Many workers merely wrote that they favored one system or another, without detailed reasons for their opinions. Dr. Sybil Smith's letter in support of the Sherman suggestions has already been published, in substance, and will not be included here.

Nutrition workers will also be interested in the following quotation from Dr. H. H. Mitchell's letter of April 10, 1928.

There is no question but that the situation with respect to the nomenclature of the components of vitamin B is confusing. The use of the letter B has been so generally applied to what was thought to be a definite dietary factor with growth-promoting and antineuritic properties, that its entire elimination from the list of vitamin letters seems advisable to me. Even its use to denote the combination of the two or more water-soluble components, as has been suggested, seems objectionable to me, since it would refer to no definite combination of dietary factors and hence would have no definite significance. I can not conceive of any situation requiring the use of such a loose term.

The A and D situation was not analogous to the B situation, since, in this country at least, vitamin A was not at all generally confused with the antirachitic factor, so that the discovery of this factor, although possibly vitiating some of the work done on vitamin A, did not modify the meaning generally attached to this term.

I favor the use of new letters to designate the components of vitamin B, but I feel that there is danger of making the same sort of an error in defining vitamins F and G as was made in defining B, with the same unfortunate confusion of ideas and the same misdirected experimentation. There is such a general feeling of satisfaction in the establishment of the identity of two factors in any scientific problem, because its ultimate solution is to that extent simplified, that the pronouncement of such an identity is frequently not subjected to the critical scrutiny that its importance deserves. In the present case, there is nothing to be gained, and the possibility of considerable confusion is incurred, by identifying vitamin F (investigated in rat-feeding experiments) with the antineuritic vitamin and, particularly, vitamin G with the antipellagra vitamin, if such there is, until the evidence of these identities is established beyond a reasonable doubt. I think Sherman's statements on this matter are premature.

To my way of thinking it is time, in these days when pronouncements of new dietary factors are becoming so frequent, to come to some general agreement concerning the proper criterion for the demonstration of a new vitamin. Surely the statement that a new vitamin exists should be something more than the mere expression of one's inability to explain experimental findings on any other basis. The factor should be obtained in a potent and concentrated form, the addition of which in minute amounts to a ration, preferably synthetic in character but in all cases demonstrably complete in all other known respects, will *invariably* induce a marked betterment in the nutritive condition of properly prepared experimental animals, an effect which is not dependent upon an increased intake of food. Some such criterion should be satisfied, preferably by more than one investigator working independently, before a letter in the vitamin series is assigned to a new dietary factor. Conservatism in such matters is the wisest policy to pursue.

It would appear that a majority of workers, who have indicated a preference, are quite agreed (in the light of Dr. Herbert Evans' introduction of vitamin F) on the use of the term "G," to denote the heat-stable factor. Some difference exists, however, relative to the term which should be used to designate the heat-labile antineuritic factor.

The committee is not ready to make its final report and it will welcome suggestions from all interested workers in the vitamin field. Steps are now being taken to cooperate with other scientific groups before making definite recommendations.

The members of the committee feel that the naming (by other than descriptive terms) of newly discovered food factors should be discouraged until a system of terminology has been agreed upon. Many workers have expressed themselves as being in favor of discouraging the designation of new vitamins until their identity has been established beyond question. In this the committee is in accord.

Suggestions have been made that an American committee be appointed, representing the interested scientific societies, which may act as a clearing house for questions in vitamin terminology and perhaps cooperate with similar foreign committees in actually naming new factors. This suggestion is made with the hope that it will avoid confusion in the literature and promote uniformity, which is highly desirable.

R. ADAMS DUTCHER, *Chairman*,
Committee on Vitamin B Nomenclature, American Society of Biological Chemists, Pennsylvania State College.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

ELECTRICAL APPARATUS FOR THE ACCURATE GENERATION AND MEASUREMENT OF NOISE AND TONE

THE scientific study of noise is becoming of increasing importance in recent years due to recognition of its possible harm and wastefulness. Since preliminary tests seem to indicate that different pitches vary considerably in their annoying properties, the apparatus used must be accurate and reliable with respect to pitch, maintaining it over long periods of time, and furnishing it at will. Intensity must be accurately controlled and must be reproducible at any time.

