

chestnut brown to blackish according to the age or state of maturity. In Europe it is regarded as a great delicacy and is often preserved in cans for winter use. It contains a greater or less amount of helvellic acid, particularly when old, and this is a highly poisonous substance; it is soluble in hot water and can be removed by boiling and rejecting the water, but the plant should never be eaten when past its prime—a remark that may well apply to all mushrooms. The symptoms of poisoning are similar to those described for phallin below and there is no known antidote for the poison.

Besides the true Ascomycetes there are a series of forms that are analogous to conidial stages of some of the forms of the Ascomycetes. Some of these are undoubtedly conidial stages of some known or unknown species of ascus-bearing fungi for which the true relations have not yet been ascertained; some may represent forms that have lost all except their conidial stage of reproduction; while on the other hand there are doubtless a number of forms provisionally placed here from some superficial resemblance that really are perfect forms in themselves. They are known as *fungi imperfecti*, and form plant diseases known as leaf spots, anthracnose, blights, and leaf wilts.

The literature bearing on the subject of the parasitic diseases of plants is very extensive, but very widely scattered in the reports and bulletins of the various state and national agricultural experiment stations. Dr. Sturgis, of New Haven, has made an elaborate index of this literature arranged by host plants.*

CLASS III.—BASIDIOMYCETES (*The Basidial-spore Fungi*).

This group is a somewhat heterogeneous one, but contains species of fungi that produce their spores on basidia (Fig. 2242). The group includes four types of fungi as follows: (1) The lower Basidiomycetes consisting of parasitic rusts and smuts; (2) The tremellines or jelly fungi. These are represented by three orders of which the jew's ear, a dark-colored fungus used as food by the Chinese, is all that need be mentioned; (3) The Hymenomyces, which contain the ordinary mushrooms and toadstools; and (4) The Gastromycetes, containing the puff-ball and their allies representing five distinct orders.

THE SMUTS AND RUSTS.

The smuts (order USTILAGINALES) are more or less familiar from their attacks on corn and the ordinary cereals, all of which are affected by one or more species. The chlamydospores of the fungus, which form the greasy black powder seen in the corn smut or in the smutted heads of grain, germinate with the grain and produce basidiospores, which germinate directly and produce a widespread mycelium which grows parallel with the growth of the host plant and ultimately matures its spores.

The rust fungi (UREDINALES) are likewise parasites affecting the higher plants and many of them form destructive diseases. They are peculiar in their methods of reproduction in that some species have three distinct methods, developing three sorts of spores; others have two methods in which two different series may be represented; others may have only one method, and it may be any one of the three sorts of reproduction known among these plants. Where two or three methods of reproduction are known, the case is often complicated by one of them occurring on a different host plant from the others. The ordinary wheat rust is the common type which presents as complicated an example as possible.

THE HYMENOMYCETES.

After passing over the three orders of the tremellines or gelatinous fungi we come to the ordinary toadstools and mushrooms which, in accord with modern terminology, form the order AGARICALES. Of these there are three families that contain fleshy species, and these can be easily distinguished by the nature of the spore-bearing

* Report Connecticut Experiment Station, 1897, 182-222.

surface which appears underneath the pileus; those bearing lamellae belong to the agaric family (Agaricaceae); those with pores or tubes to the Polyporaceae; and those with spines or teeth to the Hydnceae; a fourth family also containing fleshy species is devoid of a pileus, but consists of club-like or coral-like fungi often greatly branched and dividing; these are the Clavariaceae; there is still another family but it is not of importance in the present consideration.

1. AGARICACEAE.—In the ordinary pileate mushrooms the spore-bearing surface is spread over a series of radiating lamellae underneath the cap or pileus; on this surface the spores are borne on basidia and at maturity drop and are scattered by the wind; these spores are of different colors in various species, and this fact has been made use of in distinguishing the various genera. The young plant has the pileus commonly closed something after the manner of an umbrella, and the stem is then short so that the whole mushroom at an early stage is massed into the form of a ball. In certain species the whole plant is enveloped in a more or less membranous covering known as the *volea* (Fig. 2261, C); as the mushroom expands this volva is ruptured and it is either carried up on the top of the pileus in the form of separable scales or it remains at the base in the form of a cup; this is by far the most important portion of the mushroom as it is the one by which the most dangerous fungi are detected. It is absolutely necessary to have the complete base of the stem certainly to distinguish between edible and poisonous forms. An additional structure to be noted is the *veil*, which in the young form extends from the margin of the pileus to the stem as a complete covering, but which normally breaks away from the margin of the pileus and forms a more or less definite ring (*annulus*), which may be narrow and ring-like or hang down in the form of a skirt. In one genus the veil separates from the stem and hangs in a fringe around the margin of the young pileus; in at least two genera the veil is very slight though clearly marked in young forms but entirely disappears in the older plant so as to appear to be entirely wanting. While it is comparatively easy for one familiar with mushrooms clearly to distinguish the ordinary genera at sight as easily as the maples, oaks, or pines are distinguished among trees, it is more difficult for a novice to distinguish them even with keys at hand for separating them. The following synopsis of the genera containing edible or poisonous species may be helpful in attaining this end.

