month a sharp decrease in plasticity occurs as is indicated by the rise of the index from 106 to 146.

3. The racial indices of modifiability, obtained by averaging the results for five individuals of each sex for each of the three ages mentioned, indicate a rapid decrease in plasticity from 94 at one month to 169 at seven months of age.

Discussion of these results is not in order in the present unfinished state of the investigation. I may say, however, that I am attempting to ascertain the duration of the sexual life of the dancer, and to discover the relation of plasticity to the strength of the electric stimulus which the animal learns to avoid.

37 (293)

The crystallography of hemoglobins.

By **EDWARD T. REICHERT** and **AMOS P. BROWN.**

[*From the S. Weir Mitchell Laboratory of Physiology, University of Pennsylvania.*]

The primary object of this research was to determine whether or not corresponding albuminous substances are identical. We believed that if non-identity were established we should have a fact of great fundamental importance in relation to heredity, the origin of species, etc. The crystallographic method was adopted because we believed that by this means we might succeed where the chemist has failed; and hemoglobin was selected as the first substance of our inquiry because of its comparatively ready crystallizability. Crystals from over one hundred species have been studied, and we have not only positively shown the non-identity of the hemoglobins, but have also brought to light much information of broad biological interest. From a preliminary review of our records certain facts stand out very prominently.

1. *The constancy of generic characters in the crystals.* — For instance, the genera that have been represented by a considerable number of species, as *Felis*, *Canis*, *Papio*, etc., show in each case constancy in the characters of the crystals in each genus, with marked differences both in axial ratios and in crystal systems between the

crystals from the different genera. When the characters of the crystals from any one of these genera are tabulated, they at once recall to the mineralogist the crystallographic groups of minerals. The crystals of the genus *Felis* are as strictly isomorphous as those of the calcite group of the rhombohedral carbonates. As an example of the individuality of these generic characters, the following example may be cited: A sample of blood, marked as that of a certain species of baboon was received from one of our zoölogical gardens. Upon making preparations and examining the crystals, it was at once evident that they did not correspond to any species of baboon thus far examined, nor did they show the characters of the crystals of this genus. They were identified by their crystallographic characters as belonging to the cats (genus *Felis*), but not to any species thus far examined. Inquiry at the zoölogical garden from which the blood was received showed that the animal recorded as being subjected to a postmortem examination on the date when the blood was collected was a species of cat (genus *Felis*), but not one of which we had previously examined the blood.

2. *Specificity in the crystals of a genus.* — The crystals of different species of a genus can usually be distinguished from each other by definite differences of angle, when they are favorable for good measurement, while preserving their isomorphous character as belonging to a definite genus. From the difficulty of measurement in many cases it is hard to give these differences a quantitative value, but the variation in habit of the crystals and their mode of growth will often show specific differences.

3. *The occurrence of several types of crystals of oxyhemoglobin in many species.* — The oxyhemoglobin of some of them is dimorphous, crystallizing in two systems, or even trimorphous in many cases. Here it is generally seen that the crystals first formed crystallize in a system of a lower grade of symmetry than those formed later. When several types of crystals occur in the species of a genus, they may each be arranged in isomorphous series. The explanation of these observations seems to be indicated by the results obtained.

4. *The constant recurrence of certain angles, either plane or dihedral, in oxyhemoglobin, hemoglobin, and the "methemoglobin" of various species, even when widely separated zoölogically and when*

the crystals belong to various systems. This indicates a common substance in hemoglobin or a common structure in the various hemoglobin molecules.

5. *The importance of twinning in the formation of crystal aggregates and the constant recurrence of certain types of twinning in all of the hemoglobins.* These results will likely throw light upon the mechanism of twinning and be of importance in general crystallography.

6. *Differences between oxyhemoglobin and hemoglobin or reduced hemoglobin, in certain species.* Undoubted differences between the crystals of these two substances in the crystals of the same species have been observed.

We have gathered additional evidence leading to the conviction that other corresponding proteins, as well as certain fats and carbohydrates, will be found to exhibit similar generic specificities.

Our first memoir on this subject will shortly be published by the Carnegie Institution of Washington, under whose auspices this research is being conducted.

38 (294)

The germicidal property of milk.

By **M. J. ROSENAU** and **GEO. W. MCCOY.**

[*From the Hygienic Laboratory, U. S. Public Health and Marine Hospital Service, Washington, D. C.*]

Judged by the number of colonies that develop upon agar plates the bacteria in milk first diminish, then increase in number. The so-called germicidal property of milk occurs only in the fresh raw fluid.

For the most part our work plainly shows that no actual reduction in the number of bacteria occurs. However, when compared with the controls a restraining action is evident. The phenomenon, therefore, appears to be that of a weak antiseptic rather than that of a true germicide.

When milk is kept warm (37° C.), the decrease is pronounced within the first eight or ten hours. After this time the milk has entirely lost its restraining action.

When the milk is kept cool (15° C.) the decrease is less marked, but more prolonged.