after the fashion of a mutation in a very few individuals. There is much to be said for both sides but neither leads us to any definite conclusion. The processes and methods of evolution are clear until we attempt to study any single case.

To the entomologist Dr. Friedmann's studies are unusually suggestive because they disclose so many analogies with the parasitism of social insects (wasps, bees and ants). There are similar indications of an origin of parasitism in struggle and parasitism, of preference for single or multiple hosts, of a lapse of nidificatory behavior owing to precocious readiness for oviposition, and, in one case at least, of a derivation of parasitic from host species. This is clearly shown in the parasitism of *M. rufoaxillaris* on its ancestral species, *A. badius,* a condition strikingly paralleled among parasitic wasps, bumblebees and ants. In other respects, however, the cowbirds, cuckoos, etc., are more like certain non-social insect parasites, such as the Mutillids, Sapygids, Chrysidids, etc., because in these cases we are concerned merely with brood-parasitism as in the cowbirds and not also with an adoption of the mother parasite in the nests of the host as in the case of *Vespa austriaca* and *arctica* among wasps, the various species of Psithyrus among bumblebees and such parasitic ants as *Formica sanguinea, Polyergus, Anergates,* etc.

The volume is well printed though it contains some unfortunate typographical errors; the bibliography is ample and there is an excellent index.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A VIBRATO TONOMETER

THE recent recognition of the significance of the vibrato in artistic singing has created the need for an apparatus suitable for demonstrating the various forms which the vibrato may take and for carrying on psychological and esthetic experimentation on the perception of the vibrato. The vibrato tonometer has been developed for the purpose and is recommended to experimenters because of its simplicity, convenience and relatively inexpensive construction. With it a vibrato may be produced with the number of oscillations per second, extent of the frequency fluctuation, extent of the intensity fluctuation and frequency-intensity phase relation under separate control.

The apparatus consists of a pipe, similar to an organ pipe, enclosed in a partially sound-proof box. The frequency is varied by an oscillating movement of the plunger, and the intensity by a sliding door in the side of the box. The plunger and the door move back and forth at the same frequency. Both are controlled by scotch-links, which impart a sinusoidal form to their movements. The device is operated by a hand crank, and when turned in rhythm with a metronome, or other timing device, the rate of the vibrato produced can be very accurately controlled. The ratio of the pulleys is such that each revolution of the hand crank produces three vibrato cycles. Thus, by setting the metronome at a known number of beats per minute, a vibrato of any desired number of cycles per second can be produced.

Two scotch-links are used, one controlling the frequency and one the intensity fluctuation. They are mounted on opposite ends of the same shaft, which is turned by a belt from the hand crank. The use of adjustments on the pins of the scotch-links makes it possible to vary independently the amount of the frequency and intensity fluctuations, respectively, from zero to the maximum used in an artistic vibrato.

By changing the position of the scotch-links on the shaft with respect to each other, any phase relationship desired between the frequency and intensity fluctuations can be produced.

The device thus provides for the production of a vibrato with independent control of the extent of the frequency fluctuation, extent of the intensity fluctuation, rate and frequency-intensity phase relationship.

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LABORATORY USES OF ULTRA-VIOLET TRANSMITTING GLASSES

IT may be of interest to those who are not familiar with the special glasses, particularly those biologists and chemists who are studying the effects of ultra-violet on bacteria or on chemical decompositions and syntheses, to learn that satisfactory containers can often be blown of glass. The new glasses vary in short wave-length transmission limit from about 2500 A to 3000 A, so that within this range it is possible to study the effect of wave-length by employing test-tubes, flasks, etc., of different materials. Each container acts as a filter, making external filters unnecessary. Of course, for wave-lengths shorter than 2500 A quartz or else open containers would probably be employed.

I have recently had occasion to study the emission of the 2537 A mercury line under such a variety of conditions that a large number of very special shapes and sizes of discharge tubes was required. To have used quartz with the necessary graded seals or graded