

The investment on the dorsal surface is not usually so complete. The strengthening bands are mainly two—the rhomboid ligament, passing downward and inward from the lower end of the radius to the cuneiform and unciform bones, and the transverse dorsal ligament, extending from the scaphoid outward to the same. There is also a dorsal radiate ligament diverging from the os magnum.

The only other joint requiring especial mention is that of the metacarpal bone of the thumb with the trapezium. This is an excellent example of the joint by reciprocal reception, sometimes termed the saddle-joint. Its motions are freest in two directions, which correspond to the motions of adduction and abduction on the one hand, and of the various adjustments of opposition on the other.

Frank Baker.

WRIST-DROP. See *Lead Palsy*.

WRITERS' CRAMP. See *Hands and Fingers, etc.*

WRY-NECK. See *Torticollis*.

XANOL is sodium caffeine salicylate, a diuretic of considerable power, with very little of the caffeine effect on heart and nervous system. Dose, 0.3-1 gm. (gr. v.-xv.).

W. A. Bastedo.

XANTHELASMA, XANTHOMA. See *Eye, Tumors of*.

XANTHORRHŒA RESIN.—*Resina lutea*; *Acaroides Gum or Resin*; *Botany Bay Gum or Resin*. By these names are designated several closely related solid balsams, obtained in Australia from species of *Xanthorrhœa* (fam. *Liliaceæ*).

The resinous sap exudes spontaneously, and hardens upon the stem in tears or masses. Two principal varieties of the "gum" are distinguished: the red, in deep lumps or fragments resembling lumpy specimens of dragon's blood, having a weak odor of benzoin, and a spicy cinnamon-like taste; the yellow, in orange-yellow pieces or tears, having a strong benzoin odor.

The balsam contains, besides some bassorin and uninteresting ingredients, a large proportion of *cinnamic acid* and some *benzoic acid*. When it is decomposed with melted potash, parabenzoin and protocatechuic acids, pyrocatechin and resorcin are formed. In nitric acid the balsam dissolves readily, and yields abundance of picric acid, together with oxalic and nitrobenzoic acids.

The *xanthorrhœa* resins have long been used in Australia as a remedy for gastric troubles, intestinal catarrhs, diarrheas, etc., and are occasionally prescribed in this country for similar conditions; but their principal uses are in the arts as a source of picric acid, and in the manufacture of lacs and varnishes.

Dose, from 0.5 to 1 gm. (gr. viij. ad xvi.). It may be given in alcoholic solution.

W. P. Bolles.

XANTHOXYLUM. See *Ash, Prickly*.

XERODERMA. See *Ichthyosis*.

XEROFORM. See *Tribromphenol bismuth*.

XEROSTOMIA. See *Parotid Gland, Diseases of*.

X-RAYS. See *Roentgen Rays, etc.*

XYLOL.—A hydrocarbon, or mixture of isomeric hydrocarbons of the composition $C_8H_{10}(CH_3)_2$, occurs as a constituent of coal-tar, and is known as *xylol* or *xylene*. This substance is principally *meta-xylene* (*metadimethylbenzene*), with a certain proportion of *para-xylene* (*paradimethylbenzene*), and possibly some other hydrocarbons. Pure *meta-xylene* can be obtained by special processes. *Xylol* is a thin, colorless fluid of a faint odor, reminding somewhat of that of benzene, and of a burning taste. It is insoluble in water, but soluble in alcohol. Medicinally, *xylol* has been used in the treatment of smallpox, and had at one time an ephemeral, but undeserved, reputation as a remedy for the disease. It was administered internally in doses of from ten to fifteen drops, in emulsion, and was also applied locally to the throat. It is now obsolete as a medicine.

Edward Curtis.

YADKIN MINERAL SPRINGS.—Stanley County, North Carolina.

POST-OFFICE.—Palmer'sville. Boarding-houses. Access.—Via Southern Railroad to New London, thence six miles by private conveyance to springs.

This resort is charmingly located in a wild and picturesque region penetrated by the Yadkin River, and covered by the Oconosee Range of mountains. Like the usual North Carolina mountain climate, the atmospheric conditions prevailing in this section are eminently conducive to good health and longevity. The rainfall at the springs is about fifty-three inches annually, and is quite uniformly distributed through the seasons. There is no hotel, but during the season, from May to November, accommodations may be obtained at a reasonable rate in a number of private boarding-houses. The springs are two in number, a chalybeate spring yielding sixty gallons of water per hour, and a sulphur spring flowing at the rate of one hundred and eighty gallons per hour. No qualitative analysis is available. Much beautiful scenery is found in the neighborhood of the springs; the falls of the Yadkin River, the Narrows, and the "Devil's Den," a great cave in the hills, being the most prominent.

James K. Crook.

YARROW.—*Achillea, Milfoil*. *Achillea* L. (fam. *Compositæ*) is a genus of more than one hundred species, several of which, from ancient times, have been used in domestic and professional medicine. The most important of these is *A. millefolium* L., the herb of which is used. It is a perennial plant, indigenous to Asia and Europe and largely naturalized (or perhaps native) in North America. Its active principles are a very small amount of a volatile oil, and the bitter glucoside *achillein*. Aconitic acid also occurs, with considerable tannin, a little gum and resin. The drug is to be classed as an ordinary aromatic bitter, somewhat like chamomile. The dose varies from 0.3 to 2 gm. (gr. v. to xxx.).