SYNOPSIS OF THE GENERA OF AGARICES CONTAINING EDIBLE AND POISONOUS SPECIES

- Stem central.
 - Juice milky, white or colored LACTARIUS.
 - Juice not milky.
 - Spores white.
 - With a volva and annulus both AMANITA.
 - With a volva but no annulus AMANITOPSIS.
 - Volva wanting but annulus present.
 - Lamellae free from the stem; pileus normally scaly LEPIOTA.
 - Lamellae united with the stem ARMILLARIA.
 - Both volva and annulus wanting.
 - Lamellae thin with acute edges.
 - Lamellae free; plant reviving after drying. MARASMIUS.
 - Lamellae decurrent; stem fleshy CLITOCYBE.
 - Lamellae adnate; plant brittle; stem fleshy; pileus usually bright colored RUSSULA.
 - Lamellae sinuate; stem fleshy TRICHOLOMA.
 - Lamellae in the form of shallow folds with obtuse edges; plant yellow CANTHARELLUS.
 - Spores pink or salmon-colored; with neither volva nor annulus.
 - Lamellae free from the stem PLUTEUS.
 - Lamellae decurrent on the fleshy stem CLITOPILUS.
 - Spores rusty brown; annulus arachnoid disappearing when mature; lamellae adnate CORTINARIUS.
 - Spores dark brown or black.
 - Pileus melting to a black inky fluid when mature COPRINUS.
 - Pileus not melting; spores dark brown.
 - Veil remaining as an annulus; lamellae free. AGARICUS.
 - Veil remaining as a fringe on the margin of the pileus; evanescent when old HYPHOLOMA.
 - Stem lateral or wanting; spores white or lilac-tinted. PLEUROTUS.

Some of the above terms will require some illustration and the following figures will be useful; the lamellae may be *free* (Fig. 2260, F), or variously attached to the stem,

in which case they may be *adnate* (Fig. 2260, A), *sinuate*, or *notched* near the stem (Fig. 2260, S) or *decurrent* as in Fig. 2260, D and in Figs. 2262, 2263.

(White-spored Series.)

Amanita.—The white-spored agarics with both veil and volva contain all the most deadly fungi and their

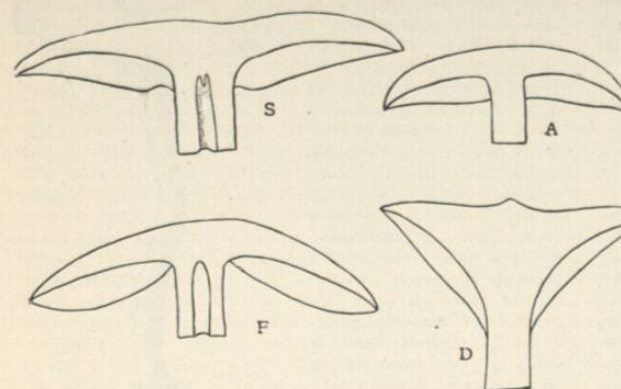


FIG. 2260.—Methods of Attachment of the Lamellae of Agarics to the Pileus and Stem, shown in Sections. A, Adnate lamellae; D, decurrent lamellae; F, free lamellae; and S, sinuate lamellae. In F and S the stems are hollow.

characters should be carefully noted. Fig. 2261 gives a characteristic illustration of *Amanita phalloides* which is the more dangerous because it superficially resembles some of the edible species. Its volva and veil have already been noted; it should be observed, however, that in some species of *Amanita* the volva in mature forms may not form a distinct cup at the base as shown in the figure, but may exist in the form of a straggling fringe of teeth at that point, the greater part having been carried up in the form of floccose scales at the top of the pileus. We have quite a number of species besides the four enumerated below, and though some of them are edible the best advice that can be given the amateur is to learn to distinguish the genus *Amanita* and then let it entirely alone.

