is the most complete hotel in the West; it is fireproof and stands in a beautiful park. A fine social club house and two country clubs are adjacent. The churches are numerous and well served. The residences are detached, with gardens and trees around them, and are for the most part pleasing in their architecture. The general air and resources of the city suggest the best type of the Eastern rather than that of the Western States.

Glenwood Springs—elevation 5,200, population 1,500—lies on the western slope of the great continental Divide, and is situated in a valley at the junction of the Grand and Roaring Fork rivers. The Denver and Rio Grande and the Colorado Midland railways pass through the town on their way from Denver to Salt Lake and the Pacific coast. Here is the far-famed Yampa hot spring, from which flows each minute 2,000 gallons of water at a temperature of 134° F. This water is rich in salts, and sulphureted hydrogen gas is freely given off from its surface. The arrangements for bathing are of the most complete and modern description. There is an open swimming pool 700 feet in length and 100 feet in width, in which a hot salt bath can be thoroughly enjoyed. On one side of this pool is a beautiful bathhouse containing baths of all kinds; on the other are sulphurous vapor caves which are most comfortably fitted up. The baths of Glenwood are justly celebrated for their efficacy in the treatment of various diseases, especially gout, rheumatism, syphilis, and certain renal and hepatic affections. Its climate is soothing and restful and of great service in irritable nervous disorders.

"Glenwood Springs has one of the finest hotels in the West. It is a large building in the Italian style of architecture, constructed of Colorado peachblow-colored stone and Roman brick. It surrounds an open court which is terraced, and has grass plats, fountains, and beds of flowers. The hotel has 200 guest rooms; it is well heated, liberally supplied with open fireplaces, and is lighted by electricity." *

Climatic Conditions at Glenwood Springs.

Monthly mean temperature (Fahr.)—	
Winter	27°
Spring	50
Summer	69
Autumn	47
Year	48
Rainfall (total, inches)—	
Winter	4.90
Spring	3.04
Summer	3.80
Autumn	4.22
Year	15.96
Monthly mean temperature for January (two years)	22°
Monthly mean temperature for July (two years)	72°
Mean yearly minimum (three years)	5°
Mean yearly maximum (three years)	100°

Therapeutic Use of Colorado.—What has been written about the use of high stations in the Alps applies to Colorado with certain modifications. The latitude of Colorado is much lower than that of the Alps, that of Colorado Springs being about the same as that of Naples. It is therefore much warmer, and also, because of its situation in the interior of the continent, much dryer; moreover, it enjoys the climate of the high plateau as well as that of the mountain. This increases the dryness, the length of sunshine, and also the windiness of the climate. If the reader will turn to the description of Colorado Springs, he will understand how this health station combines the features of a plateau and a mountain station in a remarkable degree. The other places mentioned in this article, except Denver and Pueblo, lie more in the mountains, and receive more shelter but less sunshine, and are less under the influence of the air of the plains. When Colorado was first visited as a health resort, the idea was that it was better to place stations, particularly for consumptives, in the more sheltered resorts. For instance, Manitou and Cañon City were greatly used, and Colorado Springs very little; but the experience of the patients and of the doctors brought about a change in this respect, and, in spite of the accommodations being inferior at that time, patients frequented Colorado Springs in large numbers to the neglect of the sheltered resorts. At the present time, and indeed for some years past, the accommodations and resources for invalids have been excellent at Colorado Springs, and far better than in any other resort in the Rocky Mountain region. The wisdom of this change of base has been proved by the local experience, and is further corroborated by the successful use of open-air treatment in England and elsewhere, where the exposure to wind and stormy weather is much greater than in Colorado Springs. At the same time, the more sheltered spots are of greater service to a few of the cases. While, in comparing Colorado Springs with the Alpine resorts, we find that it excels them in the amount of sunshine and dryness, and because the climate is less harsh, we must at the same time admit that it falls behind them in that there is more wind and dust. One of the most prominent advantages that Colorado Springs enjoys—an advantage which is also shared in a lesser degree by the other Colorado resorts—is that the consumptive patient can continue under the influence of the climate all the year round, there being no falling and melting snow periods as in the Alps. To this the writer attaches great importance, because he does not believe that in seriously affected cases a residence of a few months is sufficient to insure permanent results. Further, when the consumptive is able to move about and take exercise, he has a wide area over which he can pass; he can ride and drive, play golf, and vary his amusements. Also, at Colorado Springs, at least, he can have the advantage of literary and musical circles, and all kinds of educational and religious institutions, and find reasonable social distractions. Those also in whom the disease is arrested, but for whom it is inexpedient that they should return to their former home, or who do not desire to do so, can find opportunities for work or investment of money. The recent discoveries of gold at Cripple Creek have added to the wealth and prosperity of the city, and to the business opportunities of all kinds, but have not brought any of the objectionable features of the mining camp. Besides the resources of the town, there are beautiful environs in which patients can live or to which they can resort by day.