Henry H. Rusby.

YAWNING.—(Synonyms: Gaping, Oscitation; Germ., *Gähnen*; Fr., *Bâillement*.)

DEFINITION.—Yawning is a physiological modification of respiration by which the act is intensified. It consists in an involuntary, forcible, and profound inspiration, followed by a pause and a prolonged expiration. When fully developed, it is accompanied by a wide opening of the mouth, an elevation of the velum palati, and depression of the larynx, a roaring sound, and usually a click in each ear, a flow of saliva, and a suffusion of the eyes with tears, and a more or less imperative impulse to extend the limbs, especially the arms (pandiculation), to bow and twist the trunk, and to throw back the head. The inspiratory act is frequently audible, and the expiration usually acquires a distinct blowing sound. The elevation of the palate closes the posterior nares and causes the air to be admitted wholly through the mouth. In the same way the Eustachian tubes are closed, causing momentary obtunding of hearing. The contraction of the palatal muscles often precedes the opening of the mouth, and tends to persist for a moment after its closure. The commencement of their contraction is not infrequently accompanied by a rapid succession of three or four short, broken inspiratory efforts.

PHYSIOLOGY.—Yawning is a physiological expression of fatigue and a disposition to sleep. It may, however, arise from a retardation of the respiration, or from any influence which will impair the oxygenation of the blood. It is frequently, therefore, a product of melancholy, languor, ennui, torpor, or debility, or of the malaise which precedes the onset of disease. It is liable to follow prolonged abstraction of mind or concentration of thought. It is sometimes the result of feeble or laborious digestion,

of gastralgia, or of other disorder of the digestive organs; or it may occur in response to a demand for increased activity of circulation. It may be sympathetic. To some individuals it is habitual, occurring without fatigue, and being but the outgrowth of the lassitude or indolence of their natures. It may sometimes be attributed to the possession of an inferior degree of intelligence, a slothful, inactive, effeminate, timid, or lustful disposition incapable alike of vigorous mental exertion or of prolonged physical activity.

That yawning may be the response to a demand for increased activity of oxygenation in the lungs is demonstrated by placing an animal in an irrespirable atmosphere. Repeated yawning occurs shortly before the animal succumbs to asphyxia. The phenomenon is therefore usually explained on the supposition that it is due to a stimulus transmitted from the central nervous system in response to a peripheral impression, in most cases arising, in part at least, from the respiratory apparatus. Longet has attributed it to the accumulation of too great a quantity of venous blood in the right side of the heart, whence the peripheral impression is supposed to proceed. From whatever source we derive the peripheral impression, however, the act is generally admitted to be reflex in character. Of the reflex nature of the stimulus which produces the muscle contractions in the extremities, there can be no doubt; for it is a matter of repeated observation that the hand which, owing to paralysis, has been for years beyond control of the will, and has become firmly contracted by post-paralytic rigidity of its flexor muscles, will often become distended during yawning. It is evident here that the stimulus can emanate only from the spinal centres.

The mechanism of yawning is the same as that of normal respiration; the same muscles are called into action, but their movements are more extended. (See *Respiration*, Vol. VI.) The diaphragm, the scaleni, the sternocleidomastoids, the clavicular portions of the trapezii, the lesser pectorals, the subclaviculars, the external intercostals, the serrati magni, the rhomboids—in fact, all the muscles which normally act as direct or as auxiliary forces in the full expansion of the chest, take part in the inspiratory movement; and all the muscles of forced expiration are called into action in the expiratory stage. In the fully developed yawn there is the action also of the muscles of the face, the depressors of the lower jaw, the dilators of the nostrils and upper lip, the orbiculares palpebrarum, the zygomatics, and of the depressors of the hyoid bone and larynx, and finally of the muscles of the back in the bowing of the trunk, and of the extensors of the extremities when stretching occurs.

Yawning is involuntary. It begins without the sanction of the will, and, once begun, it cannot be arrested. In this it resembles sighing, sneezing, hiccough, and other modifications of respiration, without, however, possessing their full spasmodic quality. Yet the will is not entirely deprived of influence over it; for a yawn may be often in a measure concealed by a forcible effort at closure of the jaws, and the mouth may be performed by the will, though not completely; and is one that is particularly excited by an involuntary tendency to imitation, as every one must have experienced who has ever been in company with a set of yawners.

After yawning there is usually a momentary pause in the respiratory movements, followed by normal, tranquil breathing. The forced respiration has not only supplied the blood with its needed oxygen, but, aided by the muscular contractions, has removed venous engorgement and accelerated the systemic circulation. At the same time, a moment's relaxation has been given to the fatigued body, and a sense of relief is usually afforded.

SYMPTOMATOLOGY.—The value of yawning as a symptom has been at different times very differently estimated. Hippocrates recognized it as a precursor of a fever, particularly of intermittent fever. From its frequency and

intensity he prognosticated the severity and duration of the disease. Yawning, with suffusion of the eyes and pandiculation, was in early times among the most valued factors in the diagnosis of the eruptive fevers. Occurring during parturition, it was an evil omen. Roederer, in 1759, believed that he had observed a death from it. The yawning of the infant was also a cause for solicitude.

