Comments and Communications

A Collaborative Genetical Survey of the Human Populations of the Pacific Area

Roy T. Simmons, of the Commonwealth Serum Laboratories, Parkville, N.2., Victoria, Australia, and the members of the Department of Anthropology and Sociology of the University of California at Los Angeles have undertaken a long term collaborative project for the genetical survey of the native populations of the Pacific area. Mr. Simmons has been appointed a Research Associate in the Department. Formerly it was possible to conduct complete serological surveys in the field, using simple procedures, but all of the desirable genetical data can no longer be collected in this fashion. In the last few years the complicated developments of the important Rh factors, which require laboratory facilities for proper testing, together with the rarity of proper sera for the identification of the more recently isolated alleles at this and other loci, require that blood samples be transported from the field to the laboratory for efficient genetical testing.

Mr. Simmons has demonstrated the feasibility of collecting blood samples from any part of the world where local refrigeration can be obtained until the iced thermos flasks reach the feeder line of a main trunk air route. Trial samples have been successfully flown from London to Melbourne with no loss. Since 1944, Simmons and his collaborators, among whom John J. Graydon is the most active, have tested and published genetical analyses based upon blood samples flown to their laboratory from aboriginal groups in Australia, Fiji, New Caledonia and the nearby islands, the Admiralty Islands, the southern coastal region of New Guinea, Leyte in the Philippines, and New Zealand. Additional data have been published from various populations transiently accessible in Australia during the recent war: Japanese, Hollanders, and various Indonesian groups. Samples recently have been tested from the Gilbert Islands, from five populations in Borneo, and from two provinces in China, and the results will be published within the near future. Arrangements have been made for the collection of blood and saliva samples from the inaccessible Mt. Hagen region of New Guinea. These data represent a substantial addition to the knowledge of the distributions of the more recently discovered serological genes in human populations. This impressive achievement is the more remarkable in that much of it was accomplished during the pressure of the war years by a team working outside of their primary obligations as research biochemists. It is a fitting tribute to Simmons and Graydon that today our knowledge of the population genetics of Australasia is more advanced than in other regions of the world. They will continue their own work of this type in the future, in addition to collaborating in the present program.

Collaboration between the Australian and American institutions arose from the feeling that the unusual contributions made by Simmons and his team under difficult circumstances might be further facilitated with organizational, financial, and analytical assistance. Our arrangement is such that all samples will be flown via air freight to Simmons in Melbourne for the genetical testing. The Department of Anthropology and Sociology at the University of California at Los Angeles will assist in establishing the most critical areas for survey in terms of a comprehensive anthropological survey, in arranging field contacts with personnel in such regions for the collection of samples, and in enlisting financial support to defray the cost of air freight and the various necessary equipment items. Primary data will be published by Simmons and his laboratory and field collaborators. Periodically, members of both institutions will collaborate in publishing analytical syntheses of all the available data.

The task of the joint program is visualized in terms of identifying those populations critical in providing essential genetical data relative to problems centering on the dynamic processes of human evolution. Various aspects include the identification of the basic racial populations in the Pacific area, evaluation of the degree of hybridization in tested populations, the estimation of rates of gene flow, the exploration of the process of genetic drift, and ultimately the design of experiments to attempt to determine the influence of natural selection upon serological antigens. Preliminary phases will require a random sampling of populations on a broad areal basis to establish the major genetical clines in the region. Later investigations will include detail sampling in terms of groups which approximate effective breeding populations. Research emphasis will change as the basic genetical data increase.

At the present time Simmons can identify allelic serological genes at four loci on different chromosomes:

1. The O-A-B locus; Anti-O, -A_1, -A_2, -B sera are now available.
2. The M-N locus; Anti-M_1, -M_2, -N and -S.
3. The Rh locus or loci; Anti-C, -C^w, -D, -D^u, -E, -c, -e sera.
4. The Lewis locus; Anti-L_1 now available, and Anti-L_2 anticipated in the near future.

The inclusion of saliva samples allows the identification of the two alleles known at the secretor locus, which seem related in a way as yet undefined to the Lewis antigens. PTC taste-testing will be conducted where feasible. As additional sera for the above loci, or others, become available to Simmons, tests will be extended to include those routinely.