It is often urged that for a consumptive who, of necessity or by choice, returns to his home, it is far better that he be treated in the same climate. There are undoubtedly many cases, particularly those in an early stage, in which this can be done, or must be tried; but the objection which is often made, viz., that the patient in whom the disease is arrested in a different climate, especially that of an altitude, is unable to return with safety to his home climate, does not hold. The writer in his visits to England and the Atlantic seaboard of America frequently has the pleasure of meeting old patients who have recovered in Colorado, and who are continuing in good health in their former homes. It is chiefly a question of care, especially in the first months of their return, during the period of re-acclimatization. As Sir Herman Weber and other writers of eminence have said, a patient cured in a high altitude is just as much cured as one cured elsewhere, and if a patient's condition is such as to justify his return home, provided he has acquired the hygienic education that he should receive from his physician, he can do so without fear. Of course, in sending a patient far from home, his pecuniary, domestic, and social circumstances have to be very carefully investigated and considered before such a step is taken. Nostalgia is the curse of many patients, though it is surprisingly less under the sunny and stimulating influence of a high altitude than in resorts where cloudy weather and sedative influences dominate.

The journey to Colorado, owing to the distance, is usually expensive, and the cost of living ranges about twenty-five per cent. higher than in most of the cities at sea level, but is very little if any greater than in the

*Solly's Handbook on "Climatology," p. 251.

generality of health-resorts. Fair accommodations can be secured at a dollar a day, but for the well-to-do they would range from one and one-half to two and one-half per day. This applies to boarding-houses, which are both numerous and of all qualities. The best hotels charge from three to five dollars a day, somewhat lower rates being secured by the week.

The writer believes, and statistics confirm the belief, that in properly selected cases the arrest which is brought about in an altitude is more rapid and more lasting than that which has been procured in low places, this being probably mainly due to the fact that the changes in the blood quickly remove the anæmia. Open-air life is possible and agreeable for the whole twenty-four hours throughout the year, except during occasionally stormy spells, many patients sleeping out upon balconies through all the seasons. The statement is undoubtedly true that for most consumptives cold is better than heat; therefore the majority of consumptives improve more in the cool air of Colorado than in the warm air of New Mexico and Arizona. However, fibroid patients, in whom the circulation is feeble, and catarrhal individuals, to whom the variations of weather are dangerous, improve more surely during the winter in the warmer climates of New Mexico and Arizona, although in the summer time the cool, temperate weather of Colorado suits them better than the extreme heat of Arizona and New Mexico. If the reader has studied the meteorology of this region, and has read the article upon *Altitude*, he will appreciate the indications for selecting Colorado Springs or the other resorts which have been described, and also will appreciate the principles upon which the choice of an altitude should be made. *S. Edwin Solly.*

COLORING MATTERS, ANIMAL.—Many of the animal coloring matters are substances of considerable functional consequence. Some, for example, are of special service in respiration; others appear to be important factors in vision; a large number afford protective effects; several, also, are attractive in their influence. A majority, however, seem to be without any apparent physiological relations and not a few are purely excretory products.

I. Classification.

The multitude of animal pigments may be arranged conveniently in the following general groups:

1. Respiratory Pigments.—These coloring matters are very important functionally. Most of them are carriers of oxygen, with which they unite loosely, receiving it in the organs of respiration, conveying it to the body parts, and there giving it up to the tissues. The leading ones are compound ("chromo") proteids. Among them are hæmoglobin, hæmocyanin, hæmerythrin, and chlorocruorin.

2. Derivatives of Respiratory Pigments.—Some of the best-known animal coloring matters are derivatives of hæmoglobin, and many of the colored substances in the lower animals are undoubtedly formed from their blood pigments. Prominent derivatives of hæmoglobin are bilirubin (hæmatoidin), stercobilin (urobilin), urochrom, and hæmatoporphyrin.

3. Lipochromes.—These substances, yellow or yellowish red for the most part, are very numerous. They are found particularly in adipose tissue, yolk of egg, butter, and in the tissues and epidermal structures of the lower animals. In solubilities they are much like the fats, and they show absorption bands toward the violet end of the spectrum. Little is known of their chemical composition. They appear to consist of only carbon, hydrogen, and oxygen. Among them are serum lutein, tetron erythrin, and the "chromophanes."

4. Melanins.—These are brownish-black pigments occurring especially in epidermal structures. They consist of carbon, hydrogen, nitrogen, and oxygen. Nearly all contain sulphur; a few, iron. It is thought by some that they are derivatives of hæmoglobin; by others, modified lipochromes. They have been produced outside of the body from simple proteids by prolonged hydration ("melanoidins"), which fact suggests, of course, that they may be so derived within the system. Among the typical members of the group are fuscin, phymatorhusin, and sepic acid.

5. Chromogens.—These are the colorless, or less colored, precursors of actual pigments occurring in nature. The leading ones are indoxyl compounds, which give rise to red and blue indigo; melanogen; urorosein-ogen; the chromogen of the suprarenal medulla, related probably to the pigment of the skin in Addison's disease; and urobilinogen. The so-called "humous substances," obtained by destructive chemical methods, and such bodies as proteinochromogen (tryptophan), which merely form colored combinations with various reagents, are, of course, purposely excluded here.

6. Miscellaneous Pigments.—This residual group includes a very large number of protective, attractive, and other coloring matters, characteristic especially of the lower animals, studied only spectroscopically for the most part. Among those whose chemical individuality is not disputed are turacin, carminic acid, punicin, chlorophyll, and lepidotic acid.