The two most poisonous species are the fly-agaric (*Amanita muscaria*) and the poison cup (*Amanita phalloides*). *Amanita muscaria* has a yellowish pileus varying from yellowish-white to yellow orange* and has a white stem, white lamellae, and white veil. The volva appears at the base of the bulbous stem only in the form of scales, the greater part of it being carried up in the form of loose floccose scales at the top of the pileus. The poison it contains is known as muscarin, which has a very unpleasant taste; symptoms of poisoning from it occur in from a half an hour to two hours after eating. (For an account of the actions, symptoms, and treatment, see *Poisoning*.)†

Amanita phalloides is still more dangerous because it contains phallin for which there is no known antidote. The species varies in color, being pure white, yellowish, greenish-olive, or umber in its different forms; the pileus is usually viscid or slimy when moist and in age is often free from any of the remnants of the volva; the lamellae, stem, and veil are all white; the volva is subject to the greatest amount of variation of any portion, sometimes being largely carried up to the top of the pileus and sometimes remaining more prominently as a cup at the base. It has been something of a question as to whether

* In European works this species is figured a bright red, but I have never seen it this color in America.
† Illustrations of the fly-agaric may be consulted as follows: Michael: "Führer für Pilzfreunde," No. 55; Marshall: "Mushroom Book," pl. 1; Gibson: "Edible Toadstools and Mushrooms," pl. 4; Atkinson: "Studies," Figs. 52-54; Melville: "1,000 Amer. Fungi," pl. 9; Cooke: "Illust. British Fungi," pl. 117; Fries: "Sverig. atl. Svampar," pl. 1; Gillet: "Champ. de France," pl. 8.

these variations do not indicate more than one species, but the fact remains that all of them are deadly poisonous. The phallin that they contain is regarded as an albuminous poison and acts directly on the blood corpuscles. There is no unpleasant taste in the fungus to warn the patient, and preliminary symptoms do not commence until from nine to fourteen hours after the poisonous mushrooms are eaten.* Besides these two poisonous species there is one edible species that should be mentioned, since its use as an article of food is historic as well as extensive. In Italy where it has been very extensively used since the time of the Romans, hundreds of bushels are brought into the markets of the cities during its season, and it is equally common in our Southern States, being found rarely as far north as Massachusetts. This is known as *Caesar's mushroom* (*Amanita caesarea*) and is most nearly related in appearance to the fly agaric. It can, however, be readily distinguished by the following marks: the pileus is usually a deep orange yellow, rarely appearing lighter colored; the stem, veil, and gills are all a clear yellow color; the volva appears in the form of a firm cup at the base of the stem and is white, fragments being rarely carried up on the pileus as is so common in the fly agaric. It is often very large, sometimes expanding to ten inches or more across the pileus, though it occurs in much smaller forms.

Amanitopsis.—This genus differs from *Amanita* in having no veil or annulus, and agrees with it in the possession of a volva. *A. vaginata* is very common in some portions of the country and is regarded as a delicacy; it has a thin usually grayish

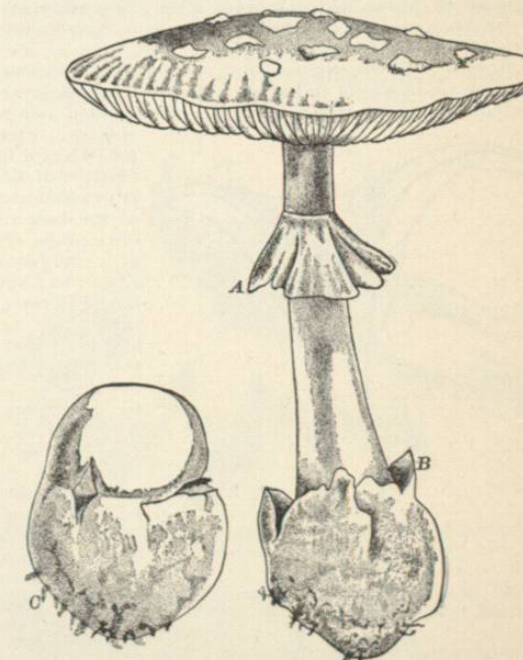


FIG. 2261.—*Amanita phalloides*, the most Poisonous Mushroom. One-half natural size. A, Annulus; B, volva; C, young plant enveloped in volva.

pileus, which is distinctly striate on the margin; the stem and lamellae are white.

Lepiota.—The species of *Lepiota* are known as parasols

* Illustrations of the poison-cup may be consulted as follows: Michael: "Führer für Pilzfreunde," No. 58; Gibson: "Edible Toadstools and Mushrooms," pl. 13; Atkinson: "Studies," Figs. 55-57; Melville: "1,000 Amer. Fungi," pl. 6, figs. 2 and 3; Cooke: "Illust. British Fungi," pl. 2; Bulliard: "Flore de la France," pl. 2; Gillet: "Champ. de France," pl. 3.

and for the most part are edible species. The only exception known is seen in the anomalous *L. Morgani* which differs from all other agarics in the possession of green spores; it is very common in various parts of the Ohio valley and southward and has occasioned severe illness from being used as food; others have partaken of it with no ill effects, but it should be classed as doubtful. *Lepiota procera* is common in the Northern States and can be distinguished by its brownish or reddish-brown pileus, three to five inches across, and its very long hollow stem frequently reaching ten inches in length and bulbous at the base. *L. naucinoides* is a white species with a slightly bulbous base; it is likely to be confused with species of *Amanita* which it resembles closely except that it has no volva; as *Amanita phalloides* sometimes grows in cultivated fields where *Lepiota naucinoides* occurs, the danger becomes all the greater of confusing the two species. There are numerous other species of *Lepiota*, but none of them need consideration here.

