To quote briefly without essential change from my previous paper:

In a gelatine solution containing bichromate, when silver nitrate is added, concentric rings are formed because the ion in the gelatine is relatively fixed. The silver ion wanders out and forms a ring by precipitation. A region on the chromate side of the ring is freed from the chromate ion, and a corresponding region on the silver side is freed from the silver ion. Growth stops until the silver again wanders out through the precipitate, and comes within range of the chromate ion when the process is repeated. The essentials of this interrupted growth theory are given in the previous article. Holmes' [5] theory closely resembles mine. Bradford's assumes unnecessary facts to explain the phenomenon. Later, I expect to give a more detailed account of this common phenomenon.

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[5] Holmes. *Journal American Chemical Society*, 1918, XL, p. 1187.

SPECIAL ARTICLES

THE IDENTITY OF CERTAIN YELLOW PIGMENTS IN PLANTS AND ANIMALS

LITTLE attention seems to be paid, from the physiological standpoint, to the fact that the yellow pigments in certain animal organs have been shown to be chemically identical with the yellow pigments common in plants.

Some cases of the identity of lipochromes (yellow pigments of animals) with carotinoids (carotin, xanthophyll, lycopersicin, and fucoxanthin of plants) have been known for several years,[1] and the list has recently been greatly extended. The lipochromes of the following animal tissues are now known to be either chemically identical or isomeric with carotinoids—the ear lobes, beaks, shanks, body fat and blood serum of fowls, and the yolks of their eggs;[2] and the fat of the body, blood serum, corpus luteum and milk of the cow.[3] It seems probable that the same is true of the nerve cells of some animals and of the blood plasma and body fat of the human body.[4] These pigments are not synthesized by the animals, but are merely taken up from their food.

It is well known that carotin ($C_{40}H_{56}$) is a highly unsaturated hydrocarbon. It has been shown[5] that part of the unsaturated linkage of its molecule is of a type that can be easily satisfied by direct addition of oxygen. Xanthophyll is carotin dioxide ($C_{40}H_{56}O_2$). Lycopersicin has the same empirical formula as carotin. Fucoxanthin ($C_{40}H_{54}O_6$) contains more oxygen than the others. The first two of these pigments are widely distributed in plants. Not only do they always accompany chlorophyll, but they are also found in flowers, fruits, seeds, and subterranean organs, and also in fungi.[6]

The physiological significance of the carotinoids has, of course, not been wholly neglected. It is commonly pointed out[7] that the tendency of carotin to unite with oxygen may be significant in connection with photosynthesis, which is a reduction process. Steenbock[8] has suggested that the fat-soluble vitamine is identical with some of the carotinoids, while Palmer[9] has cited cases that seem to cast doubt on this view. Years ago Schunck[10] suggested the question as to whether xanthophyll, being present in connection with both chlorophyll and haemoglobin, may not be of physiological importance in both cases.

Emphasis is commonly laid on the chemical similarity between the chlorophyll molecule and the hæmoglobin molecule, though similarity of function between the chlorophyll of plants and the haemoglobin of animals does not seem to have been definitely shown. An examination of half a dozen recent and standard works deal-

[1] Proc. Roy. Soc. London, 72: 165. 1903. Z. Physiol. Chem., 74: 214. 1911-12.

[2] Jour. Biol. Chem., 23: 261-279. 1915.

[3] Ibid., 17: 191-263. 1914.

[4] Jour. Amer. Med. Assn., 74: 32-33. 1920.

[5] Thatcher. The Chemistry of Plant Life. 1921.

[6] [7] Palladin's Plant Physiol. Livingston. p. 19.

[8] Sci. N. S., 50: 352-353. 1919.

[9] Sci. N. S., 50: 501-502, 1919, and Jour. Biol. Chem., 46: 559-577, 1921.

[10] Proc. Roy. Soc., London, 72: 176. 1903.

ing with the chemical phases of plant and animal physiology indicates general interest in the similarities between chlorophyll and haemoglobin. It would seem that the identity of lipochromes and carotinoids is worthy of equal attention.

The investigation of what the carotinoids of plants and lipochromes of animals have in common physiologically would seem to be a hopeful line of work. The fact that they may readily take up oxygen seems to furnish a starting point for thought and work, which will be important, whether the results prove positive or negative.

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RATE AND MODE OF SOIL DEPOSITION IN THE PALOUSE AREA OF WASHINGTON AND IDAHO

DURING the last eight years the writer has had the opportunity to observe the formation of soils on the Columbia Plateau by the wind. The soils are often a hundred feet deep or more, and are virtually great dunes of silt brought sometimes for great distances. The area where these dunes lie is locally called the "Palouse," well known for its deep and very fertile soils.

Dust storms are frequent, and, curiously, the dust deposited is generally not raised near the place of deposition. It comes from an area of widely different characteristics. This accords strictly with Richtofen's theory of loess. The loess is formed when the wind moves particles of silt from an arid or semiarid area and deposits them in a more humid one. Once deposited upon the moister land, the silt particles are not raised again but become a permanent acquisition to the more humid area. Two factors cause the permanency of the deposit, first the moisture in the soil causes coherence in the deposited mass, and secondly the heavier vegetation forms an entangling mesh. Shaler noted the same conditions prevailing in the formation of loess on the upper course of the Missouri River in Montana.

In the Palouse great dust clouds flying high in the air often nearly obscure the sun at a time when the soils for many miles around are too damp to be blown. A rain or snow fall then clears the atmosphere, carrying the dust particles to earth, and they do not rise again. At the present time drifting seldom takes place but in the past it must have done so. Otherwise the dune shaped hills extending at right angles to the direction of the prevailing winds can not be explained. Thus the deep soils over the lava plains between the Columbia Valley and the Bitter Root Mountains have been formed at the expense of the drier eastern slope of the Cascade Mountains and the Columbia Valley.

To measure accurately the amount of soil brought into an area annually is well nigh impossible. Only under particular conditions is it possible to measure that brought in by a single storm. To do so it is necessary that the soils upon which the deposit takes place be not moved by the wind bringing in the dust. Once deposited, the material must not be lifted again by the same wind, and that brought to earth must be kept separate from older deposits.

A particularly favorable situation for making measurement was presented over the eastern part of the Palouse on January 29, 1917, and at that time a series of collections was begun at Moscow, Idaho, by the writer. From that date to March 23 four dust falls took place, upon all of which measurements were possible. On the afternoon of January 28 a fall of pure white snow took place. The following morning it was covered with a coat of chocolate brown dust of variable thickness. At the time practically the whole area was covered with snow. The dust therefore must have been carried nearly a hundred miles and probably was carried twice that distance.

Measurement of the amount of material deposited was made by collecting the dust covered snow from five different areas of average contour, each of four square feet in area. The snow was melted, the water evaporated and the dust weighed. From the result the deposit upon an acre was calculated as 140 pounds. Similar dust falls occurring on March 21, 22, 23 brought, respectively, 196 pounds, 184 pounds and 585 pounds per acre as measured in the same way. The total for the four dust falls is 1,105 pounds in 55 days or approximately