II. Distribution.

Lower Animals.—Coloring matters are widely distributed throughout the whole of the animal kingdom. In some animals they occur only in the body fluids, in others they are also diffused throughout various tissues. In many they occur in the form of granules in certain cells or cellular layers. Many of the lowest types, such as infusoria, sponges, and hydroids, contain *chlorophyll* (green) in granular form and some ciliated animalcules are colored by *stentorin* (blue). Chlorophyll is found in several mollusks, crustacea, and insects, and also in the so-called livers of many invertebrates (*enterochlorophyll*). The latter organs also contain a ferruginous pigment, *ferrin* (brown) and *cholechrom* or *hepatochrom* (reddish yellow), a lipochrom; also *helicorubin* (orange red). *Hæmatoporphyrin* (purplish red), a derivative of *hæmoglobin* (red), occurs in the integument of star fishes, slugs, the common earthworm, and various sponges. A number of corals and hydroids, and some sea anemones, are colored by *actiniochrom* (red); also by *polyperythrin* (red), probably identical with hæmatoporphyrin. Some actiniæ contain a coloring matter very similar to another derivative of hæmoglobin, *hæmochromogen* (red), and convertible into hæmatoporphyrin. Many echinoderms contain *pentacrinin* (red and purple) and the following pigments give special coloration to the lower species from which the terms are derived: *aplysiopurpurin* (purple), *bonellein* (green), *echinastrin* (red), *astroidin* (yellow), *rhizostomin* (violet), *ophiurin* (yellowish brown), *asterocyanin* (bluish violet) and *comatulin* (red). *Punicin* (purple) is derived from the colorless secretions of various mollusks on exposure to light, and *carminic acid* (red) is the pigment characteristic of the cochineal.

The shells of some mollusks, and also some corals, contain "lipochromoids" and "melanoids." The brownish-black ink of Sepia officinalis, used to color the sea water and cover the flight of the animal, contains a melanin, *sepic acid* (black). The green (*chlorophan*), yellow (*xanthophan*), and red (*rhodophan*) pigments, "chromophanes," of the oil droplets in the retinal cones of birds, reptiles, and fishes, as well as the yellow substance in the yolk of egg (*ontochrin*), are lipochromes. The egg of the water spider is colored by the two lipochromes, *vitellorubin* (red) and *vitellolutein* (yellow). Some of the characteristic coloring matters in decapod crustacea are lipochromes. The red *crustaceorubin* is closely related to hepatochrom (cholechrom) in the livers of these animals. The eggs of the river crab and the lobster contain the same bluish pigment as that in the carapace of the animals. This pigment, called *cyanocrystallin*, becomes red with acid and on boiling in water. Crustaceorubin appears to be derived from it. The shells of various birds' eggs are pigmented by hæmoglobin derivatives, among which are *biliverdin* (green); *oocyanin* (blue), closely related to biliverdin; *oorhodein* (reddish brown), probably identical with hæmatoporphyrin; *oochlorin* (yellow) and *ooxanthin* (red).

In certain butterflies the white pigment of the wings consists of *uric acid;* the yellow pigment, of *lepidotic acid*, which yields uric acid on hydration. The red pigment of the body scales is closely related to lepidotic acid. The wing covers of beetles contain *coleopterin* (red). The showy colors in the plumage of birds are due in part to the influence on light which the feathers themselves exert, causing the so-called "interference colors"; in great part, however, to pigments. *Turacin* (red) is one of the best known of these. Among the many other feather pigments are *turacoverdin* (green), *zoonerythrin* (red), *zoorubin* (brown), *zoofulvin* (yellow), *picofulvin* (yellow), *turacobrunin* (brown), and *psittacofulvin* (yellow). Nearly all of these, "lipochromoids" and "melanoids," seem to be very closely related to the numerous skin pigments in birds, and scale and flesh pigments in fishes, such as *tetronerythrin* (red) and *coriosulfurin* (yellow); and to *lacertofulvin* (yellow), *lipochrin* (yellowish green) and others, in the skin of reptiles and various amphibia. The red pigment, *diemyctylin*, of Diemyctylus viridescens, like lepidotic acid, yields uric acid on hydration. Many invertebrates contain "histohæmatins," hæmoglobin derivatives, chief of which is *myohæmatin* (*myochrom*) of the red muscles; found in the muscles of insects and mollusks, also, whose hæmolymph does not contain hæmoglobin. The characteristic color of the muscles of the salmon and other related fishes seems to be due to a red lipochrom identical with tetronerythrin. The nerves, particularly the ganglia, of some worms are colored bright red by hæmoglobin.

Hæmoglobin is present in the circulating fluid of many species of the invertebrate sub-kingdoms. It has been found in several species of the star fish family; in no lower invertebrate forms, however, but in most species of all genera higher up the scale. The corpuscles in the hydrolymph of sea urchins contain *echinochrom* (yellow), a "lipochromoid," with possibly respiratory function. The hæmolymph of various invertebrates is colored yellowish to yellowish green by lipochromes; violet to purplish red by "floridins," of which *hæmerythrin* (red) is the best known. Hæmerythrin, and also *chlorocruorin* (green), replace hæmoglobin in the hæmolymph of worms; *hæmocyanin* (blue) in that of most mollusks, crustacea, and some members of the spider family. In the hæmolymph of crustacea the lipochrom, tetronerythrin (crustaceorubin, zoonerythrin), is also frequently found along with the hæmocyanin. The blood of the common house fly, and other like species, contains hæmoglobin, but that of butterflies and many related insects is green, and contains chlorophyll derived from the food; although chlorophyll occurs in other parts as well. The blood of many insects turns brown to black when it is shed, to which process the term "melanosis" has been applied.