Armillaria.—Only one species of this group needs attention here. It is a gregarious species growing about old stumps, the pileus ranging from whitish to reddish-brown, though brownish-yellow is the more common tint. The lamellae are white at first but become reddish with age. It is sometimes eaten though is not considered very palatable. It is of most importance as a destructive agent of growing timber, as its widely spreading mycelium penetrates the heart wood of trees at some distance from where the mushroom appears above ground and produces decay to the height of several feet.

Marasmius.—To this genus belongs the fairy ring champignon often seen in lawns and pastures, forming circles or part circles often many feet in diameter. The genus differs from the ordinary fleshy agarics in having a persistent pileus which revives after desiccation and produces a new crop of spores. The pileus is an inch to an inch and a half in diameter.

Clitocybe.—To this genus belong several diverse species, all agreeing, however, in having a fleshy stem and decurrent lamellae. *Clitocybe illudens* is a large golden-yellow species, often produced in clusters of fifty or a hundred at the base of old stumps. It is a gorgeous species, but has a bad reputation as an article of diet, though it is not known to be poisonous.

A smaller species (*Clitocybe laccata*) is sometimes eaten. The general characters of the genus can be seen in the two illustrations (Figs. 2261 and 2262).

Russula.—The species of *Russula* are not well known but are comparatively numerous and common and conspicuous features of every forest and shaded path from their bright colored red or green pilei. Several of the species, among them the poisonous *Russula emetica*, have a strong acrid taste when

Fig. 2262.—*Clitocybe cyathiformis*. One of the Agarics, showing Infundibuliform Pileus and Decurrent Heterophyllous Lamellae. (After Cooke.)

raw, and the members of the genus unsuitable for food may be distinguished by tasting them in a raw condition. The acrid ones have a peppery taste. *R. emetica*, as its name indicates, produces nausea and from its peppery taste is not likely to be confused with edible species; *Russula virescens* with pale apple-green pileus is often eaten. While bright colors like red and green predominate in the genus, some are white and others clay-colored and brown.

Lactarius.—The milky fungi are closely allied to *Russula* structurally, but differ in yielding a milky fluid when bruised or cut. They are often peppery to the taste, and the commonest white species is called *Lactarius piperatus* from this circumstance. By this means the objectionable species can be detected, though even *L. piperatus* is sometimes eaten as its peppery taste is said to be removed in cooking. *L. volenus* is a species with white milk and a reddish-brown pileus and stem; *L. deliciosus* differs from all others in having orange-red milk; as its specific name would indicate, it is a delicate article of diet. We have some forty species in this genus.

Tricholoma.—Only one of the many species of this genus need be considered here; this is *T. personatum*, whose spores are often dirty white instead of pure white as in most of the genus; the whole plant is a pale violet lilac color, and this color is usually constant in the younger conditions of the plant; it is very common late in the season in waste grounds and dumping places. *Tricholoma sulfureum* with a dry yellow pileus is about the only suspicious member of the genus, though even that is not known to be poisonous.

Pleurotus.—The so-called oyster mushrooms are readily distinguished by their lateral habit, either having no stem at all or being attached by a very short lateral stem; none of the species are injurious and many of them have a delicate flavor; *P. sapidus* with violet-tinted spores is the most abundant, and there are several other quite closely allied species.

Cantharellus.—This genus contains the chantarelle or Eierpilz of the Germans, much used for food in Europe where it is more common than with us. *C. cibarius* is the common species of an egg-yellow color. *C. floccosus* is a larger species of a lighter yellow color and forms funnels four to six inches high.

Pleuteus cervinus is one of the most abundant species of its group, growing always on decaying logs and characterized by its mouse-colored pileus, its lamellae separate from the stem and its pink spores. It is reputed edible. *Clitopilus* differs from this genus in its decurrent lamellae; the sweetbread fungus (*C. orella*) and the allied *C. prunulus* are the only species that are likely to be met and neither is very common.

Cortinarius is a very extensive genus, its species usually appearing in woods from late in the summer to November. They are all terrestrial, by which character the genus is distinguished from its rusty-spored neighbors; when young the species have a cobwebby veil which disappears with age. One of the commonest is the violet

(Pink-spored Series.)

