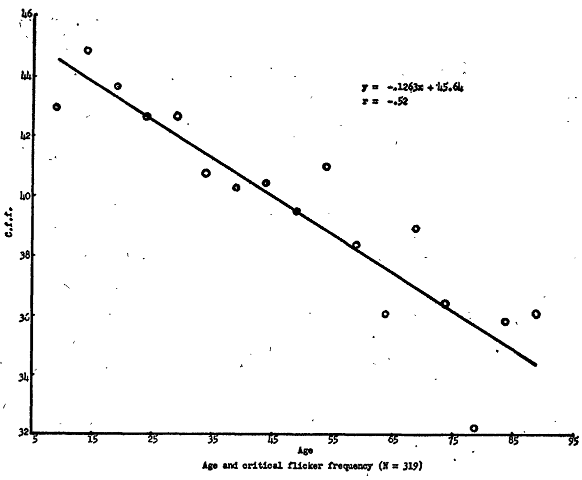

FIG. 1.

females. The mean cff for the youngest group (7-11) was 42.91, for the oldest (87–91) 36.04. The striking fact about these cff's is the large range of individual measures of 37.35 cps (18.29–55.64) and the great variability of 4.22 of the total group. In addition, there was appreciable interindividual variability within the age groups. No significant sex differences were found. The relationship between age and cff is linear and negative, the correlation coefficient, based on all individual cases, being significant but small -.52 (Fig. 1). The differences between groups are statistically insignificant, except between the groups below 30 and above 55 years of age. Thus it can be concluded that cff drops with age, this drop becoming significant in individuals later in life (after 55). However, it must be pointed out that there were cff's at age 82 as high as at age 7, and on the other hand there were cff's at age 7 as low as at age 80.

The interindividual variability tends to increase with age, a tendency generally characteristic of many mental and physical capacities. The intraindividual variability, on the contrary, shows tendency to decrease.

There is a strong indication, however, from other investigations still in progress that the relationship between cff and age differs with intensities of light, the higher the intensities the greater the slope of the line expressing this relationship.

The cause of the decrease of cff with age is hard to understand. It may lie in peripheral factors (the retina), or in central factors (subcortical or cortical), or both. A Belgian investigator, Weekers (*6*), has suggested that smaller diameter of pupil and its diminished mobility in old age may be the cause of lower cff. When he used mydriatics in his subjects, he did not find any change in cff until after 50 years of age. It is true that the iris becomes thinner and more rigid with age, and that the pupil becomes smaller and less mobile, but the present investigator does not feel that this is the sole explanation for the lower cff, especially in view of the gradual decrease of cff even before the age of a diminished mobility of the pupil, and in view of the fact that injuries of the cerebrum lower cff (*9*). The pupil factor seems to be, nevertheless, an important one. In another study (*10*), using a different apparatus with lower intensity of the flickering light, we found difference in cff between groups 20–30 and 40–50 (32.00 and 31.16, respectively), but when artificial pupils were used the cff for both groups was almost identical (24). It is possible that the key to the solution of the decrease of cff when no artificial pupils or any drugs affecting the pupil are used lies in the relationship between the sympathetic and parasympathetic systems with regard to the pupil. If the parasympathetic system becomes more dominant with age, the fact that the light reflex is more pronounced would result in the diminished diameter of the pupil, in turn lowering the retinal illumination and consequently also the cff. That is why higher intensities of flickering light would show greater differences in cff with age than lower intensities. We intend to investigate this hypothesis by further experiments.

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A Nomogram for the Calculation of Relative Centrifugal Force

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It is well known that the centrifugal force developed in a rotating system is proportional to both the radius and the square of the frequency of revolution. Nevertheless, many experiments in which centrifugal separation is an important procedure are reported merely in terms of "revolutions per minute" (rpm). Results, so reported, are of little quantitative significance. Therefore, when the rate of sedimentation is of importance, as in centrifugal fractionation, or when the volume of the sediment is measured, a more complete specification should be provided.

A convenient measure of centrifugal force is given by the ratio of the weight of a mass in the centrifugal field to the weight of the same mass when acted upon by gravity alone. This relative centrifugal force, *G*, is proportional to the absolute force applied to a suspended particle and, therefore, also is proportional to the speed of free sedimentation in a wide variety of systems. When it is permissible to neglect the increase of G along the tube, the system may be characterized by a single value; a satisfactory convention is the specification of the value of G which prevailed at the bottom of the tube, since this maximum value (G_{max}), unlike the minimum or the average value, is independent of the height of the fluid level in the tube.

