Contents

Credits Screen

Welcome to *Poisonous Fungi in Britain and Ireland*, an image-based computer identification system on CD-ROM designed to enable people with little or no mycological experience to identify poisonous fungi commonly found in gardens and in the countryside. In addition to poisonous species, a number of common non-poisonous fungi are also included.

Medical professionals can use *Poisonous Fungi...* to identify fungi frequently implicated in cases of suspected human poisoning and the poison syndromes that they cause. Members of the public should not use *Poisonous Fungi...* to diagnose or treat fungal poisoning. If you suspect that you or someone-else has been poisoned by a fungus, you are advised to seek medical attention immediately.

Navigating through *Poisonous Fungi...*

Continue button

Exit

Help

Choose Method of Identification

Navigating through *Poisonous Fungi...* -

Navigate through Windows® and the *Poisonous Fungi...* CD-ROM by using the mouse to click on various menus, menu items and buttons. Place the mouse arrow over the menu name, etc., and click by pressing the **left** mouse button and releasing it.

Answer questions by clicking on one or more answer boxes (a prompt under the question informs you how many answers you can give to that question). Note that the colours become inverted, i.e. white on black. Click again to deselect the answer. When you are happy with your answer, confirm by clicking on the **OK** button.

At different times in the identification you may need to select an item from a list, e.g. when reviewing your answers, choosing a different question or viewing images of the remaining suspects. Click on the **item** to select it. The item will become highlighted. Confirm your choice with the appropriate button.

Help -

If you need any assistance during the identification please use the **Help** menu.

Choose **How to use**... for an explanation of the screen that you are on, including the functions of the buttons. Use the **Contents** button within **Help** to find information on other areas of the system.

There are also three context-sensitive glossaries, one of which explains the words used in the fungus questions, and the other two for words in the descriptions and toxicity details. Select **Glossary** from the **Help** menu and the appropriate list of words will appear depending on the stage of the identification.

Exit -

You can exit from *Poisonous Fungi...* by clicking on the **Exit** button located on each screen.

Continue -

This button is used to move you forwards in the identification.

Click once on the **Continue** button on the Title Screen. Click once on the **Continue** button on the following screen when you have read the disclaimer and copyright statements. Your computer will then ask you to choose the method of identification.

Choose Method of Identification -

Poisonous Fungi... asks you to choose the method of identification. You have two options.

Poisonous Fungi... enables you to identify a fungus by answering questions about its appearance, such as the colour and shape of the cap. Once you have made an identification you will be able to access information about the poison syndrome that the particular fungus causes.

Alternatively, medical professionals can identify a poison syndrome by answering questions about their patients symptoms. Once you have identified the poison syndrome you can then identify the fungus. *Poisonous Fungi...* automatically selects those fungus suspects which have the potential to cause the poison syndrome and will ask you questions to differentiate between them.

Select the method of identification by clicking the **OK** button opposite (to the right of) your choice.

Poison Syndrome Question Screen

Poisonous Fungi... automatically offers you a series of questions selected to lead you through the identification of a poison syndrome.

To answer the question on the screen click on the appropriate answer (note that the colours invert when you select an answer) and confirm your choice using the **OK** button.

Note: **You must answer the question**. The buttons **Skip** and **Choose Question** are inactive.

"How many answers can I give?"

"How many poison syndromes are left?"

Buttons:

OK
Skip

Choose Question
Review Answers
View Syndrome
Restart

Navigating through *Poisonous Fungi...*

Help

Exit

"I think I know what the poison syndrome is"

"How many answers can I give?" -

The line of text directly below the question indicates that you can select **only one** answer to the question.

Clicking on a second answer will automatically cancel your first choice.

"How many poison syndromes are left?" -

A message line in the grey bar at the bottom of the screen keeps you informed of how many questions you have answered and how many poison syndromes remain. You will be asked questions until only one poison syndrome remains. A dialogue box will inform you when you reach this stage of the identification and will enable you to access the information for the poison syndrome.

OK -

Click on this button when you have completed your answer selection.

Poisonous Fungi... will use your answer to reduce the list of remaining poison syndromes and will then display the next question.

Skip -

The **Skip** button is NOT AVAILABLE when you are answering questions about the poison syndrome. You must answer the question.

Choose Question -

The **Choose Question** button is NOT AVAILABLE when you are answering questions about the poison syndrome. *Poisonous Fungi...* automatically offers you the best question to differentiate between the remaining poison syndromes.

Review Answers -

Use this button if you want to **review** your answers so far or if you want to **change** any of them.

A dialogue box appears which lists the questions that you have answered. When you click on a question your answer appears in the right-hand box.

Use the **Change** button if you want to change your answer to the highlighted question. The question will be offered to you again. Answer it in the normal way. *Poisonous Fungi...* will recalculate the list of suspect poison syndromes based on your new answer.

Use the **Cancel** button if you do not wish to change any of your answers.

View Syndrome -

When only one poison syndrome remains, a dialogue box will inform you and will enable you to access information about that poison syndrome. Should you choose to cancel either the dialogue box or the Poison Syndrome Screen, you can use the **View Syndrome** button on the Question Screen to access the poison syndrome information.

Note: this button is only available when one poison syndrome remains.

Restart -

This button should be used if you want to restart your identification of the poison syndrome from the beginning or you want to identify a fungus without completing your identification of the poison syndrome. A dialogue box will appear and ask you how you wish to make an identification.

Click on the **OK** button opposite your choice to restart the identification.

Use **Cancel** if you do not want to restart the identification.

Help -

If you need any assistance during the identification please use the **Help** menu.

Choose **How to use**... for an explanation of the screen that you are on, including the functions of the buttons. Use the **Contents** button within Help to find information on other areas of the system.

"I think I know what the poison syndrome is." -

If you think you recognise the symptoms as belonging to a particular poison syndrome, you can access the toxicity information for this poison syndrome by selecting **All poison syndromes** from the **Help** menu.

You will be offered a list of poison syndromes, arranged alphabetically. You may need to use the scroll bar to see the poison syndromes at the end of the list. Click on the name you are looking for. When you have finished, or if you can not find the name use the **Exit** button (within **Help**). If you would like to return to the list of poison syndromes use the **Back** button.

Please note that it is always advisable to make an identification by answering questions.

Poison Syndrome Screen

This screen enables you to access information on the poison syndrome.

The information is presented as a card index system. To view the information on a particular card, click on the appropriate tab label.

Buttons:

Identify Fungus

Print - use this to print all the poison syndrome information.

Cancel - this button returns you to the Question Screen.

Exit - use this to exit from *Poisonous Fungi...*

Identify Fungus -

Clicking on this button will take you to the **fungus questions**. *Poisonous Fungi...* will automatically ask you questions to differentiate between the suspects which cause the poison syndrome that you have identified.

Note: If five or fewer suspects cause the poison syndrome that you have identified, you will not be asked any questions about the fungus. You will instead be prompted to **View** the fungi and can complete your identification by comparing your specimen with photographic images.

Fungus Identification Question Screen

Poisonous Fungi... automatically offers you a series of questions selected to lead you through the fastest identification route.

To answer the question on the screen click on the appropriate answer or answers (note that the colours invert when you select an answer) and confirm your choice using the **OK** button.

If you **do not wish** to answer the question on the screen use either the **Skip** button or the **Choose Question** button. Please use the **Skip** button whenever you are unsure of the answer.

If you have already identified the poison syndrome, you can return to the relevant Poison Syndrome Screen at any time by selecting **Poison Syndrome** in the **Help** menu (see below). The **Cancel** button on the Poison Syndrome Screen will return you to the Fungus Identification Question Screen.

"How many answers can I give?"

"How many suspects are left?"

Buttons:

OK
Skip

Choose Question
Review Answers
View Suspects
Restart

Navigating through *Poisonous Fungi...*

Help

Exit

"I think I know what the fungus is"

Poison Syndrome

"How many answers can I give?" -

The line of text directly below the question indicates whether you can select **one or more** or **only one** answer to the question.

If you are only allowed to select one answer to a question, clicking on a second answer will automatically cancel your first choice. If you are able to select one or more answers, clicking on a second answer will not deselect your first choice; click on your answer a second time if you want to deselect that choice.

"How many suspects are left?" -

A message line in the grey bar at the bottom of the screen keeps you informed of how many questions you have answered and how many suspects remain. You will be asked questions until you have reduced the number of suspects to only 5 or fewer. A dialogue box will inform you when you reach this stage of the identification and will enable you access photographic images and text descriptions in order to complete and confirm your identification.

OK -

Click on this button when you have completed your answer selection - remember you can give more than one answer to some questions.

Poisonous Fungi... will use your answer to reduce the list of remaining suspect fungi and will then calculate the best question to ask you next - this question will automatically be offered to you.

Skip -

Never guess the answer to a question.

If you are unsure of the answer to the question on the screen please **Skip** it - *Poisonous Fungi...* will offer you an alternative question.

If you wish, you will be able to answer the question later on in the identification by using the **Review Answers** button.

Choose Question -

Poisonous Fungi... automatically offers you the best question to differentiate between the remaining suspects. **You may, however, wish to choose a different question to answer**, for example, if you think the fungus you are identifying has an unusual feature that will speed up its identification.

Click on the **Choose Question** button. A dialogue box will appear which asks you to Choose an item and then a question. A list of available items appears in the left-hand box. Click on one of these to select it, e.g. Cap. A list of all the available questions for that item appears in the right-hand box. Select the question that you wish to answer (you may need to use the scroll bar) and confirm your choice with the **OK** button. The question that you have chosen is offered to you to answer in the normal way.

Use the **Cancel** button to exit from the **Choose Question** option without making a selection.

Review Answers -

Use this button if you want to **review** your answers so far or if you want to **change** any of them.

A dialogue box appears which lists the questions that you have answered or skipped. When you click on a question your answer(s) appears in the right-hand box.

Use the **Change** button if you want to change your answer to the highlighted question, or to skip it. The question will be offered to you again. Answer it in the normal way. Remember that if you want to **add** an answer to your previous selection, e.g. an extra cap colour, you must select your previous answers also. *Poisonous Fungi...* will recalculate the list of suspect fungi based on your new answer.

Use the **Cancel** button if you do not wish to change any of your answers.

View Suspects -

This button is only active when **five or fewer** suspects remain or when there are no more useful questions left to differentiate between the remaining suspects. Use this button to view images of the remaining suspects and obtain descriptive and toxicity information.

You will initially be given a list of the remaining suspects, arranged alphabetically by Latin name. The first name is highlighted, but you can select another name instead. Confirm your choice by clicking on the **View** button. You can move through images of all the suspects using buttons on the **Suspects Screen**.

If you do not wish to view any of the suspects use the **Cancel** button to return to the Question Screen.

Please be careful when using the images to complete the identification. LOOK AT ALL THE IMAGES FOR ALL THE SUSPECT FUNGI and compare them carefully with your fungus material.

Restart -

This button should be used if you want to carry out another identification.

If you have identified the poison syndrome, when you click on **Restart** a dialogue box will ask you if you wish to retain the poison syndrome and just restart the identification of those fungi that cause this syndrome or, if you wish to start from the very beginning and identify either the poison syndrome or the fungus from all the suspects.

If you have not identified the poison syndrome, when you click on **Restart** you will be prompted to restart the fungus identification or identify the poison syndrome.

Click on **Cancel** if you do not wish to restart your identification and you will return to the Question Screen.

An alternative to restarting your identification is to use the **Review Answers** button to change one or more of your answers.

"I think I know what the fungus is." -

Images, a description and toxicity information can be accessed directly if you know the Latin name of the fungus. Simply select the appropriate name from the list under **Latin names** in the **Help** menu. [Note: **Latin names** is only available from the Question Screen.] You will be offered a list of suspects, arranged alphabetically by Latin name. Use the scroll bar to move down the list. [Tip: Type in the first letter of the name to move part way down the list, then scroll the rest of the way using the scroll bar.] Highlight the name you are looking for and confirm your choice by clicking once on the **View** button. If you can not find the name use the **Cancel** button.

If the Latin name that you know is not in the list, you may be using a synonym. You can find the accepted Latin name by selecting **All names** from the **Help** menu. You can also use **All names** to find the Latin name for a fungus if you only know a common name.

All names is a two-columned list. The left-hand column is an alphabetic list of the Latin names used in *Poisonous Fungi...* (these are in italics), alternative Latin names including synonyms, and common names. Scroll down the left-hand column to find the name that you know. The corresponding name in the right-hand column is the Latin name used in *Poisonous Fungi...*. Exit from Help and return to the Question Screen. Now you can look up the Latin name by selecting the **Latin names** item from the **Help** menu as described above.

If you can not find the name that you are looking for under **All names** the fungus may not be in *Poisonous Fungi....* Also, because many different common names may be applied to one fungus, the list of common names included on *Poisonous Fungi...* may not be complete.

Please note that it is always advisable to make an identification by answering questions.

Poison Syndrome -

If you have already identified the poison syndrome, clicking on **Poison syndrome** in the **Help** menu will return you to the information screen for that syndrome. Once you are viewing the poison syndrome information, you can return to the Fungus Identification Question Screen by clicking on **Cancel**.

If you have not identified the poison syndrome, the **Poison syndrome** item in the **Help** menu is inactive. You can use the **All poison syndromes** item to access information about all the poison syndromes.

Also refer to **Restart**.

Fungus Suspect Screen

This screen enables you to view images of a suspect and to access descriptive and toxicity information.

The images should be used to visually complete and confirm your identification when the list of suspects has been reduced to five or fewer. (If you have not carried out an identification, but have accessed the screen directly from the list of **Latin names** under the **Help** menu, we recommend that you do not rely on the images to confirm your choice - please identify the fungus by answering questions.)

When making an identification, **look at all the images for all the short-listed suspects**. The suspects are likely to be similar to each other because they share the characters that you selected when answering questions. If you think that the first suspect is the correct one, you should still look at the other suspects.

IF THE FUNGUS THAT YOU ARE IDENTIFYING IS NOT INCLUDED IN THE SHORT-LIST OF SUSPECTS you should return to the Question Screen by clicking on the **Cancel Screen** button and then use the **Review Answers** facility to check the answers that you have given to each question.

The Latin name of the fungus featured is shown at the top right of the screen with common names listed below.

Buttons:

Images

Toxicity

Description

Previous Suspect and **Next Suspect -** these buttons are active if more than one suspect remains. They enable you to view images of all the suspects before making your choice.

Cancel Screen - use this button to return to the Question Screen.

Images

Images are displayed top left with a caption directly below.

Several images are available for each fungus; these can be viewed in turn using the **Previous Image** and **Next Image** buttons.

The message line at the bottom of the screen informs you which of the available images is being displayed.

Each image can be enlarged using the **Zoom Image** button. Click anywhere on the zoomed image to return it to normal size.

Toxicity -

Use this button to obtain information on the toxicity of the fungus.

The toxicity information is presented as a card index system. To view the information on a particular card click on the appropriate labelled tab. A comprehensive **Glossary**, specifically compiled to help interpretation of the toxicity information, is located under the **Help** menu.

You may **Print** this information; information on all the cards will be printed.

Use the **Cancel** button to return to the Suspects Screen.

Description -

Descriptions have been provided which may assist with your identification. The descriptive information is presented as a card index system. To view the information click on the labelled tabs. A comprehensive **Glossary**, specifically compiled to help interpretation of these descriptions, is located under the **Help** menu.

You may **Print** all this information.

Use the **Cancel** button to return to the Suspects Screen.

Poison Syndromes

The clinical features presented by a patient suffering from a case of fungus poisoning usually fall into one of eight recognised poison syndromes. The eight syndromes can be subdivided into two groups, those that cause a rapid onset of symptoms usually within 2 hours of ingestion and no later than 6 hours, and those that have a delayed onset with symptoms appearing not before 6 hours and up to 21 days after ingestion.

NOTE: Factors such as individual variation and the quantity ingested may affect the clinical picture. Also, if more than one type of fungus has been ingested simultaneously, or in consecutive meals, the clinical picture may fit more than one syndrome.

Where the patient is ASYMPTOMATIC it may mean that:

1. clinical features have not had time to develop;
2. the fungus ingested causes late onset of clinical features;
3. no fungi have been ingested;
4. not enough fungus has been ingested to cause adverse effects; or
5. the fungus is of low toxicity and is not expected to cause any adverse effects.

In general, RAPID ONSET OF CLINICAL EFFECTS (usually within 6 hours of ingestion) would suggest one of the following syndromes:

Coprine poisoning
Gastrointestinal irritant poisoning
Ibotenic acid poisoning
Muscarine poisoning
Psilocybin poisoning

LATE ONSET OF CLINICAL EFFECTS (often more than 6 hours after ingestion) would suggest one of the following syndromes:

Amatoxin poisoning
Gyromitrin poisoning
Orellanine poisoning

As clinical features may not occur until many hours or in fact days after ingestion it is very important that the fungus is identified to eliminate those species that can cause fatal poisoning, particularly those causing Amatoxin poisoning.

SUMMARY OF THE SYNDROMES OF FUNGAL POISONING - click on link for full details.

Amatoxin poisoning - Onset: up to 24 hours. Effects: Severe gastrointestinal upset, dehydration, hepatic and renal failure.

Coprine poisoning - Onset: immediately (usually within 30 minutes) with alcohol or if alcohol is drunk up to 72 hours after ingestion of fungi: Effects: Flushing, metallic taste, sweating, nausea, vomiting; in severe cases confusion, severe headache, tachycardia, chest pain, hypotension.

Gastrointestinal irritant poisoning - Onset: 2 hours. Effects: Gastrointestinal upset with

vomiting, diarrhoea and abdominal pain.

Gyromitrin poisoning - Onset: 2-24 (usually 5-15) hours. Effects: Gastrointestinal upset, feeling of bloating, severe headache, pyrexia, lethargy, hepatic and renal dysfunction.

Ibotenic acid poisoning - Onset: 20-120 minutes. Effects: Nausea, vomiting, confusion, disorientation, ataxia, hallucinations, muscle cramps, deep sleep.

Muscarine poisoning - Onset: 5-120 (usually 30) minutes. Effects: Sweating, salivation, lacrimation, gastrointestinal upset, constricted pupils; in severe cases bradycardia, hypotension.

Orellanine poisoning - Onset: up to 17 days. Effects: Anorexia, gastrointestinal upset, thirst, polydipsia, polyuria, myalgia, paraesthesiae, tinnitus; in severe cases renal failure.

Psilocybin poisoning - Onset: 30 minutes. Effects: Dilated pupils, perceptual alterations, tachycardia, euphoria, confusion, dizziness, vomiting.

Amatoxin poisoning

SUMMARY

Main toxins: Amatoxins.
Target organs: Liver and kidneys.
Main risks: Hepatic failure and renal failure.

SUMMARY OF CLINICAL FEATURES OF AMATOXIN POISONING

Four phases:

1. LATENT PHASE: usually 6 to 24 hours post ingestion.
- Asymptomatic

2. GASTROINTESTINAL PHASE: onset usually 9 to 15 hours post ingestion but may be up to 24 hours; duration 12 to 24 hours.
- Severe colicky abdominal pain
- Vomiting
- Watery diarrhoea, may contain blood and mucus
- Dehydration

3. SECOND LATENT PHASE: onset 24 to 48 hours post ingestion; duration 12 to 24 hours.
- Increasing hepatic transaminase levels
- Rising prothrombin time (INR)

4. TERMINAL PHASE: onset 48 to 96 hours post ingestion:
- Gastrointestinal symptoms with watery, bloody diarrhoea
- Jaundice (Hepatocellular)
- Hepatic and renal failure
- Hypoglycaemia
- Coagulopathy
- Metabolic acidosis
- Hypoglycoaemia
- Encephalopathy
- Convulsions
- Coma

Death may occur within 5 to 16 days, mean of 8 days, if liver transplant not available.

(Adapted from: Becker et al., 1976; Lincoff and Mitchel, 1977; Rumack, 1994; Benjamin, 1995)

FUNGI THAT MAY CAUSE THIS SYNDROME:

Amanita phalloides
Amanita virosa
Conocybe filaris
Galerina spp.
Lepiota spp.