Higher Animals.—The various tissues and fluids of the higher animals owe their color, very often, to mixtures of several pigments. Colored granules are frequently derived directly from external sources; into the lungs (pneumonokoniosis), such as coal dust (anthracosis), iron particles (siderosis), etc., whence they are sometimes distributed to the liver, lymphatic glands, kidneys, and other organs. They result, also, from medicinal introduction, as reduced silver in the alimentary tract, skin, liver, kidneys, etc. (argyria.) Through the skin, also (tattoo). The following concise arrangement gives practically all the more important pigments found in man and mammalia generally, and will aid to reference to more extended accounts than can be given here. The terms in italics indicate the pigments occurring only under unusual or abnormal conditions:

Adipose tissue—lipochrom. Bile—bilirubin, biliverdin; also biliprasin and urobilin in some; *bilifuscin, cholohæmatin* (from chromogen), *hydrobilirubin, hæmoglobin, methæmoglobin, hæmatin.* Biliary calculi—bilirubin, biliverdin, bilicyanin, bilifuscin, bilihumin (?), biliprasin, choletelin (hydrobilirubin?). Blood—(*a*) corpuscles: oxyhæmoglobin, hæmoglobin; (*b*) plasma: serum lutein, bilirubin (in some); *hæmoglobin and direct derivatives, hæmoglobin compounds with poisonous substances, hepatogenous pigments, melanin.* Blood clots (old)—hæmatoidin (bilirubin), rubigin or hæmosiderin (ferric hydroxide). Bone—lipochrom in ossein and yellow marrow; red marrow: hæmoglobin. Conjunctiva—*bile pigments.* Connective tissues—lipochrom, melanin; *bile pigments.* Contusion—bile pigments, hæmatoidin. Corpus luteum—lutein, *hæmatoidin* (?) Cysts—lipochrom; hæmoglobin derivatives, including bile pigments. Eye—(*a*) choroid and iris, fuscin; (*b*) retina, 1. *rods*—visual purple (rhodopsin), visual yellow (xanthopsin); 2. *Pigment layer*—fuscin, lipochrin. Fæces—stercobilin (urobilin), indigo chromogens, urobilinogen; pigments from food, such as carrotin, chlorophyll, hæmatin; *hæmoglobin* and *siderous hæmatogenous pigments, bile* and *drug pigments.* Freckles—hæmatogenous pigment. Ganglion-cells—lipochrom. Gastro-intestinal mucosa—*hæmoglobin* and its *direct derivatives* (hæmatochromatosis). Glands in general—hæmoglobin in capillaries, chromogens, *hæmatogenous pigments.* Hair—lipochrom, melanin. Intestine—(*a*) concretions: hepatogenous pigment; (*b*) contents: essentially same as fæces, including bile pigment and hydrobilirubin normally. Leucocytes (phagocytic cells)—*any pigment* found elsewhere in the body. Liver—ferrin, cholechrom, *rubigin, non-siderous hæmatogenous* and also *bile pigments.* Lungs—*Inhaled particles, hæmosiderin, melanin* (?). Lymphatic (*a*) fluids—serum lutein, *hæmatogenous* and *hepatogenous pigments;* (*b*) glands: *hæmoglobin derivatives.* Meconium—bile pigments, *hæmoglobin* and its *derivatives.* Menstrual fluid—hæmoglobin and direct derivatives. Milk (cream, butter, cheese)—lipochrom; "blue milk," *triphenylrosanilin* (*B. cyanogenous*); "red milk," *pigment* by *M. prodigiosus.* Mole (nævus)—hæmatogenous pigment. Muscle—myochrom (diffused hæmoglobin?), myohæmatin (hæmochromogen?). Pancreas—hæmatogenous pigment. Placenta—hæmoglobin, hæmatoidin, hæmatochlorin (biliverdin?). Pus—lipochrom, pyocyanin (*B. pyocyaneus*), pyoxanthose, bilirubin, indigo blue (?), hæmoglobin and decomposition products. Sebaceous secretions—lipochrom. Skin—melanin, *bile pigments* (hæmochromatosis), *histohæmatins* (?). Spleen—hæmoglobin, *rubigin, non-siderous hæmatogenous pigment.* Sputum—*blood, bile,* and *pus pigments;* also inhaled particles. Stomach contents—food pigments; *blood and bile coloring matters.* Suprarenals—hæmochromogen and chromogen yielding red pigment on exposure to light. Sweat—*pyocyanin, indigo blue* (?), *bile pigments; hæmoglobin and derivatives* ("red sweat"); hippopotamus and kangaroo, reddish-brown pigment; dwarf antelope, blue. Tissues generally—coloration effects due to blood in capillaries; *bile pigments, hæmoglobin and hæmatogenous pigments.* Tumors—phymatorhusin, sarcomelanin, lipochrom, hæmoglobin and derivatives; horse: hippomelanin. Urine—(*a*) pigments: urochrom, urobilin, uroerythrin, hæmatoporphryrin (urospectrin), *skatoxyl red, melanin, indigo* (blue and red), *bile pigments, hæmoglobin and direct derivatives, drug coloring matters;* (*b*) chromogens: indoxyl and skatoxyl compounds; precursors of hæmatoporphyrin and urorosein (urorhodin, urorubin, etc.); urobilinogen, *hydroxybenzene derivatives* ("*alkaptonuria*"), *melanogen.* Urinary calculi and sediments—uroerythrin, urochrom hæmatoidin, indigo blue, bile pigments, hæmoglobin products. Vomit—blood, bile, food and drug pigments.