Time may be incorporated into the description by forming the product $G_{max} \times$ min to give a single datum which is adequate for the specification of many procedures. When required, this datum should be supplemented by calculation of the force gradient along the tube and by description of special geometrical features such as the degree of angulation of the tube in relation to the axis of rotation.

The necessary calculations of relative centrifugal force, G, from the *Radius* and the rpm are facilitated by the accompanying nomogram (Fig. 1). A thread stretched across the chart so as to intercept the scales of any two variables at selected values will cross the third scale at a value which satisfies the equation $G = 1.11 \times 10^{-5}\ (R) \times (\text{rpm})^2$. It should be noted that the chart can be used for the calculation of values outside the indicated ranges merely by proper shifts of the decimal points since a change in *Radius* by a factor of 10 alters G to the same extent, and a change in rpm by a factor of 10 affects G by a factor of 100.

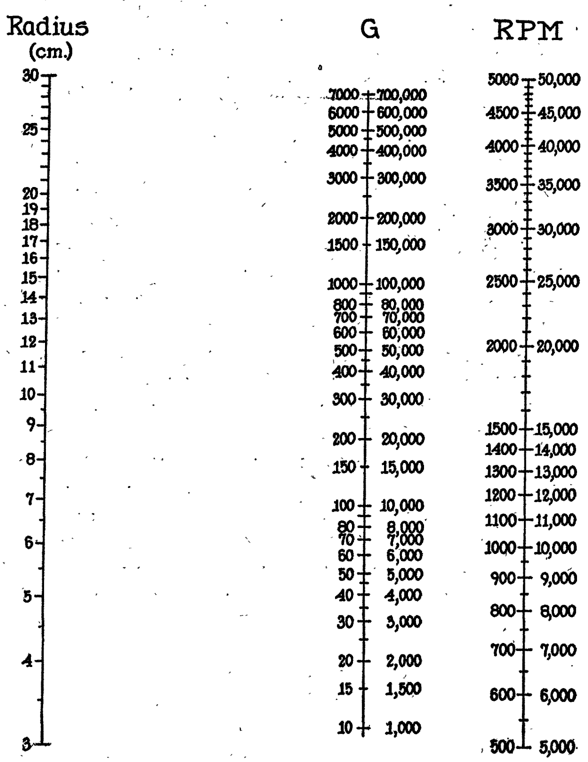

Fig. 1. Nomogram for the calculation of centrifugal force.

Use of this nomogram in our laboratory has improved the planning of centrifugal fractionations in which the proper choices of rotor head, speed, and time are required for efficient separation. With its use there has developed the habit of thinking directly in terms of the forces at work rather than in terms of a partial datum (rpm) which happens to appear on a dial at the top of the instrument.

A Laboratory Method for Evaluating the Phytotoxicity or Phytostimulation of Insecticides[1]

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Since the advent of numerous synthetic organic insecticides, particularly the chlorinated hydrocarbons, for the control of insects affecting plants, there has been an increasing need for a rapid laboratory technique to estimate relative phytotoxicity of these compounds. As it has been shown by Chapman and Allen (*1*) that DDT stimulates plant growth, the technique should also be adaptable to measuring possible plant stimulation by the insecticide. The methods currently employed for phytotoxicity studies are based largely on gross expression of plant damage when plants are grown under field or greenhouse conditions. Such methods have proved to be time-consuming and have yielded only qualitative relationships. The procedure reported here is both rapid and quantitative in nature.

Methods initially tested for possible adaptability in measuring phytotoxicities were based on the techniques that have been used in the detection of plant auxins. The *Avena* coleoptile test (*2*) and the slit pea stem test (*2*) proved inadequate. A modification of the slit pea stem test, using the pole bean or cucumber, proved usable but did not allow a distinction between phytotoxicity and growth stimulation. Growth of cucumber roots was found very sensitive and was used to a large extent; the principal difficulty, however, was in the interpretation of growth inhibition, since stimulatory (auxins) as well as inhibitory substances to aerial parts of the plant cause root inhibition. Respiration and permeability tests were discarded because the various compounds to be tested varied in their mode of action. Of the different procedures tested, it was found that readily interpretable and consistent results could be obtained by the use of the straight growth of stem sections of the Kentucky Wonder pole bean grown under standardized conditions in a nutrient solution.

Pole bean seeds from a uniform standard lot were immersed in water for 1 hr and planted in moist Vermiculite[2] in darkness and held at a temperature of 23°–26° C. At 7 days the plants have developed a long hypocotyl and the epicotyl is just ready to emerge. Plants selected for testing are taken from those in which the epicotyl has not yet emerged and

[1] Approved for publication by the director of the Wisconsin Agricultural Experiment Station.

[2] Expanded mica used commercially for insulation.