Author: Frances Northall

TOXICITY

Amatoxins are bicyclic octapeptides with an indole sulphoxide bridge. Nine have been identified (Wieland, 1983). All have the same basic amino acid structure but differing numbers of attached hydroxy groups. The main toxins are alpha- and beta-amanitin, which account for over 90% of total amanitins in a typical *Amanita phalloides*.

One cap of *Amanita phalloides* can contain sufficient quantities of amatoxins, approximately 5-7 mg, to cause a fatal poisoning in a healthy adult (Weiland, 1983). The amatoxin concentration in *Amanita virosa* is about half that of *Amanita phalloides* (Faulstich and Zilker, 1994). In the smaller species of *Conocybe filaris*, *Galerina* and *Lepiota*, 10 to 20 fruitbodies must be ingested by an adult for a fatal dose (Benjamin, 1995).

Amatoxins are primarily hepatotoxins. They rapidly penetrate liver parenchymal cells (Faulstich, 1979). They can affect all eukaryotic cells, but those with the highest rate of protein turnover are likely to be the most susceptible. Amatoxins bind reversibly to RNA polymerase II, and completely inhibit the transcription of DNA into messenger RNA (mRNA) at concentrations of 10nM (Bresinsky and Besl, 1990). This prevents protein synthesis and results in cell death and tissue necrosis. Animal studies suggest that these effects can occur within one hour of ingestion, and that the delay in overt hepatotoxicity may be explained by a pool of mRNA in the cells acting as a buffer (Faulstich and Zilker, 1994).

Amatoxins are rapidly absorbed from the gastrointestinal tract. They can be detected in serum for up to 48 hours post ingestion (Vesconi et al., 1985), although they have been found up to 72 hours post ingestion in a patient with acute renal failure (Jaeger et al., 1993).

Amatoxins are not metabolised and are mainly excreted unchanged in the urine; studies in dogs suggest more than 80% is excreted by this route (Faulstich et al., 1985). They have been detected in urine within 2 hours of ingestion (Homann et al., 1986) and for up to 120 hours post ingestion (Faulstich and Zilker, 1994). Large amounts have also been found in the faeces, presumed to be mainly from ingested material not absorbed by the gastrointestinal tract (Jaeger et al., 1993).

The amatoxins transported into liver cells are excreted into bile, and undergo enterohepatic circulation, increasing exposure to the toxins (Busi et al., 1979). The extent of toxicity depends on the time during which hepatocytes are exposed to a significant concentration of amatoxin.

The possibility of renal tubular secretion or absorption of amatoxins cannot be excluded (Faulstich et al., 1985) although some consider it unlikely (Piqueras, 1989). Amatoxins may cause changes in the renal tubular epithelium, and autopsy has revealed acute tubular necrosis with large quantities of hyaline casts in the tubules (Fineschi et al., 1996); granular casts have also been described (McClain et al., 1989).

Various methods have been developed for quantitative analysis of amatoxins but they all require reference standards and specialised equipment, reagents and skills, and are usually beyond the range of most hospital laboratories (Lampe and McCann, 1987). High-performance liquid chromatography can be applied to fungal samples (Enjalbert et al., 1992) and human biological fluids (Jehl et al., 1985), giving a 10 µg/l limit of detection. Radioimmunoassay allows a lower limit of amatoxin detection, 1 µg/l for urine and 0.1 µg/l for plasma (Andres et al., 1986). There does not appear to be any correlation between concentration of amatoxins and severity of

effects or outcome (Jaeger et al., 1993; Vesconi et al., 1985).

Amatoxins are thermostable and are not removed by boiling and discarding the water, or by any form of cooking. The toxins are not destroyed by drying and they have been found to remain potent in mushrooms stored for over 10 years (Nicholls et al., 1995).

CLINICAL EFFECTS

The severity and outcome of amatoxin poisoning depends on the amount of fungus ingested, the age, weight and individual susceptibility of the patient, and the length of time between ingestion and treatment (Homann et al., 1986).

Children appear to be particularly vulnerable to amatoxin poisoning, possibly due to their high rate of nucleic acid and protein synthesis or because they often eat the same size portion as adults so have a greater proportion of toxin per kg body weight (Floersheim, 1987). An analysis of 205 European cases from 1971 to 1980 revealed the overall mortality rate to be 22.4%. It was highest (51.3%) in children under 10, compared with 16.5% in patients over 10 years (Floersheim, 1985). More recently, treatment in intensive care facilities has reduced the mortality rate to 10-20% (Faulstich and Zilker, 1994).

1. Latent phase:
The first latent phase before the onset of symptoms is usually 6 to 24 hours. In general, the shorter the latent period the more severe the poisoning. In one review, fatal cases had an average latent period of 10.3 hours whilst in survivors the average was 12.6 hours (Floersheim, 1987). Another study grouped cases into three categories: mild - onset within 8-30 hours; moderate - symptoms within 6-24 hours; and severe - symptoms within 6-14 hours (Sabeel et al., 1995). Concomitant ingestion of alcohol may reduce toxicity (Floersheim, 1987).

2. Gastrointestinal phase (duration 12 to 24 hours):
Crampy abdominal pain rapidly followed by nausea, vomiting and profuse bloody or watery (cholera-like) diarrhoea. Dehydration with hypovolaemia is likely and may result in severe electrolyte and acid-base disturbances, hypoglycaemia, oliguria and renal failure. Large ingestions may result in direct renal toxicity (Constantino et al., 1978). Signs of hepatotoxicity are unlikely at this stage (Piqueras, 1989).

3. Second latent phase:
The second latent phase (onset 24 to 48 hours post ingestion, lasting 12 to 24 hours) is characterised by apparent remission of symptoms.

4. Terminal, or hepatorenal, phase (from 2 days post ingestion):
Jaundice and hepatomegaly may occur and bilirubin and transaminases are raised. Levels of hepatic enzymes usually peak between 72 to 96 hours and may be as much as one hundred times normal values (Bivins et al., 1985). However, where there is massive hepatic necrosis the enzyme levels may be relatively low although hepatic failure is clinically apparent. In cases of severe poisoning, patients may develop fulminant hepatic failure with hepatic encephalopathy, progressing to coma, convulsions and cardiovascular collapse. Renal failure may develop during this phase as a result of the hepatorenal syndrome, rather than a direct toxic effect. Other reported effects secondary to severe liver damage include haemorrhagic gastritis, endocardial haemorrhage and renal cortical infarctions (McClain et al., 1989); disseminated intravascular coagulation, mesenteric venous thrombosis and haemorrhagic pulmonary alveolitis have been recorded (Sanz et al., 1988). Death may occur within 5 to 16 days without

treatment.

In cases where the liver damage is reversible the recovery may be slow. Follow up at 6 months post ingestion found that 57% of survivors who had displayed moderate or severe toxicity had developed chronic active hepatitis (Bartoloni St Omer et al., 1985); another report found no long term sequelae (Piqueras, 1989).

Prognostic indicators:
Measurement of prothrombin time (PT, INR, international normalised ratio) is probably the most sensitive marker of liver disfunction in current clinical practice. However, one widely quoted prognostic indicator is the thromboplastin time (TT, Quick's test); a value of less than 10% (normal value 70 to 110%) indicates a serious intoxication with an 84% fatality rate, while a value greater than 40% indicates a mild poisoning and survival (Floersheim, 1987).

Aspartate amino transferase (AST) has also been used to assess severity, based on data from 64 cases (Bartoloni St Omer et al., 1985). Peak AST levels <1000 U/l indicated mild intoxication without complications or late sequelae; AST between 1000 and 2000 U/l indicated moderate intoxication; AST >2000 U/l indicated severe intoxication.

Pregnancy:
Cases of amatoxin poisoning involving pregnant women in the second and third trimester suggest that amatoxins do not cross the placenta during this period (Dudová et al., 1980; Belliardo et al., 1983; Nagy et al., 1994). In a report of a non-fatal case of amatoxin poisoning in a woman during the first trimester histopathological changes in the foetal liver were found which were attributed to a possible amatoxin effect (Kaufmann et al., 1978 cited in Nagy et al., 1994). However, as the termination was carried out 26 days after the poisoning while the mother was recovering, the effect of amatoxins during the first few weeks of pregnancy is uncertain.

Amatoxins have been found in breast milk (Buttenwieser and Bodenheimer, 1924 cited in Benjamin, 1995).

CASE REPORTS

A 53-year-old man in Finland ingested six *Amanita virosa*. The following day he became anuric and presented to hospital complaining of nausea and tiredness. Haemodialysis was started because of acute renal failure. Liver function was normal on admission, but 4 days post ingestion he became jaundiced. By 8 days post ingestion he developed hepatic coma and was transferred to a liver unit where he received a transplant. Renal function improved and he was discharged 38 days post ingestion with normal liver and neurological function (Doepel et al., 1994).

A 31-year-old man ingested cooked mushrooms, later identified as immature *Amanita phalloides*. He presented to hospital four days post ingestion with nausea, vomiting, abdominal pain and bloody diarrhoea. He was dehydrated and jaundiced, and his INR (international normalised ration) was 2.4. Fresh frozen plasma, vitamin K and fluids were administered intravenously. His condition improved gradually and he was discharged six days later (Nicholls et al., 1995).

Five wild mushrooms, later identified as *Amanita phalloides*, were ingested by a 14-year-old Spanish boy. 12 hours post ingestion he experienced abdominal pain, nausea, vomiting and diarrhoea and was referred to hospital. On admission he was dehydrated, acidotic and mildly

jaundiced; Quick's test was 58%. He was treated with intravenous fluids, forced diuresis, activated charcoal, intravenous thioctic acid (100 mg every 6 hours) and intravenous benzylpenicillin (1 million units every hour). On the fourth day post ingestion jaundice progressed and he deteriorated neurologically, Quick's test was 2%, he became unconscious and developed disseminated intravascular coagulation requiring fresh plasma and fibrinogen. 6 days post ingestion he required ventilation for hypoxaemia and died on the ninth day after a cardiac arrest (Sanz et al., 1988).

TREATMENT

Medical treatment:
Gastric decontamination should be considered. Repeat-dose activated charcoal should be given for a minimum of 24 hours after ingestion (in asymptomatic cases) and a minimum of 48 hours after ingestion if symptoms develop. Dose: adults 50 g then 25 g every 2 hours; children 1 g/kg then 0.5 g/kg every 2 hours. Rehydration with oral or intravenous fluids may be required, and an antiemetic if vomiting is persistent. In symptomatic patients monitor: blood pressure; fluid balance; glucose; electrolytes; pH; renal function; liver function tests and coagulation. Management is symptomatic and supportive. The administration of benzylpenicillin should be considered urgently as this may reduce toxin uptake. Liver transplant may need to be considered in severe cases.

Patients should be observed for at least 24 hours after ingestion.

For medical professionals further information or advice is available from the National Poisons Information Service. If patients are severely poisoned early discussion with the National Poisons Information Service is recommended.

Diagnosis:
Not all symptoms seen after ingesting mushrooms are due to poisoning. Fungal poisoning should be considered when other causes have been excluded. Differential diagnoses include food poisoning, excessive ingestion of edible fungi, idiosyncratic reactions, other coincident illnesses, alcohol intoxication, and drug exposure.

General Emergency Aid:
Poisonous Fungi... is not intended to be used by the public to diagnose or treat suspected fungus poisoning. The following advice is a GENERAL GUIDE to assist the public in the first steps of managing a suspected poisoning. It has not been tailored for the particular fungus. Medical attention should be sought if poisoning is suspected.

If you suspect possible poisoning from EATING a fungus:

* DO NOT try to make the person sick.

* A single glass of milk may be helpful, but if the person is unconscious or fitting do not give anything by mouth.

* IMMEDIATELY take the person to a doctor or hospital Accident and Emergency or Casualty Department.

* Note the NAME of the fungus if you think you have identified it, and TAKE a good specimen of the fungus with you, i.e. a whole fungus including the base of the stem.

* Note TIME of eating and the onset of any symptoms, which may appear some time later.

REFERENCES

Andres, R. Y., Frei, W., Gautschi, K. and Vonderschmitt, D. J. (1986). Radioimmunoassay for amatoxins by use of a rapid, 125I-tracer-based system. Clinical Chemistry 32: 1751-1755.

Bartoloni St Omer, F., Giannini, A., Botti, P., Caramelli, L., Ledda, F., Peruzzi, S. and Zorn, M. (1985). Amanita poisoning: a clinical-histopathological study of 64 cases of intoxication. Hepato-Gastroenterology 32: 229-231.

Becker, C. E., Tong, T. G., Boerner, U., Roe, R. L., Scott, R. A. T., MacQuarrie, M. B. and Bartter, F. (1976). Diagnosis and treatment of Amanita phalloides-type mushroom poisoning: use of thioctic acid. Western Journal of Medicine 125: 100-109.

Belliardo, F., Massano, G. and Accomo, S. (1983). Amatoxins do not cross the placental barrier. [Letter]. Lancet 1: 1381.

Benjamin, D. R. (1995). Mushrooms: Poisons and Panaceas. W. H. Freeman and Company: New York.

Bivins, H. G., Knopp, R., Lammers, R., McMicken, D. B. and Wolowodiuk, O. (1985). Mushroom ingestion. Annals of Emergency Medicine 14: 1099-1104.

Bresinsky, A. and Besl, H. (1990). A Colour Atlas of Poisonous Fungi: A Handbook for Pharmacists, Doctors, and Biologists. Wolfe Publishing Ltd.: London.

Busi, C., Fiume, L., Constantino, D., Langer, M. and Vesconi, S. (1979). Amanita toxins in gastroduodenal fluid of patients poisoned by the mushroom, Amanita phalloides. [Letter]. New England Journal of Medicine 300: 800.

Buttenwieser, S. and Bodenheimer, W. (1924). Über den Übertritt des Knollenblätterschwammgiftes in dies Brustmilch. [On the occurrence of Amanita poison in breast milk.] Deutsche Medizinische Wochenscrift 50: 607.

Constantino, D., Falzi, G., Langer, M. and Rivolta, E. (1978). Amanita-phalloides-related nephropathy. Contributions to Nephrology 10: 84-97.

Doepel, M., Isoniemi, H., Salmela, K., Penttilä, K. and Höckerstedt, K. (1994). Liver transplantation in a patient with Amanita poisoning. Transplantation Proceedings 26: 1801-1802.

Dudová, V., Kubicka, J. and Veselský, J. (1980). Thioctic acid in the treatment of Amanita phalloides intoxication: 190-191. In: Faulstich, H., Kommerell, B. and Weiland, T. (eds), Amanita Toxins and Poisoning. International Amanita Symposium, Heidelberg, 1-3 November, 1978. Verlag Gerhard Witzstrock: Baden-Baden.

Enjalbert, F., Gallion, C., Jehl, F., Monteil, H. and Faulstich, H. (1992). Simultaneous assay for amatoxins and phallotoxins in Amanita phalloides Fr. by high-performance liquid chromatography. Journal of Chromatography 598: 227-236.

Faulstich, H. (1979). New aspects of Amanita poisoning. Klinische Wochenshcrift 57: 1143-1152.

Faulstich, H. and Zilker, T. R. (1994). Amatoxins: 233-248. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Faulstich, H., Talas, A. and Wellhöner, H. H. (1985). Toxicokinetics of labeled amatoxins in the dog. Archives of Toxicology 56: 190-194.

Fineschi, V., Di Paolo, M. and Centini, F. (1996). Histological criteria for diagnosis of Amanita phalloides poisoning. Journal of Forensic Sciences 41: 429-432.

Floersheim, G. L. (1985). Treatment of mushroom poisoning. [Letter]. Journal of the American Medical Association 253: 3252.

Floersheim, G. L. (1987). Treatment of human amatoxin mushroom poisoning: myths and advances in therapy. Medical Toxicology 2: 1-9.

Homann, J., Rawer, P., Bleyl, H., Matthes, K.-J. and Heinrich, D. (1986). Early detection of amatoxins in human mushroom poisoning. Archives of Toxicology 59: 190-191.

Jaeger, A., Flesch, F., Jehl, F., Sauder, Ph. and Kopferschmitt, J. (1988). Les intoxications par champignons. [Mushroom poisoning.] Journal de Médecine de Strasbourg 19(7): 381-384.

Jaeger, A., Jehl, F., Flesch, F., Sauder, P. and Kopferschmitt, J. (1993). Kinetics of amatoxins in human poisoning: therapeutic implications. Journal of Toxicology - Clinical Toxicology 31: 63-80.

Jehl, F., Gallion, C., Birckel, P., Jaeger, A., Flesch, F. and Minck, R. (1985). Determination of alpha-amanitin and beta-amanitin in human biological fluids by high-performance liquid chromatography. Analytical Biochemistry 149: 35-42.

Kaufmann, M., Müller, A., Paweletz, N., Haller, U. and Kubli, F. (1978). Fetale Schädigung bei einer Knollenblätterpilzvergiftung der Mutter in der Frühschwangerschaft. [Fetal damage due to mushroom poisoning with Amanita phalloides during the first trimester of pregnancy.] Geburtshilfe und Frauenheilkunde 38: 122-124.

Lampe, K. F. and McCann, M. A. (1987). Differential diagnosis of poisoning by North American mushrooms, with particular emphasis on Amanita phalloides-like intoxication. Annals of Emergency Medicine 16: 956-962.

Lincoff, G. and Mitchel, D. H. (1977). Toxic and Hallucinogenic Mushroom Poisoning: A Handbook for Physicians and Mushroom Hunters. Van Nostrand Reinhold Company: New York.

McClain, J. L., Hause, D. W. and Clark, M. A. (1989). Amanita phalloides mushroom poisoning: a cluster of four fatalities. Journal of Forensic Sciences 34: 83-87.

Nagy, I., Pogátsa-Murray, G., Zalányi, S., Jr., Komlósi, P., László, F., Jr. and Ungi, I. (1994). Amanita poisoning during the second trimester of pregnancy: a case report and a review of the literature. Clinical Investigations 72: 794-798.

Nicholls, D. W., Hyne, B. E. B. and Buchanan, P. (1995). Death cap mushroom poisoning. [Letter]. New Zealand Medical Journal 108: 234.

Piqueras, J. (1989). Hepatotoxic mushroom poisoning: diagnosis and management. Mycopathologia 105: 99-110.

Rumack, B. H. (1994). Symptomatic diagnosis and treatment of mushroom poisoning: 149-163. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Sabeel, A. I., Kurkus, J. and Lindholm, T. (1995). Intensive hemodialysis and hemoperfusion treatment of Amanita mushroom poisoning. Mycopathologia 131: 107-114.

Sanz, P., Reig, R., Borrás, L., Martínez, J., Máñez, R. and Corbella, J. (1988). Disseminated intravascular coagulation and mesenteric venous thrombosis in fatal Amanita poisoning. Human Toxicology 7: 199-201.

Vesconi, S., Langer, M., Iapichino, G., Constantino, D., Busi, C. and Fiume, L. (1985). Therapy for cytotoxic mushroom intoxication. Critical Care Medicine 13: 402-406.

Wieland, T. (1983). The toxic peptides from Amanita mushrooms. International Journal of Peptide and Protein Research 22: 257-276.

Coprine poisoning

SUMMARY

Main toxins: Coprine, a cyclopropylglutamine, N5-(1-hydroxy cyclopropyl)-L-glutamine, and its metabolite 1-aminocyclopropanol.
Target organs: Cardiovascular system.
Main risks: Unpleasant symptoms when fungi and alcohol are ingested, not necessarily at the same time.

SUMMARY OF CLINICAL FEATURES OF COPRINE POISONING

Onset of symptoms: Symptoms occur almost immediately after alcohol is drunk (20-120 minutes, usually within 30 minutes), if fungi have been consumed up to 72 hours (occasionally up to 120 hours) previously.