(Rusty-spored Series.)

(Brown- or Black-spored Series.)

(Brown- or Black-spored Series.)

Agaricus contains the common field mushroom (*A. campestris*) and quite a number of allied species. While this species is generally well known it may be well to add its diagnostic marks: 1. It has no volva whatever at the base of the stem. 2. The lamellae are pink when young but gradually change to brown or blackish-brown as the spores mature. 3. The lamellae are free from the fleshy stem, and when young are covered with a veil which later forms a distinct ring around the stem. 4. The stem is stuffed, or filled with a somewhat softer substance. This is the mushroom commonly cultivated from spawn, and immense quantities of mushrooms inferior to those that can be grown in this country are canned in France and imported to this country. It is said that mushrooms may be grown at a profit to retail at twenty five cents a pound, but the price in New York is sometimes six or eight times that amount.*

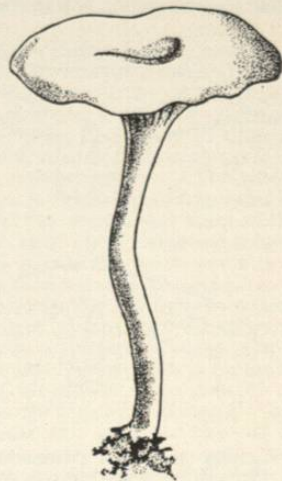


Fig. 2263.—*Clitocybe fragrans*. One of the Agarics, showing Umbilicate Pileus and Decurrent Lamellae. (After Cooke.)

Cortinarius, which has a deep violet color throughout, except the mature lamellae which become rusty brown from the ripening spores. Our numerous species are not so well known as those of many other genera; none of the species, however, are reputed poisonous.

(Brown- or Black-spored Series.)

Hypholoma.—One of our commonest late fall mushrooms is the brick-top often growing in large masses at the base of stumps. Professor Peck distinguished several species, using taste as a guide in separating species. *H. sublateritium* is commonly reputed poisonous in Europe, but many of the closely allied species have a delicate flavor. Specimens used for food should be individually tasted before cooking and those with a bitter taste should be rejected.

Coprinus.—The species of this genus are among the most abundant of the wild mushrooms and three species are common in lawns and waste places. The genus can be very readily recognized by the fact that the pileus melts speedily to an inky fluid when mature, and it has taken the popular name of ink-cap from this circumstance. *C. micaceus* is a small species that grows in prodigious quantities about old stumps, often appearing very early in the spring; it has a thin pileus of a pale buff or yellowish color and narrow lamellae. *C. atramentarius* grows in clusters often of many individuals; it has a grayish-brown moist pileus and very wide crowded lamellae; *C. comatus*, popularly called the shaggy mane, is cylindrical in shape and has a shaggy pileus formed of yellowish-brown scales on a white foundation. It is more common in the autumn, usually growing in waste grounds.

In recent years the subject of edible mushrooms has become considerable of a fad in this country and several works of greater or less value have appeared treating the subject in a more or less popular manner. Among the best of these are Miss Marshall's "Mushroom Book," Gibson's "Edible Toadstools and Mushrooms," and Atkinson's "Studies of American Fungi," while McIlvaine has published a more aspiring work under the title "One Thousand American Fungi." All are extensively illustrated, the first and third named with many reproductions of photographs. The best general work on the subject of edible species, however, is Michael, "Führer für Pilzfreunde." The text is in German, but the principal edible and poisonous species, most of which are common to Europe and America, are illustrated with excellent colored plates.

The nutritious character of mushrooms has been greatly overstated in many works of a popular nature. The nitrogen supposed to be the nutrient element in mushrooms is found to belong in part to proteid substances of low food value, and a portion is found in substances that are indigestible and hence not available for

food. The mushrooms are to be regarded as a delicacy rather than as a staple article of food, and their nutrient value, instead of being comparable to meats as was formerly supposed, is rather to be compared with succulent vegetables. Their cultivation and study, however, are worthy of much greater attention than they have been given heretofore in this country.*

2. POLYPORACEÆ.—Certain of the fleshy species of bracket fungi, such as are seen growing on old tree trunks, are edible. Among these *P. sulfureus* with bright-yellow pores and dainty pinkish-yellow pileus is best known; it is a large species often growing in large overlapping masses which are conspicuous from their brilliant color. *P. frondosus*, a brownish species with extensive compound branches, is also said to be edible. Most of the bracket fungi, however, are curious and ornamental merely as they are of a woody consistence; the two mentioned above indeed are useful for food only when very young. It is said that the substance of *Polyporus officinalis* has been used as a substitute for quinine, but its properties have never been thoroughly investigated. The beefsteak fungus (*Fistulina hepatica*) grows as a fleshy tongue-like mass from chestnut trees and can be easily recognized by its fibrous beef-like consistency and its tubes whose mouths are entirely separate from each other. It has much the same appearance as real beefsteak and is cooked in the same way.