III. Chemical and Physical Qualities.

The animal pigments have been the subjects of many laborious researches, but, owing to the great difficulties they present to the investigator, our knowledge of the chemical characters of most of them is very slight and uncertain. The primary obstacle in the way of their proper chemical study is the strikingly minute amount

in which they commonly occur, and, as nearly all of them have very great tinctorial power, their coloration effects, therefore, are usually out of all proportion to the actual quantity in which they are present in any medium. Further, isolation of the pigments by chemical means is apt to induce radical changes in them, for many are very unstable, and much confusion has resulted from failure to recognize this important fact. Nearly all of the animal coloring matters seem to have definite and characteristic effects on the spectrum, and may be differentiated, to a certain extent, by the number and position of their absorption bands. But even the extremely delicate indications of the spectroscope have undoubtedly led to error in some cases, since very wide spectroscopic differences may be brought about by very slight changes of molecular structure or physical condition, such as often result from ordinary chemical treatment. Consequently, there is good reason for believing that not a few of the coloring matters which have been dignified with special names are merely closely related artificial derivatives (oxides, reduction products, etc.) of several antecedent pigments or chromogens. It would carry us far beyond the scope of this particular article to present detailed reference to each of the pigments already mentioned. All of the most important are given due notice in more extended accounts of blood, urine, fæces, bile, etc., in these volumes, so that it will be sufficient here to describe, in conclusion, a few of the best known of those found in the lower animals.

Hæmocyanin (blue), chlorocruorin (green).—Each of these pigments is analogous to hæmoglobin in chemical structure and in function, the first replacing it in the hæmolymph of mollusks and related forms, the second in that of worms. Both, like hæmoglobin, unite loosely with oxygen; oxyhæmocyanin is blue, hæmocyanin itself is colorless. Hæmocyanin contains copper in place of iron and has no special influence on the spectrum. Chlorocruorin, on the other hand, yields hæmatin and shows characteristic absorption bands.

Turacin is a red, feather pigment. It possesses a spectrum which is almost identical with that of oxyhæmoglobin. It contains seven per cent. of copper, besides carbon, hydrogen, nitrogen, and oxygen. The quantity of turacin in the feathers of a single bird does not exceed two or three grains. It may be extracted from the feathers with 0.1 per cent. alkali and precipitated from its solution with dilute acid. It is insoluble in water, alcohol, and ether.

Carminic Acid (Carmin).—The female cochineal (Coccus cacti) contains from twenty-five to fifty per cent. of this coloring matter. The pigment is also found in the blossoms of certain plants. Its composition is shown by its formula: $C_{17}H_{18}O_{10}$. Some of its compounds produce effects on the spectrum analogous to those of oxyhæmoglobin. Carminic acid is a glucoside; when it is boiled with dilute acids, and thereby hydrated, it yields an optically inactive, non-fermentable sugar and also "carmin red" ($C_{11}H_{12}O_7$):

$$C_{17}H_{18}O_{10} + 2H_2O = C_{11}H_{12}O_7 + C_6H_{10}O_5.$$

Carminic acid may be extracted from the cochineal with warm water. The pigment is soluble in alcohol and dilute acids, and forms salts with alkalies and metallic compounds.

Punicin.—The colorless secretion of a glandular organ, situated at the lower part of the mantle, between the gill and the rectum of various species of Murex and Purpura, assumes, on exposure to light, a bluish-green color at first, then red, and lastly a purple-violet. This coloring matter, "Tyrian purple," is the "purple of the ancients" and for centuries was the dye of greatest beauty and value. Punicin is the name of the pigment; the chromogen has not been isolated. Punicin is insoluble in water, alcohol, and ether; soluble in boiling glacial acetic acid. It dissolves readily in boiling aniline, from which it separates, on cooling, in crystalline form.

Chlorophyll.—This important plant pigment is found in *Hydra viridis, Spongilla fluviatilus,* in the elytra of cantharides beetles, in the blood of many insects, in the so-called livers of many invertebrates, etc. It is insoluble in water, but dissolves in alcohol and ether, and consists of carbon, hydrogen, nitrogen, and oxygen, and possibly iron. Chlorophyll, treated with concentrated acid, yields phyllocyanin. The latter, on fusion with caustic soda, is transformed into phylloporphyrin ($C_{16}H_{18}N_2O$), a close relative of hæmatoporphyrin ($C_{16}H_{18}N_2O_3$), which may be produced from hæmoglobin, on treatment with acids, and is isomeric with bilirubin ($C_{16}H_{18}N_2O_3$.) Phylloporphyrin and hæmatoporphyrin are probably oxides of one and the same radicle. This kinship corresponds to analogous physiological relations of the pigments from which each can be derived.