Symptoms include:
- Sensation of warmth
- Flushing of the face and neck
- Metallic taste in mouth
- Sweating
- Nausea and vomiting
- Swelling of hands and face

In severe cases:
- Confusion
- Severe headache
- Tachycardia and chest pain
- Hypotension and collapse

(Adapted from: Lincoff and Mitchel, 1977; Kunkel and Connor, 1994; Rumack, 1994; Benjamin, 1995)

FUNGI THAT MAY CAUSE THIS SYNDROME, or a DISULFIRAM-LIKE REACTION WITH ALCOHOL:

Boletus luridus group
Clitocybe clavipes
Coprinus atramentarius
Coprinus comatus
Coprinus disseminatus
Coprinus micaceus
Coprinus picaceus

Author: Marie Pickford

TOXICITY

Coprine (N5-(1-hydroxy cyclopropyl)-L-glutamine) is the only known naturally occurring compound that contains a cyclopropanone and is thus unique (Lincoff and Mitchel, 1977).

Toxicity is due to interference with alcohol metabolism. Normally alcohol is converted to acetaldehyde, which in turn is converted to acetate and finally broken down to carbon dioxide and water. In the presence of coprine, metabolism of acetaldehyde is inhibited and it accumulates in the bloodstream (Coldwell et al., 1969). This accumulation is due to 1-aminocyclopropanol, a metabolite of coprine, inhibiting the enzyme aldehyde dehydrogenase which controls the breakdown of acetaldehyde (Tottmar and Lindberg, 1977; Marchner and Tottmar, 1978).

Acetaldehyde reacts with the beta-adrenergic receptors of the autonomic nervous system, producing the unpleasant and potentially violent vasomotor responses associated with coprine intoxication (Benjamin, 1995).

A reaction may be expected to occur if alcohol is drunk from half an hour, up to 72 hours or even 5 days after fungi consumption. When alcohol is consumed prior to, or at the same time as, fungi then symptoms result only when sufficient alcohol is drunk to maintain an elevated blood level until the coprine is metabolised (Kunkel and Connor, 1994; Benjamin, 1995).

Disulfiram (Antabuse(TM)) is a drug used in the management of alcoholics. The combination of alcohol and disulfiram produces the same unpleasant clinical effects as coprine and alcohol, because of a similar action on the enzyme aldehyde dehydrogenase, hence the two are often compared (Benjamin, 1995). Initially it was suspected that disulfiram may be naturally present in *Coprinus atramentarius*. However, its presence has been disproved by at least two studies (Wier and Tyler, 1960; List and Reith, 1960 cited in Chilton, 1994).

There is some evidence that poisoning occurs only when the fungi are cooked but this is unclear (Buck, 1961; Lincoff and Mitchel, 1977; Kunkel and Connor, 1994; Benjamin, 1995).

CLINICAL EFFECTS

Alcohol/fungus reaction

Symptoms are always associated with alcohol consumption and occur when blood alcohol levels are above 0.05 g/l, becoming more severe with larger concentrations and may produce unconsciousness when alcohol levels exceed 1.25 g/l (Benjamin, 1995).

Symptoms are usually more unpleasant than severe. The duration and severity depends on the amount of alcohol and fungus ingested, and the time interval between the two events (Caley and Clark, 1977). Effects usually last for 3 to 6 hours and rarely up to 24 hours (Kunkel and Connor, 1994). They may recur, although progressively decreasing in severity, if further alcoholic beverages are consumed within the days following mushroom ingestion (Duffy and Vergeer, 1977 cited in Benjamin, 1995).

Initial effects may include a rash or flushing of the face, neck and chest, a sensation of warmth and a metallic taste in the mouth. There may also be paraesthesiae of arms and legs, swelling of the hands and face, nausea and vomiting. More severe effects may include tachycardia, hypotension, shortness of breath, a severe pounding headache, sweating and shock (Reynolds and Lowe, 1965; Caley and Clark, 1977). Supraventricular ectopics and atrial fibrillation have been reported (Caley and Clark, 1977). There is one report of oesophageal rupture due to violent emesis (Mayer et al., 1971).

CASE REPORTS

Four acutely ill adults presented to the emergency room complaining of flushing of the face and a metallic taste in the mouth followed by paresthesia of the extremities, tachycardia, nausea and vomiting immediately after drinking beer. Upon closer investigation it was discovered that all patients had ingested a large meal the previous evening containing several varieties of mushrooms but the majority being *Coprinus atramentarius*. Within three hours of onset of symptoms all patients were much improved (Reynolds and Lowe, 1965).

A single case of cardiac arrhythmia has been documented in a 37-year-old man with no previous cardiac history (Caley and Clark, 1977). He ingested fried *Coprinus atramentarius* followed 2 hours later by 3 pints of beer. He became flushed, developed a blotchy rash, swelling of hands and face, sweating, nausea and vomiting. He became tachycardic with frequent supraventricular ectopic beats. After 12 hours he felt better but was in atrial fibrillation for 60 hours before spontaneous recovery. The authors suggest that cardiac abnormalities caused by coprine poisoning may be more common than is documented and may be missed due to the interval between mushroom consumption and alcohol ingestion. Serious complications may occur in patients with cardiovascular disease. Cardiac arrhythmias and myocardial infarction have been observed in patients taking disulfiram and alcohol (Markham and Hoff, 1953).

A 53-year-old man presented giving a history of *Coprinus atramentarius* and beer ingestion. Several hours later he complained of flushing, nausea and haematemesis. He had sharp epigastric pain which radiated to his back. Immediate investigation of his oesophagus demonstrated a distal rupture into the left pleural space requiring surgical repair (Mayer et al., 1971).

TREATMENT

Medical treatment:
Gastric decontamination may be considered (only if alcohol has been ingested). Management is symptomatic and supportive with reassurance. Rehydration with oral or intravenous fluids may be required, and an anti-emetic administered if vomiting is persistent. All symptomatic patients should be observed with monitoring of blood pressure, pulse, ECG, respiratory rate and electrolytes if indicated. There is no specific antidote. Advise avoidence of alcohol for up to 5 days.

If serious or unexplained symptoms occur medical professionals should contact the National Poisons Information Service.

Diagnosis:
Not all symptoms seen after ingesting mushrooms are due to mushroom poisoning. Differential diagnosis includes food poisoning, excessive ingestion of edible fungi, idiosyncratic reactions, other coincidental illnesses, and alcohol intoxication. As well as disulfiram, a number of other pharmaceuticals and chemical agents have been known to produce similar reactions. These include chloramphenicol, griseofulvin, metronidazole, glipizide, chlorpropamide, phenformin, procarbazine, and hydrogen sulphide.

General Emergency Aid:
Poisonous Fungi... is not intended to be used by the public to diagnose or treat suspected fungus poisoning. The following advice is a GENERAL GUIDE to assist the public in the first steps of managing a suspected poisoning. It has not been tailored for the particular fungus. Medical attention should be sought if poisoning is suspected.

If you suspect possible poisoning from EATING a fungus:

* DO NOT try to make the person sick.

* A single glass of milk may be helpful, but if the person is unconscious or fitting do not give anything by mouth.

* IMMEDIATELY take the person to a doctor or hospital Accident and Emergency or Casualty Department.

* Note the NAME of the fungus if you think you have identified it, and TAKE a good specimen of the fungus with you, i.e. a whole fungus including the base of the stem.

* Note TIME of eating and the onset of any symptoms, which may appear some time later.

REFERENCES

Benjamin, D. R. (1995). Mushrooms: Poisons and Panaceas. W. H. Freeman and Company: New York.

Bresinsky, A. and Besl, H. (1990). A Colour Atlas of Poisonous Fungi: A Handbook for Pharmacists, Doctors, and Biologists. Wolfe Publishing Ltd.: London.

Buck, R. W. (1961). Mushroom toxins - a brief review of the literature. New England Journal of Medicine 265: 681-686.

Caley, M. J. and Clark, R. A. (1977). Cardiac arrhythmia after mushroom ingestion. British Medical Journal 2: 1633.

Chilton, W. S. (1994). The chemistry and mode of action of mushroom toxins: 165-231. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Coldwell, B. B., Genest, K. and Hughes, D. W. (1969). Effect of Coprinus atramentarius on the metabolism of ethanol in mice. Journal of Pharmacy and Pharmacology 21: 176-179.

Duffy, T. J. and Vergeer, P. P. (1977). California Toxic Fungi. Mycological Society of San Francisco Toxicology Monograph 1: 1-29.

Kunkel, D. B. and Connor, D. A. (1994). Coprine-containing mushrooms: 303-307. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Lincoff, G. and Mitchel, D. H. (1977). Toxic and Hallucinogenic Mushroom Poisoning: A Handbook for Physicians and Mushroom Hunters. Van Nostrand Reinhold Company: New York.

List, P. H. and Reith, H. (1960). Der Faltentintling, Coprinus atramentarius Bull., und seine dem Tetraethylthiuramdisulf ähnliche Wirkung. [The mushroom Coprinus atramentarius and its tetraethylthiuramdisulfide-like action.] Arzneimittel-Forschung 10: 34-40.

Marchner, H. and Tottmar, O. (1978). A comparative study on the effects of disulfiram,

cyanamide and 1-aminocyclopropanol on the acetaldehyde metabolism in rats. Acta Pharmacologica et Toxicologica 43(3): 219-232.

Markham, J. D. and Hoff, E. C. (1953). Toxic manifestations in the antabuse-alcohol reaction: study of electrocardiographic changes. Journal of the American Medical Association 152: 1597-1600.

Mayer, J. H., Herlocher, J. E. and Parisian, J. (1971). Esophageal rupture after mushroom-alcohol ingestion. [Letter]. New England Journal of Medicine 285: 1323.

Reynolds, W. A. and Lowe, F. E. (1965). Mushrooms and a toxic reaction to alcohol: report of four cases. New England Journal of Medicine 272: 630-631.

Rumack, B. H. (1994). Symptomatic diagnosis and treatment of mushroom poisoning: 149-163. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Tottmar, O. and Lindberg, P. (1977). Effects on rat liver acetaldehyde dehydrogenases in vitro and in vivo by coprine, the disulfiram-like constituent of Coprinus atramentarius. Acta Pharmacologica et Toxicologica 40(4): 476-481.

Wier, J. K. and Tyler, V. E., Jr. (1960). An investigation of Coprinus atramentarius for the presence of disulfiram. Journal of the American Pharmaceutical Association 49(7): 426-429.

Gastrointestinal irritant poisoning

SUMMARY

Main toxins: dependant on the fungus involved. In many cases the actual toxins are unknown.
Main risks: gastroenteritis leading to dehydration and, rarely, shock.

SUMMARY OF CLINICAL FEATURES OF GASTROINTESTINAL IRRITANT POISONING

Onset of symptoms: 15 minutes to 2 hours post ingestion.

- Nausea
- Vomiting
- Diarrhoea
- Abdominal pain
- Anxiety
- Headache
- Cold clammy skin

In cases with severe diarrhoea:

- Features secondary to dehydration

(Adapted from: Rumack, 1994; Benjamin, 1995)

Author: Sarah McCrea

TOXICITY

Gastrointestinal irritation is caused by a large, heterogenous group of fungi that contain a variety of toxins. The toxins are generally excreted rapidly so intoxications last a few days at most. In many instances the exact cause of toxicity is unknown except that the toxins cause irritation of the gastric and intestinal mucosae. Many of these fungi are known as 'partials', i.e. they only cause poisoning if they are consumed when inadequately cooked or when raw. Some 'partials' contain heat labile toxins, such as haemolysins, which are destroyed during the cooking process. Some 'partials' can be consumed by some people with impunity yet cause gastrointestinal upset in others. Finally, there are species which cause gastrointestinal irritation whether they are consumed raw or cooked. Some members of this group of fungi contain very small amounts of toxins that cause serious effects when eaten in quantity (e.g. muscarine) from other more toxic species. The presence of minute levels of these toxins may or may not have a function in the complications recorded with species that in general cause only gastrointestinal irritation.

CLINICAL EFFECTS

Because of the range of fungi included, there can be considerable variation in the time of onset, severity and combination of symptoms that occur.

The onset of symptoms is usually between 15 minutes and 2 hours, though they may be delayed for up to 4 hours post-ingestion.

Symptoms include: nausea; vomiting; diarrhoea which may be watery; and abdominal colicky pains. These may be accompanied by cold clammy skin, headache, anxiety, tachycardia. Other symptoms can be related to loss of fluids and dehydration, and include electrolyte imbalance, haemodynamic disturbances, and muscle cramps.

Symptoms usually resolve after 12 to 24 hours, but some may continue for a number of days. Unless there has been severe dehydration, few cases require hospitalisation and most symptoms although initially severe are usually transient.

In addition to causing non-specific gastrointestinal irritation, a few species can also cause further complications such as haemolysis, or a mild form of one of the other seven syndromes.

TREATMENT

Medical treatment:
Gastric decontamination is not required. Management is symptomatic and supportive. Rehydration with oral or intravenous fluids may be required, and an anti-emetic administered if vomiting is persistent. If vomiting and/or diarrhoea is severe and persistent then monitor urea and electrolytes and correct if necessary.

If serious or unexplained symptoms occur medical professionals should contact the National Poisons Information Service.

Diagnosis:
Not all symptoms seen after ingesting mushrooms are due to mushroom poisoning. Differential diagnosis includes food poisoning, excessive ingestion of edible fungi, idiosyncratic reactions, and other coincident illnesses.

General Emergency Aid:
Poisonous Fungi... is not intended to be used by the public to diagnose or treat suspected fungus poisoning. The following advice is a GENERAL GUIDE to assist the public in the first steps of managing a suspected poisoning. It has not been tailored for the particular fungus. Medical attention should be sought if poisoning is suspected.

If you suspect possible poisoning from EATING a fungus:

* DO NOT try to make the person sick.

* A single glass of milk may be helpful, but if the person is unconscious or fitting do not give anything by mouth.

* IMMEDIATELY take the person to a doctor or hospital Accident and Emergency or Casualty Department.

* Note the NAME of the fungus if you think you have identified it, and TAKE a good specimen of the fungus with you, i.e. a whole fungus including the base of the stem.

* Note TIME of eating and the onset of any symptoms, which may appear some time later.

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Gyromitrin poisoning

SUMMARY

Main toxins: Gyromitrins (monomethylhydrazine produced by hydrolysis).
Target organs: Gastro-intestinal tract; liver; central nervous system.
Main risks: Gastrointestinal symptoms and rarely, hepatic or renal failure.

SUMMARY OF CLINICAL FEATURES OF GYROMITRIN POISONING

Two phases:

1. GASTROINTESTINAL PHASE: onset 2 to 24 hours after ingestion.
- Feeling of fullness and bloating
- Lower abdominal pain
- Vomiting
- Diarrhoea
- Dizziness
- Lethargy
- Severe headache
- Pyrexia

2. HEPATORENAL PHASE: onset 36 to 48 hours after ingestion.
- Hepatotoxicity and jaundice
- Methaemoglobinaemia
- Tremor and muscle fasciculations
- Haemolysis
- Renal failure
- Convulsions and delirium
- Coma
- Respiratory arrest

- The majority of patients experience only gastrointestinal effects and recover within 2 to 6 days.
- Fatalities are rare.

(Adapted from: Lincoff and Mitchel, 1977; Trestrail, 1994a; Rumack, 1994; Benjamin, 1995)

FUNGI THAT MAY CAUSE THIS SYNDROME:

Disciotis venosa
Gyromitra esculenta
Helvella spp.
Helvella acetabulum
Helvella leucomelaena
Peziza spp.

Author: Frances Northall

TOXICITY

Gyromitrin (acetaldehyde N-methyl-N-formylhydrazone) was first characterised in 1968 (List and

Luft, 1967 cited in Chilton, 1994). Smaller amounts of eight homologous compounds, together referred to as gyromitrins, were found later (Pyysalo, 1975 cited in Chilton, 1994). Gyromitrins are unstable, heat-sensitive, water soluble, volatile compounds which are hydrolysed to toxic hydrazines, mainly monomethylhydrazine (MMH) which has been used commercially as rocket fuel.

Toxicity of these fungi can be reduced by boiling and draining or by drying. Boiling in a large volume of water for 10 minutes in an uncovered pan has been shown to remove 99.5% of the hydrazines by extraction into the water and volatilisation (Pyysalo, 1976), whilst drying alone removed 99-100% of the hydrazines (Pyysalo, 1976). Boiling twice or drying until crisp is recomended to fully remove the toxins; boiling is the traditional mode of preparation, but such precautions have not always prevented toxicity (Chilton, 1994). Drying at room temperature for two to six months resulted in the lowest concentration of monomethylhydrazine (MMH), the main toxin (Andary et al., 1985).

An estimated lethal dose of gyromitrin in adults is 20-50 mg/kg body weight and 10-30 mg/kg body weight in children, corresponding to approximately 0.4-1 kg and 0.2-0.6 kg of fresh mushroom, respectively (Schmidlin-Mészáros, 1974 cited in Michelot and Toth, 1991). The concentration of MMH in fresh *Gyromitra esculenta* is estimated as between 50 to 300 mg per kg (Michelot and Toth, 1991).

Severity of gyromitrin poisoning is inconsistent, producing a large range of symptom severity in different individuals. There are reports of trouble-free consumption of untreated fungi, and also of individuals who have eaten the same fungi for years before developing symptoms (Lincoff and Mitchel, 1977; Chilton, 1994; Benjamin, 1995). There is some evidence of toxin accumulation if the fungi are eaten in consecutive meals (Coulet and Guillot, 1982).

Several hypotheses have been offered to explain these inconsistencies:

A narrow margin between a non toxic and a toxic dose, which has been demonstrated in monkeys (Back and Pinkerton, 1967)

Seasonal and geographical variations in gyromitrin content of fungi and differing concentrations within the parts of a single fruiting body (Andary et al., 1985)

Inter-individual variation in the ability to acetylate hydrazine compounds, hence toxic effects may vary between 'slow acetylators' and 'fast acetylators' since MMH is detoxified by acetylation (Evans, 1968).

Enzyme systems may become activated by repeated ingestions of gyromitrin so that consecutive meals can become increasingly toxic (Coulet and Guillot, 1982).

Variations in toxicity are probably due to a combination of these factors.

In the stomach, gyromitrins are rapidly hydrolysed to N-methyl-N-formylhydrazine (MFH), some of which is then hydrolysed more slowly to the major toxin monomethylhydrazine (MMH). A proportion of MFH is de-toxified by acetylation. MMH and remaining un-hydrolysed MFH are oxidised in the liver to unstable diazenes which decompose to either free methyl radicals or diazonium salts (Michelot and Toth, 1991).

The mechanism of toxicity is not entirely clear. Monomethyl hydrazine (MMH) can bind to

pyridoxine (vitamin B6) which is a co-factor in various enzyme systems and in amino acid metabolism. This may have various consequences such as inhibition of the enzymes glutamic acid decarboxylase and 5HT decarboxylase with consequent reduction in levels of gamma-hydroxybutyric acid (GABA) and serotonin (5-hydroxytryptamine) respectively, factors which may account for the neurotoxic effects.

The free methyl radicals and diazonium salts can bind to haeme or flavin groups, or protective molecules such as glutathione, and the resulting loss of biological activity of these systems can eventually lead to liver damage (Michelot and Toth, 1991).

Hydrazines are thought to be teratogenic in rats (von Kreybig et al., 1970 cited in Chilton, 1994) and gyromitrin has been listed as a naturally occurring carcinogen (Anon., 1983).

CLINICAL EFFECTS

Ingestion:
There is typically a latent period of 2 to 24 hours (usually 5 to 15 hours) before clinical effects are seen and these can range from a mild gastrointestinal disorder to death in the most serious cases (Bresinsky and Besl, 1990). Severity of poisoning is not consistent between individuals (Michelot and Toth, 1991).

Effects are sudden in onset with a feeling of bloating, nausea, vomiting and abdominal pain, with severe, watery or bloody diarrhoea which may lead to dehydration. Other symptoms include weakness, lethargy, pyrexia and severe headache.

In most cases the effects are limited to gastrointestinal symptoms and recovery is complete within 2 to 6 days (Lampe, 1979).