Most of the fleshy spore-bearing fungi, however, belong to the genus *Boletus*, of which we have many common species. Some of them have a bitter taste like the common *B. feltus* and should be rejected; one entire section of the genus has tubes whose mouths are a lurid red, a totally different color from the rest of the tube; these are regarded as poisonous and are to be carefully avoided; other members of the genus change the color of the flesh to a bright blue when wounded and exposed to the air. This is particularly true of a species which in one of our popular works on mushrooms has been figured under an incorrect and misleading name †; it has a reddish pileus

and the flesh instantly changes on exposure to injury. It is a dangerous species, the more so because it has been figured as an edible one.

Many of the *Boleti* are edible, but the species are difficult to distinguish by a description; like most fungi they have distinctive characters by which they may certainly be known when seen and the safest guide is some one already familiar with the species. Once learned in this way the species of mushrooms are as easily distinguished as the ordinary fruits or vegetables.

3. HYDNACEÆ.—Two types of edible toothed fungi are found. One consists of white coral-like masses in

* Concerning the nutrient value one can profitably consult Dr. Mendel's results of chemical analysis in American Journal of Physiology, 1: 225-238, 1898.
† Palmer's: "Mushrooms" as *Boletus subtomentosus*; its true name is *B. miniato-olivaceus*.

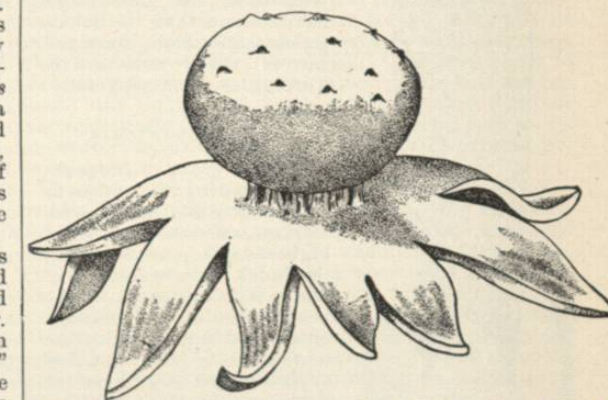


Fig. 2264.—*Myriostoma coliforme*, a Rare Member of the Puff Ball Family (Lycoperdales).

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which the teeth all point downward when growing; all the species are found on tree trunks. They are easily recog-



FIG. 2265.—*Catastoma circumscissum*. One of the Lycoperdales. Natural size. a, Shows the outer peridium rupturing at the equator; b, shows the upper part removed and overturned with the inner peridium rupturing with a single crater at a point originally at its base; and c, shows the lower half of the outer peridium left as a cup in the earth after the removal of b. (After Morgan.)

nized by their teeth, and the three common species, *Hydnum coralloides*, *H. erinaceus*, and *H. caput-ursi* are all equally edible.

Two pileate species are also edible; *H. repandum* with yellowish or whitish-yellow pileus and teeth very brittle, and *H. imbricatum*, brown with overlapping scales on the pileus and grayish teeth.

4. CLAVARIACEÆ.—The club-fungi growing in the form of coral-like masses with the branches pointing upward in growth contain several edible species. None of them are dangerous, and they form a good subject for experimentation as they are often abundant in moist woods.

It will be readily seen from the above sketch that no hard and sharp rules can be given that will distinguish

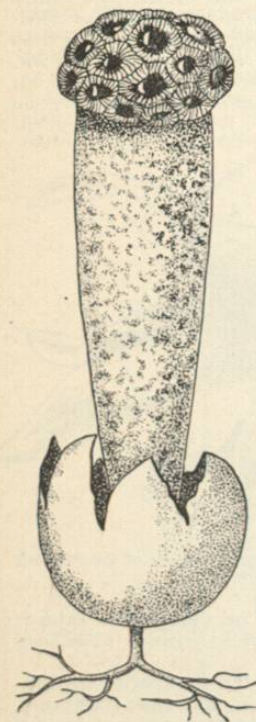


FIG. 2266.—*Simblum rubescens*. One of the Phalloids. In life the stem is reddish; in the early stage the entire plant is enclosed in the cup-like base, then in the form of an egg. (After Gerard.)

ball is pure white and much the consistence of cottage cheese that it is suitable for food, and any indication of darkening, caused by the ripening of the spores, should cause the plant to be rejected.

