$$N = \frac{4N_o - 2}{2 + \sigma_{ik}^2}.$$

Of greater probable importance in nature are cyclic variations in numbers. In a cycle of not too long a period (in generations) the effective size

$$\left(N = \frac{n}{\sum_{i=1}^{n} \frac{1}{N_i}} \right).$$

is controlled largely by the phase of small numbers. A small N permits random fixation of non-adaptive characters and to some extent control by mutation pressure. In a large species, restrictions on interbreeding may permit differentiation of local populations. The variance of gene frequencies (σ_q^2) takes the value $q_t(1-q_t)$ f, where q_t is the mean gene frequency in the species and f is the inbreeding coefficient. In a population distributed continuously over a large area, but with mates always drawn from small groups (size N) the value of f for groups separated by n generations of ancestry (or by $\sqrt{n}$ diameters of the unit area), lies between $\frac{\Sigma}{2N+\Sigma}$ and $\frac{\Sigma}{2N-\Sigma}$ where $\sum = \sum_{x=1}^{n}(1/X)$. This permits considerable fluctuating local differentiation where N is less than a few hundred but leads to approximate fixation of differences only if N is much smaller. In a species, whose range is essentially one dimensional, Σ has the value $\sum_{x=1}^{n} \sqrt{1/X}$. Differentiation increases much more rapidly with distance than in the preceding case. Another mode of attack is appropriate where the range is subdivided into partially isolated territories. As shown previously σ_q^2 here takes the form $q_t(1-q_t)/4N_m + 1)$ where N is the effective size of the local group and m the effective proportion of immigrants from the species as a whole. Both N and m may be much smaller than indicated by actual numbers and amounts of cross breeding with neighboring groups. If small enough, there is random non-adaptive differentiation of local groups. With small m, but not N, there is adaptive differentiation in respects related to differential conditions. These processes may be expected to be supplemented by intergroup selection such that those local groups which happen to acquire combinations of characters of more than local adaptive significance multiply relatively rapidly and supply more than their share of emigrants. The simultaneous action of partial isolation and intergroup selection should result in a more rapid evolutionary process than either isolation alone or intragroup selection alone. Splitting of species requires nearly complete isolation. In some cases (as where translocations become fixed) there is evidence of fixation against very strong selection, likely to occur (in a sexually reproducing species) only if there are numerous outlying territories in which the populations are so isolated and so liable to extinction that the lines of continuity frequently pass through single stray individuals.

The mechanism of hearing as revealed through experiment on the masking effect of thermal noise: HARVEY FLETCHER. In an electrical conductor there is a statistical variation of the electrical potential difference between its two ends, which is due to the thermal agitation of the atoms, including the electrons. This electrical noise is amplified by means of a vacuum tube amplifier and then converted into an acoustical noise by means of a telephone receiver held on the ear. When this noise is present it reduces the capability of the ear to hear other sounds. The intensity per cycle of the acoustical noise compared to the intensity of a pure tone which can just be perceived in the presence of a noise was determined experimentally using a group of observers. This relative intensity for a given frequency range was constant throughout a wide variation of intensity. However, its value does vary with the position in the frequency spectrum, and it is the amount of this variation which enables one to calculate the relation between the frequency of the tone and its position of maximum stimulation along the basilar membrane. The results of such a calculation are given and shown to be in good agreement with determinations from animal experimentation.

(*To be concluded*)

SCIENTIFIC EVENTS

THE MOUNT EVANS LABORATORY

THE Mt. Evans Laboratory, which is sponsored by the Massachusetts Institute of Technology and the University of Denver, will be available to research workers in the field of the sciences during the months of July, August and September. This laboratory is located on Mt. Evans (altitude 14,260 feet) which is 65 miles from Denver by automobile road.

The services rendered by the laboratory are materially enhanced by the availability of the laboratories of the University of Denver and the University of Colorado School of Medicine; stations at altitudes of 11,000, 8,000 and 7,000 feet, respectively, where one may obtain living accommodations and electric power; deep snow-fed lakes at high altitudes, which include Summit Lake on the road to Mt. Evans five miles from the peak; mines and tunnels in and near Idaho Springs, which is at a distance of 15 miles, and the Division of Photography of the Army Air School in Denver. The greatest demand has come from workers in the field of cosmic rays, but there are many problems in science which may be studied at this altitude.

