inated insect must have become infected since at least ten or twelve days, but possibly as far back as several months, before biting the new case on hand, and the latter was probably bitten by the contaminated mosquito between three and nine days before he was taken sick.

2. If the yellow-fever mosquito is a normal dweller in the locality which we are considering, there is a possibility that an unrecognized yellow-fever patient, within the first days of his illness (perhaps a passenger in a railway train stopping a few moments in the city station, on a ferry, or in any other conveyance) may have been bitten incidentally by one of the local Stegomyia mosquitoes, so that after the lapse of a couple of weeks cases of yellow fever may begin to develop in the locality.

3. Contaminated mosquitoes may be introduced with an immature contamination, so that the first non-immunes who happen to be bitten by them will not take the disease while, a few days later, every non-immune who is bitten by the same insects will be likely to be attacked with yellow fever within the week following the bite.

Manner in which Contaminated Mosquitoes may be Conveyed from One Place to Another.—The most obvious modes of conveyance include the casual imprisonment of contaminated insects inside of trunks, boxes, parcels, etc., and it sometimes happens that a mosquito is entrapped under a hat at the moment when it is actually biting the wearer's head. Within certain variable limits of time, in accordance with what has been said regarding the longevity of the yellow-fever mosquito, the contaminated insect may be restored to liberty when the trunk or the box comes to be opened, or the first time the wearer of the hat uncovers his head; and thus the foundation for an epidemic may be laid. The mosquito, as a rule, does not fly away to any distance from the dwelling where it has established itself; but it may wander away the length of one or two blocks in pursuit of a victim or when driven from its quarters by obnoxious fumes such as are developed in disinfecting a house or a room, if the retreat of the infected insects has not been cut off. With its short wings the yellow-fever mosquito is incapable of supporting itself in the air when a strong wind is blowing. Under these circumstances, if carried away by the wind from the deck of a ship, or from the shore, it might strive to save itself from drowning by alighting upon some floating object, which, drifting with the current, would perhaps land the insect at a greater distance than it could have reached flying. Vessels trading with ports in the yellow-fever zone are apt to be boarded by the Stegomyia mosquito, and new broods of that species may be developed in the water tanks or barrels, or in accidental collections of stagnant fresh water in any part of the ship. Fruit vessels or those laden with sugar must be particularly attractive to these insects. Thus it is evident that without any actual imprisonment the Stegomyia may make its temporary or permanent home in vessels as well as in public conveyances, railway carriages, freight cars laden with fruit, etc., when the local conditions are favorable. In the presence of so many sources of danger it must, therefore, be recognized that our only chance of actually controlling the propagation of yellow fever lies in our ability to carry out the following precepts:

1. To protect yellow-fever patients from the bites of mosquitoes.

2. To prevent the escape of any of the mosquitoes that have bitten a yellow-fever patient before adequate measures can be taken for their destruction.

3. To prevent the access of non-immunes to localities in which contaminated mosquitoes may still be alive.

The fact that by satisfying these conditions the propagation of yellow fever can be absolutely controlled has been fully demonstrated by Major W. C. Gorgas while he was at the head of the Sanitary Department of Havana, and by our subsequent experience in the same city, showing that non-immunes run no risk of becoming infected by staying in the presence of imported cases of the disease, when both the patient and the non-immunes are effectually protected against the bites of the yellow-fever mosquito. *Charles J. Finlay.*

YELLOW FEVER: SYMPTOMATOLOGY AND TREATMENT. See The Appendix.

YELLOW SPRINGS.—Greene County, Ohio. Hotel.

Access.—Yellow Springs is a station on the Little Miami Railroad, seventy-four miles northeast of Cincinnati (Walton).

The springs are pleasantly situated on the banks of the Little Miami River. The surrounding country is undulating, and attractive drives lead in all directions. The springs yield about six hundred and sixty gallons of water per hour. An analysis by Messrs. Wayne and Locke resulted as follows: One United States gallon contains (solids): Calcium carbonate, gr. 19.57; calcium sulphate, gr. 1.35; sodium chloride, gr. 0.15; magnesium chloride, gr. 0.17; calcium chloride, gr. 1.54; iron oxide, gr. 0.39. Total, 23.17 grains.

The water possesses mild diuretic and tonic properties. *James K. Crook.*

YELLOW SULPHUR SPRINGS. — Montgomery County, Virginia.

Post-Office.—Yellow Sulphur Springs. Hotels and cottages.

Access.—Via Norfolk and Western Railroad to Christianburg depot, thence three and one-half miles by stage to springs.