Tetronerythrin (Crustaceorubin, Zoonerythrin).—The red pigment in the warty integument round the eyes, and also in the feathers, of various birds, and in the hypoderm and hæmolymph of many invertebrates, is one of the most widely distributed of all the pigments. It is soluble in ether, alcohol, and chloroform, and shows the absorption bands and gives the reactions of a typical lipochrom.

Lepidotic Acid.—The yellow pigment in the wings and excrements of butterflies (pieridinæ). It may be extracted with hot water or dilute alkalies, and is precipitated from such extracts on acidification. Its solutions show a greenish fluorescence and, on warming with dilute nitric acid, it yields uric acid. Warmed with dilute sulphuric acid a purple product, lepidoporphyrin, is obtained, which shows two characteristic absorption bands; this substance may also be derived directly from uric acid. The close relation of lepidotic acid to xanthin and uric acid is shown by the figures for their percentage composition:

	C.	H.	N.	O.
Xanthin (dioxypurin)	39.4	2.6	36.8	21.1
Lepidotic acid	38.1	3.5	37.1	21.3
Uric acid (trioxypurin)	35.7	2.4	33.3	28.6

William J. Gies.

COLTSFOOT.—*Tussilago. Farfara.* The plant *Tussilago Farfara* L. (fam. *Compositæ*). This is a perennial herb with a branched and creeping root stock which sends up in the early spring numerous simple scaly flower stems, and later in the season large, angular, heart-shaped leaves. It is common in rich, moist places in Europe and Asia, and occasional in the United States.

The rhizome, leaves, and flower heads have been separately employed. The leaves, which have been most used, contain gum, tannin, and a bitter glucoside, besides a slight amount of an unknown odorous principle. The drug possesses no very active properties. It has been used chiefly as an expectorant and mild tonic. Its use is now mostly confined to patent medicine and domestic practice.

Coltsfoot is the only species of its genus, but the next genus, *Petasites*, resembles it very closely, and has several species which have enjoyed about the same reputation as coltsfoot.

This name is also applied, in some sections of the United States, to *Snakeroot*, Canada, which see.

Henry H. Rusby.

COLTSTAIL. See *Erigeron*.

COLUMBIA SPRINGS.—Columbia County, New York. Post-Office.—Hudson. Hotel.

Access.—Viâ New York Central and Hudson River Railroad, or by steamer on the Hudson River to Hudson, 115 miles north of New York and 27 miles south of Albany; thence 4 miles northeast by carriage to springs.

This is a very pleasant, quiet resort, where salubrious air and charming rural scenery may be enjoyed. The springs are four in number. An analysis by Professor Atwood shows the following contents:

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.
Calcium carbonate	21.79
Sodium hyposulphite	8.15
Calcium sulphate	64.94
Sodium phosphate	2.14
Sodium chloride	84.72
Potassium chloride	1.19
Magnesium chloride	31.43
Iron sesquichloride	3.42
Loss	.82
Total	218.60

Sulphureted hydrogen gas, 4.49 cubic inches.

This analysis shows a very valuable saline-sulphur water, with a considerable proportion of iron. A new examination is desirable, as we are informed that this analysis was made many years ago.

James K. Crook.

COLUMBO.—CALUMBA. "The root of *Jateorhiza palmata* (Lam.) Miers (fam. *Menispermaceæ*)" (U. S. P.)

The columbo plant is a large, perennial climber, often ascending to the tops of the loftiest trees, with a rounded, thick, yellow rhizome, from which numerous fleshy roots are given off. These roots are fusiform, resembling long dahlia or sweet-potato roots, attached to the also tuberous root stock. They are dug up, sliced transversely, and dried in the shade.

Columbo is a native of Mozambique, Zanzibar, and the adjacent lands of tropical Africa, and is said to be cultivated.

The dried sliced root has a very characteristic appearance. It is in circular discs from 1 to 5 or 6 cm. in diameter (½ to 2 in.), and from one-fifth to one-half inch in thickness; the edge (surface of the root) is brown and rough; the flat surface (sections of the root) lemon-yellow, and depressed in the middle from collapse of the soft, thin-walled cells of the pith in drying. A dark circle marks the cambium, and one or two indistinct circles of woody bundles can be seen within it. The tissue is chiefly parenchyma, loaded with starch.

FIG. 1473.—Section of Calumba. About Natural Size. (Baillon.)

Columbo contains several bitter principles. One of them, *berberine*, is found in several other plants (see *Barberry*). *Columbin* is a colorless crystalline substance of excessively bitter taste and neutral reaction. *Columbic acid* is a yellow amorphous powder, also bitter. The medicine owes its value to all these constituents. Besides these, it contains starch and mucilaginous substances.

None of the active principles of columbo are in any degree poisonous. They unite in making it a simple bitter tonic.

The dose of the powdered root is from 0.5 to 1 gm. (gr. viij. ad xvi.), but it is seldom employed so. A fluid extract and a ten-per-cent. tincture are official.

W. P. Bolles.

COLUMNÆ ADIPOSÆ. See *Skin*.

