and green were developed out of, and white (at a still earlier time) the color which yellow and blue were developed out of? Does the great discovery of Lavoisier—the occurrence of the chemical reaction—exist for the color-physicist in vain?[4]

Violet is a popular but unscientific name for a slightly reddish blue, as any one can see by giving the matter a moment's attention. A child can perform this analysis. My little girl, when three years old, stopped on the street—her scientific curiosity aroused—when she saw for the first time a brilliant purple surface, and exclaimed "Bu!—wed!—wed!—bu!" This is proof positive—what the Eskimos have also furnished proof of—that purple really is at once blue and red or red and blue. And yet a physicist even at the present day (Frank Allen) can propose a theory in which violet (a red-blue) is a fundamental color—that is, a sensation which is assumed to have a single physiological correlate attached to it! And Professor Knight Dunlap has proposed a theory (*The Psychological Review* **22**, 99, 1915) which he seems, however, not to have insisted upon in later years, in which the elements assumed are mauve, peacock and yellow (in other words, red-blue, blue-green and green-red)! The fundamental principles which make such an assumption as this quite impossible have been admirably set forth by Professor G. E. Mueller. (*Zeitschrift. f. Psych. 10,* 2, 321, 1896.)

But color is a subject in which the physicist is very apt to engage in fallacies. So distinguished a scientist as Professor Millikan is capable, when speaking of color, of committing a plain "wrong conversion," as the logician has called it. He says (textbook on Physics, by Millikan and Gale) after having shown that white light can be separated up into all the colors of the spectrum, "we have shown that white light is composed of all the colors of the spectrum." But in fact white light is composed of red, green and blue; or—just as well—by the mixing of the most homogeneous obtainable yellow and blue light rays; it is not at all necessary to put in all the blue-greens, the green-yellows, etc., nor even yellow. Moreover, white can be seen *at every point of the spectrum* (with no mixing whatever) in these several (additional) cases:

B. The normal eye (*a*) in a faint light,
(*b*) in the extreme periphery of the retina,
(c) when a minute point is looked at,
C. The totally chroma-blind,
D. The lower animals (below the bees).

[4] See "Tetrachromatic Vision and the Genetic Theory of Color." SCIENCE, *55*, 555–560, 1922.

Until the physicist can be persuaded to give his attention to such facts as these, he will never be able to speak with intelligence on the subject of the color-sensations. But the case is not altogether hopeless. Professor Peddie has said in *Nature* (July 18, 1925) that the theory which I have proposed for holding together all these very complicated facts—the genetic theory of color—"may well turn out to be the real state of things"; and Professor Crew, in the new edition of his "General Physics" has used it as the *cadre* in which all these facts can best be understood. The physicist is recommended to read Professor Crew's exposition.

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ADDITIONAL RECORDS OF THE OCCURRENCE OF THE FRESH-WATER JELLY-FISH

THROUGH the kindness of the Bureau of Fisheries the following communication and specimens of this fresh-water medusa were brought to the attention of the National Museum:

July 30, 1927

The Commissioner,
U. S. Bureau of Fisheries,
Washington, D. C.

Dear Sir:

Inasmuch as the organism Craspedacusta is considered so rare according to Ward and Whipple in their "Fresh-Water Biology," I would like to take this opportunity to let you know that we have found our Slow Sand Filters swarming with the Medusa form of above, and specimens taken into laboratory are apparently thriving on the organisms in raw water. Our supply is fresh water taken from above Great Falls above tidal water possibilities and I would appreciate if you could tell me where their source might be.

This is the first time this organism has ever been noted here in our twenty-three years' operation.

Very truly yours,
(Signed) CARL J. LAUTER,
Chief Chemist

Mr. Lauter tells me the medusae he brought to the Bureau of Fisheries on July 30 were first noticed on July 28, and that they occurred at one time or another thereafter in practically every bed.

Each filter-bed is about 200 feet square and about four feet of water above the level of the sand. The beds are virtually in total darkness and there is very little circulation of air. The temperature of the water at this time of the year differs but little from that of the open storage reservoir from which it is drawn. At 8 A. M. on August 17 the temperature of the water at the surface in the filter was 74° F.

and in the open reservoir 75° F., August 18 at about 11 A. M. air temperature outside 71°, water in open reservoir 73° F., and in filter-bed 75° F. The water is slowly admitted to each bed through a main, discharging about 3 million gallons per day.