A smaller fungus is commonly seen in *Bovista plumbea*, which is only an inch or so in diameter, but is considered a delicacy in some places. The numerous smaller species of *Lycoperdon* are likewise edible, but are usually too small to be considered available for food. Allied to the puff balls are the curious earth-stars of which no less than three genera are represented in America. Fig. 2264 represents the least common form. *Geaster*, more common, differs mainly in being attached to the outer peridium at one point and opening by a single crater.

Another puff ball with the curious habit of overturning and opening at the bottom of the inner peridium is seen in *Catastoma*, whose life history was first studied by Morgan (Fig. 2265).

The stink-horns belong to an order (Phallales) distinct from the puff balls (Lycoperdales). These well-known members of the group are reputed poisonous and all doubtless contain phallin as one of their constituents. They form underground in the shape of an egg, and this bursting allows the rapid distention of the stem by means of which the spore mass is carried up where flies may be attracted to it and aid in their dispersion. Three of the larger species are more or less common throughout the country, and there are several curious forms less widely known, one of which is represented in Fig. 2266.*

Lucien M. Underwood.

FURUNCLE. See Boil.

GAINESVILLE (GA.) MINERAL SPRINGS.—The town of Gainesville is located in Hall County on a small tableland 1,300 feet above the sea-level, and lies between the headwaters of the Oconee River, which flows into the Atlantic, and those of the Chattahoochee, which finds its way to the Gulf. The Alleghanies, stretching around the place to the north and west, form a natural bulwark which breaks the force of the northern winds of winter. The town thus enjoys a dry, bracing climate, without extremes of either heat or cold. Daily observations made for the United States Signal Service during the period of ten years showed a mean winter temperature of 44° F. and a mean summer temperature of 71° F. The health tables of the United States census show a lower death rate in this portion of Georgia than in any other section of the country. White, in his "Statistics of Georgia," makes the statement that no case of consumption was ever known to originate in Hall County. In close proximity to the thriving and rapidly growing little city are numerous mineral springs, some of which have come into use as health resorts. We have thought it advisable to consider these springs in the following group:

Gower Springs form one of the chief attractions of the city. They are located just beyond the corporate limits, and are connected with the city by a street-car line. These springs are chalybeate in character, the iron being held in solution by carbonic acid, which makes it readily assimilable. The following qualitative analysis was made some years ago by Prof. W. J. Land, of Atlanta:

Free carbonic acid.	Iron crenate.
Hydrosulphuric acid.	Lithium phosphate.
Iron carbonate.	Calcium sulphate.
Manganese carbonate.	Magnesium sulphate.
Iron apocrenate.	Potassium bromide.
Potassium sulphate.	Oxygen gas.
Sodium sulphate.	Nitrogen gas.

An excellent hotel is maintained at the Springs, and we are informed that an increased number of visitors come to the resort every year. The waters are recommended in general debility, digestive disorders, and kidney affections.

The *Deal Spring*, located two miles from the city, wells up in a basin of solid rock, and is said to possess excellent properties in the treatment of indigestion and dyspepsia and in the dentition period of children.

*The present illustrations are reproduced from a series used to illustrate an introductory work on fungi, by the author of this article, "Moulds, Mildews, and Mushrooms," New York, Henry Holt & Co.

The *New Holland Springs* are also within two miles of Gainesville, on the Southern Railroad, which has a station at the Springs. The improvements consist of a hotel and cottages for two hundred guests. The situation is in a beautiful and extensive grove of native oaks, and the Springs furnish about two hundred gallons of water per minute. The water is recommended for indigestion and general debility, but we are unable to present a complete analysis in verification of its claims. An old qualitative examination showed the presence of the following ingredients:

Calcium carbonate.	Iron, probably combined
Magnesium carbonate.	with carbonic acid.
Potassium carbonate.	Sodium chloride.
	Carbonic acid gas.

James K. Crook.

GALACTAGOGUES.—(Gr. γάλα, milk, and ἀγειν, to lead.) The secretion of milk is normally associated with pregnancy, but may occur in pseudocyesis, and in ovarian and uterine tumors. It is often seen during the first week of life, in both male and female children. The secretion of milk may be established and maintained by the application of a nursing child to the breast of a woman who is not at the time and never has been pregnant. In one case a child eight years old nursed her mother's infant for some months, and in another a woman, fifty-nine years old, ten years after the cessation of menstruation, nursed a child for some time.

The length of time during which the milk may continue to be secreted varies from nine to sixteen months, but in rare cases this period may be prolonged for as long a time as five years, if the child be allowed to nurse.