This resort is located near the summit of the Alleghany Mountains, at an elevation of 2,000 feet above the sea. We find here the usual beautiful scenery and charming climate characteristic of the Alleghany resort. Four miles north of the springs is the village of Blacksburg, the location of the Virginia Agricultural and Mechanical College and the State Experimental Station. The Montgomery White Sulphur Springs are also within a distance of only four miles. The Alleghany Springs are fifteen miles, and the wonderful Mountain Lake and Bald Knob eighteen miles distant. A large new hotel, having sixty-four bed-chambers, a handsome ball-room, a large and well-ventilated dining-room, numerous bath-rooms, etc., are among the recent improvements. The lawn and pleasure grounds are shaded by magnificent forest trees, whose dense foliage makes a delightful and luxurious shelter in warm weather. The Yellow Sulphur Springs yield one hundred and eighty gallons of water per hour. This water, which has a temperature of 55° F., is transparent and very palatable. Baths of this water are always to be had at any desired temperature. The following analysis of the water is taken from the United States Dispensatory for 1880, p. 1832:

One United States gallon contains (solids): Calcium carbonate, gr. 8.64; magnesium carbonate, gr. 1.38; iron carbonate, gr. 0.62; free carbonic acid, gr. 4.68; calcium sulphate, gr. 63.30; magnesium sulphate gr. 21.09; aluminum sulphate, gr. 3.18; potassium sulphate, gr. 0.11; sodium sulphate, gr. 0.75; calcium phosphate, gr. 0.01; magnesium phosphate, gr. 0. 01; potassium chloride, gr. 0.09; sodium chloride, gr. 0.08; organic matter, gr. 3.73; and traces of iron protoxide. Total, 107.67 grains.

The title to the designation "sulphur" water is not made clear by this analysis, yet it shows a valuable combination of mineral ingredients. The water should possess antacid, diuretic, and laxative properties. It contains sufficient iron to give it a tonic influence and enough free carbonic acid to impart a pleasant sparkle and to endow it with a grateful sedative action on the stomach. The water has been found, on continued use, to brace up and give tone to the muscular system and to allay chronic and subacute inflammation of the gastro-intestinal mucous membrane, thus regulating the secretory function, tranquillizing the nervous system, and tending to promote sound and refreshing sleep. It is highly recommended in chronic disorders of the female generative organs, especially in amenorrhœa, in dysmenorrhœa of certain forms, and in leucorrhœa. It also acts as a valuable restorative in general debility and in convalescence from acute prostrating diseases. The baths are recommended for rheumatism and chronic squamous skin affections. *James K. Crook.*

YELLOWSTONE NATIONAL PARK SPRINGS.—The great Yellowstone Park is undoubtedly destined to become prominent as a health resort. Within its limits are contained upward of two thousand springs, many of which have been found to be highly mineralized as well as thermal. We present the following table of reactions, etc., of thirty-four of these springs, geysers, and streams, which we have compiled from analyses made in 1883, 1884, and 1885 by Messrs. Frank Austin Gooch and James Edward Whitfield*:

Springs and Geysers of the Yellowstone National Park.

	Temperature °F.†	Reaction.	Solid contents per U. S. gallon.‡
			Grains.
Cleopatra Spring	159.80	Alkaline	121.64
Orange Spring	145.40	"	101.54
Hot River	136.40	"	113.10
Soda Bath Spring	64.40	"	.....
Fearless Geyser	191.40	Neutral	95.02
Pearl Geyser	187.20	"	.....
Constant Geyser	197.60	Acid	94.44
Coral Spring	163.40	"	111.35
Echinus Spring	195.80	"	48.38
Schlammkessel	195.80	"	98.52
Fountain Geyser	179.60	Alkaline	81.03
Great Fountain Geyser	179.60 to 199.80	"	76.37
Hygeia Spring	109.40	"	68.79
Madison Spring	140.00	"	76.95
Excelsior Spring	197.60	"	85.70
Old Faithful Geyser	189.20 to 191.40	"	81.03
Splendid Geyser	199.80	"	95.02
Giantless Geyser	199.80	"	82.20
Bee-hive Geyser	199.80	"	70.54
Grotto Geyser	199.80	"	82.78
Turban and Grand Geysers	195.80	"	81.03
Artemisia Geyser	192.02	"	86.28
Taurus Geyser	197.60	"	74.62
Asta Geyser	187.20	"	39.05
Bench Spring	191.40	Slightly acid	27.40
Chrome Spring	197.60	Neutral	166.32
Alum Creek	.....	Acid	71.12
Mush-pot Spring	185.00	"	64.13
Devil's Ink Pot	197.60	"	197.05
Firehole River at Marshalls	44.40	Alkaline	24.26
Gardiner River above Hot River	44.40	.....	12.24
Water Supply at Mammoth Hot Springs	.....	.....	15.74
Soda Springs	42.80	Acid	48.90
Yellowstone Lake	.....	.....	99.11

† Converted from degrees centigrade.
‡ Converted from grams per kilograms.

