them could serve as basis for the distinction of a human race. There are color-blind people among all races, but there is no race of color-blind men, because without a scientific investigation no one is able to select his mate in regard to this quality.

The human races, such as they are, would never have developed in nature in the absence of man's own social actions, the results of which are not restricted to the differentiation between the major races of mankind. Differences between tribes, some of them counting only a few hundred individuals, are due to the same cause.

The races of mankind are no less a product of man than the races of his dogs and horses. Here, too, a certain potential variability is a prerequisite for the creation of a number of races. In the case of the dog this must have been present in the wolf and the other wild species of carnivores which went into the crosses from which the various types of dogs were bred. This original variability is natural and not due to human action, but it need not show and may lie hidden in a comparatively uniform animal like the wolf.

The origin of this primary variability need not be discussed at present and is, as yet, uncertain. Only, it may be stated that the natural forces responsible for this variation have not necessarily long ago ceased to be active. There is reason to believe, for instance, that in man the character which is designated as blood group *A* has originated only a few thousand years ago.

Whatever the nature of this primary variability it does not lead to a distinction between races, if not accompanied by isolation of the various types in one way or another. Many recognize various environmental factors, as, for instance, the climate, as such isolating agencies. The various climates, it is said, would produce the human races. However, it is not clear why the climate would only affect the dispersal on earth of visible characters and not that of the more numerous characters which are more or less invisible.

Each of the human races, if inhabiting the earth alone, might spread over a somewhat different area, and factors like climate, or physical barriers obstructing migration, may have something to do with the segregation of mankind into groups with different types. But the social motives in regard to mate selection are much stronger than any motive to select a certain climate or other environmental condition. Generally speaking, members of the white race are willing to live all over the earth, but not to marry into other races.

If the idea discussed above is correct the problem of the human races is one to be more studied by sociologists than by biologists. It also gives hope that race differences will be viewed with less superstition and that race problems will be recognized as being more amenable to humane solutions than they appear to many at present.

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THE FLOATING POPULATION OF THE AIR

IN my recent studies of the biota of the islands off the coast of Southern California I have found that the endemic insects appear to be mainly confined to certain groups, especially the more or less bulky Tenebrionid beetles, which can not fly. Excluding the species certainly or probably introduced by man, there is still a very large population of flying insects, as well as spiders, quite identical with species of the mainland. It might at first appear that these species were very constant in their characters, with little tendency to form distinct races or species when isolated. The true explanation, however, appears to be that they are constantly arriving through the air. The floating population of the air has not been sufficiently understood in the past, but the essential facts are admirably presented by Mr. P. A. Glick in his recently published work on "The Distribution of Insects, Spiders and Mites in the Air" (U. S. Department of Agriculture, Technical Bulletin 673, May, 1939). In this paper full details are given of the collections made by aeroplane in Louisiana and Durango, Mexico, the specimens secured having been carefully sorted and so far as possible identified. The work at Tallulah, Louisiana, involved 1,314 aeroplane flights, during which the insect traps were in operation for 1,007 hours. There were 44 flights in Durango, Mexico. In Louisiana, by day, 24,559 insects and arachnids were taken in 51,178 minutes. By night, 3,955 were taken in 6,790 minutes. Two hundred and twenty-five were taken in 2,455 minutes at altitudes over 5,000 feet; one spider at 15,000 feet. In Mexico, 1,294 specimens were taken in 2,120 minutes. There were numerous small wingless forms, carried upward by the air currents. All the various aspects of the work and its significance are most ably discussed by Mr. Glick, the bulletin extending to 150 pages. It is evident that the islands must be constantly receiving insects, spiders, and also spores and some seeds, through the air. Only a very small percentage of these can survive, but the constant supply enables the available environments to be populated, so that even recently introduced plants are often infested as they would be on the mainland. Thus at the Rancho Escondido, Sta. Catalina, I found the cocklebur, *Xanthium spinosum,* swarming with the trypetid fly which attacks it elsewhere. The introduced *Diaspis* scale of the prickly pear, at the same place, was infested by chalcidoid parasites. At the present time, the manner of arrival of the various species can only be guessed, but if the very numerous planes constantly flying about the islands could be utilized (with no in-