In more severe cases further symptoms are seen, but may be preceeded by a second latent period.

Liver toxicity with jaundice and hepatosplenomegaly occurs by about 36 to 48 hours post ingestion. Hepatic damage is mainly a fatty degeneration but may occasionally progress to necrosis. Haemolysis develops rarely but is more likely in glucose-6-phosphate dehydrogenase deficient individuals. Renal failure is very rare and is probably secondary to haemolysis and/or dehydration although it may represent a direct effect of the toxins. Methaemoglobinaemia, characterised by cyanosis unresponsive to oxygen, has been documented.

Neurological signs which indicate severe, potentially terminal, poisoning include: dilated pupils, tremor, muscle fasciculations, delirium, convulsions, coma and respiratory arrest. These effects may be a consequence of hepatic encephalopathy or renal failure but often develop earlier than would be expected from such causes, hence may be a direct toxic effect.

Inhalation:
Gyromitrin and monomethylhydrazine are volatile and can be inhaled during cooking or commercial drying leading to systemic toxicity.

There may be a latent period of 2 to 8 hours followed by headache and vomiting. Inhalation of monomethylhydrazine can result in irritation of the nose and eyes, and salivation (Shaffer and Wands, 1973).

Dermal:
Gyromitrin can be absorbed through the skin. The clinical significance of this mode of exposure is unclear (Benjamin, 1995) and toxicity is unlikely to occur.

CASE REPORTS

A 53-year-old woman picked some mushrooms which she ate raw. The next day she developed persistent vomiting and diarrhoea. She presented to hospital and was treated with plasma infusions and corticosteroids. Vomiting and diarrhoea persisted for three days. She was noted to be hypotensive, jaundiced and anuric and was transferred to intensive care. Her liver was enlarged and she developed a right-sided hemiplegia. Bilirubin and liver function tests were elevated. Death occurred 3 days post ingestion. At post-mortem there was marked cerebral oedema, mild pulmonary oedema, hepatic necrosis and renal damage. The mushrooms were later identified as *Gyromitra esculenta* (Giusti and Carnevale, 1974).

Between April and July 1991 the Blodgett Regional Poisons Center, Michigan, collected data on 65 cases of ingestion of 'Beefsteak' (*Gyromitra*) mushrooms resulting in symptoms. Effects ranged from gastric upset to liver abnormalities. 71% experienced vomiting, 35% diarrhoea, 8% jaundice, 3% dizziness. 26% required hospital admission (Trestrail, 1994a).

TREATMENT

Medical treatment:
Ingestion:
Gastric decontamination should be considered. Patients should be observed until at least 24 hours post ingestion. Management is symptomatic and supportive. Rehydration with oral or intravenous fluids may be required, and an anti-emetic administered if vomiting is persistent. Monitor electrolytes, renal and liver function, blood sugar and in severe cases free haemoglobin (especially if glucose-6-phosphate dehydrogenase deficient) and methaemoglobin levels. Pyridoxine may be considered as a specific treatment for convulsions or coma.

Inhalation:
Management is symptomatic and supportive. Patients should be observed until at least eight hours post exposure.

Dermal:
Wash with soap and water and treat symptomatically.

For medical professionals further information or advice is available from the National Poisons Information Service. If patients are severely poisoned early discussion with the National Poisons Information Service is recommended.

Diagnosis:
Not all symptoms seen after ingesting mushrooms are due to mushroom poisoning. Differential diagnosis includes food poisoning, excessive ingestion of edible fungi, idiosyncratic reactions and other coincident illnesses.

General Emergency Aid:
Poisonous Fungi... is not intended to be used by the public to diagnose or treat suspected fungus poisoning. The following advice is a GENERAL GUIDE to assist the public in the first steps of managing a suspected poisoning. It has not been tailored for the particular fungus.

Medical attention should be sought if poisoning is suspected.

If you suspect possible poisoning from EATING a fungus:

* DO NOT try to make the person sick.

* A single glass of milk may be helpful, but if the person is unconscious or fitting do not give anything by mouth.

* IMMEDIATELY take the person to a doctor or hospital Accident and Emergency or Casualty Department.

* Note the NAME of the fungus if you think you have identified it, and TAKE a good specimen of the fungus with you, i.e. a whole fungus including the base of the stem.

* Note TIME of eating and the onset of any symptoms, which may appear some time later.

REFERENCES

Albin, R. L., Albers, J. W., Greenberg, H. S., Townsend, J. B., Lynn, R. B., Burke, J. M., Jr. and Alessi, A. G. (1987). Acute sensory neuropathy-neuronopathy from pyridoxine overdose. Neurology 37: 1729-1732.

Andary, C., Privat, G. and Bourrier, M.-J. (1985). Variations of monomethylhydrazine content in Gyromitra esculenta. Mycologia 77: 259-264.

Anon. (1983). Gyromitrin (acetaldehyde formylmethylhydrazone): 163-170. In: Evaluation of the Carcinogenic Risk of Chemicals to Humans: Some Food Additives, Feed Additives and Naturally Occurring Substances. International Agency for Research on Cancer Monograph No. 31.

Back, K. C. and Pinkerton, M. K. (1967). Toxicology and pathology of repeated doses of monomethylhydrazine in monkeys. Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, Report No. AMRL-TR-66-199.

Benjamin, D. R. (1995). Mushrooms: Poisons and Panaceas. W. H. Freeman and Company: New York.

Bresinsky, A. and Besl, H. (1990). A Colour Atlas of Poisonous Fungi: A Handbook for Pharmacists, Doctors, and Biologists. Wolfe Publishing Ltd.: London.

Chilton, W. S. (1994). The chemistry and mode of action of mushroom toxins: 165-231. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Coulet, M. and Guillot, J. (1982). Poisoning by Gyromitra: a possible mechanism. Medical Hypotheses 8: 325-334.

Evans, D. A. P. (1968). Genetic variations in the acetylation of isoniazid and other drugs. Annals of the New York Academy of Science 151: 723-733.

Giusti, G. V. and Carnevale, A. (1974). A case of fatal poisoning by Gyromitra esculenta.

Archives of Toxicology 33: 49-54.

Harati, Y. and Niakan, E. (1986). Hydrazine toxicity, pyridoxine therapy, and peripheral neuropathy. [Letter]. Annals of Internal Medicine 104: 728-729.

Kirklin, J. K., Watson, M., Bondoc, C. C. and Burke, J. F. (1976). Treatment of hydrazine-induced coma with pyridoxine. New England Journal of Medicine 294: 938-939.

Lampe, K. F. (1979). Toxic fungi. Annual Review of Pharmacology and Toxicology 19: 85-104.

Lincoff, G. and Mitchel, D. H. (1977). Toxic and Hallucinogenic Mushroom Poisoning: A Handbook for Physicians and Mushroom Hunters. Van Nostrand Reinhold Company: New York.

List, P. H. and Luft, P. (1967). Gyromitrin, das Gift der Fruehjahrslorchel, Gyromitra (Helvella) esculenta Fr. [Gyromitrin, the toxin of the spring lorchel, Gyromitra (Helvella) esculenta.] Tetrahedron Letters 20: 1893-1894.

Michelot, D. and Toth, B. (1991). Poisoning by Gyromitra esculenta - a review. Journal of Applied Toxicology 11: 235-243.

Pyysalo, H. (1975). Some new toxic compounds in false morels, Gyromitra esculenta. Naturwissenschaften 62: 395.

Pyysalo, H. (1976). Tests for gyromitrin, a poisonous compound in false morel Gyromitra esculenta. Zeitschrift für Lebensmittel-Untersuchung und -Forschung 160: 325-330.

Rumack, B. H. (1994). Symptomatic diagnosis and treatment of mushroom poisoning: 149-163. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Rumack, B. H., Rider, P. K. and Gelman, C. R. (eds) (1998). POISINDEX® System. Micromedex Inc.: Englewood, Colorado (Edition expires 30/06/98)

Schmidlin-Mészáros, J. (1974). Gyromitrin in Trockenlorcheln (Gyromitra esculenta sicc.). [Gyromitrin in dried morels (Gyromitra esculenta sicc.).] Mitteilungen aus dem Gebiet der Lebensmitteluntersuchung und -Hygiene 65: 453-465.

Shaffer, C. B. and Wands, R. C. (1973). Guides for short-term exposure limits to hydrazines. Proceedings of the Fourth Annual Conference on Environmental Toxicology, 16-18 October 1973. Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, Report No. AMRL-TR-73-125: 235-242.

Trestrail, J. H., III (1994a). Monomethylhydrazine-containing mushrooms: 279-287. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

von Kreybig, T., Preussmann, R. and von Kreybig, I. (1970). Chemische Konstitution und teratogene Wirkung bei der Ratte. 3. N-Alkylcarbonhydrazide, noeitere Hydrazinderivate. [Chemical constitution and teratogenic effects in rats. 3. N-alkylcarbonhydrazides and other hydrazine derivatives.] Arzneimittel-Forschung 20(3): 363-367.

von Wright, A., Niskanen, A. and Pyysalo, H. (1981). Amelioration of toxic effects of ethylidene gyromitrin (false morel poison) with pyridoxine chloride. Journal of Food Safety 3: 199-203.

Wason, S., Lacouture, P. G. and Lovejoy, F. H., Jr. (1981). Single high-dose pyridoxine treatment for isoniazid overdose. Journal of the American Medical Association 246: 1102-1104.

Ibotenic acid poisoning

SUMMARY

Main toxins: Ibotenic acid and muscimol.
Main risks and target organs: Central nervous system effects.

SUMMARY OF CLINICAL FEATURES OF IBOTENIC ACID POISONING

Onset of symptoms: 30 to 120 minutes post ingestion.

- Nausea, vomiting
- Confusion and disorientation resembling alcoholic intoxication
- Ataxia
- Lethargy/hyperactivity cycles
- Visual and perceptual misinterpretations
- Muscle fasciculations/twitching
- Muscle cramps and spasms
- Convulsions (more likely in children)
- Final phase of deep sleep

Recovery within 4 to 14 hours post ingestion, drowsiness may persist for 24 hours.

(Adapted from: Lincoff and Mitchel, 1977; Rumack, 1994; Benjamin, 1995)

FUNGI THAT MAY CAUSE THIS SYNDROME:

Amanita gemmata
Amanita muscaria
Amanita pantherina

Author: Frances Northall

TOXICITY

There is a long history of the use of *Amanita muscaria* in religious rituals and it has been suggested that it may be the oldest pharmacological agent used to induce a trance-like state (Piomelli, 1991). The most often quoted example of abuse is an 18th century account of the natives of Siberia who used the fungi to achieve a state of intoxication. Those unable to afford their own fungi drank the urine of their richer fellows to obtain similar effects (von Strahlenburg, 1730 cited in Benjamin, 1995).

Ibotenic acid (alpha-amino-3-hydroxy-5-isoxazole acetic acid) and muscimol (5-aminomethyl-3-isoxazole) were identified by Bowden et al. (1965). Other isoxazoles, such as muscazone, may be present but appear less pharmacologically active (Ellenhorn and Barceloux, 1988). There may also be minute amounts of other compounds present, such as muscarine (Spoerke and Hall, 1990).

Ibotenic acid is structurally similar to glutamic acid and mimics many of its effects (Johnston et al., 1968; Spoerke and Hall, 1990). Ibotenic acid has the flavour-enhancing properties of monosodium glutamate (a salt of glutamic acid) but is twenty times more potent and leaves an

unusual aftertaste. Ibotenic acid is unstable and on drying it degrades to muscimol. Toxic effects may be retained in dried fungi for 5-7 years (Rumack et al., 1998). Isoxazole compounds are water soluble and are not destroyed by cooking.

A substantial amount of ibotenic acid is excreted unchanged in the urine (Chilton, 1994), usually within 20 to 90 minutes of ingestion (Spoerke and Hall, 1990). Ibotenic acid is converted by decarboxylation to muscimol which is a structural analogue of the inhibitory neurotransmitter gamma-aminobutyric acid (GABA). Conversion mirrors the decarboxylation of glutamic acid to GABA but is more rapid (Chilton, 1994).

Muscimol is a potent inhibitor of spinal neurone activity (Johnston et al., 1968) via an agonist action at GABA receptors (Curtis et al., 1979). Some actions of muscimol have been compared to those of diazepam as both appear to activate GABA receptors and produce similar pharmacological effects (Biggio et al., 1977). Once muscimol binds to the receptors it is not degraded or removed by either glutamate or GABA active uptake systems, resulting in prolonged effects. The precise mechanism of action is not understood, however, and muscimol probably binds to other receptors which have not been characterised (DeFeudis, 1980). Muscimol and its metabolites are excreted in the urine; 30 to 35% of muscimol is excreted unchanged (Benjamin, 1995).

Both ibotenic acid and muscimol cross the blood-brain barrier and the excitatory effect of ibotenic acid and depressant effect of muscimol may explain the fluctuating symptoms (Benjamin, 1995).

CLINICAL EFFECTS

Onset of effects is usually 30-120 minutes post ingestion but may occur within a few minutes or even be delayed for up to 3 hours (Hall and Hall, 1994).

There is usually an initial phase of nausea which varies in intensity and can be accompanied by abdominal pain, vomiting and diarrhoea.

The main central nervous system effects then become apparent. Initially it is similar to alcohol intoxication with incoordination, ataxia, confusion, euphoria, rarely diplopia and dizziness. There may be alternating periods of lethargy and hyperactivity (especially in children). In more severe cases, tremor, muscle fasciculations and cramps, myoclonic jerking and occasionally convulsions (more likely in children). Pupils may be dilated or constricted and may fluctuate between these extremes (Benjamin, 1992).

Confusion may progress to mania or delirium and some patients experience visual and auditory misperceptions resulting in bizarre behaviour. Objects may appear much larger (macropsia) or, more rarely, smaller (micropsia). There may also be subjective changes in perception of physical abilities, usually manifest as an impression of increased strength.

The central nervous system effects usually peak at about 2-3 hours post ingestion and may continue at this intensity for 3 to 4 hours. They wear off gradually within 12 hours leaving a feeling of tiredness which may culminate in a period of deep sleep, usually of 4-8 hours duration. A 'hangover' sensation may persist for 24 hours (Chilton, 1994) and occasionally a residual headache may last for several days (Rumack et al., 1998). There may be amnesia for the whole or part of the experience. There is one report of a mild effect persisting for 6 weeks post ingestion of *Amanita pantherina*, described as 'an inability to grasp and remember minor

details of everyday life' (Bosman et al., 1965).

Cardiac effects are not expected but there is a report of 'rapid cardiac fibrillation' and 'unobtainable' blood pressure after ingestion of *Amanita gemmata* by an adult male who recovered 'with treatment' (Page, 1975 cited in Lincoff and Mitchel, 1977).

Death is rare, less than 1% of cases (Rumack et al., 1998), and is more likely in severely poisoned young children, elderly patients, or those with underlying serious chronic illnesses (Spoerke and Hall, 1990).

CASE REPORTS

A 41-year-old man and two boys aged 9 and 10 ate a mixture of an edible mushroom with *Amanita pantherina*. Within an hour all felt confused and disorientated. Two to three hours later the man was still very confused and both he and the 10-year-old experienced muscle twitching, most pronounced in the arms and legs. They arrived in hospital five hours post ingestion complaining of tingling in the extremities, vertigo, ataxia, confusion and disorientation. All became very tired and kept falling asleep although they were easily roused. Treatment was supportive only and they were discharged ten hours post ingestion but they continued to feel sleepy until the following day (Spoerke et al., 1985).

Nine cases of children admitted to hospital after ingestion of fungi have been reviewed (Benjamin, 1992). Eight cases involved ingestion of *Amanita pantherina* and one involved *Amanita muscaria*. Onset of effects was within 30-180 minutes. The dominant presenting features involved the central nervous system with ataxia, unconsciousness and cyclical symptoms of lethargy, euphoria and hysteria with bizarre behaviour and incoherent babbling. Convulsions or myoclonic twitching were seen in 4 cases. All returned to a normal level of activity within 12 hours of ingestion.

Two adults both aged 35 years lunched on *Amanita pantherina*. Within an hour they became dizzy, weak and nauseated. In hospital the woman became unconscious with 'spasmodic jerkings of her whole body'. Both were hypothermic with dilated pupils and bradycardia. The woman regained consciousness and became violent, dizzy and confused. Both were well the next day despite having been treated with emetics, atropine and castor oil. In the same paper another accidental A. pantherina ingestion by a male adult is mentioned; the effects were 'much the same' but with a fatal outcome attributed to 'a weak heart' (Hotson, 1934).

A famous case involved Count de Vecchia, an attaché to the Italian Legislation in Washington, DC. The Count ate 24 *Amanita muscaria*. He collapsed within half an hour and had convulsions which were so violent that he apparently broke his bed. He then lost consciousness and died one day later (Fischer, 1971 cited in Benjamin, 1995).

In 4 cases of ingestion of *Amanita gemmata* reported in North America, diarrhoea and dizziness were reported in 3 cases and nausea in 2 cases. Other symptoms were abdominal pain, drowsiness, flushing, severe hallucination, hypothermia, muscle spasm, palpitation, salivation, vomiting and weakness (Cochran, 1987).

Six hours after ingesting *Amanita crenulata*, a North American species closely related to *Amanita gemmata*, a 2-year-old girl became irritable and complained of abdominal discomfort. She was admitted to hospital seven hours post ingestion and had a convulsion. The child 'ceased breathing' 25 minutes later and died (Buck, 1969).

TREATMENT

Medical treatment:
Gastric decontamination may be considered. Patients should be observed until at least four hours after ingestion. Management is symptomatic and supportive. Psychological effects may be managed by reassurance and a calm environment. Sedatives should be avoided if possible as animal studies suggest they may cause respiratory depression or arrest.

If serious or unexplained symptoms occur medical professionals should contact the National Poisons Information Service.

Diagnosis:
Not all symptoms seen after ingesting mushrooms are due to mushroom poisoning. Differential diagnosis includes food poisoning, excessive ingestion of edible fungi, idiosyncratic reactions, other coincident illnesses, alcohol intoxication and drug exposure.

General Emergency Aid:
Poisonous Fungi... is not intended to be used by the public to diagnose or treat suspected fungus poisoning. The following advice is a GENERAL GUIDE to assist the public in the first steps of managing a suspected poisoning. It has not been tailored for the particular fungus. Medical attention should be sought if poisoning is suspected.

If you suspect possible poisoning from EATING a fungus:

* DO NOT try to make the person sick.

* A single glass of milk may be helpful, but if the person is unconscious or fitting do not give anything by mouth.

* IMMEDIATELY take the person to a doctor or hospital Accident and Emergency or Casualty Department.

* Note the NAME of the fungus if you think you have identified it, and TAKE a good specimen of the fungus with you, i.e. a whole fungus including the base of the stem.

* Note TIME of eating and the onset of any symptoms, which may appear some time later.

REFERENCES

Benjamin, D. R. (1992). Mushroom poisoning in infants and children: the Amanita pantherina/muscaria group. Clinical Toxicology 30: 13-22.

Benjamin, D. R. (1995). Mushrooms: Poisons and Panaceas. W. H. Freeman and Company: New York.

Biggio, G., Brodie, B. B., Costa, E. and Guidotti, A. (1977). Mechanisms by which diazepam, muscimol, and other drugs change the content of cGMP in cerebellar cortex. Proceedings of the National Academy of Sciences of the United States of America 74: 3592-3596.

Bosman, C. K., Berman, L., Isaacson, M., Wolfowitz, B. and Parkes, J. (1965). Mushroom

poisoning caused by Amanita pantherina: report of 4 cases. South African Medical Journal 39: 983-986.

Bowden, K., Drysdale, A. C. and Mogey, G. A. (1965). Constituents of Amanita muscaria. Nature 206(4991): 1359-1360.

Buck, R. W. (1969). Mycetism. [Letter]. New England Journal of Medicine 280: 1363.

Chilton, W. S. (1994). The chemistry and mode of action of mushroom toxins: 165-231. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Cochran, K. W. (1987). Poisonings due to misidentified mushrooms. McIlvainea 8(1): 27-30.