Most of these waters, it will be seen, are not only highly thermal, but are quite heavily mineralized, the solid contents ranging from 12.24 to 197.05 grains per gallon. These mineral ingredients consist chiefly of calcium, sodium, potassium, lithium, magnesium, silicon dioxide, sulphur trioxide, carbon dioxide, chlorine, and basic oxygen. The chemists also discovered the following ingredients in small quantities or traces: Titanium, arsenic, iron, bromine, aluminum, manganese, barium, strontium, rubidium, cæsium, ammonium, hydrogen sulphide, boron, phosphoric and hydrochloric acids. The various combinations of these elements and bases have not been fully determined, but the waters may in general terms be classed as calcic, alkaline, silicious, saline, and sulphureted. It may be stated that the waters for the above examinations were collected during the months of July, August, September, and October, and the thermometric records represent as a rule the summer temperatures. It is probable that the waters of the hot springs show little variation in temperature at the fountains during the year. We present in full the analysis of the Fountain Geyser, which may be regarded as fairly representative of the group. The hypothetical combinations have been worked out for the author by E. E. Smith, M.D., Ph.D., of New York.

Fountain Geyser (Yellowstone National Park). One United States gallon contains (solids):* Sodium chloride, gr. 30.47; potassium chloride, gr. 2.09; sodium bromide, gr. 0.03; lithium bicarbonate, gr. 1.98; sodium bicarbonate, gr. 22.46; magnesium bicarbonate, gr. 0.35; calcium bicarbonate, gr. 0.33; iron bicarbonate, gr. 0.035; potassium sulphate, gr. 2.48; sodium phosphate, gr. 0.01; sodium tetraborate, gr. 1.16; sodium arseniate, gr. 0.20; alumina, gr. 0.96; silica, gr. 19.33; and a trace of manganese bicarbonate. Total, 81.885 grains. The water also contains free carbonic acid and a trace of sulphureted hydrogen.

This analysis presents a fairly strong alkaline-saline water. It possesses useful properties as an antacid, diuretic, and aperient. In addition, it contains an appreciable quantity of arsenic, and in continued dosage should speedily produce the physiological effects of that drug. The water of La Bourboule, in France, which contains but slightly more arsenic than this geyser, has long been celebrated in the treatment of skin diseases, notably in eczema and the other rheumides. The Yellowstone waters will no doubt in time be found to possess equal virtue in these affections. At the present time the waters are used for bathing only at the Fountain Geyser Hotel. At this resort the waters are conducted into the hotel building, which is supplied with an excellent system of bath-rooms. The thermal waters of the park will probably come into high repute, in the near future, in the treatment of gout, rheumatism, and syphilitic affections. Some of the springs contain a considerable proportion of sulphureted hydrogen, while free hydrochloric acid is found in several others. We may expect that all of these different waters will at some future time render useful service in practical therapeutics. We are informed that intensely hot weather is practically unknown in the park. Following is a temperature table of the summer and early autumn months, made during a recent season:

	Sunrise.	Midday.	Sunset.	Mean.
July	55° F.	77° F.	69° F.	67° F.
August	50	79	66	65
September	41	66	58	55
October	41	57	52	50

Visitors to the park should be amply prepared for cool weather, no matter what the season may be. *James K. Crook.*

YERBA SANTA.—(*Eriodictyon*, U. S. P.; "Consumptive's weed," "Mountain balm," etc.) The dried leaves of *Eriodictyon Californicum* (H. et A.) Greene (fam. *Hydrophyllaceæ*). A very pretty evergreen shrub, growing on the western side of the United States and in northern Mexico, in gregarious clumps and patches in barren soils and among rocks. The drug is thus described: Usually much broken; blade narrowed into a very short and broad petiole, 5–12 cm. (2–5 in.) long and rarely exceeding 3 cm. (1¼ in.) in breadth, oblong-lanceolate, gradually tapering to an acutish point, most irregularly serrate- or crenate-dentate, thick and brittle, or flexible in a damp and warm atmosphere, the margins more or less incurved; upper surface yellowish-green, more or less resinous, smooth, the veins somewhat impressed; lower surface whitish or yellowish-white, with finely and conspicuously reticulate dark veins, densely but very shortly tomentose; odor somewhat aromatic, strongly balsamic if heated in the closed hand; taste balsamic, sweetish, somewhat tea-like.

The principal constituent of this drug is its ten to

* Bulletin 47 of the United States Geological Survey, 1888.

* The combinations, as estimated by the original analysts, have recently come under our observation. The result does not materially differ from those given above. It is probable that the proportion of sodium arseniate is somewhat over-estimated.

twelve per cent. of resin, divisible into two parts, one of which, constituting its chief bulk, possesses the property of precipitating quinine from its salts. It also contains volatile oil, ericinol, sugar, and the peculiar body *eriodictyonic acid*, which in some respects resembles tannin.

Yerba santa, as one of its names shows, has a local reputation on the Pacific slope for coughs, colds, bronchitis, and phthisis, a reputation which is shared by many other resinous substances and has some foundation. It is also a pretty good vehicle for the administration of quinine, whose taste, like liquorice or glycyrrhizin, it covers pretty well. Of the official fluid extract, 3 or 4 c.c. (♏ xlv. ad lxv.) may be given for coughs. A syrup, as a vehicle for quinine, is sometimes prepared.