It is now comparatively seldom, however, that we think of yawning as more than an indication of fatigue and a precursor of sleep, or of lassitude and a lazy disposition. But that it may denote a diseased state of the system is a well-recognized fact. As indicative of fatigue, it may be a symptom of profound mental or physical exhaustion. It may, in fact, of itself constitute a morbid condition of spasmodic nature and of grave import. It is not infrequently indicative of a deficient oxygenation of the blood, especially when it is associated with the dyspnea which results from the lung consolidation of fibrinous pneumonia, the lung compression of hydrothorax or pneumothorax, or after profuse and exhausting hemorrhages. In the latter connection, it is at times a valuable factor in the diagnosis of concealed hemorrhage.

Modern experience has but confirmed the observations of the ancients with regard to the occurrence of yawning in the prodromal stage of fevers, particularly of the intermittents. In these, as also in such neurotic affections as epilepsy, hysteria, catalepsy, and somnambulism, frequent gaping often signifies the immediate supervention of a seizure. When it occurs during the course of a disease it not seldom indicates the approach of resolution or of a crisis. It is so frequently observed during parturition, however, as a consequence merely of fatigue, that no great significance is now attached to it.

As a symptom of feeble or suppressed menstruation in anemic young girls, it is probably in most instances a manifestation of hysteria, so often a complication of this disorder. It is probable also that many of the reported cases of spasmodic yawning have been of hysterical origin. Nevertheless, cases have been reported in which yawning of a spasmodic character developed without hysteria, and resembled whooping-cough, spasmodic laughing, crying, sneezing, etc. Of a reflex nature, the affection may be indicative of various disorders of the central nervous system, particularly of cerebral anæmia, of circulatory disturbances in the medulla oblongata, or it may occur in the wake of cerebral hemorrhage. It also shows a predilection for individuals who, from necessity, are confined to small, closely crowded work-rooms, and for convalescents from neuralgic affections, especially cardialgia and hemicrania.

To the surgeon yawning is of interest chiefly on account of its occasionally producing luxation of the lower jaw. The mechanism of this accident is considered under *Dislocations*, in Vol. III. James M. French.

YAWS is a chronic, highly contagious disease, probably caused by a micro-organism, confined to certain tropical countries, and characterized by a peculiar cutaneous eruption which goes through the stages of squamæ, papules, and tubercles; it is accompanied by a variable (but generally slight) amount of constitutional disturbance, and tends to recovery.

SYNONYMS.—Yaws is the common name given to this disease in the British colonies and by the negroes from West Africa. Sauvages, in 1759, suggested *frambæsia* as the scientific name, from the resemblance of the split tubercle to a raspberry (*framboise*); though Rat thinks that the characteristic tubercle is more like the top of a pickled cauliflower than a raspberry. Charlevoix, in 1881, proposed *poly-papilloma tropicum*; and later, Nicholls has suggested *granuloma tropicum* as a more correct and scientific designation. And it is to be regretted that one or other of these two names has not found universal acceptance. Different places, too, have furnished different names for this disease, the chief of which are as follows: In the French West Indies it is called *pian*; in Brazil and the Spanish and Portuguese possessions, *tabas*,

bobas; in Ceylon, *parangi*; in the Dutch Indies, *patek*; on the Gold Coast, *ajortor*, *dube*, *dubea*, *tongara*; in Calabar, *framosi*; in Congo, *tetia*; in Samoa, *lupani*, *tomo*; in Fiji, *coko*; in New Caledonia, *tonga*, *tono*; in the Moluccas, *bouton d'Amboine*.

GEOGRAPHICAL DISTRIBUTION.—Yaws is endemic in the tropics, chiefly in the West India Islands (notably Dominica and Jamaica), Central and South America, Western Africa, Mozambique, Madagascar, Ceylon, Java, the East Indian Archipelago, and Polynesia. Its limits seem to be ten degrees on each side of the Equator; though lately cases have been reported from Kimberley, in South Africa. Negro slaves from Africa probably took the disease to the West Indies. The first account of the affection was given by Oviedo in 1525; he met with it in Hispaniola (now St. Domingo).

ETIOLOGY.—The direct cause of the disease is undoubtedly a micro-organism, but so far it has not been absolutely identified. Hirsch, Pieroz, and Nicholls and Watts have reported the finding of a micrococcus, to which they ascribe the disease; Breda attributes yaws to a bacillus; and Powell to a yeast. Yaws is generally acquired by direct contagion, and is inoculable through a sore, or an abrasion of the skin, also by the nipples of a nursing mother or the mouth of an infant; but flies, mosquitoes, and other insects may also be the means of disseminating the disease. It is also transmitted by clothes, rugs and mats, and dirt from the floor or walls of filthy and infected hovels. As predisposing factors may be mentioned: *Age*. Infants below one or two years are generally exempt; children between two and fourteen years are most liable to be attacked by the disease. *Sex* has but little influence, the number of males affected being slightly in excess of the females. *Race*. The negro is much more liable to yaws than the white man or mulatto. *Hygiene* is an important factor in this apparent immunity of the whites; and the negro's absolute ignorance of and indifference to things hygienic will go far to explain his susceptibility to yaws. A constitution worn out by disease or dissipation and unhygienic surroundings are potent predisposing factors. *Heredity* plays no part, for children are not born with yaws; this is an important difference between this disease and syphilis. But Hallen has reported a case of yaws in an infant twenty days old. The mother was suffering from yaws and the child probably got infected during labor. *Vaccination* seems to have a favorable influence on the disease. In persons who have been vaccinated an attack of yaws is generally very mild, while a similar result is often experienced from vaccinating a person suffering from yaws. One attack of yaws usually confers *immunity* from future attacks, at any rate for a number of years; but occasionally a person acquires the disease a second or even a third time.