Curtis, D. R., Lodge, D. and McLennan, H. (1979). The excitation and depression of spinal neurones by ibotenic acid. Journal of Physiology 291: 19-28.

DeFeudis, F. V. (1980). Binding studies with muscimol: relation to synaptic gamma-aminobutyrate receptors. Neuroscience 5: 675-688.

Ellenhorn, M. J. and Barceloux, D. G. (1988). Mushrooms: 1324-1351. In: Ellenhorn, M. J. and Barceloux, D. G. (eds), Medical Toxicology: Diagnosis and Treatment of Human Poisoning. Elsevier: New York.

Fischer, O. E. (1971). Mushroom poisoning. In: Kauffman, C. H. (ed.), The Gilled Mushrooms of Michegan and the Great Lakes Region (Dover reprint). Dover: New York.

Hall, A. H. and Hall, P. K. (1994). Ibotenic acid/muscimol-containing mushrooms: 265-278. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Hotson, J. W. (1934). Mushroom poisoning at Seattle. Mycologia 26: 194-195.

Johnston, G. A. R., Curtis, D. R., Groat, W. C. de and Duggan, A. W. (1968). Central actions of ibotenic acid and muscimol. Biochemical Pharmacology 17: 2488-2489.

Lincoff, G. and Mitchel, D. H. (1977). Toxic and Hallucinogenic Mushroom Poisoning: A Handbook for Physicians and Mushroom Hunters. Van Nostrand Reinhold Company: New York.

Page, L. (1975). Poisoning due to Amanita gemmata. Boston Mycological Club Bulletin No. 3.

Piomelli, D. (1991). One route to religious ecstasy. [Letter]. Nature 349: 362.

Rumack, B. H. (1994). Symptomatic diagnosis and treatment of mushroom poisoning: 149-163. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Rumack, B. H., Rider, P. K. and Gelman, C. R. (eds) (1998). POISINDEX® System. Micromedex Inc.: Englewood, Colorado (Edition expires 30/06/98)

Spoerke, D. G. and Hall, A. H. (1990). Plants and mushrooms of abuse. Emergency Medicine

Clinics of North America 8: 579-593.

Spoerke, D. G., Rumack, B. and Spoerke, S. E. (1985). Rocky Mountain high. [Letter]. Annals of Emergency Medicine 14: 828-829.

von Strahlenburg, F. J. (1730). An historic-geographic description of the North and Eastern parts of Europe and Asia. Stockholm.

Muscarine poisoning

SUMMARY

Main toxins: Muscarine.
Main risks and target organs: Autonomic nervous system.

SUMMARY OF CLINICAL FEATURES OF MUSCARINE POISONING

The primary symptoms caused by muscarine poisoning are excessive perspiration, salivation and lacrimation, known as PSL syndrome. The combination of these three symptoms together is not shown by any other fungal toxin.

Onset of symptoms: usually within 30 (maximum 120) minutes after ingestion.

- Perspiration
- Salivation
- Lacrimation
- Constricted pupils
- Blurred vision
- Bradycardia
- Flushing
- Increased peristalsis and colicky abdominal pain
- Watery diarrhoea
- Urinary urgency

(Adapted from: Rumack, 1994; Benjamin, 1995)

FUNGI THAT MAY CAUSE THIS SYNDROME:

Clitocybe spp.
Inocybe spp.
Lepista nebularis
Mycena pura
Omphalotus olearius

Author: Nicola Scott

TOXICITY

Muscarine is an alkaloid with potent parasympathomimetic activity. It is structurally similar to acetylcholine and acts as a partial agonist for may muscarinic responses. Acetylcholinesterase usually removes acetylcholine from synapses by cleavage to choline and acetic acid. As muscarine is not metabolised by acetylcholinesterase, synaptic receptors are persistently stimulated. Primary receptors affected are postganglionic (muscarinic) parasympathetic receptors of smooth muscle and various glands such as tear, sweat and salivary (Young, 1994). The receptors on the neuromuscular junction (nicotinic receptors) are not affected (Benjamin, 1995).

The effects of muscarine are dose dependent. Muscarine is water soluble and is not destroyed by cooking or digestion. It is absorbed by the gut and distributed through the body. It does not

cross the blood brain barrier, however, and has no direct effect on the central nervous system.

CLINICAL EFFECTS

Onset of symptoms is usually between 15 and 30 minutes of ingestion, but may be delayed for up to 120 minutes post ingestion (Benjamin, 1995; Young, 1994).

Primary effects are profuse perspiration usually accompanied by salivation and lacrimation - the PSL syndrome (Rumack and Salzman, 1978).

Gastrointestinal effects may include, nausea, vomiting, colicky abdominal pain and watery diarrhoea (Young, 1994). The pupils may be constricted and vision blurred.

There may be vasodilation, bradycardia and hypotension. Significant hypotension is likely in severe cases only. Symptoms possibly related to these cardiovascular effects are headaches, dizziness and muscular tremors (Young, 1994; Benjamin, 1995).

Occasionally, partial bronchoconstriction makes breathing difficult and is accompanied by bronchial secretions, nasal congestion and asthma-type wheezing. Bladder contractions can occur resulting in a painful urge to urinate (Benjamin, 1995).

There are no significant central nervous system effects. In cases of severe poisoning, cardio-respiratory failure may occur with the risk of subsequent cerebral anoxia and coma (Benjamin, 1995).

In cases of mild muscarinic poisoning, the symptoms are usually self limiting and resolve within 2 hours (Eisen, 1988) although they may persist for up to 24 hours in severe cases (Rumack and Salzman, 1978).

Although some symptoms of muscarine toxicity could be confused with those caused by anxiety; muscarine causes bradycardia, hypotension and constricted pupils (as opposed to dilated pupils and tachycardia in anxiety).

CASE REPORTS

A 25 year old woman ingested fried fungi for breakfast. Approximately one hour later she developed blurred vision, salivation, sweating and lacrimation. Her pulse was 56 beats per minute and blood pressure was 90/50 mmHg. Atropine was given and the patient recovered uneventfully. The fungi were identified as *Inocybe fastigiata* (Wilson, 1947).

Sweating and vomiting were reported in one case of ingestion of *Clitocybe dealbata* in Washington (Trestrail, 1998).

TREATMENT

Medical treatment:
Gastric decontamination may be considered. Patients should be observed until at least 2 hours after ingestion. Management is symptomatic and supportive, monitoring fluids and electrolytes. In severe cases atropine may be required (Stallard and Edes, 1989; Young, 1994).

For medical professionals further information or advice is available from the National Poisons

Information Service. If patients are severely poisoned early discussion with the National Poisons Information Service is recommended.

Diagnosis:
Not all symptoms seen after ingesting mushrooms are due to mushroom poisoning. Fungal poisoning should be considered when other causes have been ruled out. Differential diagnosis includes food poisoning, excessive ingestion of edible fungi, idiosyncratic reactions, other coincident illnesses, and drug exposure.

General Emergency Aid:
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REFERENCES

Benjamin, D. R. (1995). Mushrooms: Poisons and Panaceas. W. H. Freeman and Company: New York.

Eisen, T. F. (1988). Mushrooms, part II. Ibotenic acid-muscimol - group II. Clinical Toxicology Review 10(10): 1-2.

Lampe, K. F. (1977). Mushroom poisoning in children updated. Paediatrician 6: 289-299.

Rumack, B. H. (1994). Symptomatic diagnosis and treatment of mushroom poisoning: 149-163. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Rumack, B. H. and Salzman, E. (eds) (1978). Mushroom Poisoning: Diagnosis and Treatment. CRC Press: West Palm Beach, Florida.

Stallard, D. and Edes, T. E. (1989). Muscarinic poisoning from medications and mushrooms. A puzzling symptom complex. Postgraduate Medicine 85: 341-345.

Trestrail, J. H., III (1998). 1997 annual report of the North American Mycological Association's

mushroom poisoning case registry. McIlvainea 13(2): 86-91.

Wilson, D. (1947). Poisoning by Inocybe fastigiata. British Medical Journal 2: 297.

Young, A. (1994). Muscarine-containing mushrooms: 289-301. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Orellanine poisoning

SUMMARY

Main toxins: Orellanine.
Target organs: Kidneys.
Main risk: Renal failure.

SUMMARY OF CLINICAL FEATURES OF ORELLANINE POISONING

Three phases of variable onset and duration, as follows:

1. LATENT PHASE: at least 36 hours but may last up to 17 days post ingestion. The shorter the latent phase, the more severe the toxicity.

2. 'PRE-RENAL' PHASE: may commence from 36 hours or be delayed up to 17 days post ingestion. Lasts for 7 days on average and consists mainly of gastrointestinal and neurological symptoms.
- Anorexia
- Nausea and vomiting
- Diarrhoea or constipation
- Headache
- Chills / shivering / sweats (without pyrexia)
- Severe thirst
- Polydipsia and polyuria
- Paraesthesiae
- Tinnitus
- Myalgia

3. RENAL PHASE: severe cases only - usually occurs 7 to 21 days post ingestion; seen in 50-70% of all cases.
- Loin pain
- Oliguria or anuria
- Interstitial nephritis
- Proteinuria, haematuria and leucocyturia
- Chronic renal failure ultimately results in 10-15% of cases

(Adapted from: Bouget et al., 1990; Michelot and Tebbett, 1990; Jaeger, 1994; Benjamin, 1995; Horn et al., 1997)

FUNGI THAT MAY CAUSE THIS SYNDROME:

Cortinarius subgenus *Leprocybe*
Cortinarius splendens

Author: Frances Northall

TOXICITY

Orellanine (3,3',4,4'-tetrahydroxy-2,2'bipyridyl) is insoluble in water and the toxicity is not destroyed by cooking, freezing or drying (Jaeger, 1994); it has been found in dried fungi over 60

years old (Rapior et al., 1988). The pure compound readily decomposes at temperatures greater than 150°C (celsius) and is deoxidised in ultra-violet light, first to orellinine and then to the non-toxic orelline (Schumacher and Høiland, 1983). Orellanine can be detected in plasma by a complicated laboratory process involving fluorimetry, thin-layer chromatography and photodecomposition (Andary et al., 1989).

Cyclic decapeptides, the cortinarins, have also been isolated and characterised (Tebbett and Caddy, 1984 cited in Michelot and Tebbett, 1990) and their toxicity demonstrated by injection in animals. Later studies, however, have cast doubt on the existence of these toxins (Prast et al., 1988; Laatsch and Matthies, 1991).

Orellanine is generally accepted as the major toxin, though animal experiments (Nieminen, 1976 cited in Michelot and Tebbett, 1990) suggest that hepatic metabolism may be necessary for toxicity. The bipyridyl structure is similar to that of the herbicide paraquat leading to speculation that similar mechanisms of toxicity may be involved (Schumacher and Høiland, 1983), though differing electrochemical properties suggest otherwise (Richard et al., 1988). Ultrastructural changes observed in the nuclei of affected cells are compatible with disruption of RNA production and consequent decline in protein synthesis, resulting in cell damage and death (Lahtiperä et al., 1986).

Renal biopsies from affected patients (Short et al., 1980; Holmdahl et al., 1984; Bouget et al., 1990) have shown interstitial nephritis (particularly affecting the proximal tubules), degenerative lesions, interstitial oedema and inflammatory fibrosis. Progression of tubular lesions has occurred up to 3 months post ingestion (Bouget et al., 1990), and evidence of tubular recovery but worsening interstitial fibrosis has been found 6 months post ingestion (Andary et al., 1989; Hölzl et al., 1997). Studies in rats have demonstrated similar renal effects, with interstitial infiltrates in the outer medulla and necrotic changes in the cortex (Nieminen et al., 1975; Lahtiperä et al., 1986; Prast and Pfaller, 1988). The earliest effects, including dilatation of the endoplasmic reticulum, swollen mitochondria and increased lysosomes have been seen as early as two days post ingestion, with necrosis of the proximal tubules by 5 days post ingestion. Tubular regeneration may start by 10 days post ingestion.

Individual response to similar amounts of orellanine is highly variable. This has not been explained and does not appear to correspond to genetic differences in hepatic metabolism (Bouget et al., 1990). In animal experiments, (Nieminen and Pyy, 1976) 20-30% of rats seemed resistant to the effects of orellanine although those affected showed a dose-dependent severity.

CLINICAL EFFECTS

A latent period of 36 hours to 17 days occurs before the onset of clinical effects which are mainly gastrointestinal. A further delay may occur before the development of renal toxicity. The duration of the latent period before onset of symptoms is considered prognostic (Grzymala, 1965; Bouget et al., 1990). A latent period of more than 6 days suggests long term effects are unlikely whereas a rapid onset of symptoms within 2 to 4 days indicates damage may be irreversible, and long term dialysis or renal transplantation may be required.

Initial symptoms are nausea, vomiting, abdominal cramps and diarrhoea or constipation. A burning sensation in the mouth with intense thirst is a common effect, leading to polydipsia and polyuria. Anorexia and persistent headache are likely. There may be a sensation of cold with chills, shivering and sweating, but without a fever. Other recorded symptoms include tinnitus, lethargy, myalgia, fatigue, paraesthesiae of the extremities and mild hypertension. Effects

typically persist for approximately 7 days, with mild cases experiencing only slight malaise. Thirst is the most frequently reported symptom (98% of cases). 50-70% of cases develop some renal involvement, and 10-15% are likely to develop chronic renal failure (Grzymala, 1965; Bouget et al., 1990; Michelot and Tebbett, 1990; Benjamin, 1995; Horn et al., 1997). There is an isolated report of a death secondary to rhabdomyolysis and malignant hyperthermia after a fungi meal; effects were thought to be due to orellanine as a metabolite was found in the urine and there was no other relevant history (Bedry et al., 1993).

The onset of renal effects may be seen as soon as 4 days post ingestion, but usually occurs between 7 to 21 days, with interstitial nephritis of varying severity and leucocyturia, proteinuria and haematuria. Initially oliguria, then anuria followed by acute renal failure. Renal damage may be reversible with renal function recovering slowly over three to four weeks in mild cases, or several months in more severe poisoning (Grzymala, 1965; Bouget et al., 1990; Michelot and Tebbett, 1990). An initial recovery of renal function may not be sustained (Holmdahl and Blohmé, 1992), but since the increase in availability of renal dialysis and renal transplants fatalities have become rare. During the apparent recovery period, nausea, night sweats, headaches and anorexia may persist for weeks or months (Horn et al., 1997).

CASE REPORTS

26 French soldiers on a survival exercise ate equal portions of soup made from *Cortinarius orellanus*. Consequent effects ranged from minor to severe. Onset of symptoms was 2 to 9 days post ingestion and included gastrointestinal upsets, thirst, headaches and weakness. The soldiers did not attend hospital until 10 to 12 days post ingestion.

On presentation they were broadly divisible into two groups:

Twelve patients presented with acute tubulointerstitial nephritis and acute renal failure. Other reported symptoms included lumbar pain, paraesthesiae in the extremities and a strange taste in the mouth. Eight of these required haemodialysis on admission, four suffered chronic renal failure for several months. Nine patients with renal inflamatory lesions were given corticosteroids (methylprednisolone 10 mg/kg/day intravenously for three days, followed by 1 mg/kg/day for three weeks) which did not alter the course of the renal failure but this was thought to be because of the delay in presentation. Eight of the twelve recovered rapidly, a degree of renal failure persisted in two patients but did not require dialysis; one had a sucessful renal transplant after 10 months and the twelfth remained under chronic haemodialysis.

Of the remaining fourteen patients, twelve presented with leukocyturia, but renal function was normal and remained so. Leukocyturia was still present after one month in ten patients. No specific treatment was required in this group.

The wide range of individual response to the same quantity of mushroom soup could not be explained and did not correspond to genetic differences in hepatic metabolism (Bouget et al., 1990).

Three young adults consumed wild mushrooms, *Cortinarius speciosissimus*, whilst on holiday in Scotland. All developed gastrointestinal effects after 36-48 hours, followed by other effects including muscle pain, night sweats, headaches severe thirst and oliguria. The two men aged 30 and 31 years presented to hospital 10 days post ingestion, drowsy and oliguric with severe interstitial nephritis. They required haemodialysis and their renal function did not improve; both received renal transplants 9 months later. The third member of the party was a 25-year-old woman who suffered similar effects initially and noticed a low urine output for 7 days followed by polyuria for 3 days. She presented to hospital 11 days post ingestion. Renal function tests were normal and she did not require admission. Anorexia, nausea and night sweats continued for several weeks (Short et al., 1980).

TREATMENT

Medical treatment:
Gastric decontamination should be considered. Because the onset of effects can be considerably delayed, asymptomatic patients should be advised to seek urgent medical attention if they experience any relevant effects within the next 17 days. Management is symptomatic and supportive, monitor renal function.

For medical professionals further information or advice is available from the National Poisons Information Service.

Diagnosis:
Not all symptoms seen after ingesting mushrooms are due to poisoning. Fungal poisoning should be considered when other causes have been excluded. Differential diagnoses include food poisoning, excessive ingestion of edible fungi, idiosyncratic reactions, other coincident illnesses, alcohol intoxication, and drug exposure.

General Emergency Aid:
Poisonous Fungi... is not intended to be used by the public to diagnose or treat suspected fungus poisoning. The following advice is a GENERAL GUIDE to assist the public in the first steps of managing a suspected poisoning. It has not been tailored for the particular fungus. Medical attention should be sought if poisoning is suspected.

If you suspect possible poisoning from EATING a fungus:

* DO NOT try to make the person sick.

* A single glass of milk may be helpful, but if the person is unconscious or fitting do not give anything by mouth.

* IMMEDIATELY take the person to a doctor or hospital Accident and Emergency or Casualty Department.

* Note the NAME of the fungus if you think you have identified it, and TAKE a good specimen of the fungus with you, i.e. a whole fungus including the base of the stem.

* Note TIME of eating and the onset of any symptoms, which may appear some time later.

REFERENCES

Andary, C., Rapior, S., Delpech, N. and Huchard, G. (1989). Laboratory confirmation of Cortinarius poisoning. [Letter]. Lancet 1: 213.

Bedry, R., Pillet, O., Sentilhes, A., Desusclade, S., Richard, J. M., Creppy, E. E. and Favarel-Garrigues, J. C. (1993). Lethal rhabdomyolysis contemporaneous with a Cortinarius intoxication. [Abstract]. European Association of Poison Centres and Clinical Toxicologists Scientific Meeting, Metabolic Complications of Poisoning, Birmingham, 26-28 May, 1993.

Benjamin, D. R. (1995). Mushrooms: Poisons and Panaceas. W. H. Freeman and Company: New York.

Bouget, J., Bousser, J., Pats, B., Ramee, M.-P., Chevet, D., Rifle, G., Giudicelli, C.-P. and Thomas, R. (1990). Acute renal failure following collective intoxication by Cortinarius orellanus. Intensive Care Medicine 16: 506-510.

Grzymala, S. (1965). Etude clinique des intoxications par les champignons du genre Cortinarius orellanus Fr. [Clinical picture of poisoning with Cortinarius orellanus Fr.] Bulletin de Medecine Legale et de Toxicologie Medicale 8: 60-70.

Heath, A., Delin, K., Edén, E., Mårtensson, E., Selander, D., Wickström, I. and Ahlmén, J. (1980). Hemoperfusion with Amberlite resin in the treatment of self-poisoning. Acta Medica Scandinavicum 207: 455-460.

Holmdahl, J. and Blohmé, I. (1992). Renal transplantation after Cortinarius speciosissimus poisoning. [Abstract]. European Association of Poison Centres and Clinical Toxicologists XV Congress, Istanbul, Turkey, 24-27 May, 1992: 102.

Holmdahl, J., Mulec, H. and Ahlmen, J. (1984). Acute renal failure after intoxication with Cortinarius mushrooms. Human Toxicology 3: 309-313.

Hölzl, B., Regele, H., Kirchmair, M. and Sandhofer, F. (1997). Acute renal failure after ingestion of Cortinarius speciocissimus [sic.]. Clinical Nephrology 48: 260-262.