Henry H. Rusby.

YOLK SAC.—(Umbilical vesicle: Vitelline sac.) Since the human yolk sac is a vestigial organ, its significance

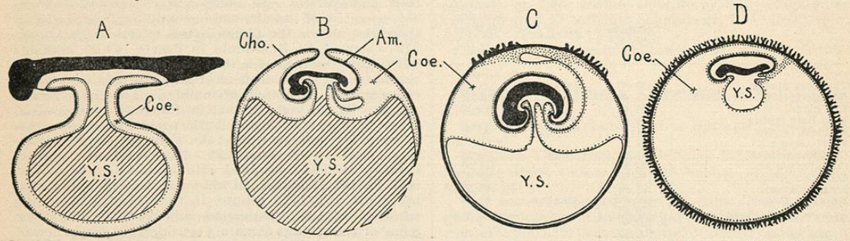

FIG. 5046.—Diagrams Illustrating the Development of the Yolk Sac: *A*, in fish; *B*, in birds; *C*, in the rabbit; *D*, in man. The embryos are drawn in black, the ectoderm in heavy lines, the entoderm in light lines, and the mesoderm in dotted lines. The yolk is shaded. *Am.*, Amnion; *Cho.*, chorion; *Coe.*, extra-embryonic cœlom; *Y. S.*, yolk sac. (After Hertwig, Duval, and Minot.)

can be appreciated only after examining the corresponding structure in other animals.

COMPARATIVE EMBRYOLOGY.—In fish embryos the entoderm lining the digestive tract is distended ventrally, and its cells are loaded with nutritive material in the form of granules. This solid mass of yolk-laden entoderm is covered on the outside with a layer of mesoderm, and the entire structure is known as the yolk sac. In sharks the sac joins the body by a constricted portion, the yolk stalk (Fig. 5046, *A*). The ventral body wall, composed of

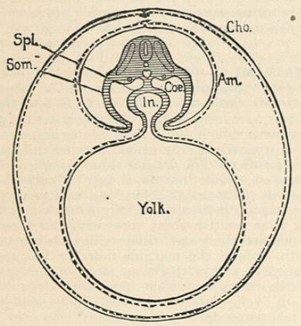

FIG. 5047.—Diagrammatic Cross-Section of an Amniote Embryo. The body of the embryo is shaded; the extra-embryonic mesoderm is represented by a dotted line. *Som.*, somatopleure; *Spl.*, splanchnopleure; *Cho.*, chorion; *Am.*, amnion; *Coe.*, cœlom; *In.*, intestine; *Yolk.*, yolk sac. (Minot.)

ectoderm with a lining of mesoderm, extends over the yolk sac, but is separated from it by an extension of the body cavity or cœlom. As the fish grows, the yolk is consumed as food and the ventral swelling is gradually taken up until no trace of it remains. In the mesoderm of the yolk sac blood-vessels develop very early and extend to and from the body of the embryo. In some viviparous sharks the vascular yolk sac is thrown into folds which, by fitting into corresponding uterine folds, also vascular, constitute a sort of placenta (Balfour).

In birds the yolk material is enormously developed, and, though not at first divided into cells, is still to be regarded as intracellular and as belonging chiefly to the entoderm. The germ layers spread gradually over its surface (Fig. 5046, *B*). The small embryo sinks into the yolk mass, and the ectodermal layer, with the accompanying mesoderm, closes in over its back to form the amnion, *Am*, and to become cut off from the chorion, *Cho*. The extra-embryonic cœlom consequently becomes dilated. These relations are further illustrated in the cross section, Fig. 5047. From the posterior end of the intestinal tract an out-pocketing projects into the cœlom, in which it lies free. This entodermal pocket is the allantois, an organ composed of the same layers as the yolk sac, and like it, highly vascular. Its competition with the yolk sac in placental mammals will be described presently. The yolk sac of birds, in later stages, is drawn into the abdominal cavity, and there it remains in water fowl, as a permanent diverticulum at about the middle of the small intestine. (Oppel.)

