designation, using this system, is: *Lake Nokoni,* Rocky Mountain National Park Quadrangle, L 51½°, R 56½°. The letters R and L before the angles refer to the right and left corner angles, respectively.

It will be noted that these designations are unaltered by any change in scale of the map, through reproduction or otherwise, and that they may be used with equal facility on photographs or sketches.

RONALD L. IVES

BOULDER, COLO.

KARL FRIEDRICH GAUSS AND HIS FAMILY RELATIVES

IN this crisis of civilization the reflections of one too old for active service turn toward the history of the human progress that is now at stake. The appearance of a familiar name in the American news is a reminder of the great achievements coming from the classic ground of the Georgia Augusta at Göttingen, the famous foundation of King George the Second. In the early years of the last century a young assistant at the observatory, already a great mathematician, directed his attention to the philosophy of geodesy. He recognized that an observer at station A could make his survey of his neighborhood by use of the fixed stars as a frame of reference; while an observer at a distant terrestrial station B could likewise make a local survey, by aid of the same framework of stars now however in quite different relative position. The two observers or any set of such pairs could know nothing more about their mutual relations if they were outside each other's range of vision owing to the protuberance of the earth's curvature; unless they had the property of locomotion, and could carry measuring chains about with them. The philosophical question of the relation of the results of survey by astronomical angular observations to the results of a chain triangulation of the non-spherical surface, and the foundations required to express their mutual consistency in a single scheme impressed the attention of Gauss so far as even to entice him to undertake a practical survey in the kingdom of Hanover with that end in view. This was the beginning from which the famous mathematical theory of a surface, like that of the earth, arose, considered as a self-contained region standing by itself without any support from a frame of space such as the stars had provided in the practical geodesic problem. Building on his foundation Riemann, also at Göttingen, extended it far beyond this self-contained surface of two dimensions to cognate loci of many dimensions, in results which were made available to the public only many years later, after his premature death. And more recently the Italian geometers Ricci and Levi-Civika condensed its complications into a very remarkable system of general classification of a system of related abstract concepts. This in turn has been annexed during the last great war as a foundation for a universe of mathematical relativity, which by abolishing time and space and evading all dependence of expression of results on frames of reference, has presented a mathematical model of a concise new physical world free from observational imperfections that insisted on arising from the fact of the delay in time of transmission of influences, which is in fact necessary if there is to be any analyzable medium of transmission at all.

This digression leads to my query. Long ago the great mathematician Felix Klein, well known in America, mentioned to me that he understood that

[1] C. F. Reed, SCIENCE, 93: 68, 1941.
[2] L. Hubrecht and R. O. Erickson, SCIENCE, 93: 288, 1941.