D. K. Froman and J. C. Stearns connected a Ferranti electrostatic voltmeter between a horizontal wire and ground. This wire was supported by two poles to which it was attached by porcelain insulators. The air was ionized by burning splints in tin cans which were affixed to the wire. With the wire six inches above ground the voltmeter reading varied from 0 to more than full scale reading, which was 2,500 volts.

At this altitude not only are there corona discharges from physical projections, but one quite often experiences electric discharges from the tips of his fingers or ears. The quick changes in weather, which varies from winter to summer each day, makes this an interesting location at which to make a study of the potential gradient.

Examples of other general fields of investigation in physics are those of the electrical conductivity of air, ultra-violet light and cosmic rays. The time necessary to secure data in the field of cosmic rays is materially decreased, for at this altitude the intensity of primary cosmic rays and cosmic ray showers is respectively five and ten times their intensity at sea level. The figure for showers is only approximate and may be greater than this for many particle showers. This enables the collection of data during the summer season which would require observations extending over a period of a year at sea level. In addition, intermediate altitudes, deep mines, lakes and aeroplanes are available to workers in the field of cosmic rays.

In the field of biology the laboratory offers an opportunity to study two types of problems: One, the influence of the increase of natural radiations on the biological processes; and the other, the biological effects due to the decrease of oxygen. An example of the former is the work of Dr. Victor Jollos, who used the laboratory to study the effect of cosmic primary and shower radiation on mutations in Drosophila. A problem in the latter field is the study of mountain sickness, which may be carried on to advantage as there are patients in great numbers; those who are summer guests at the laboratory and a large number of tourists. (The tourists are directed up another peak, and this one hike so thoroughly satisfies most of them that there is a minimum number of uninvited visitors at the laboratory.)

It is hoped that the laboratory may soon be utilized throughout the year by the department of meteorology. At the present a preliminary study of the meteorological conditions at this altitude during the summer months should be of scientific interest. Those interested in Alpine botany and nature study will be surprised and pleased at the variety of flowering plants above timber line. A region on the Mt. Evans road about 10 miles from the peak has been preserved for botanical study. While the automatic devices are taking data in the laboratory, an inviting field for research is Summit Lake, well stocked with large mountain trout which defy the efforts of all dieticians to prescribe a bait which will tempt them.

The physical plant has been described in another article.[1] If there is a growing demand for the services of the laboratory, it will be improved and enlarged to meet these requirements. Those wishing to use the laboratory this summer should communicate at an early date with Professor J. C. Stearns, University of Denver, Denver, Colorado.

J. C. STEARNS

[1] J. C. Stearns, *The Scientific Monthly*, 46: 242–248, 1938.

GRANTS AWARDED BY THE AMERICAN PHILOSOPHICAL SOCIETY

THE committee on research of the American Philosophical Society, Philadelphia, made in February grants as follows:

Edward W. Berry, the Johns Hopkins University, for the illustrations of a study of the Tertiary flora of Cuba	$ 100
Ralph E. Cleland, Goucher College, for continuation of work on cytogenetics and phylogeny of Onagra (evening primrose)	1,500
H. S. Jennings, the Johns Hopkins University, for the study of the cytology of ciliate protozoa, in particular the chromosomes and their behavior at conjugation in *Paramecium bursaria* and in other species of Paramecium; also the chromosomes in the Opalinidae	1,200
Ernest W. Brown, Yale University, and W. J. Eckert, Columbia University, for the continuation of the verification of the polar coordinates which are used to predict the moon's place	500
William Berryman Scott and Glenn L. Jepsen, Princeton University, for the continuation of the monograph of White River Mammalia	600
Donald H. Andrews, the Johns Hopkins University, for the measurement of the heat capacities of nine or more organic compounds to be made in the range 1° to 300° K. together with supplementary measurements necessary to determine the values of the free energy and entropy at 300° K.	1,000
D. H. Kabakjian, University of Pennsylvania, for a study of the energy levels in pure or activated crystals and the dependence of these on physical structure	350
J. Kenneth Donahue, College of Charleston, for the study of the occurrence of hormones in marine invertebrates with special reference to the female sex hormone	500
Nabih Amin Faris, Princeton University, for the continuation of the editing from old manuscripts and translating into English the major work of al Ghazzali, the Ihya 'Ulum al-Din, which treats of Moslem theology and jurisprudence, Moslem political theory and constitutional law	500
Clarence E. McClung, University of Pennsylvania, for continuation of the project of bringing together as representative a group as possible of the short-horned grasshoppers for cytological, genetical and phylogenetic studies	400
Alexander Weinstein, Columbia University, for a	