The mammals present several types of yolk sac. Except in the monotremes the sacs are empty; the yolk-charged protoplasm has given place to a single layer of well-defined entodermal cells surrounding a cavity filled with thin fluid. The conditions in the rabbit, at a stage comparable with the bird, *B*, are shown in Fig. 5046, *C*. The allantois does not lie free in the cœlom, but has fused with the chorion, into which its vessels extend to form the fœtal part of the placenta. In the rabbit the cœlom never extends farther around the yolk sac than is shown in the figure. The lower half of the sac consists of entoderm and ectoderm only. This lower half soon breaks down and disappears, leaving the entoderm of the upper half to rest against the uterine wall. It is then said to become villous and perform placental functions. (O. Schultze.) Except in some rodents and in the marsupials, the mesoderm extends completely around the yolk sac. In the marsupials the sac is large, almost enveloping the embryo and its amnion. It unites with the chorion and becomes the fœtal portion of the placenta. (Osborn.) The allantois in these animals does not reach the chorion. In the carnivora both yolk sac and allantois are connected with the chorion until birth, and both are vascular. The horse shows similar relations, but the area of chorionic connection with the yolk sac becomes very small, and at birth is merely a scar. (Bonnet.) In ruminants and swine the contact of sac and chorion is slight and transient. In Tarsius and the primates the yolk sac is very small, and in early stages quite distant from the chorion (Fig. 5046, *D*). The extra-embryonic cœlom is correspondingly greatly developed. The human

yolk sac is therefore a small and rudimentary organ, neither containing yolk material nor performing placental functions.

GROSS ANATOMY OF THE HUMAN YOLK SAC.—The youngest human embryos known, and those 1.5 mm. long, are attached to a rounded yolk sac having a diameter equal to the length of the embryo and being connected with nearly the whole extent of the intestinal tract. The embryo grows faster than the yolk sac. At 2.15 mm. the relations are those shown in Fig. 4827 in the present volume. The opening of the globular yolk sac now occupies the middle third of the entodermal tract. A little later the sac becomes pyriform (Fig. 4829), and its intestinal orifice is relatively much smaller. In embryos of about 7 mm., or in the fourth week, the yolk sac is said to attain its maximum development. It is then round or oval, 4–7 mm. in diameter, connected with the intestine by a slender yolk stalk. The sac lies between the amnion and the chorion; its stalk has become included in the umbilical cord (see *Umbilical Cord*, and Fig. 4831). Subsequently the yolk stalk loses its lumen and proceeds to disintegrate, beginning at a point near the future umbilicus. Thus in a three months' embryo the yolk stalk is found in the proximal part of the cord, but no trace of it exists in the distal portion. At birth the part within the cord has gone, but beyond the cord, between the chorion and amnion, traces of it are found, and the sac itself is almost invariably present. (? Mayer, 1834; B. S. Schultze, 1861.)

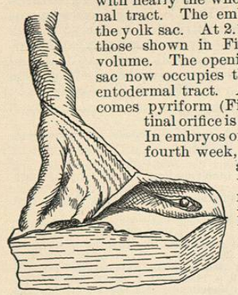

FIG. 5048.—The Placental Insertion of an Umbilical Cord, showing Schultze's Fold. A part of the amnion covering the fold has been reflected, disclosing the yolk sac and persistent vitelline vessels. One-half natural size. (After Lönnberg.)

The umbilical cord is attached to the mature placenta at an angle varying from 0° to 90°. If the cord is gently extended, a thin, triangular or crescentic fold may be expected in this acute angle of insertion. It is thinner than other folds, which are due to blood-vessels. Sometimes it is inconspicuous or absent; in other cases it is 5 or 6 cm. high and very prominent as in Fig. 5048. It is the only place where the amnion is not closely adherent to the cord. In it and beyond it Wharton's jelly is found, sometimes extending a considerable distance over the placental surface. The amniotic villi occur chiefly on this fold. (Winkler, 1868.) According to its discoverer, Schultze, the fold is caused by the yolk stalk, which, if present, is seen within it as a delicate thread running just beneath the surface. It may be absent, or present in detached fragments; occasionally it is continuous from the cord to the yolk sac. If the amnion is removed from the chorion in the quadrant indicated by Schultze's fold, the *sac* will appear as a round or oval vesicle adhering to the amnion (rarely to the chorion), being about 5 mm. in diameter, and possessing a whitish, yellow, brown, or greenish nucleus. Lönnberg, in two hundred placentas, found the yolk sac under the placental area thirty-one times, at the placental border nine times, and beyond the placenta one hundred and sixty times, an extreme case being 27 cm. from the placental insertion of the cord.

The proximal end of the yolk stalk enters the ileum. In young embryos the extensive loop of intestine to which the stalk is attached is found outside of the body, in the cœlom of the umbilical cord. As the intestine is withdrawn into the body, a part of the yolk stalk passes from the navel inward, to a point on the small intestine which at birth is about one foot from the cæcum, and in the adult some four feet. This section of the yolk stalk is normally obliterated. The place where it entered the intestine may be marked by a diverticulum, generally less than four inches in length, although sometimes much longer, known as Meckel's diverticulum. Meckel in 1809 understood its origin and knew that the yolk sac was never connected with the vermiform appendix!