As has been first pointed out by the late Wallace Sabine, the total amount of noise in a room varies with the absorption of persons, rugs, walls, furniture, etc. Either these conditions must be kept uniform or the ideal instrument must automatically compensate for the variation in absorption units from one room to another. If a standard physical adjustment of intensity is used on the source of sound, the perceptible sound intensity will vary when it is moved from one room into a more absorbent room. For noise tests at the Colgate Psychological Laboratory, for instance, we have a cubical room, lined on the walls and ceiling with acousticelotex, and whose period of reverberation is .12 seconds, but for field work where physical conditions vary from one factory to another our noise machine must be correctible to give reliable results.

The orthodox methods for the production of auditory stimuli consist of mechanical means almost entirely. The most common form of apparatus is of the type of the Stern tone variator. Experiments have been performed in which tin cans have been dragged across the floor and phonograph records played. In tests at the Colgate laboratory last year a rotating hexagonal drum filled with bolts and screws was used as a source of noise. However, these sounds are not satisfactory for scientific purposes, since there is so much variability and lack of control, and they are not easily resolved into components of pitch and intensity. Apparatus has been developed and is being used by the laboratory which can easily supplant former methods such as the ones described.

This apparatus consists of three major divisions: an unvarying source of sound, an amplifier and a loudspeaker to spread the sound throughout the room.

The Tone Generators

As a source of sound we have two forms of apparatus. The most successful of these consists of audio-oscillators manufactured by the General Radio Company, and are used in our permanent set-ups. These consist of tuning-forks which are actuated by a six-volt storage battery and generate a small alternating current of .5 to 5 volts at the same frequency as the fork. The second form which is being developed is a portable set-up using high-frequency radio buzzers which have the advantage of light weight and low cost, and are fairly unvarying when used only for a few minutes at a time. For more specialized work where intermediate points of the scale are desired, the beat frequency oscillator of the General Radio Company is used, wherein two vacuum tube circuits, oscillating at different frequencies, beat on one another with a range of from twenty to nine thousand cycles.

Amplifying the Standard Tone

The alternating current produced by the oscillators is fed into the primary circuit of the first transformer of an ordinary radio amplifier. We have found three stages of radio amplification satisfactory for most purposes. The input coming from the tone generator is fed into the first transformer, whose secondary is in the grid circuit of a Daven UX-201 A tube. Standard transformer-coupled amplification with 3 to 1 ratio audio-frequency transformers steps this up through three stages. The tubes have 135 volts on their plates, and operate on six volts supplied by a storage battery. For field work dry cells are used and may be contained in a box about 15″x10″x6″ having the set mounted in the top.

Where a source of direct current of more than 135 volts is available for plate voltage, power tubes and transformers are very satisfactory for increased volume. Since the energy output of the amplifier depends on how much energy is put into it, an increased voltage, if the tubes are built to stand it, will raise the upper limit of volume. Using 135 volts on three UX-201 A type tubes, in a room having a period of reverberation of about one second, we are able to get about 75 T. U.

Measuring the Intensity Produced

The output of the amplifying unit is passed into an audibility meter and loudspeaker which can be calibrated to read in standard transmission units (T. U.) or audibility sensation units. Due to individual characteristics each loudspeaker unit must be calibrated separately with a volume control.

To protect the loudspeaker unit and to eliminate possible distortion, it may be advisable under certain conditions to insert an output transformer between the output of the amplifier and the loudspeaker unit.

Frequencies of 500, 1,000 and 1,500 cycles are sufficient for our purposes. These may be combined in any form desired. All three frequencies may be imposed on the same amplifier and loudspeaker, but the result may not give distinct pitches due to individual differences in the loudspeakers. Some loudspeakers are best adapted to low frequencies up to 1,000 cycles, while others take the 1,500 cycle pitch better than the two lower ones. We recommend an individual amplifier and loudspeaker for each desired pitch.

The regular 60-cycle alternating current lighting circuit may be used to supply a low 60-cycle tone. The current is passed through a toy transformer, with taps for graduations in voltage, into a suitable loudspeaker.