Horn, S., Horina, J. H., Krejs, G. J., Holzer, H. and Ratschek, M. (1997). End-stage renal failure from mushroom poisoning with Cortinarius orellanus: report of four cases and review of the literature. American Journal of Kidney Diseases 30: 282-286.

Jaeger, A. (1994). Orellanine mushrooms: 249-264. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Laatsch, H. and Matthies, L. (1991). Fluorescent compounds in Cortinarius speciosissimus: investigation for the presence of cortinarins. Mycologia 83: 492-500.

Lahtiperä, S., Naukkarinen, A. and Collan, Y. (1986). Mushroom poisoning due to Cortinarius speciosissimus: electron microscope study in rats. Archives of Toxicology Supplement 9: 315-319.

Michelot, D. and Tebbett, I. (1990). Poisoning by members of the genus Cortinarius - a review. Mycological Research 94: 289-298.

Nieminen, L., Möttönen, M., Tirri, R. and Ikonen, S. (1975). Nephrotoxicity of Cortinarius speciosissimus: a histological and enzyme histochemical study. Experimentelle Pathologie 11: 239-246.

Nieminen, L. (1976). Effects of drugs on mushroom poisoning induced in the rat by Cortinarius speciosissimus. Archiv für Toxicologie 35: 235-238.

Nieminen, L. and Pyy, K. (1976). Individual variation in mushroom poisoning induced in the male rat by Cortinarius speciosissimus. Medical Biology 54: 156-158.

Prast, H. and Pfaller, W. (1988). Toxic properties of the mushroom Cortinarius orellanus II.

Impairment of renal function in rats. Archives of Toxicology 62: 89-96.

Prast, H., Werner, E. R., Pfaller, W. and Moser, M. (1988). Toxic properties of the mushroom Cortinarius orellanus I. Chemical characterization of the main toxin of Cortinarius orellanus (Fries) and Cortinarius speciosissimus (Kühn and Romagn) and acute toxicity in mice. Archives of Toxicology 62: 81-88.

Rapior, S., Andary, C. and Privat, G. (1988). Chemotaxonomic study of orellanine in species of Cortinarius and Dermocybe. Mycologia 80: 741-747.

Richard, J.-M., Louis, J. and Cantin, D. (1988). Nephrotoxicity of orellanine, a toxin from the mushroom Cortinarius orellanus. Archives of Toxicology 62: 242-245.

Schumacher, T. and Høiland, K. (1983). Mushroom poisoning caused by species of the genus Cortinarius Fries. Archives of Toxicology 53: 87-106.

Short, A. I. K., Watling, R., MacDonald, M. K. and Robson, J. S. (1980). Poisoning by Cortinarius speciosissimus. Lancet 2: 942-943.

Tebbett, I. R. and Caddy, B. (1984). Mushroom toxins of the genus Cortinarius. Experientia 40: 441-446.

Psilocybe poisoning

SUMMARY

Main toxin: Psilocybin, psilocin.
Target organs: Central nervous system.
Main risk: Physical injury secondary to inappropriate behaviour.

SUMMARY OF CLINICAL FEATURES OF PSILOCYBIN POISONING

Onset of symptoms: 10 to 30 minutes after ingestion.

- Dilated pupils
- Perceptual disorders or a dreamy state, uncharacteristic behaviour
- Tachycardia
- Hyperreflexia
- Nausea, vomiting and abdominal pain
- Euphoria
- Depression and anxiety
- Confusion
- Dizziness and impaired co-ordination
- Pyrexia and convulsions (mainly in children)

Effects usually wear off within 6-12 hours, or rarely as long as 24 hours.

(Adapted from: Hollister, 1961; Peden et al., 1981; Benjamin, 1995)

FUNGI THAT MAY CAUSE THIS SYNDROME:

Gymnopilus junonius
Mycena pura
Panaeolina foenisecii
Panaeolus sphinctrinus
Panaeolus subbalteatus
Psilocybe cubensis
Psilocybe cyanescens
Psilocybe semilanceata
Stropharia aeruginosa

Author: Frances Northall

TOXICITY

Psilocybin (4-phosphoryl-N, N-dimethyltryptamine) and psilocin (4-hydroxy-N, N-dimethyltryptamine) were identified in 1958 (Hoffman et al., 1958 cited in Smolinske, 1994). They are tryptamine derivatives structurally similar to other centrally active amines such as serotonin (5-hydroxytryptamine) and overall effects appear to be associated with this structural similarity (Chilton, 1994). Psilocybin is rapidly de-phosphorylated to psilocin by phosphatase (Horita and Weber, 1961) and as the two compounds are so similar they are usually described together (Chilton, 1994).

Psilocybin is heat stable and soluble in water (Smolinske, 1994). On drying, fungi gradually lose their potency through oxidation, although dried herbarium specimens preserved for approximately 20 years were found to have retained 5-10% of the psilocybin content of fresh specimens (Stijve and Kuyper, 1985).

There is a wide variation in psilocybin and psilocin content of fungi, with one investigated species displaying variation by a factor of four in samples grown under controlled conditions and a factor of ten in field specimens (Bigwood and Beug, 1982). The total psilocybin and psilocin content in a range of species has been found to vary from 0.1% to 2% dry weight (Beug and Bigwood, 1982). The number of fungi ingested for purposes of abuse varies from 2-4 (Schwartz and Smith, 1988) to 20-30 or over 100 (Harries and Evans, 1981).

The effects of psilocybin are similar to LSD, to which it is structurally related, although estimated to be 90 times less potent (Aboul-Enein, 1974). Individuals develop a degree of cross tolerance to LSD and psilocybin suggesting a similar mode of action (Isbell et al., 1961). Tolerance to psilocybin can develop if it is taken more than once every 7-10 days and up to twice as much may be needed to achieve the same effects if it is abused on consecutive days (Cooper, 1980).

Identical doses of psilocybin can have widely differing effects in different people, and effect on mood may depend on personality (Parashos, 1976-7) as well as environment, company and other factors (Smolinske, 1994). In general a dose of 4 mg results in pleasant sensations of relaxation, both physical and mental, and detachment from the environment. 6-20 mg causes more profound changes with distortion of time, space and self perception, illusions and hallucinations (Chilton, 1994).

Data from animal studies using psilocin suggest that up to 85% is excreted within 24 hours (approximately 65% in the urine and 15-20% in the bile and faeces) with most of the products excreted in the first 8 hours. The remainder is excreted much more slowly and metabolites may be detected in the urine for up to 7 days post ingestion. Approximately 25% of the psilocin is excreted unchanged (Kalberer et al., 1962).

CLINICAL EFFECTS

Ingestion:
Onset of psychological and physical effects is usually within 30 minutes and may be within 5-10 minutes especially if taken in a liquid form (Smolinske, 1994). Recovery is generally complete by 6 hours post ingestion but effects (usually in a milder form) can persist for 12 to 24 hours. In rare cases with severe physical effects recovery may be more prolonged. The main risks during psilocybin intoxication are from the acute effects on behaviour which may be life-threatening (Peden et al., 1981). Injuries may be sustained whilst under the influence of pscilocybin, for example head injury after a fall from a roof (Schwartz and Smith, 1988).

Psychological effects are variable and include feelings of relaxation, euphoria, agitation, alterations in perception (usually visual), hallucinations, alteration in perception of self (e.g. a sensation of swollen body parts including the tongue), a sense of deja-vu, confusion, disorientation, uncontrollable laughter and feelings of impending doom (Peden et al., 1981). Colours often appear very vivid and objects may have coloured haloes, there may be kaleidoscopic effects or flashes of coloured lights and objects may change in shape and colour and appear threatening. Hallucinations may be visual or auditory but are less common than illusions. Schizophrenia-like syndrome has been seen after chronic ingestion (Hyde et al., 1978).

Commonest physical effects are dilated pupils (reacting to light), tachycardia and hyperreflexia. Nausea, vomiting, abdominal pain and paraesthesia (which may be unilateral), flushing and urinary incontinence are less common.

Severe effects including hyperpyrexia, convulsions and hypertension are rare and are more likely in children (McCawley et al., 1962; Heim et al., 1966 cited in Pollock, 1974).

There is one reported case of convulsions and myocardial infarction with cardiorespiratory arrest in an adult (Borowiak et al., 1998).

A mild and transient rise in liver function tests has been seen after ingestion of *Psilocybe cyanescens* and *Conocybe cyanopus* (McCormick et al., 1979).

Flashback phenomena may be experienced and have occurred up to 4 months post ingestion (Francis and Murray, 1983). Panic attacks precipitated by heavy drinking up to 9 days post ingestion have been reported (Peden et al., 1981). There is one report of a persistant anxiety state thought to have been related to psilocybin use (Benjamin, 1979).

Injection:
Three recorded cases of intravenous injection resulted in effects including nausea, vomiting, diarrhoea, rigors, arthralgia, myalgia, loin pain, headache, skin eruptions, hypoxia, mild methaemoglobinaemia and hyperpyrexia (Curry and Rose, 1985). Injection may also result in raised liver function tests, which can take a week or more to return to normal; raised creatinine, which may be secondary to dehydration; and leucocytosis with a left shift (Sivyer and Dorrington, 1984).

CASE REPORTS

100 young people attended a mushroom festival where they browsed freely on a patch of *Psilocybe semilanceata* on the outskirts of Cardiff. 19 sought medical attention with varying degrees of euphoria, fear, hallucinations, nausea and vomiting. One had paraesthesia affecting only one side of the face and one arm, without associated weakness, an effect which lasted 12 hours then gradually wore off over the next 12 hours (Harries and Evans, 1981).

A 24-year-old man developed severe uncharacteristic anxiety symptoms thought to be related to psilocybin. He ingested 25 psilocybin mushrooms and two pints of beer with friends. Three hours later he became emotionally labile and 'blacked out' briefly, but felt well next day. Two weeks later he suffered an anxiety attack with a sense of impending doom, palpitations, dry mouth and depersonalisation. The effects recurred daily for three weeks and he was referred to hospital. Attacks were controlled with lorazepam 2.5 mg; chlorpromazine 50 mg twice daily was also tried but had no effect (Benjamin, 1979).

An 18-year-old man suffered convulsions and cardiopulmonary arrest after ingesting *Psilocybe semilanceata*. He was resuscitated and intubated. He had several episodes of supraventricular tachycardia which were controlled with verapamil. Three hours post admission he was in regular sinus rhythm and his ECG showed Wolff-Parkinson-White syndrome and changes consistent with an anterolateral myocardial infarction. The patient suffered a degree of neurological damage due to anoxia which had occurred at the time of his cardiac arrest. Drug screen was negative and effects were attributed entirely to fungi which he had been frequently abusing in recent weeks prior to this ingestion (Borowiak et al., 1998).

Two adults and four children aged 4, 4, 6 and 9 years ingested fungi (*Psilocybe baeocystis*). The children all had dilated pupils, nausea, abdominal pain, pyrexia (38.8°C to 41.1°C) and intermittent clonic-tonic convulsions. In one case the convulsions were almost continuous; the child became hyperpyrexial (rectal temperature 41.1°C) and convulsions were only partly controlled with drug therapy. The child was ventilated on the second day post ingestion and later became bradycardic and hypotensive and died three days post ingestion. At post-mortem, cerebral oedema and slight pulmonary oedema were the only notable findings. In contrast to the severe effects seen in the children, the two adults experienced only anxiety and excitement which they likened to alcohol intoxication (McCawley et al., 1962).

A 30-year-old man went to a party where *Psilocybe* mushrooms were heated then squeezed and the resulting juices administered intravenously. Within ten minutes he experienced chills, rigors, dyspnoea, headache and severe myalgias involving all muscle groups. Despite these effects he drove home where he developed persistent vomiting and an ambulance was summoned.

On arrival at hospital he was vomiting repeatedly, hypoxic, cyanosed centrally and peripherally and in severe pain. His temperature was 40.1°C and he was tachycardic. He did not experience any hallucinations or other central nervous system effects. He was found to have a methaemoglobin of 5.1%. Electrocardiogram and chest x-ray were normal. Investigations did not reveal any infection.
Treatment was with oxygen, intravenous fluids and analgesia. By 2.5 hours post-admission the methaemoglobin level was down to 0.6%. He was apyrexial by 16 hours post-admission. Nausea, vomiting and myalgias resolved over 24 hours and he was asymptomatic when he self-discharged at 36 hours post-admission (Curry and Rose, 1985).

In Scotland, a 34-year-old man cooked and ingested more than 20 fruitbodies of *Panaeolus subbalteatus* for breakfast. Within 40 minutes he experienced sensations of detachment from conversation and was unable to take in his surroundings. He presented to hospital where 1 hour 15 minutes post ingestion he felt 'far away, and incapable of following speech at normal speeds'. He also felt elated even though he was worried about his condition. Gastric lavage was carried out but was only half completed as the tube became blocked. The patient left hospital 2 hours 45 minutes post ingestion. He was experiencing some sexual stimulation and had an urge to laugh and smile. He rested in bed for the afternoon and his elation waned during the evening (Bennell and Watling, 1983).

In April 1970 a person in Leipzig prepared a site in his garden to grow a Stropharia rugosoannulata culture. By mid July a colony of unidentified mushrooms had grown that were considered edible by a "mushroom expert". They were eaten by 3 people. An hour later a state of euphoria had developed in all three. Two had "pins and needles" in their hands and feet, and also nausea and vomiting, while one had only a dry mouth. They were treated in hospital and had recovered in a few hours. The fungi were identified as *Panaeolus subbalteatus* (Bergner and Oettel, 1971).

TREATMENT

Medical treatment:
Ingestion:
Gastric decontamination may be considered. Gastric lavage is not advised as it may increase or precipitate anxiety or panic attacks, the mushrooms block standard lavage tubes and there is no evidence that gastric lavage affects severity or duration of effects (Peden and Pringle, 1982;

Peden et al., 1982; Francis and Murray, 1983). Management is symptomatic and supportive, there is no specific antidote.

Reassurance and calming of fears in a quiet environment, with supervision to prevent harm through inappropriate actions, is usually all that is required. In cases of severe anxiety, distressing hallucinations or panic attacks, diazepam may be given (Benjamin, 1995). Chlorpromazine should be avoided as it may enhance anticholinergic effects (Jansen, 1988).

The patient should be warned of the possibility of flashbacks which are often precipitated by stress. Diazepam may be required if flashbacks are severe (Peden et al., 1981).

Heavy drinking should be avoided for at least 9 days post ingestion as it may precipitate panic attacks (Peden et al., 1981).

Injection:
Management is symptomatic and supportive; there is no specific antidote. Monitor renal and hepatic function and oxygen saturation, and check methaemoglobin level if indicated.

Diagnosis:
Not all symptoms seen after ingesting mushrooms are due to mushroom poisoning. Differential diagnosis includes food poisoning, excessive ingestion of edible fungi, idiosyncratic reactions and other coincident illnesses.

General Emergency Aid:
Poisonous Fungi... is not intended to be used by the public to diagnose or treat suspected fungus poisoning. The following advice is a GENERAL GUIDE to assist the public in the first steps of managing a suspected poisoning. It has not been tailored for the particular fungus. Medical attention should be sought if poisoning is suspected.

If you suspect possible poisoning from EATING a fungus:

* DO NOT try to make the person sick.

* A single glass of milk may be helpful, but if the person is unconscious or fitting do not give anything by mouth.

* IMMEDIATELY take the person to a doctor or hospital Accident and Emergency or Casualty Department.

* Note the NAME of the fungus if you think you have identified it, and TAKE a good specimen of the fungus with you, i.e. a whole fungus including the base of the stem.

* Note TIME of eating and the onset of any symptoms, which may appear some time later.

REFERENCES

Aboul-Enein, H. Y. (1974). Psilocybin: a pharmacological profile. American Journal of Pharmacy 146: 91-95.

Benjamin, C. (1979). Persistent psychiatric symptoms after eating psilocybin mushrooms. British Medical Journal 1: 1319-1320.

Benjamin, D. R. (1995). Mushrooms: Poisons and Panaceas. W. H. Freeman and Company: New York.

Bennell, A. P. and Watling, R. (1983). Mushroom poisonings in Scotland. Bulletin of the British Mycological Society 17: 104-105.

Bergner, H. and Oettel, R. (1971). Vergiftung durch Düngerlinge. [Poisoning by Panaeolus subbalteatus.] Mykologisches Mitteilungsblatt 15(3): 61-64.

Beug, M. W. and Bigwood, J. (1982). Psilocybin and psilocin levels in twenty species from seven genera of wild mushrooms in the Pacific Northwest, U.S.A. Journal of Ethnopharmacology 5: 271-285.

Bigwood, J. and Beug, M. W. (1982). Variation of psilocybin and psilocin levels with repeated flushes (harvests) of mature sporocarps of Psilocybe cubensis (Earle) Singer. Journal of Ethnopharmacology 5: 287-291.

Borowiak, K. S., Ciechanowski, K. and Waloszczyk, P. (1998). Psilocybin mushroom (Psilocybe semilanceata) intoxication with myocardial infarction. Journal of Toxicology - Clinical Toxicology 36: 47-49.

Chilton, W. S. (1994). The chemistry and mode of action of mushroom toxins: 165-231. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Cooper, R. (1980). A Guide to British Psilocybin Mushrooms. Red Shift Books: London.

Curry, S. C. and Rose, M. C. (1985). Intravenous mushroom poisoning. Annals of Emergency Medicine 14: 900-902.

Francis, J. and Murray, V. S. G. (1983). Review of enquiries made to the NPIS concerning Psilocybe mushroom ingestion, 1978-1981. Human Toxicology 2: 349-352.

Harries, A. D. and Evans, V. (1981). Sequelae of a 'magic mushroom banquet'. Postgraduate Medical Journal 57: 571-572.

Heim, R., Hofmann, A. and Scherter, H. (1966). Sur une intoxication collective a syndrome psilocybin causee en France par un Copelandia. [On a group poisoning with psilocybin syndrome caused in France by Copelandia.] Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. D: Sciences Naturelles 262: 519-523.

Hoffman, A., Heim, R., Brack, R. and Kobel, H. (1958). Psilocybin, ein psychotroper Wirkstoff aus dem mexikanischen Rauschpilz Psilocybe mexicana Heim. [Psilocybin, a psychotropic substance from the Mexican mushroom Psilocybe mexicana Heim.] Experientia 14: 107-109.

Hollister, L. E. (1961). Clinical, biochemical and psychologic effects of psilocybin. Archives Internationales de Pharmacodynamie et de Therapie 130: 42-52.

Horita, A. and Weber, L. J. (1961). Dephosphorylation of psilocybin to psilocin by alkaline phosphatase. Proceedings of the Society for Experimental Biology and Medicine 106: 32-34.

Hyde, C., Glancy, G., Omerod, P., Hall, D. and Taylor, G. S. (1978). Abuse of indigenous psilocybin mushrooms: a new fashion and some psychiatric complications. British Journal of Psychiatry 132: 602-604.

Isbell, H., Wolbach, A. B., Wikler, A. and Miner, E. J. (1961). Cross tolerance between LSD and psilocybin. Psychopharmacologia 2: 147-159.

Jansen, K. L. R. (1988). Magic mushrooms: a fast growing problem. Journal of General Practice 5: 7-10.

Kalberer, F., Kreis, W. and Rutschmann, J. (1962). The fate of psilocin in the rat. Biochemical Pharmacology 11: 261-269.

McCawley, E. L., Brummett, R. E. and Dana, G. W. (1962). Convulsions from Psilocybe mushroom poisoning. Proceedings of the Western Pharmacology Society 5: 27-33.

McCormick, D. J., Avbel, A. J. and Gibbons, R. B. (1979). Nonlethal mushroom poisoning. Annals of Internal Medicine 90: 332-335.

Parashos, A. J. (1976-7). The psilocybin-induced 'state of drunkenness' in normal volunteers and schizophrenics. Behavioural Neuropsychiatry 8: 83-86.