Bed No. 8, examined August 9, seemed crowded with medusae. When the door of the bed was opened, the jelly-fish hastened to the light from all directions. There were literally thousands in sight at one and the same time. Though still present in this bed on August 12 and 13, not a single one was noticed on August 14 even after vigorous churning of the water. In fact, none were noticed in more than half a dozen beds opened that day. Late the same afternoon a few were found in Bed No. 7, where on the morning of August 15 over a hundred were secured. A few days later, so far as known, the medusae had completely disappeared.

In their exceptional appearance and sudden disappearance these specimens ran true to form, but in this case at least attention must be called to the fact that during the period that the medusae were found in the filtration plant the water eight miles above this point was not being alum treated, though their sudden disappearance did about coincide with its resumption on August 19. Mr. Lauter assured me, however, that traces of alum are never found in water entering the beds. This would seem to indicate that the medusae had entered the filters with the inflowing river water, but as they were not noticed at any time in either of the two open storage reservoirs through which the water entering the system passes, the medusae may have originated coincidentally from "microhydras" within the filter-beds. However, scrapings of the side walls, the surface sand, and a plank walk extending from the entrance door down to the surface of the sand, of a freshly drained filter-bed in which medusae had been found, failed to reveal any trace of the hydroid generation. On the other hand, the well-known hydroid *Cordylophora lacustris* Allman was found abundant, thus adding another strictly fresh-water record to its occurrence in the United States.

A newspaper mention of this phenomenon resulted in a communication to the museum by Mr. J. W. Keys, of Washington, D. C., who reported seeing jelly-fish in two connected pot-holes on the Virginia shore of the Potomac near Great Falls. He first observed them on August 7, and again on the twenty-first, but by the time of his third visit to the place, about September 1, they had vanished.

Dr. H. B. Bigelow, of the Museum of Comparative Zoology, kindly determined the medusae as *Craspedacusta sowerbii* (Lankester). In North America the species has been found several times in the eastern United States and at one locality in the middle west.

The first fresh-water jelly-fish recorded from the United States was observed by Edward Potts,[1] who gave it the name of the hydroid from which he had seen it budded off, *Microhydra ryderi*. It appears to be a juvenile stage of *Craspedacusta sowerbii*, which name takes precedence by right of priority. The hydroid form had been taken from the rocky bed of a mill stream, Tacony Creek, near Philadelphia, and later also found prevalent along the Schuylkill River.

The year before Potts made his last report on this jelly-fish it appeared in a greenhouse aquarium at Shaw's Lily Pond, on the outskirts of Washington, D. C., as recorded by the late Prof. C. W. Hargitt.[2] These aquaria have not been in use for a number of years and there is no recollection by present generation of Shaws that they ever recurred since the original find.

On a number of different occasions, most of which were made public through these columns, Prof. Harrison Garman[3] has found *Craspedacusta* in great numbers in Benson Creek, Kentucky.

Meanwhile, Dr. R. E. Coker discovered some specimens in an artificial pond at Augusta, Georgia. These are mentioned in the only complete account of the development of the medusa since the studies made by Potts on the younger stages, by Prof. Fernandus Payne[4] under the name *Craspedacusta ryderi*. He had abundant material over a period of years from 1918 to 1924, from an artificial body of water, Boss Lake, near Elkhart, Indiana.

Since the foregoing was written, Mr. Henry S. Barton, of Owensboro, Kentucky, has presented the National Museum and the Bureau of Fisheries with a number of specimens of *C. sowerbii* he had taken in "Indian Lake," August 21. This body of water presumably is near Owensboro, and the latter is about 120 miles to the westward of Benson Creek where Dr. Garman found the first Kentucky specimens. Their transparency, short life and unsubstantial constitution, together with conditions under which they occur in nature render it difficult and often impossible for the casual observer to notice their presence in any body of water. Garman says "The best conditions, judging by the character of the three seasons when it has been found [in Benson Creek], are settled, clear days, when the water is low, free from silt, and there is little current in the creek," and it should be added, during August and September. It may be that the appearance of this jelly-fish is as sporadic

[1] *Amer. Nat.*, Vol. 31, 1897, p. 1032, and *Quart. Jour. Micros. Sci.*, N. S., Vol. 50, pt. 4, No. 200, 1906, pp. 623–633; also *Del. County Inst. Sci. Proc.*, Vol. III, no. 3, 1908, pp. 90–106.

[2] SCIENCE, Vol. XXVI, 1907, p. 638, and *Biol. Bull.*, Vol. XIV, 1908, pp. 304–318.