Blood-vessels. — The vitelline, omphalo-mesenteric, or omphalo-mesaraic vessels, which supply the yolk sac, are among the first blood-vessels to develop. In young chick embryos blood from the yolk sac enters the body by two veins which unite to form the heart. These are the vitelline veins. From the heart two arteries extend back along the body of the embryo and branch out on either side over the yolk sac. There a vascular network places them in connection with the veins just described. In later stages a caudad continuation of each artery in the body of the chick causes the portion which passes to the yolk sac to appear as a branch, the vitelline artery. The stems from which these branches arise fuse to form the dorsal aorta. In mammals there are at first many vitelline arteries on each side, irregularly distributed. These are replaced by a few vessels said to be segmentally arranged in pairs. (Mall, Tandler.) Finally a single pair becomes predominant.

By the early development of the vitelline circulation the nutritive yolk is transferred to the body. The spread of the vascular network over the yolk proceeds from the embryonic pole. Its extent is bounded by an encircling vessel, the terminal sinus. This sinus is well defined in birds, is less distinct in mammals, and in man has never been seen, since in the youngest known human embryos the yolk sac is already completely covered with blood-vessels. In birds the vitelline area is the seat of the extensive formation of blood corpuscles, and in mammals it may have the same function.

The vitelline arteries fuse with one another between the aorta and the intestine, and again ventral to the intestine. The intestine becomes encircled by a vascular ring, one half of which, usually the left, soon disappears. A single vitelline artery is thus formed which passes on the right side of the intestine to the yolk sac. With the degeneration of the yolk sac this artery is obliterated, except that portion between the aorta and intestine, which remains as the superior mesenteric artery.

The vitelline veins, at first a pair, also fuse, and form two loops around the intestine. From the intestine they extend as a single fused vessel across the abdominal cavity to the umbilicus. The distal part of this vein is later obliterated. Portions of the loops around the intestine become the portal vein, from which a new branch arises to form the superior mesenteric vein (Dexter).

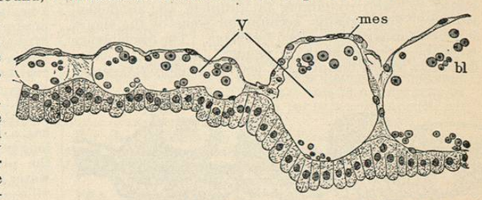

FIG. 5049.—Vertical Section of the Wall of the Yolk Sac of a Rabbit Embryo of Thirteen Days. *V*, Blood-vessels; *bl*, blood cells; *mes*, mesoderm. (Minot.)

In the carnivora the vitelline vessels are pervious for a few days after birth In man the extra-abdominal part is usually obliterated in the first half of pregnancy. Cases of persistent vitelline vessels at birth have been reported, first by Bischoff in 1834. Lönnberg states that there may be two, three, or four vessels, usually three. The arteries may anastomose with the umbilical arteries, but the vein goes through the cord to enter the fœtus

directly. Fig. 5048 shows the persistent vessels around the yolk sac.

Histology.—The wall of the yolk sac of a young rabbit consists of two layers, a lining of simple cylindrical entodermal epithelium and an outer layer of vascular mesoderm (Fig. 5049, from Minot). The latter soon appears divisible into mesenchyma and mesothelium. These with the entoderm make the three layers which are characteristic of later stages. The lining of the human yolk

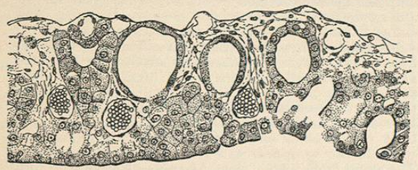

Fig. 5050.—Cross Section of a Human Yolk Sac, from a 9.4 mm. Embryo. × 95 diameters.

sac is said to be of simple epithelium at first. Subsequently it becomes stratified and thrown into folds, variously interpreted. Kölliker and von Baer have described villi containing blood-vessels, and Paladino has figured irregular elevations in the yolk sacs of dog and rabbit. Tourneux found epithelial depressions extending into the mesoderm, separated from one another by mesodermal papillæ. Spee observed slender tubes of entoderm extending across the mesoderm, branching dichotomously, and ending in alveolar enlargements. These he found all over human yolk sacs of six to nine weeks. With Paladino, who regards the mammalian yolk sac as a gland with an internal secretion, and Saxer who finds it a blood-forming organ containing giant cells and blasts, Spee unites in making comparisons with the liver.

The yolk sac of a human embryo 9.4 mm. long, of about four weeks, is without villi. Its proliferated epithelium shows alveolar pockets sometimes resting on the mesothelium and often having no outlets. Between the alveoli there is a small amount of vascular mesoderm, covered with a layer of mesothelium (Fig. 5050).

In a better preserved yolk sac from a 23 mm. embryo of about two months, only an occasional epithelial cyst is found. The dense mesenchyma forms a more definite layer, and the mesothelium is quite distinct (Fig. 5051). The blood-vessels cause elevations on the outer surface which are macroscopic. The entodermal cells are vacuolated, probably containing fat droplets, and are degenerating. They possibly account for some of the stages in blood formation described by Saxer. The resemblance with the liver seems to be remote. At birth the entoderm has wholly disappeared, leaving a connective-tissue

Fig. 5051.—Cross Section of a Human Yolk Sac from a 23 mm. Embryo. × 95 diameters.

envelope surrounding débris, calcareous granules, fat, and albuminoid bodies (Lönnberg). Rauber described yolk elements lying free in the mammalian yolk sac. If yolk is present it should be within the entodermal cells; probably Rauber's yolk is a degeneration product.

