building or the roof of a piazza, certain parts of thin clouds, or edges of thick clouds, will usually be seen tinged with red or green, the colors often appearing together with red predominating. Occasionally the tint will be straw-color or purple. The effect may be seen at any time during the day, preferably when the sun is at a considerable elevation above the horizon. The colors are seldom intense, but are, nevertheless, very beautiful. They may be distinguished, when faint, by comparing them with any white cloud at an angle of 30° or 40° from the sun.

As the clouds in question are very brilliant, one's eyes have to become accustomed to the glare before the colors can be seen. Hence it is better to use smoked glass or dark glasses.[1] A smoked glass plate, on which the density of the smoke deposit varies from one edge to the other, is very convenient, as the best density for any particular cloud may quickly be found.

The following facts indicate that the mechanism of the effect is totally different from that by which the rainbow is produced. The colors appear in irregular patches of various sizes, and not in arcs of circles concentric with the sun. In fact, two small clouds may be close together, one being colored while the other is pure white. The red and green do not always appear together, the red occurring alone more frequently than the green. The same portion of cloud will frequently change from one color to the other.

It seems most reasonable to attribute these colors to interference. To make this clear, consider what must happen when white light passes through a water drop or ice crystal. At the surface where the light emerges, the ray will be divided, part passing through, and part being reflected back, to be reflected from the upper, or incident, surface of the drop, thence passing out through the lower surface. This second part will afford interference with the part of the ray that passed through unreflected, for a certain wave-length, provided a sufficient difference of phase, between the two parts of the ray, has been introduced. Owing to the shape of the drop, or particle, only one particular ray will, after undergoing this division, have *both* these parts sent in the direction of an observer on the ground (just as in the rainbow, each drop behaves like a prism, to an observer, but only for light that passes through one particular plane). If, further, we suppose that there are many drops of very closely the *same diameter*, then an observer should see light of the same color as that transmitted through a thin film, *e. g.*, a soap film or thin mica, of a thickness equal to this diameter.

[1] A solution of a substance, having transmission bands in the red and green only, would be best for observing the colors most frequently seen, namely, red and green.

Certain evidence supports the above explanation. The phenomenon is especially prominent in clouds that are increasing or decreasing in density. For example, in one particular cloud that was observed, which was increasing in size, the edge was first red, then green, then gray. Further, a cloud was occasionally seen with the red and green arranged in three or four alternate bands, strikingly suggestive of Newton's rings, or the fringes produced by an interferometer.

If the explanation here given is correct, these colors, besides of interest as being possibly the only sky colors produced by interference, may also be of some meteorological importance, namely; in giving an idea of the degree of homogeneity of size of drops in portions of thin clouds, by the intensity of the color; of the extent of these portions, by the area occupied by the color, and of the size of the drops, by the particular color present. Perhaps more information could be obtained by a spectroscopic method, whereby the spectrum of a small portion of cloud would show dark bands, corresponding to the wave-lengths removed from the light by interference.

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Worcester, Mass.,
November 2, 1913

ORIGIN OF MUTATIONS

Gates, in a personal letter, has kindly called my attention to a misstatement contained in my note[1] regarding the possible origin of mutations in somatic cells, in which I erroneously credited to Davis[2] the suggestion that triploid (semi-*gigas*) mutants of *Œnothera* are to be accounted for through the production of occasional diploid gametes by an extra fission of chromosomes. Obviously, as Gates points out, Davis's suggestion of diploid gametes could not have been offered as an explanation of triploid mutants, for the reason that the triploid condition in *Œnothera* was not known in 1911. Davis's suggestion was offered to account for the tetraploid condition of *gigas* mutants. The suggestion that tetraploid mutants may arise through a double fission of chromosomes in some mitosis soon after fertilization should have been credited to Gates.[3] I am grateful to Gates for setting me right in these matters.

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HOW ORYCTES RHINOCEROS, A DYNASTID BEETLE, USES ITS HORN

MANY beetles, particularly in the family Dynastidæ, have more or less conspicuous horns or processes on their head or prothorax. These often assume fantastic shapes and enormous proportions. Sometimes they occur on both sexes, but more often they are found only on the male or at least reach their greatest development there. In the latter case they have been looked upon by some as characters that may have been developed through sexual selection, the assumption being that males so ornamented were more attractive to the females or in some other way were more likely to be able to mate and thus perpetuate their kind. While such a theory may not be very satisfactory without more detailed observations or experiments to prove its soundness, we know of no other that is any more acceptable.

Many of the horns and projections are of such a size and character that it is hard to conceive of their being of any possible use to the insect in its struggle for food, or with its enemies. Possibly some of them are of no use in this way, but while studying the rhinoceros beetles, *Oryctes rhinoceros*, in Samoa last summer, I had an opportunity to watch these insects making a very evident and profitable use of the horn on their heads. The horn is present on both sexes and is usually longer on the male than on the female, but many males may be found with very short horns and many females with long horns, so that the sexes can not be separated by this character. The horns vary in length from 1.5 mm. to 10 mm., 6 or 7 mm. being about the average length. The beetles feed on the growing heart in the crown of the coconut trees. They usually enter the trees close to the base of a leaf, crawling down as far as they can between the tree and leaf-stem before beginning to bore. The spiny legs enable the beetle to brace itself firmly before it begins literally to root its way into the web-like sheath through which it usually has to pass before it reaches the hard wood. In doing this the head is lowered and the horn thus thrust forward. The horn becomes imbedded in the tissue of the plant and when it is raised serves as an anchor to hold the insect while it pulls or pushes its body forward with its legs, or while it tears the tissue of the plant with its heavy mandibles. The insect will always root and push its way as deep as it can before it begins to bore. The amount of power it can develop while trying to force its way between the bases of two leaves or in other tight places is truly remarkable.

Thus, in this instance at least, we see that this horn is of direct use in aiding the insect to reach its food.

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September, 1913

SCIENCE AND THE NEWSPAPER

WHILE recently giving a discussion of the inclined plane, an idea which was new to me suddenly presented itself. The equation asserts that the force required to make a mass slide up the plane would under certain conditions be made less, by making the plane

1 *Amer. Nat.*, 47: 375, 1913.

2 *Annals of Botany*, 25: 959, 1911.

3 *Archiv f. Zellforsch.*, 3: 525, 1909.