This apparatus for making tests on noise gives us a constant pitch of tuning fork accuracy; there is a complete range of intensity variation possible; it is mechanically simple to operate with only loose tubes and battery charge to watch; it will generate and amplify without variation for twenty-four hours at a time; it can be built in portable units; and through the use of the audibility meter it almost automatically compensates for variations in the tonal intensity, due to being placed in a sound-reverberant or in a sound-absorbent room.

DONALD M. CRAWFORD
PSYCHOLOGICAL LABORATORY,
COLGATE UNIVERSITY

SPECIAL ARTICLES

MUTATION, CHROMOSOME NON-DISJUNCTION AND THE GENE[1]

MODERN genetics distinguishes several types of mutations; gene mutation, where only one gene is affected; deficiencies, where a whole series of genes may be dropped out; chromosomal mutations, where the effect is due to irregularities in chromosome behavior or number as in non-disjunction, triploid or sex intergrade formation, etc. For some years flies of unique appearance have sporadically appeared in certain of my experiments, which under the older terminology would be considered mutations, although they appear best considered under the more limited rubric as due to chromosome non-disjunctions and not mutation in the gene sense. The variable nature in the time of appearance of these abnormal forms makes them resemble fluctuating mutations which are of so much interest in connection with the mechanism of mutation. The abnormal flies represent morphological variates extending all the way from male on the one hand to female on the other. Cytological analysis of the chromosomes shows that the sex intergrade forms are the result of a multiplication of the chromosome groups in the mother fly to form eggs with double the ordinary number of chromosomes. The sex intergrades consequently carry three sets of autosomal chromosomes and two sex chromosomes. Another class of females, showing increased size and larger eye pattern, have three full sets of chromosomes or are triploids. Incidentally, therefore, these results furnish independent confirmation of Bridges' hypothesis that sex is determined by a balance of the sex chromosomes and autosomes. In this antagonism of forces the sex chromosomes have a female tendency, while the autosomes have the male tendency. Extensive pathological changes are found in these forms; instead of all male parts going together or all female parts together, all manner of combinations of the two are witnessed. In fact, the study of the unbalanced conditions shows that external appearance is not always a criterion of internal structure, since female-appearing sex intergrades may have testes and male-appearing intersexes may have ovaries.

The frequency with which these mutant forms appear within this stock is many times that in normal stocks. Careful examination of a normal stock of 15,785 flies showed but one triploid mutant and no sex intergrades. On the other hand, examination of 1,775 flies from normal appearing parents in the sporadically mutating stock showed thirty-four sex intergrades and triploids, or a rate of one in fifty-two flies, three hundred times as frequent as in the normal stock. These two sets of flies were grown in the same bottles under as nearly the same conditions as possible. The classification is believed to be accurate, as many of each class have been bred to test genetically the accuracy of the separation, with results which have thus far checked perfectly. Another stock made by outcross and extraction showed in 1,173 flies thirty-seven sex intergrades and triploids, or a rate of one to thirty-one—500 times the normal rate. Besides these exceptional classes two others appear. The first is the familiar exception to sex linkage due to non-disjunction of the sex chromosomes. These appear in large numbers. The second mutant involves the vigor of the fly, the bristles, the eyes and fertility and has some of the characteristics of a dominant.

Genetic analysis designed to determine the causative agent behind this series of phenomena shows that a third chromosome recessive factor controls these events. This factor is inactive in the male, as males homozygous for the factor never produce exceptions. In the homozygous females the exceptions freely occur. With the single dose, heterozygous, or when this factor is absent these mutant flies rarely appear. This factor for mutant production is associated with and probably identical with a factor which causes practically complete linkage or lack of separation of any of the factors in any chromosome in the female. It is evident from these facts that the chromosomes of the male and female Drosophila pass through phases which must be divergent in at least two particulars, chromosomal linkage and disjunction. That one factor should be capable of throwing the whole mechanism of mitosis out of gear, even to altering the behavior of the chromosomes in which it is not located, is an extremely interesting fact. The action of this gene finds expression only in the female's progeny, making the case look like one of maternal inheri-

[1] From the Department of Animal Pathology of the Rockefeller Institute for Medical Research, Princeton, N. J.