SYMPTOMS AND COURSE OF THE DISEASE.—The disease begins with a *period of incubation*, of from two to eight weeks (but generally nearer the former figure), and lasting till the appearance of the local lesion. Usually there are no prodromes, and occasionally there are a few vague symptoms, such as malaise, languor, headache, itching, pains in the limbs, vertigo, constipation, fever, and palpitation of the heart. In children these symptoms are apt to be more pronounced. This is followed by the *eruptive stage*, which may last for a period varying from a couple of months to as many years. The symptoms mentioned above become more pronounced, and the skin becomes dry, scaly, and lustreless, and in the negro lighter in color. This squamous eruption soon gives place to papules, one or more of which may sometimes be found, on close examination, at the seat of the inoculation. These papules at the point of inoculation may either heal (with treatment in about two weeks, or without treatment in about two months), or break down and ulcerate. They are most apt to appear on the face, perineum, areola of the breast, genitals, anus, toes, lips, mouth, and nose, also at the junction of the mucous membranes with the skin. The papule, which at first is about the size of a pinhead, grows to the dimensions of a pea or a pingpong

ball, or even larger. It is conical in shape, and the skin over it becomes thinner and redder and more shiny, and eventually splits in the centre of the tubercle or granuloma, as it is now called. On the splitting of the skin there appears a raw protuberance which seems to push itself through the epidermis; this is the "*framboise*," and is often covered with an offensive exudate of a dull seropurulent fluid, which forms a scab; and this, if removed, is replaced by new crusts. The surface under these crusts is red except in cachectic individuals, when it is of a dirty-yellow color. These tubercles are either single or they coalesce, or they may appear in successive crops; they are the essential lesion of yaws. They may measure as much as two or three inches in diameter, and a quarter of an inch in thickness. They are not painful or tender to pressure, except when they are situated in the palms of the hands or the soles of the feet or under the nails. When situated in the axilla or on the thigh they are apt, from pressure, to become flat. The tubercles gradually shrink, and the scabs or crusts drop off, leaving only a macule which itself eventually disappears. The lymphatic glands in the immediate neighborhood are sometimes involved, in which case they become swollen, and may even suppurate. During this stage some squamæ and papules may also be present. A few papules occasionally remain after the others have disappeared, and are called by the negroes "*membra*" yaws ("*membra*" being equivalent to *remember*). In a mild case of yaws there are no sequelæ; but in severe cases and in the debilitated and dissipated there may be serious ulceration, also bone lesions; but the latter are more apt to be a result of syphilis, and the possibility of this disease being present with yaws must not be overlooked. At the same time care must be taken not to give too much mercury, or serious results may follow, for which the yaws is not responsible.

IRREGULAR VARIETIES.—Occasionally one of the yaws tubercles is larger than the others, is more or less isolated, comes earlier, or lasts longer, and is considered by the negroes to be responsible for the other tubercles; such a one is called a "*maman*" pian or "*mother*" yaws. When the soles of the feet and palms of the hands are affected, there is apt to be severe inflammation; and the disease thus localized is called *crab yaws*, *crabs*, *crappox*, *tubboes*, or *tubba*. *Ringworm yaws* is the name given when the papules become confluent and are arranged circularly.

Pian d'artre is the name given when most or all of the tubercles are replaced by yellowish spots slightly elevated.

When a number of tiny vesicles remain scattered over the trunk the condition is called *Pian gratelle*. This is an occasional sequel of yaws.

DIAGNOSIS.—The transition of the squamæ to papules and later to tubercles which split and exhibit a tumor with a yellowish discharge, is fairly characteristic of yaws. Syphilis is the disease with which yaws is most likely to be confounded. Hutchinson believes yaws to be a species of syphilis modified perhaps by climate and race, but still syphilis. Pieroz, Powell, Nicholls, Rat, and most other observers believe that these two diseases are absolutely distinct. Among the points of difference may be mentioned: 1. Yaws is practically confined to the tropics, while syphilis is found almost everywhere. 2. Yaws is not hereditary; syphilis is hereditary. 3. In yaws the primary lesion when found is a soft ulcer; in syphilis it is a hard chancre. 4. Yaws does not invade the nervous system or viscera; syphilis attacks both. 5. In yaws there is considerable itching; in syphilis none. 6. The eruption in yaws is characteristic and *sui generis*; that of syphilis is polymorphous. These are enough to differentiate between the two diseases; but it must be remembered that both syphilis and yaws can occur in the same patient.

PATHOLOGY.—According to Macleod ("Pathology of the Skin"), the clinical lesions, namely, squamæ, papules, and tubercles, are stages in the evolution of a common histological process.