COMANJILLA.—Guanajuato, Mexico. There are about eighteen of these springs. On account of their heat they are called "Calderas." The waters have a temperature of 96° C., and are therefore considered the hottest springs in the world. Amongst other substances they contain carbonate of lime and sulphate and oxide of alumina.

They are very useful in rheumatism, syphilis, and diseases of the skin.

N. J. Ponce de Léon.

COMEDO.—(Synonyms: Blackheads, acne punctata; Ger., *Mittesser*; Fr., *Verres bleues.*)

DEFINITION.—A comedo has most usually been defined as a collection of sebaceous matter in the excretory duct of a sebaceous gland. More correctly, the blackhead is a parakeratosis of the epidermic lining of the duct and encloses between its concentric layers and in its central portion a variable amount of sebaceous matter.

SYMPTOMATOLOGY.—Comedones or blackheads are represented by slightly prominent and elevated, but in some instances depressed and discolored, points occupying and corresponding to the external follicular orifices of the sebaceous glands. They occur especially on the face, forehead, and cheeks, but also on the temples, around and in the ears, on the neck, the back, and the chest. They have also been seen frequently on the penis, scrotum, mons veneris, and on other parts of the body supplied with fat glands. Comedones may occur singly and may be distributed in a discrete manner, or they may be closely aggregated and packed together. In some cases only a few may be present, while in others they may be so numerous that the skin has a discolored, dirty and rough appearance. In their color and in their size great variations may be seen. In color, they may be light yellow, or brown, bluish, and even black, while in size they may occur as minute dark points—on the chin producing a dusky appearance; or, as on the nose, cheeks, or back, the individual lesion may be as large as a pinhead or even larger.

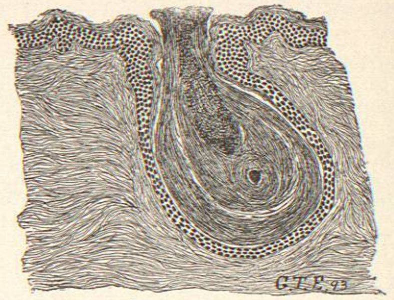

FIG. 1474.—Section of a Comedo from the Back. (Original.)

Usually single, it is not unusual to meet with a double comedo, that is, one which, while consisting of one body, yet occupies two or more ducts of separate glands. When this is the case, the dark points are grouped together, separated by narrow bridges of normal skin. Pressure does not cause extrusion of one blackhead, but of all at the same time. Another type of comedo, which has been described, is constituted of "grouped comedones" (Crocker). They occur occasionally on the trunk, but particularly on the cheeks, forming symmetrical groups of densely crowded black points. They show no tendency to inflammatory reaction and suppuration. On the temples, on the lobes of the ears, and on the chest, small, papular, whitish elevations are often seen, which on pressure yield a soft, white, filiform body resembling vermicelli sticks. They are usually classed with comedones, but are in reality small retention cysts, the sebaceous matter being accumulated in the gland body and not implicating the duct in any way. (They should not be confounded with milia, however, as the contents of these latter cannot be squeezed out.)

When pressure is applied to a comedo, a somewhat dense, resistant, more or less globular or ovoid body emerges from the follicular canal. Its outer end is yellow to black, its body is yellowish, while the lower end is soft and white, consisting of sebaceous matter from the gland body itself. The life history of a comedo is of variable duration. It may be removed by washing or rubbing, or it may persist unchanged for a long time. Inflammation of the cutaneous tissues surrounding it may and most frequently does occur, and results in the formation of a pustular lesion—an acne pustule.

ETIOLOGY.—Puberty is accused of being the most frequent and constant cause of the comedo formation. It certainly occurs most usually at or about that age, but it is also not uncommon in younger children and even in infants. That the comedo may also develop much later and in adult life is a matter of too frequent observation to constitute a rarity. The active hair growth which takes place at puberty has been regarded as an important etiological factor, as well as a want of tonicity of the walls of the follicular canal; but in all probability the physiological rather than the anatomical conditions in the evolution of the sebaceous glands at the age of development should be considered. At any rate, it can be said that coincident with the origin of the blackheads, there are also found one or more of those defects of nutrition, or those systemic disturbances so usually present at the time of puberty, such as anæmia, constipation, gastric and intestinal disturbances, errors of diet, etc. The comedo formation has also been ascribed to uncleanliness, but, except under exceptional circumstances, this condition can scarcely act as a factor. Comedones are not uncommonly, however, of artificial origin. That is to say, the external appearances characteristic of a comedo may be due to some foreign substances blocking up the orifice of a sebaceous gland. Among such, tar may be mentioned especially, and similar conditions may be seen in workers in brass and iron factories and workshops, or in firemen, oilers, or stokers. In other words, any substance blocking up the orifice of a sebaceous gland may simulate a comedo.