The causes of defective lactation are various in character. Thus, for example, there may be some mechanical interference with the escape of the milk, as when the lactiferous tubes and acini are not developed, or the epithelial cells are imperfect, or a previous injury or disease has caused total destruction of the glandular tissue. These conditions are not amenable to treatment. On the other hand, when there is simply a lack of development, or the gland and nipple have received some trifling injury, the condition should be investigated and treated before the end of gestation. The breast of every pregnant woman should be examined by her physician three or four months before the expected confinement, and if the breasts are found to be small and poorly developed and the nipples fissured or depressed, appropriate treatment should be instituted. If the nipples are hard, the application of some bland aseptic oil or ointment—e.g., lanolin and boric acid—will be found useful as a means of softening them. The breast should be massaged, and at the same time the nipples should be drawn out by grasping them between the thumb and finger, while with the other hand the breast is stroked toward the nipple. This should be done daily for five or ten minutes at a time. The adoption of these measures will enable the child, when placed at the breast—which should be done as soon after labor as the mother's strength will permit—to grasp the nipple effectively. After this first attempt at nursing, the child should be placed at each breast, alternately, every four hours. Should the child be unable to grasp the nipple, the latter should be drawn out with the breast pump or a clay pipe, and, if this does not prove sufficient, a glass nipple shield, with rubber nipple, should be employed. The sucking of the child is the best stimulus to the flow of milk, and should always be obtained if possible; but, if the child cannot be made to nurse, then suction will have to be made with the breast pump for five or ten minutes every four hours. The breast at the birth of the child contains colostrum, and at the end of from thirty-six to sixty hours ripe milk. During the first period the child should be nursed every four hours, but afterward, on the appearance of ripe milk, it should be nursed every two hours.

Another cause of defective lactation is a plethoric state

of the body, a condition which readily responds to treatment. The diet should be carefully regulated, milk being made one of its chief constituents, and all stimulants should be avoided. The extract of thyroid gland should also be prescribed in five-grain doses. Under this plan of treatment, combined with the occasional administration of a dose of castor oil, the obstruction to the flow of milk should soon disappear. In these cases the use of the thyroid gland extract not only increases the flow of milk, but at the same time improves its nutritive quality.

Torpor of the mamme is another cause of inactivity of their secretory apparatus, and when this is the case great benefit may be derived from the application of electricity. Both poles having been moistened, the positive one is placed deep in the axilla or on the back, while the negative one is applied gently over the nipple. The current employed should be no stronger than is agreeable to the patient, and this mode of applying it should be continued for about two minutes. Afterward, the negative pole should be glided along the sides of the breast, in a stroking fashion, for another two minutes. Then, finally, the poles should be applied to the sides of the breast for the same length of time. Electricity may be applied in this manner once a day for a period of four or five days; and usually it will be found that a single such séance will fill the breasts after the milk has disappeared for some days.

Among the other local therapeutic methods which have been used with varying success may be mentioned the application of warm poultices made of a weak mixture of mustard (not strong enough to burn) or of calabar bean, or of the leaves of the castor-oil plant. Gentle massage alone will often suffice to start the flow, or we may combine with it inunction of olive oil or of castor oil. Repeated applications of the breast pump and enveloping the breast with warm cloths are also very efficient methods.

The internal administration of drugs, for their galactagogue action, has not proved very satisfactory. *Jaborandi* will, it is true, increase the flow of milk, but its action is only temporary and cannot be depended upon when a prolonged effect is needed. It is best given in the form of the fluid extract of pilocarpus, in half-drachm doses; this preparation being less nauseating than the *jaborandi* itself. Or the effects of the drug may be obtained from hypodermatic injections of pilocarpine hydrochlorate, in gr. $\frac{1}{16}$ doses.

Physostigmine increases temporarily the flow of milk. So also do the preparations of ammonia—the carbonate and the acetate—when given in moderately large and continued doses. The alcoholic stimulants, such as ale, porter, and beer, and the malt preparations possess the power of increasing the quantity of milk secreted, but the quality is thereby deteriorated. To such a degree is this true that they should rarely be used except in small quantities. The volatile oils, especially the oil of anise, impart a pleasant flavor to the milk, and in consequence the child will be likely to draw much better. In this indirect manner they may serve to increase the flow of milk.

The most usual cause of defective lactation is anæmia. It is a well-known fact that the functional activity of an organ is directly proportional to the supply of blood furnished to that organ, and this is a very important law to remember when we are dealing with such a gland as the mammary. We may therefore expect to secure the greatest improvement in the secretion of milk from the taking of those substances and the adoption of those hygienic measures which tend to increase the supply of blood and to improve its nutritious qualities. The mother should be in the best possible condition before and after the arrival of the child, and this result should be secured by the administration of tonics, such as iron, arsenic, nux vomica, and quinine, and by the patient's taking proper food and exercise. The diet suitable for a nursing mother should be nutritious and easily digested. For the first few days of the puerperal period