I. "*Changes in the Corium.*"—1. Blood-vessels: Dilata-

tion, and tortuosity of those in the papillary and sub-papillary layers; no thickening of the vessel walls or endothelial proliferation; vessels persist in the granuloma. 2. Cellular infiltrate consists of: (a) Plasma cell infiltration at first most marked in the neighborhood of the vessels, follicles, and glands, rapidly becoming diffused; no definite arrangement in rows; no large multinuclear cells or true giant cells. (b) Mast cells, connective-tissue cells, and small mononuclear cells; no tendency to organization detected. (c) Marked extravasation of polymorphous leucocytes. 3. Fibrous stroma: (a) Collagen attenuated where the granuloma is densest; no definite degeneration. (b) Elastin similarly affected. 4. Hair follicles, sebaceous glands, and coil glands seemed healthy.

"II. *Changes in the Epidermis.*"—1. Marked proliferation and down growth of the interpapillary processes so great in the older lesions as to resemble condyloma acuminatum. 2. Basal layer interrupted. 3. Edema affecting prickle cells and interepithelial spaces. 4. Disappearance of pigment in the affected area. 5. Transitional layers imperfect. 6. Cornification; marked hyperkeratosis and parakeratosis, with deposition of leucocytes and debris between the horny lamella." (Macleod.)

PROGNOSIS.—This is favorable, as the disease nearly always terminates in recovery. Under proper treatment a period of a few months suffices for restoration to health. Very young children and the feeble and dissipated may die of exhaustion.

TREATMENT.—Cleanliness and proper hygiene are the best prophylactic measures. The first step in treatment is the segregation of those afflicted. So necessary has this been found that in some of the West India islands, e.g., Dominica, there are yaws hospitals to which those suffering from the disease must go under penalty of imprisonment. Actual treatment consists in cleansing the patient, then in the use of local antiseptic washes, good nourishing food, and tonics. The drugs most often used are: iron, arsenic, iodide of potassium, mercury. The bowels must be regulated, and any concurrent diseases, such as syphilis, be appropriately treated. In *crab yaws* the feet and hands should be soaked in hot water and the softened skin then pared away till the yaws growth is exposed; it can then be treated as mentioned above.

R. J. E. Scott.

LITERATURE.

Schenbe's Diseases of Warm Climates; Hirsch's Geographical and Historical Pathology; a paper by Pieroz, in the Transactions of the Pan-American Medical Congress of 1893; an article by Firth in Allbutt's System of Medicine; and an article by Nicholls in the Twentieth Century Practice of Medicine; with the bibliography supplied in each.

YEAST.—(*Cerevisia Fermentum*; *Leaven*.) The fungus *Saccharomyces Cerevisia* Meyer (fam. *Saccharomycetes*), in its commercial forms more or less mixed with vegetable substances constituting its nutrient medium.

The alcohol ferment so well known under the name brewers' yeast, consists chiefly of living cells of the plant named above, mixed according to convenience with starch, sugar, malt, meal, or similar substances, and sometimes with hops.

This little plant consists, in its usual form, of single ovoid cells containing turbid protoplasm and vacuoles (vide Fig. 5045, *i*) about the $\frac{1}{1000}$ of an inch in length. These cells, in active yeast, increase in numbers to an incredible extent by budding (Fig. 5045, *ii*, *iii*, *iv*), usually separating almost as fast as the new cells attain any considerable size, but also often, especially upon the surface or where the fermentation is slower, cohering for a while in colonies (*v*); under rare circumstances, mother cells (asci?) are formed in which two or several cells are differentiated, and finally liberated by the disappearance of the original cell wall; these then grow and bud in the same way as the preceding. During the growth and multiplication of these little cells starch and the different sugars are ultimately disintegrated into alcohol and carbon dioxide. (See the articles on *Bacteria*, *Enzymes*, and *Fermentation*.)

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The early history of yeast is lost in antiquity. It is frequently mentioned in the Bible as leaven, and in some shape or another has been, and is, used by nearly all races of mankind; its production in the great beer and spirit breweries of Europe and America amounts to thousands of tons, and it is consumed and often made in nearly every family of Christendom.

As a commercial product, yeast exists in three principal forms: (1) Brewers' yeast (formerly official in England), the skimmings of the fermenting beer vats, containing the plant in a state of high activity, of which the following

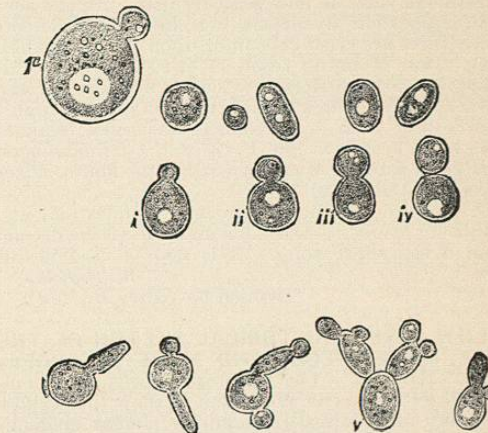


FIG. 5045.—Cells of Ordinary Brewer's Yeast. (Copied from an Atlas of Practical Elementary Biology, by G. B. Howes, London, 1885.) *i*, *ii*, *iii*, *iv*, Stages in division of the same cell; *v*, cell *i* as seen under Gundiach's one-sixteenth immersion lens; *v*, a branching colony, the cells of which still retain their original connections.