convenience to the service or the pilots) for studies like those of Mr. Glick, we should soon have a mass of positive information. We may leave it to mathematicians to calculate, on the basis of the work done, the probable number of insects in the air, but the figure must be surprisingly large. There is also another aspect of the matter, which I have not seen referred to. The sea in the vicinity of the coasts (how far out, we do not know) must be constantly receiving a rain of small arthropods, which must represent a not inconsiderable food supply for the marine animals.

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A REQUEST TO MATHEMATICAL GENETICISTS

THE lack of clarity in many papers dealing with theoretical genetics will probably retard to some extent the development of the science. Some of these are valuable contributions, but their merit is unnecessarily limited by the inadequate presentation of the mathematical materials. Much of the mathematics is simple algebra, but the lines of reasoning are frequently very hard to pursue, because many crucial equations are omitted. Sometimes lengthy and rather involved processes must be followed from one printed equation to the next, and there is not the slightest hint in the text as to what these processes are. Geniuses may have little difficulty with these papers, but such geneticists are scarce. Among the rank and file of animal and plant breeders one of the following courses is likely to be followed:

(1) The papers are ignored. Attempts to analyze a few of them bring the conviction that it is useless, and one can "get by" without them anyhow!

(2) The conclusions are accepted, but the reasons for them are not understood. It is obvious that such a state of mind is scientifically unsound.

(3) An enormous amount of time is expended in reading and analyzing the paper—very much more than would be required if a few crucial equations were added. A busy teacher is likely to give up through sheer need of sleep and revert to class (1) or (2)!

We teachers are training the geneticists of the future, and if we are not provided with reasonable opportunities for understanding the advances in mathematical genetics, such contributions may be too little known in the next generation. Genetics will not advance as it should. It is sometimes claimed that editors will not accept papers with too much mathematical material, for such printing is expensive. In reply, it may be said that there is little reason for publishing a paper if it is so brief that it can not be understood. Furthermore, mathematical clarity can usually be attained by adding such a small number of "clew" equations that the costs of printing would not be materially increased.

Biometricians should always remember that they are not writing for mathematicians, but for biologists who know the elements of mathematics, yet are not very familiar with many devices used in mathematical procedure. Please don't leave out so many equations!

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THE RANGE OF HEARING OF CANARIES

TESTS[1] on starlings, English sparrows and domestic pigeons show that the range of hearing of these birds is considerably more restricted than human hearing. Their ranges cover about five octaves; normal human hearing is about ten octaves.

The method used in testing the canaries was the same as in the earlier experiments. The investigation of the hearing of five birds was conducted by means of conditioned reflexes to a range of sound which, during the conditioning of the experimental birds, had been followed by a mild electric shock from the feeding tray. The canaries' range was similar to that of the earlier birds experimented on but was even more restricted. Canary's range, 1,100–10,000 c.p.s., is only slightly over three octaves. Low and moderately high sounds are not heard. However, the bird undoubtedly hears all the sounds produced in its own song.

A. R. BRAND

P. P. KELLOGG

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SCIENTIFIC BOOKS

PLANE TOPOLOGY

Elements of the Topology of Plane Sets of Points. By M. H. A. NEWMAN. Cambridge: At the University Press; New York: The Macmillan Company, 1939, viii + 221 pp., 93 figs. $3.50.

ACCORDING to the publisher's jacket, this book "has the double purpose of providing an introduction to the methods of Topology, and of making accessible to analysts the simple modern technique for proving the theorems on sets of points required in the theory of functions of a complex variable." It is divided into two parts. The first, occupying slightly less than half the volume, opens with some calculus of abstract sets, and investigates properties in metric spaces of closed and open sets, continuous mappings and connected sets.

[1] A. R. Brand and P. P. Kellogg, 1939. *Wilson Bulletin*, 51: 38–41, 1939.