[3] SCIENCE, Vol. XLIV, 1916, p. 858; Vol. LVI, N. S., 1922, p. 644; Vol. LX, N. S., 1924, p. 477.

[4] *Jour. Morph.*, Vol. 38, no. 3, 1924, pp. 387–411.

and irregular as that of *Apus* in many parts of the world.

From the accumulated records one can not but be convinced that *Craspedacusta* and its alternative generation are much more common and widely distributed in the fresh waters of the eastern and eastern central United States, at least, than heretofore believed, and that continued and careful examination of particular bodies of water over a period of years will prove this to be the case.

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THE MAGNETO-OPTICAL EFFECT AND THE ZODIACAL LIGHT

IN SCIENCE for October 21, 1927 (Vol. 56, page 376), Dr. Elihu Thomson publishes a new hypothesis to explain the zodiacal light. Some years ago he noticed that the particles of iron from the smoke of an arc were oriented by a magnetic field, so as to reflect light strongly in certain directions. He suggests that the zodiacal light may be due to particles of iron oriented by the earth's magnetic field.

The zodiacal light is a faint illumination seen in the west just after twilight, or in the east just before dawn. It is always centered on the ecliptic, or plane of the earth's orbit, being brightest just above the haze which nearly always dims anything seen near the horizon. The brighter portions of the zodiacal light are distinctly more brilliant than the milky way. Spectroscopic tests indicate that it is simply sunlight, and it is fifteen or twenty per cent. polarized, as would be expected after reflection.

The generally accepted hypothesis may be summed up in Moulton's words "It is universally agreed that the zodiacal light is due to a great swarm of small bodies, or particles, revolving around the sun near the plane of the earth's orbit. These small bodies are in reality planetesimals which have not been swept up by the planets, ..." The new Russell-Dugan-Stewart text on astronomy presents this hypothesis with the introductory statement "The observations make it almost certain that . . . ."

Although ordinarily not seen to extend more than ninety degrees from the sun, tests at Mt. Wilson have shown that some illumination extends over the entire sky. Keen eyes can, under the best conditions, discern a faint patch of light at the point on the ecliptic directly opposite the sun. This is known as the gegenschein. The swarm of small bodies must extend in appreciable numbers well beyond the earth's orbit. Particles opposite the sun would be seen at the "full" phase, like the full moon. The gegenschein is further explained by the fact that the combined attraction of the earth and sun tends to concentrate such particles in a sort of dynamic whirlpool about a point nearly a million miles outside the earth's orbit.

The fact that iron lines are conspicuous in the solar spectrum, and that iron is an important constituent of meteorites, suggests that iron particles may be numerous among those reflecting to us the zodiacal light, but the following observational evidence indicates that Dr. Thomson's effect is unimportant.

(1) The zodiacal light is most conspicuous just outside of twilight, perhaps 30 degrees to 40 degrees from the sun, and ordinarily fades into invisibility before 90 degrees is reached. The Thomson effect would produce the glow at 90° to 150° from the sun.

(2) The zodiacal light is always seen along the ecliptic, or plane of the earth's orbit. The orbits of all the major planets are nearly in this plane. The Thomson effect depends on the earth's magnetic field, and so, in general, would not follow the ecliptic.

(3) As the earth's shadow extends to more than three times the distance of the moon, the gegenschein, or glow at the point opposite the sun, must be produced by particles which are presumably too distant to be oriented by the earth's magnetic field. Particles as near as the moon would, in that direction, be within the shadow of the earth and, therefore, invisible.

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THE INDIGENOUS NATIVE POPULATION OF ALGERIA IN 1926[1]

IN a recent book[2] the indigenous native population of Algeria was studied in considerable detail, as the only example known to me of a human population which had virtually completed an entire logistic cycle of growth within the period of census taking. To the counts of this population made by the French between the years 1851 and 1921 inclusive, there was fitted, by least squares, the logistic curve

$$y = 2.238 + \frac{3.141}{1 + e^{1.2059 - 0.4232x}} \qquad \text{(i)}$$

with the results shown in Table 1 for the years 1881 to 1921 inclusive, during which period the observed figures may be regarded as substantially reliable.

There have now come to hand[3] the results of the 1926 census of Algeria. It appears that the indige-

[1] From the Institute for Biological Research of The Johns Hopkins University.

[2] Pearl, R. The Biology of Population Growth. New York (Alfred A. Knopf), 1925. Pp. xiv + 260.

[3] *Jour. Soc. Stat. de Paris*, November, 1927, p. 291.