Peden, N. R., Bisset, A. F., Macaulay, K. E. C., Crooks, J. and Pelosi, A. J. (1981). Clinical toxicology of 'magic mushroom' ingestion. Postgraduate Medical Journal 57: 543-545.

Peden, N. R. and Pringle, S. D. (1982). Hallucinogenic fungi. [Letter]. Lancet 1: 396-397.

Peden, N. R., Pringle, S. D. and Crooks, J. (1982). The problem of psilocybin mushroom abuse. Human Toxicology 1: 417-424.

Pollock, S. H. (1974). A novel experience with Panaeolus: a case study from Hawaii. Journal of Psychedelic Drugs 6: 85-89.

Schwartz, R. H. and Smith, D. E. (1988). Hallucinogenic mushrooms. Clinical Pediatrics 27: 70-73.

Sivyer, G. and Dorrington, L. (1984). Intravenous injection of mushrooms. [Letter]. Medical Journal of Australia 140: 182.

Smolinske, S. C. (1994). Psilocybin-containing mushrooms: 309-324. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.

Stijve, T. and Kuyper, T. W. (1985). Occurrence of psilocybin in various higher fungi from several European countries. Planta Medica 51: 385-387.

Glossary for Questions

Appendiculate
Ascending
Attached

Bracket
Branched
Bulbous

Cap
Conical
Cuticle
Cylindrical

Descending
Dotted

Earthball
Equal

Filamentous
Fixed
Flesh
Forked
Free

Gill
Granular
Grooved

Horizontal

Inrolled

Lateral
Latex

Margin
Mixed
Mobile
Morel
Mottled
Mushroom

Net

Oval

Pleated
Pore

Puffball
Pyramidal

Ring
Ring-zone
Rooting
Running down

Scales
Scaly
Silky
Spore
Spore deposit
Stalk
Stinkhorn
Striate

Teeth
Tube
Umbo
Umbonate
Upturned

Veil
Veined
Volva

Woolly

Appendiculate-
cap margin fringed with hanging fragments of the **veil**.

Ascending-
when the free edge of a **ring** points upwards.

Attached-
when a **gill** is attached to the **stalk** but it does not extend down the stalk beyond the depth of the gill.

Bracket-
a fungus which forms a shelf-like structure growing out of living tree trunks and dead stumps, branches and twigs. The fungus can have many **caps** which overlap and fuse with each other. A bracket fungus may form very large fruitbodies.

Branched-
when a fungus has a coral-shaped fruitbody with many branches arising from a central base.

Bulbous-
when the base of a **stalk** has a clearly delimited swelling.

Cap-
the hemispherical, convex-, **conical**-, bell- or funnel-shaped structure at the top of the **stalk** which bears the **spore**-producing structures on the underside.

Conical-
cone-shaped.

Cuticle-
the skin or outer surface covering a **cap** or **stalk**.

Cylindrical-
of equal thickness throughout.

Descending-
when the free edge of a **ring** points downwards.

Dotted-
with small spots of colour.

Earthball-
an almost spherical fungus with a thick tough skin, containing firm flesh which becomes powdery as the **spores** mature. The skin is usually rough with flattened **scales**.

Equal-
of equal thickness throughout.

Filamentous-
composed of thin cobweb-like fibres.

Fixed-
when a **ring** is attached to a **stalk** and can not be moved up and down.

Flesh-
the tissue between the **cap cuticle** and the **gills** or **pores** and throughout the **stalk**.

Forked-
splitting into two or more branches.

Free-
when the edge of the **gill** is not attached to the **stalk**.

Gill-
blade-like structure on the underside of a **cap** which produces the **spores**.

Granular-
grainy, gritty.

Grooved-
when a **cap** has grooves or ridges from the centre to the edge.

Horizontal-
when the **ring** stands out at 90º to the **stalk**.

Inrolled-
when a **cap** edge is strongly incurled downwards and towards itself.

Lateral-
when the **stalk** is attached to the **margin** of a **cap**.

Latex-
a milky, coloured or clear fluid exuded by the broken **gills** and **flesh**.

Margin-
the edge of a **cap**.

Mixed-
a woodland with both coniferous and deciduous (broadleaved) trees.

Mobile-.
when the **ring** is not attached to the **stalk** and can be moved up and down.

Morel-
a fungus with a lobed, honeycombed or veined **cap** which can be **conical** or spherical in shape.

Mottled-
the appearance of a **gill** when it is covered in spots or patches of different shades and colours.

Mushroom-
a term used to describe the fruitbody of a fungus, especially one with **gills** or **pores**. Mushroom is also used to refer to an edible fungus.

Net-
a raised network on the surface of a **stalk**.

Oval-
when the **cap** is egg-shaped.

Pleated-
when the edge of a **cap** has a zigzag or grooved pattern like so: VVVVVV.

Pore-
the opening of the tubular **spore**-producing surface of some fungi.

Puffball-
an almost spherical to club-shaped fungus with a thin skin and soft flesh which becomes powdery as the **spores** mature. The skin may be smooth or have tiny easily detached spines.

Pyramidal-
pyramid-shaped.

Ring-
the remains of the **veil** which form a small skirt or band around a **stalk**.

Ring-zone-
the remains of a **filamentous** or cobweb-like **ring** found on a **stalk**.

Rooting-
when the base of a **stalk** is deeply buried in soil.

Running down-
when the edge of a **gill** extends down the **stalk**.

Scales-
formed from the outer surface of a **cap** or **stalk** which splits and cracks.

Scaly-
covered in **scales** which can vary from large and shaggy to hair-like.

Silky-
covered with silky fibres

Spore-
the reproductive unit of fungi.

Spore deposit-

the colour of **spores** is usually determined from a spore deposit or spore print. Prepare a spore deposit as follows: remove the **stalk**, if present, and place the **cap** with the fertile surface, i.e. **gills**, **pores**, facing downwards on a piece of white paper or a glass slide. Cover the fungus with a tin or glass jar to prevent the cap from drying out and leave for a few hours, or preferably overnight. Scrape the spores together and note the colour.

Stalk-
the stem of a fungus.

Stinkhorn-
common name given to phallic-shaped fungi which have a sticky, **oval**-shaped **cap** at the top of a slender white **stalk**, the base of which is sometimes encased in the remains of the primordial egg.

Striate-
with fine lines, ridges or grooves, especially at the **cap** edge.

Teeth-
spine-like structures on the underside of a **cap**.

Tube-
the **spore**-producing structure of the boletes and polypores (**bracket** fungi).

Umbo-
swelling or boss, usually at the centre of a **cap**.

Umbonate-
a **cap** with a central **umbo** (swelling or boss).

Upturned-
with edges bent backwards or upwards.

Veil-
membranous tissue which sometimes surrounds a developing fungus fruitbody.

Veined-
with low intertwined ridges.

Volva-
sack-like structure encasing the base of a **stalk**.

Woolly-
covered densely with long hairs.

Mycological and Medical Glossaries

To aid with the interpretation of the fungus descriptions and the toxicity information, two glossaries are provided.

Mycological Glossary for Descriptions

Medical Glossary for Toxicity Information

Glossary for Descriptions

Adnate
Adnexed
Amyloid
Agaric
Annulate
Annulus
Apex
Apical
Appendiculate
Appressed
Ascending
Ascomycete
Ascus
Astipitate

Basidiomycete
Basidium
Bolete
Broad
Bulbous
Bullet-shaped

Caespitose
Calcareous
Campanulate
Cap
Centripetal
Chambered
Clavate
Concolorous
Conical
Cortina
Cuticle
Cylindrical

Decurrent
Deliquesce
Denticulate
Depressed
Descending
Detrinoid
Dimidiate

Earthball
Elliptical
Eccentric
Expanding

Fairy ring

Farinaceous
Felted
Fibril
Fibrillose
Filamentous
Fixed
Flesh
Floccose
Forked
Free
Fruitbody
Fusiform

Genus
Germ pore
Gill
Glabrous
Gleba
Globose
Glutinous
Granular
Grooved

Habitat
Hoary
Hyaline
Hygrophanous
Hypha
Hymenium

Imbricate
Inamyloid
Incurved
Inferior
Infundibuliform
Inrolled

Lateral
Latex

Margin
Mealy
Median
Melzers reagent
Micron
Mitriform
Mobile
Morel
Mottled
Mucilaginous
Mushroom

Mycelial
Mycelium

Ovoid

Papilla
Papillate
Parasite
Partial Veil
Pellicle
Pitted
pl.
Polypore
Pore
Puffball
Punctate
Pyriform

Reflexed
Reticulate
Reticulum
Ring
Ring-zone
Rooting

Saccate
Scale
Sect.
Sheathing
sing.
Sinuate
Spathulate
Species
Spine
Spinose
Spore
Spore deposit
sp.
Sterigma
Stinkhorn
Stipe
Striate
Stuffed
Subfusiform
Subglobose
Subsect.
Substrate
Superior
Synonym

Taxon

Teeth
Toadstool
Tomentose
Tomentum
Truncate
Tube

Umbo
Umbonate
Universal veil

Veil
Velar
Verrucose
Vinaceous
Volva

Wart
Wick
Woolly

Zonate

Adnate-
term used to describe a **gill** that is attached to the **stalk** by the entire depth.

Adnexed-
term used to describe a **gill** that is narrowly attached to the **stalk**.

Agaric-
a **mushroom** or **toadstool** (Order Agaricales) always with a **cap** and **gills**, and usually a **stalk**.

Amyloid-
term used to describe **spores** which turn blue in **Melzers reagent** (starch-iodine reaction).

Annulate-
term used to describe a **stalk** with an **annulus**.

Annulus-

the remains of a **partial veil** which form a skirt or a band of membranous tissue around a **stalk**.

Apex-
the tip.

Apical-
at the tip or **apex** (typically of a **spore**).

Appendiculate-

term used to describe a **cap margin** fringed with the hanging remains of the **partial veil**.

Appressed-
(of scales) closely flattened.

Ascending-

when the free part of the **annulus** (**ring**) points upward.

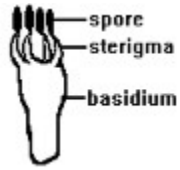
Ascomycete
a member of the largest class of fungi in which the **spore**-producing unit is an **ascus** (**pl.** asci). The formation of asci distinguishes the Ascomycetes from the **Basidiomycetes**. The Ascomycetes include: Cup fungi, Flask fungi, **Morels** and Truffles.

Ascus-
the **spore**-producing unit, cylindrical or sack-like, of an **Ascomycete**. Each ascus typically contains eight spores (**pl.** asci).

Astipitate-
lacking a **stalk**.

Basidiomycete-
a member of the class of fungi in which the **spore**-producing unit is a **basidium** (**pl.** basidia). The formation of basidia distinguishes the Basidiomycetes from the **Ascomycetes**. The Basidiomycetes include: **Agarics**, **Boletes**, **Earthballs**, **Polypores**, **Puffballs**, and **Stinkhorns**.

Basidium-



(pl. basidia) the **spore**-producing unit of a **Basidiomycete**. Spores are formed externally on sterigmata (sing. **sterigma**) which extend from the basidium. Each basidium typically produces four spores.

Bolete-
a fungus with an **agaric**-shaped **fruitbody** but with **pores** and **tubes** instead of **gills**. The tubes can be separated easily from the cap.

Broad-
thick or wide.

Bulbous-

term used to describe a **stalk** with a clearly delimited swelling at the base.

Bullet-shaped-

term used to describe the shape of **spores** of some **species** of *Lepiota*.

Caespitose-

term used to describe **fruitbodies** which are tufted or joined at the base of the **stalk**.

Calcareous-
containing lime or chalk (of soils).

Campanulate-

bell-shaped.

Cap-
the hemispherical, convex, **conical** or **globose** structure at the **apex** of the **stipe** which has a lower **spore**-producing surface. Scientific name: PILEUS.

Centripetal-

term used to describe the colouration of a **gill** when **spore** maturation begins at the edge of the **gill** furthest from the **stalk**.

Chambered-
large, irregular spaces in the **flesh** of the **stalk**.

Clavate-

club-shaped, referring to the **stalk**.

Concolorous-
of the same colour.

Conical-

cone-shaped.

Cortina-
a filamentous or web-like **partial veil** covering the very young **gills**; found on members of the Cortinariaceae family, e.g. *Cortinarius, Hebeloma*, and *Gymnopilus*.

Cuticle-
common term used to describe the outer membrane of a **cap** or **stalk**. Scientific name: CUTIS.

Cylindrical-
of equal thickness throughout.

Decurrent-

term used to describe the attachment of a **gill** that extends down the **stalk**.

Deliquesce-

liquefy at maturation (used to describe **gills** of some **species** of *Coprinus* which dissolve into black ink after **spore** maturation.)

Denticulate-
with fine teeth.

Depressed-
when the centre of a **cap** is sunken.

Descending-

when the free part of the **annulus** (**ring**) points downward.

Dextrinoid-
term used to describe **spores** that turn yellowish or reddish brown in **Melzers reagent** (dextrin-iodine reaction).

Dimidiate-
semi-circular **fruitbody** with broad **lateral** attachment to a **substrate** and usually lacking a **stalk**.

Earthball-
an **subglobose** fungus, usually lacking a **stalk**, with a firm **gleba** which becomes powdery as the **spores** mature, and a thick tough skin which splits to release the **spores**.

Elliptical-

the simplest equilateral spore shape in which both ends are rounded and the sides are curved.

Eccentric-

off-centre attachment.

Expanding-
opening or spreading out, a term often used to describe the changing shape of the **cap**.

Fairy-ring-
ring of **agarics** resulting from the outward concentric growth of **mycelium**, usually seen on grassland and occasionally on the ground in woods.

Farinaceous-
odour of flour.

Felted-
covered in very short **woolly** hairs.

Fibril-
fine hair or fibre.

Fibrillose-
evenly covered with fibrils or hairs.

Filamentous-
consisting of fine threads; used to describe a **cortina**.

Fixed-

when an **annulus** (**ring**) is attached to a **stalk** and can not be moved up and down.

Flesh-
the tissue between the **cap cuticle** and the **hymenium**, and throughout the **stalk**, composted of hyphae (**sing. hyphae**). Scientific name: CONTEXT.

Floccose-
cottony.

Forked-

splitting into two or more branches.

Free-

term used to describe a **gill** that is not attached to the **stalk**.

Fruitbody-
common term to describe the structure which gives rise to, and protects, the **spore**-producing surfaces. Other terms used to describe the fruitbody include: **agaric**, **bolete**, **bracket** fungus, cup fungus, **earthball**, **morel**, **mushroom**, **polypore**, **puffball**, **stinkhorn**, **toadstool** and truffle.

Fusiform-

almost **cylindrical** with tapered ends.

Germ pore-
a hole or narrowing in a **spore** wall, usually at the **apex** through which a germ tube emerges.

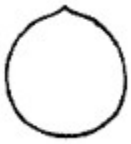
Genus-
a single, or group of more than one, **species** possessing shared characteristics which distinguish it from other groups. A genus is given a single Latinized name, e.g. *Amanita*. Each species takes the generic name and combines it with an epithet to produce a name unique to that species, e.g. *Amanita muscaria*.

Gill-
the **spore**-producing structure of **agarics**. Scientific name: LAMELLA (pl. lamellae).

Glabrous-
featureless, smooth, lacking scales or hairs.

Gleba-
the internal **spore**-producing tissue of the gasteroid fungi (**Earthballs**, **Puffballs** and **Stinkhorns**) and Tuberales (Truffles).

Globose-



spherical, globe-like.

Glutinous-
slimy when wet; specifically when the **cap** is covered with gluten which becomes adhesive when wet.

Granular-
grainy, gritty.

Grooved-
more deeply marked than **striate**.

Habitat-
the immediate environment of the organism.

Hoary-
covered densely with silky hairs, similar to **woolly**.

Hyaline-
transparent, often colourless.

Hygrophanous-
having a water-soaked appearance.

Hymenium-
a **spore**-producing surface, for example **gills**, **spines** and **tubes**.

Hypha-
an individual thread-like unit which makes up the **mycelium** and the **fruitbody** (pl. hyphae).

Imbricate-
forming overlapping layers.

Inamyloid-
term used to describe **spores** which not turn blue in **Melzers reagent**.

Incurved-

when a **cap margin** is downcurved.

Inferior-
when an **annulus** is present on the lower half of a **stalk**.

Infundibuliform-
funnel-shaped.

Inrolled-

when a **cap margin** is strongly curved downwards and inwards.

Lateral-
when a **stalk** is attached to the **cap margin**.

Latex-
the milky, coloured or clear fluid exuded from broken **gills** and **flesh**. The colour of the fresh and dried latex can be used as a guide to identify some species of *Lactarius* in the field.

Margin-
the edge of a **cap** or **gill**.

Mealy-
odour of meal.

Median-
when an **annulus** (ring) is attached half way up a **stalk**.

Melzers reagent-
an iodine-containing stain used to determine **amyloid** and **dextrinoid** spores. Melzers reagent contains chloral hydrate (100.0 g), potassium iodide (1.5 g), and iodine (1.5 g) in distilled water (100.0 ml).

Micron-
one thousandth of a millimetre (0.001 mm).

Mitriform-
shaped like a (Bishops) mitre.

Mobile-

when an **annulus** is not attached to a **stalk** and can be moved up and down.

Morel-
an **Ascomycete** having a **conical** to spherical **cap** with a honeycomb or veined appearance, and a **stalk** which may be furrowed, and **chambered** to hollow.

Mottled-

covered in spots or patches of different shades and colours.

Mucilaginous-
slimy when wet.

Mushroom-
a term used to describe the **fruitbody** of a fungus, particularly that of an **agaric** or a **bolete**. Mushroom is also used to refer to an edible fungus.

Mycelial-
composed of **mycelium**.

Mycelium-
(**pl.** mycelia) the vegetative form of a fungus consisting of a mass of hyphae (sing. **hypha**) or fine threads growing in a **substrate**, for example, in soil or inside wood.

Ovoid-
rounded at both ends but ends are of unequal widths; egg-shaped; oval.

Papilla-
small rounded process.

Papillate-
having a papilla.

Parasite-
an organism living on or in, and gaining its nutrients from, another organism.

Partial veil-
the tissue which attaches a **cap margin** to a **stalk** to protect the **hymenium** in young **fruitbodies**. As the cap **expands** the partial veil may form a membranous **annulus** or **cortina**.

Pellicle-
a detachable skin-like **cuticle** of a **cap**.

Pitted-
with conspicuous sunken spots, used to describe the surface appearance of the **stalk** of some **species** of *Lactarius*.

pl.-
plural.

Polypore-
common term for **bracket** fungi which usually are leathery or woody, grow on wood, and have a tubular **spore**-producing surface.

Pore-
the open end of a **tube**.

Puffball-
a **pyriform** to **subglobose** fungus, usually lacking a **stalk**, containing a firm to soft **gleba** which becomes powdery as the **spores** mature and a thin skin that splits to release the **spores**.

Punctate-
marked with very small indents.

Pyriform-
pear-shaped.

Reflexed-
upturned or bent back at the edge.

Reticulate-
netted, refers to: (1) the surface appearance of the **stalk** of some **boletes**; and (2) ornamentation of *Lactarius* and *Russula* **spores**.

Reticulum-
a raised network covering: (1) the surface of the **stalk** of some **boletes**; and (2) **spores** of *Lactarius* and *Russula* (see below).

Ring-

common term used to describe the remains of the **partial veil** which form a skirt or a band of membranous tissue around a **stalk**. Scientific name: **ANNULUS**.

Ring-zone-
the remains of a **cortina** around a **stalk**.

Rooting-

term used to describe the base of a **stalk** which is deeply buried.

Saccate-
large, loose or bag-like.

Scale
fragment formed when a **cuticle** splits or cracks.

Sect.-
section; used to describe a group of **species** below the level of **genus**.

Sheathing-
term used to describe an **annulus** (**ring**) which encases a **stalk** like a sock.

sing.-
singular.

Sinuate-
term used to describe a **gill** when the edge is notched, sometimes with a **decurrent** tooth.

Spathulate-
spoon or spatula-shaped.