The yolk stalk in the cord can be distinguished from the allantois by its cylindrical epithelium, generally simple, but sometimes two- or three-layered. The epithelium of the allantoic duct is cuboidal.

Pathology.—Meckel's diverticulum may contain concretions, and become inflamed like the vermiform appendix. The intra-abdominal yolk stalk sometimes persists as a band of fibrous tissue, a frequent cause of intestinal obstruction. (Fitz.) Portions of the stalk may form large cysts, and be connected with the intestine or the umbilicus, or lie free in the mesentery. (Roth.) The stalk may remain open from intestine to umbilicus, producing an intestinal fistula. (Neurath and Roth.) Fungiform adenoma at the umbilicus has been attributed to the yolk stalk remains. (Hüttenbrenner.) Cysts which may be numerous along the extra-abdominal yolk stalk (Ahlfeld) and persistent vitelline vessels have no harmful effect upon the fœtus. *Frederic Thomas Lewis.*

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YOUNG'S NATURAL GAS WELL AND MINERAL SPRINGS.—Lake County, California.

These natural wonders are located in the eastern edge of Kelseyville on a slightly elevated ground, about three miles south of Clear Lake and near the base of Uncle Sam Mountain. The well is, so far, more of a curiosity than a health resort. While boring for gas, in 1888, the proprietors set free, at a depth of about one hundred and fifty-eight feet, a large volume of water mingled with gas. It rushed out with great force, and the flow has continued, geyser fashion, ever since. For an instant it stops, and then comes another violent ejection to the height of about forty feet; this occurs as often as seventy or eighty times to the minute. The flow of water, which has a temperature of 76° F., is about six thousand gallons per hour. Many people from various localities visit the place to witness the peculiar phenomenon. The water has been extensively used by the people of Kelseyville and vicinity, and they pronounce it excellent for liver, kidney, and bowel disorders. The following analysis of the water was made by Winslow Anderson in 1889. One United States gallon contains (solids): Sodium chloride, gr. 15.76; sodium carbonate, gr. 36.52; sodium sulphate, gr. 19.16; potassium carbonate, gr. 3.40; potassium iodide, gr. 0.78; magnesium carbonate, gr. 7.14; magnesium sulphate, gr. 21.90; calcium carbonate, gr. 6.36; calcium sulphate, gr. 9.72; manganese carbonate, gr. 0.18; ferrous carbonate, gr. 4.95; borates, gr. 3.12; alumina, gr. 5.18; silicates, gr. 6.45; and traces of barium carbonate, lithium carbonate, and organic matter. Total solids, 140.62 grains. Free carbonic acid gas, 9.60 cubic inches; also traces of petroleum and carbureted hydrogen (inflammable gas).

The water may be described as a fairly strong saline chalybeate. If sufficiently palatable it ought to prove useful as a therapeutic agent. Its action is tonic, antacid, aperient, and diuretic. It is the owner's intention to establish a health and pleasure resort on the premises. Several inflammable gas wells are also found on the ground. These yield a gas composed largely of light carbureted hydrogen. *James K. Crook.*

YUMA, ARIZONA.—This desert "city" of 1,800 inhabitants lies in the extreme southwestern corner of Arizona, at the junction of the Gila and Colorado rivers. It has an elevation of only 140 feet, and is situated in the Great Arizona Desert, about sixty miles from the Gulf of California and a few miles from the Mexican border. It is on the line of the Southern Pacific Railroad.

Climate of Yuma, Arizona. Latitude, 32° 45′; Longitude, 114° 36′.—Period of Observation, Eight Years.

	Jan.	Feb.	March.	May.	July.	August.	Oct.	Nov.	Dec.	Year.
Temperature—(Degrees Fahr.)										
Average or normal	53.5°	59.0°	65.0°	77.3°	92.4°	91.0°	72.0°	60.5°	56.0°	72.1°
Mean of warmest	60.3	65.0	71.8	81.8	94.0	92.7	77.0	65.4	59.3	74.0
Mean of coldest	50.2	52.2	58.3	74.4	89.6	88.6	66.7	56.7	52.8	70.2
Average daily range	10.1	12.8	13.5	7.4	4.4	4.1	10.3	8.7	6.5	3.8
Highest or maximum	80.0	90.0	100.0	108.7	118.0	115.0	102.0	91.0	80.0	
Lowest or minimum	22.5	25.0	31.0	49.0	61.0	64.0	41.4	31.0	27.0	
Humidity—										
Average relative	44.6%	42.2%	41.6%	33.8%	39.3%	42.3%	40.1%	38.9%	44.6%	40.3%
Precipitation—										
Average in inches	.43	.52	.08	.01	.22	.25	.04	.03	.31	2.08
Wind—										
Prevailing direction—From	N.	N.	W.	W.	S.	S. E.	N.	N.	N.	N.
Average hourly velocity in miles	5.6	7.0	5.9	5.8	6.0	5.5	4.4	5.2	4.9	5.5
Weather—										
Average number clear days	20.8	19.2	23.1	28.0	22.5	21.8	24.1	22.8	22.4	282.4
Average number fair days	8.1	6.6	6.6	2.6	7.8	7.7	6.1	5.8	6.9	66.3
Average number clear and fair days	28.9	25.8	29.7	30.6	30.3	29.5	30.2	28.6	29.3	351.7