This project has received a grant from the Research Committee of the University of California at Los Angeles to allow the initiation of field work. We are indebted

to the Viking Fund for a generous sustaining grant to cover field expenditures of the survey during the years 1950–1952. The Pacific Science Board has approved the project and has agreed to arrange for naval air transport where feasible throughout the Trust Territory. Harold Coolidge, executive secretary of the Pacific Science Board, now on several months' tour of the Trust Territory, is generously arranging for field personnel to assist in the collection of blood and saliva samples. The present plan is to concentrate survey efforts in Micronesia and Polynesia, since naval air transport will not be available there later than July 1, 1951. During this period it is planned to obtain samples from the ports of call of the floating laboratory, *U.S.S. Whidbey*. These latter results may be of special importance, since detailed physiological and medical data will be routinely obtained by medical personnel from the same individuals.

This survey promises an efficient and inexpensive way in which our knowledge of population genetics can be rapidly expanded and by means of which evolutionary hypotheses can be tested. Individuals who may be able to assist in the establishment of proper field contacts in the Trust Territory at this time, or in Australasia or Southeastern Asia at a later date, are asked to communicate with the undersigned.

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The Concept of "Internal Compensation"

The purpose of this communication is to propose an experimental solution to the problem of the meaning of "internal compensation" as applied to meso compounds. A few years ago C. R. Noller (*Science*, 1945, **102**, 508) pointed out the lack of meaning of the phrase "inactive by internal compensation." His argument was based on the well-known thesis (founded on a mass of empirically correlated data [e.g., cf. H. Gilman, *Organic chemistry*, 2nd Ed. New York: John Wiley and Sons, 1943. P. 214 ff.] and on theoretical grounds [e.g., cf. W. J. Kauzman, J. E. Walter, and H. Eyring, *Chem. Rev.*, 1940, **26**, 339]) that the symmetry properties of a molecule as a whole determine the nature of its interaction with polarized light. The epitome of this argument is that symmetric molecules do not, and dissymmetric molecules do, have optical rotatory power. A symmetric molecule may be differentiated from a dissymmetric one by the criterion that the former is, whereas the latter is not, superimposable on its mirror image (enantiomorph). In the light of this concept, Noller showed that some staggered configurations of meso compounds are dissymmetric and hence should be optically active (cf. also G. W. Wheland, *Advanced Organic Chemistry*, 2nd Ed. New York: John Wiley and Sons, 1949. P. 191). In support of his argument, Noller proposed the synthesis of some substituted succinic acids which should be stabilized in the staggered configuration, due to the bulkiness of the substituents.

In a rebuttal to C. R. Noller's paper, George F. Wright (*Science*, 1946, **104**, 190) has taken the position that a

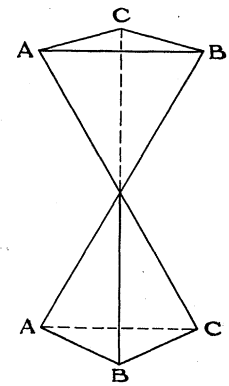

FIG. 1.

meso compound may be regarded as made up of two nonsuperimposable enantiomorphous halves, each rotating plane-polarized light in opposite directions to the same extent. This argument is taken as a justification of the term "internal compensation," although the symmetry property of the molecule as a whole (i.e., the criterion for optical rotatory power as stated here) is apparently disregarded. Arguing on the basis of this misconception, Wright has predicted that the staggered form (Fig. 1) should be optically inactive, whereas the symmetry criterion (already mentioned) shows that this molecule must be optically active.

In view of this controversy, the isolation and resolution of such staggered meso forms would constitute an important experimental contribution. The use of Noller's compounds, however, meets with two serious objections: (1) The compounds have iodine (or iodine and bromine) atoms on adjacent carbon atoms; they would therefore be expected to be quite unstable and it is doubtful that they could be synthesized. (2) The assumption that rotation about the central carbon—carbon bond is restricted, based essentially on the study of molecular models, leaves the activation energy corresponding to the rotational energy barrier an unknown quantity; hence the rate of racemization might still be appreciable at room temperature, necessitating special techniques and complicating the task of separation and resolution.

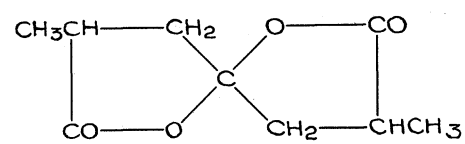

FIG. 2.

The experimental solution of the problem may be found in the resolution of compounds having the spiran ring system, as exemplified by 3,8-dimethyl-1,6-dioxaspiro-[4.4]nonane-2,7-dione (Fig. 2). Such compounds, in which the ring systems are at right angles to each other, and which in addition contain two dissymmetric groupings, can exist in six stereoisomeric forms (cf. Wheland, G. W., *loc. cit.* p. 201). Two of these steroisomers, which are enantiomorphous (Figs. 3 and 4), have the