PATHOLOGY AND MORBID ANATOMY.—A comedo has usually been considered as an accumulation of sebum in the duct of a sebaceous gland. The causes of the accumulation have been ascribed to a loss in tonicity and contractility of the walls of the ducts, and the improper fatty degeneration of the glandular cells has also been brought into the question. More lately (Unna), the development of the comedo has been attributed to a parakeratosis of the external stratum corneum and that portion of it lining the duct of the gland. The cause of this hyperplasia of the horny layer is claimed by Unna to be a minute bacillus, but corroboration of his claim is still wanting. Kaposi, in view of Biesiadecki's investigations, had also long before claimed that the corneous and outer layer of a comedo was due to a hyperplasia of the epidermic lining of the duct, but he had considered the irritation from the impinging of lanugo hairs on the walls as the cause of the thickening. At any rate, a comedo cannot be regarded as simply a sebum plug, since histologically it will be found to be made up for the most part of concentric layers of horny epidermis surrounding a central cone of sebum, lanugo hairs, and epidermic scales. At times the acarus or demodex folliculorum may be present, but it is not of any particular consequence in human beings.

The color of the outer end of a comedo is generally ascribed to dust, particles of dirt, etc. Unna has claimed that it was due to ultramarine normally present in the secretions and to a darkening of the horny plug consequent upon exposure to the air. Owing to the inconsequence of the subject, definite or corroborative investigations have not been made.

The double comedo does not differ in origin from the ordinary or single lesion. The fact, however, that it communicates with a single cavity has been shown to be due to pressure atrophy. Two contiguous sebaceous glands, becoming each plugged up with a comedo, does not cause cessation of glandular secretion. The resulting accumulation leads to mutual distention, pressure, absorption of intervening tissue, and ultimately to formation of a single cavity.

The pathological importance of a comedo resides in its intimate relationship to acne. It very usually constitutes the point of origin of a perifolliculitis and a folliculitis, or, in other words, of an acne pustule.

DIAGNOSIS.—There should be no difficulty in recognizing comedones. Their localization, their situation in the follicular orifices, their color, and the fact that they so commonly are a focus for perifollicular inflammation and suppuration should readily obligate their recognition.

PROGNOSIS.—The outlook in the case of comedones is always favorable, except that their presence usually leads to the development of an acne. The process is one amenable to treatment, though complete cessation in their development is difficult of attainment. In some individuals, the period during which they appear is of short duration, in others the predisposition may exist during life.

TREATMENT.—Particular importance in all cases of comedones should be given to the systemic health. Investigation should be made for any and all etiological factors which may be in existence, and these, whatever they may be, should be removed. Anæmia, gastric or intestinal or other derangements, should be corrected, and the same attention to the general and functional health should be given as would be done in a full-fledged case of acne. The diet should be regulated. Sweets, candies, oatmeal, cheese, nuts, rich entrées, etc., should be expressly forbidden, and the regimen be made a plain but nutritious one. Moderate outdoor exercise and attention to general hygiene is called for, as well as all other matters which may conduce to improvement of the patient's bodily conditions. The *local treatment* is also of great importance. The comedones may be removed mechanically by means of a comedo extractor, such as are found at any instrument maker's. This, however, should be done by the physician and not entrusted to the patient, and should be followed by the application of that one or other local application ordered in the case. Scraping the surface with a sharp curette has also been recommended; but it does not remove more than the outer portion of the comedo, which then quickly reforms. The operation is likewise painful and disfiguring, and in the writer's experience demands a very submissive patient. Face massage is a means of removal advocated by advertising so-called complexion specialists. The comedones are removed, but the ultimate results are usually disastrous. The same statements may be made in regard to face steaming, as the process is not disposed of simply by removing the comedo. It is the patient and his skin who require such care and such appropriate treatment as will prevent the re-formation of the comedo after its removal that is necessary. In view of what has just been stated, it may be understood that all purely local remedies are therefore only such as are aids to the general systemic treatment. An efficacious and simple remedy, which softens and removes the blackhead, is an ointment: ℞ Sod. borat., ʒ ij.; Ungt. aq. rosæ, ℥ i. M. Sig.: Apply freely, and after a half to one hour wash off with soap and *cold* water. Then apply one or the other of these lotions: ℞ Zinci sulphat., Kali sulphuret, Sulph. lact., āā gr. xv.; Aq. rosæ, ℥ i. M. and S.; or ℞ $HgCl_2$, gr. ij.; Acid. acetic. dil., ʒ vi.; Aq. rosæ, Spts. vini, āā ℥ ss. M. and S.; or a saturated solution of salicylic acid in alcohol may be used. The latter causes a free exfoliation of the horny epidermis, and the comedones are frequently removed entirely by its means. Among ointments, there may also be mentioned the Ungt. hydrarg. ammoniat., 5 to 10 per cent.; Ungt. resorcin., 3 to 10 per cent.; Ungt. sulphur., 5 to 10 per cent.; etc. Soap and cold-water washings twice a day are of great value. The kind of soap is not of importance, so long as it is a neutral one and does not contain an excess of lye. However, soaps with sand or with marble dust have been recommended, as well as the tincture of green soap, and also a host of medicated soaps with which the market is to-day inundated; but when it is borne in mind that the cause of the comedo formation is the important factor requiring treatment, it can be judged that all of these are only subsidiary and not agents of any special value.

George T. Elliot.

COMFREY.—SYMPHYTUM. The root of *Symphytum officinale* L. (fam. *Boraginaceæ*). This is a coarse, rough, perennial herb of Europe, sparingly naturalized in the United States. For medicinal use the root is gathered in