had, and it seems to me worth while to state what conclusions my studies have led me to.

No group of birds with which I am acquainted shows such remarkable uniformity in their pterylography as do the humming-birds. So far as I can see Professor Thompson's figures of *Patagona* would answer, almost without change, for any of the 11 species I have examined. The only important difference is the absence of anything like what he calls the 'lateral' tract; I have found this in none of the specimens before me. In the feathering of the occipital region, moreover, my specimens do not agree with his figure, though they answer well to his description. Even nestlings and embryos (removed from the egg before hatching) of *Mellisuga* have precisely the same pattern of pterylosis, as in all adults. The swifts are not so constant to a single pattern as the hummers, and show some considerable generic diversity, but they nevertheless possess a very characteristic type of pterylosis. I am utterly unable to agree (however much we may allow for individual diversity in the birds and the personal equation of the observer) to either Dr. Shufeldt's account, or Professor Thompson's figure, of the cypseline pterylosis. This is not the place to enter into details, but one point at least must be mentioned. The posterior cervical apterium, so conspicuous in the humming-birds, is present in every swift I have examined, and I have not seen it in any other birds. Professor Thompson failed to find it in *Collocalia* and Dr. Shufeldt says it is *never* present in the swifts!

In the feathering of the head, the humming-birds do show a slight resemblance to the goat-suckers, but this is really not so close as appears at first sight. The swifts differ from both, but some species have the feathers on the occiput few and far between, as in the hummers. It must be borne in mind, however, that the pterylosis of the head is quite variable, perhaps more so than that of any other part of the body. In the pterylosis of the neck, the swifts and humming-birds are very similar, especially on the upper side, while the goat-suckers are strikingly different. The feathering of the back shows considerable resemblance between swifts and humming-birds, for while some swifts have the femoral tracts separate, others have them more or less united with the dorsal, as they are in the humming-birds. The dorsal tract of the *Caprimulgi* is obviously different, and the femorals are always well defined and free from the dorsal. The humeral tracts in both swifts and hummers are near the dorsal, and their posterior ends tend to run into either the dorsal or the anterior end of the femorals. In the goat-suckers, the humerals are narrow and some distance from the dorsals. On the ventral side, we find the sternal tracts in the goat-suckers are more or less abruptly narrowed to form the rather long ventrals, while in the swifts and the humming-birds, the sternals pass imperceptibly into the short ventrals. As far as the number of secondaries is concerned, that is chiefly a matter of size; humming-birds have 5–7, swifts 8–11, and goat-suckers 12–14.

For these, and very similar reasons, I am led to disagree with Professor Thompson that the humming-birds are nearer to the goat-suckers than to the swifts, and I must dissent quite as strongly from Dr. Shufeldt's opinion that the pteryloses of swifts and humming-birds are 'essentially different.' To my mind, the swifts and humming-birds are pterylographically nearer each other than are grouse and guans, and almost as nearly allied as grouse and quail. I cannot see that the *Caprimulgi* have any close relationship to either.

HUBERT LYMAN CLARK.

OLIVET, MICH.,
October 30, 1901.

INJURIES TO THE EYE CAUSED BY INTENSE LIGHT.

THERE may be some general interest in the following cases of optical phenomena brought about by exposure of the eye to intense light.

Professor M., while working in a rather dark corner of his laboratory, accidentally broke a low-resistance circuit in which an electric current at a pressure of five hundred volts was flowing. The arc formed was about a foot from his eyes and appeared like a ball of fire rather more than six inches in diameter. Immediately there was a feeling that something had 'given way' in his right eye, though no

pain was experienced. Shortly afterwards he noticed that a part of the retina was permanently affected, the injured portion being in the form of a square, with the center of vision in one corner. The sharp outlines of this field could be easily distinguished, and upon closing the eye, fan-shaped flashes of a violet color spread out from one corner over the injured area at equal intervals of several seconds, their recurrence being entirely involuntary. After being some time in the dark the flashes of color ceased.

There was in general an apparent lack of illumination over this part of the retina, accompanied by a loss of power to properly distinguish colors, more especially green. The outlines of objects were blurred, their dimensions also appearing to be reduced by about one quarter. Printed letters could not be recognized at more than half the distance at which they were easily read by the uninjured eye. Parallel lines seemed to converge over the injured portion. In walking and riding he noticed at a short distance ahead what seemed to be a spot a few inches in diameter and about two inches high, which he often turned his wheel aside to avoid. The injured eye was also very defective in estimating distances. The effect lasted several weeks with almost undiminished intensity, but has since been gradually disappearing.

The second case is that of Mr. R., who in May, 1900, imprudently observed for some time the partial eclipse of the sun with his eyes unprotected in any way. No effect was noticed until late in the day, when in looking over the hillside he saw apparently a flock of eight or ten red birds whose movements were very erratic. Since the birds appeared wherever he looked, he carefully examined the field of vision, and discovered that the sun had formed a crescent image on the center of the retina of the left eye. The color of the image was green with a narrow red border. The injured area seemed to be quite blind, and parallel lines diverged around it, this effect being just the opposite of the previous case. The injury is always noticeable and very annoying, especially in reading. In making observations in the physical laboratory he had to discontinue the use of his left eye, which he had been accustomed to use constantly. The effect is still noticeable after a year, though it causes much less annoyance.

A case exactly similar to this has been described, in which the injury had lasted ten years.

Frank Allen.

Cornell University.

CURRENT NOTES ON METEOROLOGY.

RAINFALL, COMMERCE AND POLITICS.

A suggestive paper by H. H. Clayton in the *Popular Science Monthly* for December, on 'The Influence of Rainfall on Commerce and Politics,' forcibly emphasizes the interest and value of the studies that may be made along the lines of human, or economic, meteorology. In pointing out that 'every severe financial panic (in the United States) has been closely associated with a protracted period of deficient rainfall,' and that 'there has been no period of protracted drought without a severe financial panic except a period, the effects of which were masked by the large disturbances attending our Civil War,' the author has clearly indicated how closely national crises are related to the changing meteorological conditions of successive years. The sequence of deficient rainfall—deficient food supply—financial panics—changes in the dominance of political parties,—is also considered. There is much in this discussion that might well occupy the attention of those who take pleasure, not only in studying the correlations of meteorological conditions and politics in the past, but who also wish to try their luck at forecasting the political changes of the future. Mr. Clayton rightly calls attention to the value of such investigations on the economic side of meteorology, and to the need of more opportunity in our universities for the study of the influences of the atmosphere upon health, upon commerce and upon politics.

This interesting paper suggests a number of other, somewhat similar, examples of the influence of weather upon political movements of greater or less importance. Among the causes of the 'Boxer' outbreak in China, which