was the official description: "Viscid, semi-fluid, frothy, exhibiting under the microscope numerous isolated, roundish, or oval cells, or short-branched filaments composed of united cells; odor peculiar, taste bitter"; (2) cake yeast (dry) consists of the above mixed with starch flour or, usually, in this country, Indian meal, rolled and cut into little biscuits and dried; and finally, (3) super-sedding both the above forms for domestic use in cities and towns, the German or compressed yeast in little moist cakes enclosed in tinfoil, which consists of an almost solid mass of yeast cells with a minimum of starch or sugar. This is made by taking the beer skimmings and repeatedly washing and straining them, and allowing the cells to settle, and finally pressing nearly dry between cloths; or by propagating them in a definite mixture of barley-malt, rye flour, and barley, and collecting, washing, and pressing in the same way. "Compressed" yeast is a very concentrated and active form of yeast. In its moist state, however, it does not keep very well, and should be obtained fresh every day or two, and laid in the ice chest until wanted.

Whether the characteristic properties of yeast are dependent upon the existence and manifestation of life in the plant, or are merely the result of chemical activity on the part of some principle capable of extraction in an active state, has been an intensely interesting and highly important question ever since the discovery of active constituents in plants. The most recent experiments by Büchner seem to prove that the latter is true, the enzyme *zymase* having been described by him. Since it is incapable of escaping through the pores of the cell wall, its extraction is dependent upon a process of extreme disintegration. *Zymase* retains its properties after extraction for only a comparatively short period, a few months being the longest time recorded.

Into the general uses of yeast it is not the design of this article to enter. It is concerned in the production of all beers, wines, and liquors, and of the common "raised" breads and cakes. As a modifier of food in these instances it has considerable dietetic importance; when

mixed with a moderately thick dough, the disengagement of carbonic acid taking place throughout, fills it with innumerable minute interstitial bubbles, or makes it spongy, as the housewives say, or light. If baked in this condition these bubbles expand with the heat, making the bread still "lighter," or more porous, and in a condition for more ready disintegration in the stomach and intestine than breads made without yeast, and depending upon the vaporization of water only for their lightness. The alcohol is mostly dissipated in the baking and cooling of the bread; the cooked yeast itself is probably of no special dietetic consequence.

In medicine yeast is now scarcely used. It has been given in indigestion, dyspepsia, etc., but is of little consequence (there are yeast cells in or upon our food almost always). Dose of liquid yeast, 15 or 20 gm. (3 ss.). It still survives to a moderate extent as a poultice (*Cataplasmata Fermentis*), which is simply a thin raised dough.

Take of beer yeast, 6 fluidounces; wheaten flour, 14 ounces; water heated to 100° F. (37.8° C.), 6 fluidounces. Mix the yeast with the water and stir in the flour. Place the mass near the fire till it rises.

Yeast poultice is a light, agreeable application, and is thought to overcome the odor and reduce the decomposition of sloughing sores. It is seldom used in this country.

W. P. Bolles,

Revised by Henry H. Rusby.

YELLOW FEVER: HISTORICAL SKETCH OF THE DISEASE, ITS ETIOLOGY AND MODE OF PROPAGATION.—**HISTORY.**—The remotest records about epidemic diseases in the Old World fail to show that yellow fever or any other disease presenting similar epidemiological features had ever been observed previous to the discovery of America in 1492; while in the newly discovered lands it soon became apparent that every expedition of European settlers that came to the Antilles or to the Spanish Main had to pay a heavy tribute to an unknown pestilence, during the first summers of their residence, suffering thereafter no further trouble from the climate. Was this pestilence yellow fever?

In order to answer that question Bérenger-Féraud and I, independently of each other, undertook minute historical researches, some fifteen years ago. We both came to the same conclusion: that the disease mentioned in the old Spanish chronicles as the "peste," "contagio," or "epidemia," was no other than our modern yellow fever; and that, at the time of the discovery, it was endemic on the coast of Mexico, at the present site of Vera Cruz, as well as on the Atlantic side of the isthmus, and on the Spanish Main along the coast of Colombia and Venezuela inhabited by the Carib Indians. These warlike Indians were constantly plying across the Caribbean Sea in their canoes, and through them yellow fever appears to have been sometimes conveyed to their own Isles of Dominica, Guadeloupe, Porto Rico, and to the eastern end of Hispaniola (the Province of Higüey in Santo Domingo) which was often visited, if not held in actual subjection by that fierce Indian tribe. The disease was called "Poulicantina" by the Caribs (Bérenger-Féraud) and "Cocolitzle" by the Mexicans (see my "Epidemiologia primitiva," in *Cronica Medico-Quirurgica de la Habana*, Mayo 15, 1897).