Like Phœnix in the same State, Yuma is famed for its sunshine, heat, and dryness. It can be used only as a winter resort, for it is excessively hot in the summer, the thermometer sometimes rising as high as 115° F. or over, and for many days in succession it ranges above 90° F.

Such a region and climate present conditions closely resembling those which are found at the health resorts of Egypt, which are in nearly the same latitude. The accommodations in the latter country, however, are vastly superior in abundance and excellence to those at Yuma, which are insignificant in comparison, although we are told that "ample accommodation is had at the Depot Eating House, situated on the very bank of the Colorado, with encircling balconies for enjoyment of guests." One would hardly choose, however, a railroad station for a pulmonary invalid seeking pure air free from dust. What other suitable accommodations, if any, exist is unknown to the writer. There is little at Yuma to attract one in the way of amusements or diversion. Such vegetation as is found here is of a semitropical nature. The soil is that which is peculiar to all desert regions.

The climate is that typical of the desert in a tropical latitude, and presents many interesting phases for study. In the first place, we observe from the chart that there are 282.4 clear days, and 351.7 clear and fair days, or over 90 per cent. The mean number of cloudy days for 6 years was 21 (Solly). One may therefore enjoy here almost continuous sunshine. What a contrast, for instance, to Sitka, Alaska, where there are only 66 clear days on an average during the year! Secondly, the extraordinary heat of the warmer months of the year is to be noticed, the temperature in the shade having been known to rise as high as 118° F.; and in the year 1893, from April to October inclusive, out of 214 days, there were 162 during which the thermometer stood above 90° F., and the maximum temperature for the year was 111° F. (Solly, "Medical Climatology.")

It is to be borne in mind, however, that this is a very dry heat—the dryness of the desert, and hence more endurable than a lower temperature would be in combination with a moist atmosphere. From the table we see, again, that the relative humidity is very low, 40.3 per cent. for the year; and the average rainfall for the year only 2.08 inches, and in some years much less than his. Thus, for example, in 1899, there was only 0.6 inch of rain, 0.5 of which fell in November. (Hinsdale, "System of Physiologic Therapeutics, Climatology.") The winter climate, the season in which an invalid would seek such a resort, is sunny and mild, the average temperature being 56.1° F., about five degrees higher than that at Phœnix for the same season, and about two degrees lower than that of Cairo, which is 58.3° F.

For a comparison of the climate of this desert region of Arizona with that of the winter resorts of Egypt, the reader is referred to the article on the latter country in Vol. III. of this Handbook. It will be seen how closely the climatic characteristics of these two regions resemble each other; both illustrate the features of a warm desert climate, and with equally good accommodations and attractions both would probably produce similar results in the treatment of disease.

The conditions and diseases for which such a climate as that to be found at Yuma is to be recommended are also those for which the Egyptian climate is favorable. All stages of phthisis may be favorably influenced by a residence in this desert climate, provided the conditions are not acute. As in Egypt, the disadvantage of such a resort is the short time of year during which it is available; this is a distinct objection in the treatment of phthisis, although even with this disease change is sometimes desirable and advantageous, and this is oftener true of many other maladies. Change *per se* is a therapeutic resource of no mean value.

For the consideration of the climate of Arizona as a whole, the reader is referred to the article on *Arizona* in Vol. I. of this Handbook. *Edward O. Otis.*

ZEA. See *Corn Silk.*

ZEDOARY.—(*Rhizoma Zedoariæ*, P. G.) The rhizome of *Curcuma Zedoaria* Roscoe, order *Zingiberaceæ*. This is one of the numerous ginger-like plants which inhabit the warmer parts of Asia, and whose rhizomes or seeds are used as spices or condiments. Zedoary is indigenous in India and China, in which places it is also cultivated. It is introduced and cultivated also in Java and other Pacific islands. The rhizome is the part used, being dug up, washed, or scraped, and then sliced and dried. It is commonly stated that the smaller branches form the "long Zedoary," and the central tubercles or clumps the "round Zedoary"; but, according to the French Codex and some other authorities, the latter is the rhizome of a related plant, *C. aromatica* Salisbury. Zedoary comes