The Caribs maintained in captivity upon their own isles a number of women and youths captured by them from the peaceful and even timorous tribes who dwelt upon the greater Antilles, the male adult prisoners having been disposed of to satisfy the cannibal instincts of the captors. Being born or bred in the endemic foci on the mainland, the Caribs must have been immune against the Poulicantina, just as the natives of Cuba have been hitherto against yellow fever; but the presence of the non-immune captives may have supplied the required material for the occasional development of poulicantina epidemics in the Carib Isles, and also in the Higüey district of San Domingo; and in this way the disease could readily have reached any foreigners who chanced to visit those islands. This is indeed what seems to have hap-

pened to the Spaniards, newly arrived in Hispaniola, during a long succession of summers ever since their first settlement in 1494; and to the French ever since their first attempts to colonize the Carib Isles, one and a half centuries later. The French missionaries, less reticent than the Spanish colonists had been, made no mystery of the symptoms of the epidemic disease which attacked them, and which, they said, was known in the Spanish Islands under the names of "peste" or "epidemia"; so that the identity between our modern yellow fever and the poulicantina as well as with the "peste," "contagio," "epidemia," of the Spanish colonies, could no longer be doubted, after the description of Du Tertre, who witnessed the epidemic of Guadeloupe in 1648, and Cogoludo's minute account of that of Yucatan the same year.

First Names Given by the Spaniards to the Pestilential Disease which Attacked the Spanish Settlers Newly Arrived in Hispaniola and Darien.—On the 2d of February of 1494, two months after the arrival of Columbus at Hispaniola, on his second voyage, bringing with him the first European expedition (fifteen hundred men) that ever set foot on American soil, twelve of the seventeen vessels on which that expedition had come sailed away, under command of Antonio Torres, for Spain, taking, no doubt, the route through the Canary Islands which was still followed in those days. At the port of departure where the colonists, by order of the admiral, were building the town of Ysabela, most of the men had been falling sick since the last week of January; but though many were on the sick list only few died. Critics are mostly agreed in attributing to malarial fevers the illness which attacked the men at this time, the admiral himself having been one of the sufferers. It is possible, however, that some of the fatal cases may have been yellow fever. At any rate, as the year advanced, the situation became more critical, and by the end of May, when the admiral's brother, Bartolomé Colon, arrived with three vessels laden with provisions from Spain, sickness and death had been rife among the Spanish settlers in Hispaniola, not only at the port of Ysabela, but also in the interior of the island where forts had been constructed near the gold mines. The Indians then began to run away from their masters, deserting the culture lands, perhaps in order to preserve themselves from a contagion with which they were already familiar; but the Spaniards attributed their dispersion to a preconceived plan for starving the foreign invaders out of their country by not planting at the proper season the vegetables upon which the inhabitants were most dependent for their subsistence. Oviedo attributes to this action of the Indians the great mortality which followed. From two-thirds to one-half of the Spaniards died, but innumerable were also the deaths among the Indians themselves, whose cadavers lay strewn in the fields, producing, says the chronicler, a most horrible and pestilential stench. Columbus, in the mean time, had been absent from the island since the end of April, exploring the coasts of Cuba and Jamaica, and intending also to visit Porto Rico. About the middle of September, on his way from Jamaica to Porto Rico, he came close to the shore on the south coast of Hispaniola, holding intercourse with the Indians and landing nine men of his crew to convey information about his own movements to his people at Ysabela, across the island. He was detained by a severe hurricane during seven or eight days in a narrow pass between the coast and the islet of Saona, close to the Higüey district. On the 25th or 26th of September, as he was proceeding toward Porto Rico, he was suddenly attacked by a grave illness, which deprived him of his senses and so much alarmed the crew that they turned from their intended course and brought the admiral and the other two vessels back to Ysabela, where they arrived on the 29th. He continued several days ill, and had a long convalescence, probably prolonged by a return of his malaria infection, as often happens in Cuba in the convalescence of yellow fever. In a letter which the admiral wrote to the King, he states that his illness on that occasion had been a "modorra pestilencial," prob-

ably the name which Dr. Chancas, the physician attached to the expedition, had given to the disease which had been causing so many deaths on the island since the admiral's departure in April. This same pestilential disease appears also to have been carried from Hispaniola to the Canary Islands, either by the vessels of Antonio Torres, or, more probably, by the three which returned to Spain after having landed D. Bartolomé Colon at Ysabela; for Humboldt and Bonpland inform us that "what remained of the Guanches on the Island of Teneriffe perished mostly in 1494, in the terrible epidemic called the "Modorra." Though every subsequent expedition which landed at Hispaniola lost one-third or more of their contingent from the same pestilence during the first summers of their residence on that island, the chroniclers, warned by the panic which had been created in Spain by rumors of the first epidemic, were silent as to the name and symptoms of the disease, always attributing the great mortality to the bad quality of the food and to the change of climate. But in 1514, when Pedrarias Davila landed at Darien with a splendid expedition, among whom were the chronicler Oviedo and Andagoya, both of whom had lived in former years in Hispaniola, a terrible epidemic broke out among the newcomers, causing seven hundred deaths in one month, and each of the above-mentioned authors declares that the cause of it was the "modorra sickness"; adding that after the newcomers had gone through that ordeal, the climate proved as salubrious to them as that of Spain. The name of "modorra" was, however, soon abandoned, probably because the stupor or coma which characterizes some particular epidemics of yellow fever (see Cornillac, ed. 1875, p. 423) was found to be a less constant symptom than Dr. Chancas had imagined. In subsequent years the uncompromising terms of "peste," "pestilencia," "epidemia," "contagio," were substituted, and continued in use till the end of the seventeenth century.

The names of vomito negro and yellow fever were first given to the disease in the early part of the eighteenth century. In 1753, a surgeon of the Spanish navy, Dr. Josef Gastelbuondo, who had settled in private practice at Cartagena de Indias, published a book on the "vomito negro," stating in his preface that he had been studying the disease and investigating its causes during the previous forty years, and had performed several autopsies. Strange to say, he attributes the disease to the same causes which had been constantly invoked by the early Spanish colonists of the two previous centuries, namely, to the change of climate and to the poor quality of food for which the newcomers were unprepared. Other names such as typhus amaril, typhus icterode, hæmogastric pestilence, malignant remittent, putrid fever, etc., continued, however, to be used conjointly with that of "vomito negro," yellow fever, fièvre jaune, febre gialla, till the commencement of the nineteenth century.

During the first two hundred years after the discovery of America the ports of Santo Domingo, Cartagena de Indias, Porto Bello, Darien, Vera Cruz, where the "flotas de Indias" brought each year, during the summer months, a large number of non-immunes from Spain, yellow fever assumed the character of a permanent endemic, while on the Island of Cuba, owing perhaps to its cooler climate and to the fact that its communication with Spain was less direct, the disease obtained a permanent foothold only in 1761, after the occupation of Havana by the English and the subsequent opening of Cuban ports to general commerce. Since that time and until 1901 Havana has been considered a constant menace of yellow-fever infection for the United States and for European ports. Rio de Janeiro, Brazil, on the other hand, has become an endemic focus only since 1850.

New Orleans also was at one time considered an endemic focus of yellow fever, not less than forty-eight epidemics having been recorded in the first sixty years of the nineteenth century; but the success which has followed the observance of strict quarantine measures after the civil war plainly shows that the infection of that port had in reality been derived from repeated importa-

tions from Vera Cruz, Havana, Central America, or from the West Indies. The propensity of yellow fever to spread into neighboring countries, along the lines of traffic, and to be carried in ships to far distant ones when certain climatic and topographical conditions are realized, has been verified again and again, causing innumerable victims as well as serious financial distress, and spreading terror over large areas in North and South America, on the western coast of Africa, in the Canary Islands, in the southwest part of Europe, and at times reaching as far north as Quebec and Swansea, and as far south as Montevideo and Buenos Aires. The climatic and topographical conditions to which reference has been made are essentially those which are compatible with the existence and functional activity of the insect which, as will be seen, assumes the rôle of a natural transmitter of the yellow-fever infection; the principal ones being the prevalence of temperatures between 70° and 90° F., low levels above the seaboard, proximity to the sea or to watercourses, and protection from strong winds. There is, however, another condition which must be inferred by reason of the geographical distribution of the disease, but for which no satisfactory explanation has yet been offered. I refer to the fact that while yellow fever is so frequently carried over the waters of the Atlantic Ocean, and, very exceptionally, far into the Mediterranean Sea, it is a remarkable fact that there is no record of the disease having ever been conveyed over the waters of the Pacific Ocean beyond the western coast of America, where epidemics have often occurred. Whether or not this fortunate state of things will continue after the Panama canal is thrown open, must be a matter of conjecture; but the bare possibility that it might not so continue should be borne in mind and act as a stimulus for all nations interested in the matter to urge the stamping out of yellow fever from the Caribbean Sea and the Gulf of Mexico, as well as from the western shores of America, before free communication is established between the waters of the two oceans in the very heart of the yellow-fever territory *par excellence*.

For a detailed account of yellow-fever epidemics in different countries the readers must be referred to Bérenger-Féraud's valuable chronology of the disease ("La Fièvre Jaune," Paris, 1890), and to Dr. G. M. Sternberg's article in the first edition of this HANDBOOK.

ETIOLOGY AND MODE OF PROPAGATION.—In the first edition of this HANDBOOK, Dr. G. M. Sternberg expressed himself in the following terms regarding the etiology of yellow fever.

"As to the nature of the *specific cause* of the disease there can scarcely be two opinions. The present state of science justifies the belief that it is a living micro-organism; and facts relating to the origin and extension of epidemics show that, as in cholera and in typhoid fever, this micro-organism is capable of development outside of the human body under conditions which will be discussed hereafter. Unfortunately, the present state of science does not enable us to give an account of the deadly microbe which we assume to be the cause of the disease under consideration. We know to-day the morphological and physiological characters and the habitat, within the body of an infected individual, of the specific cause of cholera, of typhoid, and of relapsing fever, but the researches made up to the present time have failed to demonstrate the 'germ' of yellow fever" (REFERENCE HANDBOOK OF MEDICAL SCIENCES, Vol. VI., 1887).

My tetragenus febris flavæ (*M. tetragenus versatilis* Sternberg) fared no better under Dr. Sternberg's keen criticism than did the *germs* of Freire, Carmona, or Gibier, nor shall I at present renew my claim as to its etiological significance; but I think it worth while recording the following remarkable coincidence. In 1895, in a paper on "Tetracoccus Versatilis," which was published in the *Edinburgh Medical Journal* (December, 1895), I called attention to the curious circumstance that pure cultures of my tetragenus, which had been filtered through Kitasato filters, had on two occasions given evidence that some of the tetragenus germs had passed