Species-
a group of individuals which possess certain similarities which define the group, and certain dissimilarities between the group and other species. The Latinized name of a species is a combination of the generic name (e.g. *Amanita*) and a specific epithet producing a unique binomial, e.g. *Amanita muscaria*.

Spine-
a narrow sharply pointed process referring to: (1) a **spore**-producing tooth-like structure of hydnoid (toothed) fungi; and (2) ornamentation of a **spore**.

Spinose-
having spines.

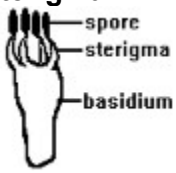
Spore-
the reproductive unit of fungi. A spore is usually single celled and is produced: (1) in response to, and resistant under, adverse conditions; and/or (2) as a result of sexual or asexual reproduction. The spore may also be adapted for dissemination. Spores may be thick- or thin-walled, ornamented or smooth, pigmented or not, and variously shaped. However, the spores of one **species** are uniform. The manner in which spores are produced is used to divide the kingdom Fungi (or Eumycota) into four divisions, including Ascomycota (**Ascomycetes**) and Basidiomycota (**Basidiomycetes**).

Spore deposit-

the colour of **spores** is usually determined from a spore deposit or spore print. Prepare a spore deposit as follows: remove the **stalk**, if present, and place the **cap** with the fertile surface, i.e. **gills**, **pores**, facing downwards on a piece of white paper or a glass slide. Cover the fungus with a tin or glass jar to prevent the cap from drying out and leave for a few hours, or preferably overnight. Scrape the spores together and note the colour.

sp.-
(**pl.** spp.) **species**, an abbreviation used after a generic name to indicate that the **taxon** under discussion includes only one species.

Sterigma-



(**pl.** sterigmata) a projection of a **basidium** on which a **spore** is produced.

Stinkhorn-
common name given to a fungus which develops from a gelatinised egg into a phallus-shaped **fruitbody** with a sticky **ovoid** to **conical cap** at the apex of a slender hollow **stalk**, the base of which is encased in the remains of the primordial egg.

Stipe-
scientific name used to describe a stalk.

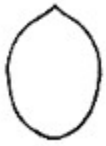
Striate-
fine lines, ridges or grooves.

Stuffed-
when the central part of a **stalk** is composed of loose or soft tissue.

Subfusiform-

elongate with one rounded end and one unequally tapered end.

Subglobose-



almost spherical.

Subsect.-
subsection, a group of **species** below the level of **section**.

Substrate-
the growth medium of a fungus, for example rotted wood.

Superior-
when an **annulus** (**ring**) is found on the upper half of a **stalk**.

Synonym-
an alternative Latin name for a **species** or group, usually a later name that has been used in the past but which is now redundant. Only important and commonly recognised synonyms are cited in this database.

Taxon-
(**pl.** taxa) any formally named group of fungi, be it at the **species** (e.g. *Russula emetica*), **genus** (e.g. *Russula*), family (e.g. Russulaceae), etc. level. The term is sometimes used to refer to informal subgroupings of these categories; for example in this database the taxon *Lactarius* includes the 53 or so species recorded from Britain and Ireland excluding the edible species belonging to the subsection Dapetes.

Teeth-
spinose spore-producing structures of hydnoid (toothed) fungi.

Toadstool-
the fleshy fruitbody of an **agaric** or a **bolete**, usually referring to an inedible or poisonous fungus to distinguish it from an edible **mushroom**. However, there are no scientific differences between mushrooms and toadstools, and the term toadstool should be avoided.

Tomentose-
with a **tomentum**, a covering of short downy hairs.

Tomentum-
a dense covering of short downy hairs similar to very short velvet.

Truncate-
cut off (flattened).

Tube-
the spore-bearing structure of **boletes** and **polypores**, opening as a basal **pore**.

Umbo-

a raised swelling or boss at the centre of a **cap**.

Umbonate-

having a raised swelling or an umbo**.**

Universal veil-
the membranous tissue which sometimes surrounds a developing **fruitbody**. The universal veil may remain as a **volva** at the base of a **stalk** and/or as loose **warts** on the **cap** after the fungus has matured.

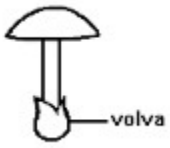
Veil-
the membranous tissue which sometimes protects a developing **fruitbody** and **hymenium**; see **partial veil** and **universal veil**.

Velar-
relating to the **veil**.

Verrucose-
having small round **warts**.

Vinaceous-
colour of red wine.

Volva-



the cup-like remains of the **universal veil** which encase the lower part of a **stalk**.

Wart-
(1) a loose patch of **universal veil** remaining on a **cap**, usually seen as **felted** patches on the caps of some **species** of *Amanita*; and (2) surface ornamentation on **spores**.

Wick-
term used to describe a strand of tissue hanging down in the upper part of a hollow **stalk**.

Woolly-
covered densely with long hairs.

Zonate-
having concentric bands of pale and darker zones or different colours.

Medical Glossary for Toxicity Information

This glossary provides simple explanations of medical terms. For definitions you should consult a medical dictionary or text book.

A
abdominal
abortifacient
abscess
absorption
acetylcholine
acetylcholinesterase
acid labile
acidosis
activated charcoal
activator
acute
adenocarcinoma
adenoma
adsorption
-aemia
aetiology
agglutinant
agglutination
agonist
albuminuria
alkalinisation
alkaloid
allergen
allergenic
allergenicity
allergy
alopecia
alveolitis
alveolus (plural alveoli)
Alzheimers disease
amino acid
amiodarone
amnesia
anaemia
anaemia, aplastic
anaesthetic
anaesthetic, general
anaesthetic, local
anal
analgesia
analgesic
anaphylaxis
anorexia
antagonist
anterior

anti-inflammatory
anti-mitotic
anti-spasmodic
anti-thrombotic
anti-tumour
antibiotic
antibody
anticholinergic
anticoagulant
anticonvulsant
antidote
antiemetic
antifungal
antigen
antihistamine
anuria
anus
aphrodisiac
aplasia
aqueous
aromatic
arrhythmia
arrhythmogenic
arterial
arthralgia
arthritis
ascites
asphyxiation
aspiration
AST
asthma
astringent
asymptomatic
asystole
ataxia
atrial fibrillation
atrophy
autoimmune disease
autonomic nervous system
autonomic neuropathy
autosome
AV (atrioventricular) block, 2nd degree
avitaminosis B1
axillae
axillary adenitis
azotaemic

B
baroreceptor
benign
benzylpenicillin

beta-blocker
bidirectional tachycardia
bigeminy
bilateral
bile
bilirubin
biopsy
blepharitis
blepharospasm
blister
blood gas
bolus
bone marrow aplasia
bowel
brady-
bradycardia
bretylium
bronchus (plural bronchi)
bronchial
bronchitis
bronchoconstriction
bronchospasm
bulla (plural = bullae)
bullous

C
caecum
cancer
carcinogen
carcinogenic
cardiac
cardiac arrest
cardio-
cardioactive
cardiogenic
cardiogenic shock
cardiopulmonary
cardiopulmonary bypass
cardiorespiratory arrest
cardiorespiratory function
cardiotoxic
cardiovascular
carotid sinus
catalysis
catalyst
cathartic
cellular respiration
cellulitis
centrilobular
cerebellar
cerebellum

chelating agent
chemosis
chloramphenicol
choleretic
cholinesterase
chromatic
chronic
chronotrope
ciliary muscle
circulation
cirrhosis
clinical
clinical effects
coagulopathy
colic
collapse
colon
coma
comatose
conductivity (nerves)
congenital
congestion
conjunctiva
conjunctival
conjunctivitis
connective tissue
constricted pupils
contact dermatitis
convulsion
cornea
corneal
cornified
coroner
cortex
cortical
corticosteroid
cramp
creatine kinase
Crohns disease
cross reaction
cross reactivity
crude extract
CT (computer aided tomography) scan
cutaneous
cyanosis
cystitis
cyto-
cytochrome oxidase
cytochrome P40
cytolysis
cytomegalovirus (CMV)

D
deactivation
decoction
decompose
dehydrate
delirium
demarcated
demulcent
dependence (drug)
depersonalisation
depigmentation
depilate
depolarisation
derivative
dermal
dermatitis
dermis
Descemets membrane
desquamation
detoxification
diagnosis
dialysis
diaphragm
diarrhoea
diazepam
DIC
diffusing capacity
digitalis
dilated pupils
diplopia
disseminated intravascular coagulation (DIC)
distal
distension
distortion
disulphide bonds
diuretic
DNA
dominant gene
dorsum
double-blind
dropsy
duodenal aspiration
duodenum
dys-
dyscrasia
dysfunction
dysphagia
dysphonia
dyspnoea
dysuria

E
ECG
ectopic
ectopic beats
eczema
EEG
effusion
electrolyte
electrolyte imbalance
emesis
emetic
encephalopathy
endocardial
endocardium
endocrine
endoplasmic reticulum
endoscopy
enema
enterohepatic circulation
entomologist
enzymatic hydrolysis
enzyme
eosinophil
eosinophilia
epidemic
epidemiology
epidermis
epigastrium
epinephrine (adrenaline)
episclera
epithelial
epithelium
erythema
erythema multiforme
essential oil
eukaryotic
euphoria
excretion
expectorant
expectoration
exposure
extraocular
extrasystole
extrinsic
exudate

F
faeces
fasciculation
febrile

fetal
fetus
fibrinogen
fibrosis
fissure
flaccid
flare
flecainide
fluoroscein
flushed
formulation
frusemide
fulminant

G
GABA
galactose
gammaglobulin
gastric
gastric decontamination
gastric lavage
gastritis
gastroenteritis
gastrointestinal
gastrointestinal tract
gene
genera
genetic
genitalia
genus
gingivitis
gland
glandular
glucose
glucose-6-phosphate dehydrogenase (G6PD) deficiency
glutathione
glycoprotein
glycoside
goitre
goitrogen
gout
grand-mal convulsion
granuloma
granulomatous

H
haemagglutinin
haematemesis
haematoma
haematuria
haemodialysis

haemoglobin
haemoglobinuria
haemolysis
haemolytic anaemia
haemolytic crisis
haemorrhage
hallucination
hallucinogen
heart block
heart block, 1st degree
hemiplegia
hepatic
hepatic first-pass metabolism
hepatomegaly
hepatosplenomegaly
hepatotoxic
herbal medicine
herbalist
high pressure liquid chromatography (HPLC)
histamine
histology
histopathology
homoeopathic (or homeopathic) medicine
homologous
hormonal
hormone
hyaline cast
hydrocortisone
hydrolysis
hyperaemia
hyperbilirubinaemia
hyperexcitability
hypergammaglobulinaemia
hyperglycaemia
hyperkalaemia
hyperkeratosis
hypernatraemia
hyperreflexia
hypersensitivity
hypertension
hyperventilation
hypocalcaemia
hypodermic
hypoglycaemia
hypokalaemia
hypolipidaemic
hypomagnesaemia
hyponatraemia
hypophosphataemia
hypopyon
hypotension

hypothesis
hypoprothrombinaemia
hypothrombinaemia
hypovolaemia
hypovolaemic shock
hypoxaemia
hypoxia

I
icterus
ICU
idiosyncratic reaction
idioventricular
Ig E
ileum
ileus
immune
immune reaction/response
immunity
immunostimulant
immunosuppressant
impermeable
impetignisation
impetigo
in vitro
in vivo
incision
incoordination
incontinence
inducer
induration
inebriation
infarct
infarction
inflammation
infusion
ingestion
inhalant
inhalation
inhibit
inhibitor
innocuous
inotrope
INR
insecticide
insoluble
interstitial
intestinal
intestine
intracranial
intraepidermal

intramuscular
intraperitoneal
intravenous
involution
iris
iritis
irradiation
irrigate
irritant
ischaemia
-itis
ITU

J
jaundice
jejunal
jejunum

K
keratoconjunctivitis

L
labile
lacrimation
lactic acidosis
larynx
latent
latex
laxation
laxative
LD50
lectin
lesions
lethargy
leuco-
leucocyte
leucocytopenia
leucocytosis
leucocyturia
leukaemia
LFT
lichenification
lidocaine (lignocaine)
liniment
lipid
lipid solubility
lobe
lobule
loin
lumbosacral
lumen

lymph node
lymphocyte
lymphocytosis
lysosome

M
macropsia
magnetic resonance, nuclear (NMR)
malaise
malodour
mania
manic psychosis
mechanical irritant
mechanical ventilation
median sternotomy
mediastinal drain
medullary centre
melanotic
menses
menstruation
menstruation-inducers
mesenteric
mesentery
metabolism
methaemoglobinaemia
methaemoglobin
micro-organism
micropsia
micturition
mitochondrion (plural = mitochondria)
moiety
monograph
morbidity
mortality
mucous membrane
multifocal
multiorgan
muscle fasciculations
musculature
mutagenic
myalgia
myasthenia gravis
mydriatic
mydriasis
myo-
myocarditis
myocardium
myoclonic
myoclonus
myopathy

N
narcosis
narcotic
nasal
nausea
necrolysis
necrosis
neoplasia
nephritis
nephr(o)-
neuralgia
neurological
neuromuscular junction
neuron
neuropathy
neurotransmitter
non-commensal bacteria
non-steroidal anti-inflammatory drug (NSAID)
nuclear
nuclear magnetic resonance (NMR)
nystagmus

O
ocular
oculomotor
oedema
oesophageal
oesophagus
oliguria
opacification
opacity
ophthalmologist
opiate
opisthotonus
oral
oropharynx
osteoarthritis
oxygen tension

P
pacemaker
paediatric
pallor
palpitation
pancreatitis
papule
paresis
paraesthesia
paralysis
parameter
paranoia

parasympathetic
parasympathomimetic
parenteral route
patch testing
peptide chain
perceptual alterations
percutaneous
peri-
periocular
perioral
periorbital
peripheral nervous system
peripheral neuritis
peripheral neuropathy
peripheral vasodilation
peristalsis
peristaltic contractions
permeable
perspiration
petechiae
pH
pharmacology
pharmacopoeia
phenytoin
photo-
photochemotherapy
photophobia
photosensitive
phototoxic
phototoxicity
phototoxin
physostigmine
phyto-
phytophotodermatitis
phytophototoxic
pigmentation
pinpoint pupils
placebo
placebo-controlled
plantar
plasma
plasmapheresis
platelet
platelet activating factor (PAF)
platelet aggregation
pleural
polarised
poliomyelitis virus
polydipsia
polymerase
polyuria

portal hypertension
post-mortem
post-mortem examination
post-operative
posterior
postganglionic
pre-sternal area
precursor
prednisone
procainamide
prognosis
prophylaxis
protein synthesis
proteinuria
prothrombin time
pruritus
psoriasis
psychiatric
psychoactive
psychotomimetic
psychotropic
ptosis
pulmonary
pulp
pulse
pulse rate
purgative
purpura
pustule
pyoderma
pyrexia

R
radial aspect
radiology
radius
rash
receptor
refractory
rehydrate
remission
renal
repolarisation
respiratory arrest
respiratory depression
resuscitate
reticuloendothelial cells
retina
retinal
retro-auricular
retrograde amnesia

rhabdomyolysis
rheumatism
rhinitis
rhinorrhoea
ribosome
right bundle branch block
rigors
RNA (ribonucleic acid)

S
salivation
scabies
schizophrenia
sclera
secretion
sedation
sedative
sepsis
sequelae
serum
shingles
shock
sign
sinus arrest
sinusoids
slough
sodium bicarbonate
sotalol
spasm
spasmolytic
spina bifida
spinal cord
spleen
sporothrix
sporotricosis
status epilepticus
stereoisomers
steroidal
steroids
stimulus
subcutaneous
subepidermal vesiculation
suberosis
supine
supportive
suppuration
supraventricular
symptom
symptomatic
synovitis
systemic

systolic

T
T cell lymphomas
T wave inversion
tachy-
tachyarrhythmias
tachycardia
tachypnoea
tactile
tenesmus
teratogenic
tetany
theoretical
therapy
thiopental (thiopentone)
thrombocytopaenia
thromboplastin time
thrombosis
thrombus
tincture
tissue hypoxia
tomography
tonic clonic convulsions
tonus
topical
torsade de pointes
toxaemia
toxicity
toxin
trachea
trance
transaminase
transvenous pacing
tremor
trimester
trypsin
tumour

U
ulceration
ulna
ulnar aspect
uraemia
urea
-uria
urinary tract
urticaria
uterotonic
uvulva

V
vagotonia
vasculitis
vasodilatation
vasomotor
vasopressor
veno-occlusive disease (VOD)
venous
ventricle
ventricular fibrillation
vesication
vesicle
vitiligo
volatile

W
wheal
wheeze
whole bowel irrigation
Wolfe-Parkinson White Syndrome

X
xanthopsia
xerosis
xerostomia

abdominal-

pertaining to the body cavity between the chest and the pelvis.

abortifacient-

an agent which causes abortion.

abscess-

localised collection of pus.

absorption-

uptake of substance into or across tissues.

acetylcholine-

a neurotransmitter; a chemical substance released from nerve endings to activate nerves, muscle and secretory glands.

acetylcholinesterase-

an enzyme involved in the breakdown of acetylcholine.

acid labile-

chemically unstable in acidic conditions.

acidosis-

a high concentration of hydrogen ions in the blood, resulting in an acidic blood pH.

activated charcoal-

finely powdered material with an huge surface area, which is capable of binding a variety of drugs and chemicals.

activator-

a substance which renders another substance active.

acute-

short and severe, not long drawn out (as opposed to chronic).

adenocarcinoma-

a malignant growth (cancer) of glandular tissue.

adenoma-

a type of benign (non-cancerous) tumour.

adsorption-

the attachment of one substance to the surface of another.

-aemia-

suffix pertaining to blood.

aetiology-

the study of causation of disease.

agglutinant-

a substance which causes adhesion and clumping.

agglutination-

sticking or clumping together.

agonist-

a substance that causes a change in cell function by binding to a cell receptor.

albuminuria-

the presence of the protein albumin in the urine.

alkalinisation-

the act of making alkaline.

alkaloid-

resembling an alkali; a large group of organic substances found in plant which possess physiological actions.

allergen-

a substance that causes an allergic reaction.

allergenic-

acting as an allergen.

allergenicity-

a measure of the of the strength of an allergic reaction.

allergy-

a state of hypersensitivity to a particular allergen.

alopecia-

hair loss.

alveolitis-

inflammation of the alveoli.

alveolus (plural alveoli)-

smallest unit in the lung, involved in air exchange;.

Alzheimers disease-

a progressive degenerative disease of the brain which may occur at any age.

amino acid-

a group of organic compounds, the basic unit for building protein.

amiodarone-

a drug used in the treatment of abnormal heart rhythm.

amnesia-

lack or loss of memory.

anaemia-

reduction in the number of red blood cells in the blood.

anaemia, aplastic-

a type of anaemia where the bone marrow fails to produce an adequate number of blood elements.

anaesthetic-

producing anaesthesia i.e. a loss of sensation.

anaesthetic, general-

a substance that produces loss of sensation and loss of consciousness.

anaesthetic, local-

a substance that produces a loss of sensation in a part of the body.

anal-

pertaining to the anus.

analgesia-

relief of pain.

analgesic-

a substance given to control pain.

anaphylaxis-

an immediate hypersensitivity reaction in which sensitised individuals may develop life-threatening signs and symptoms.

anorexia-

lack or loss of appetite.

antagonist-

a substance that prevents an action of another substance.

anterior-

the front surface of an object/organism.

anti-inflammatory-

a substance that counteracts or suppresses inflammation.

anti-mitotic-

a substance that prevents or inhibits mitosis (a process of cell division).

anti-spasmodic-

a substance that relieves spasm.

anti-thrombotic-

a substance that prevents or interferes with formation of thrombi (blood clots).

anti-tumour-

a substance that prevents tumour formation.

antibiotic-

a substance that kills or inhibits the growth of bacteria.

antibody-

a protein that binds to a foreign body (antigen) within the body.

anticholinergic-

a substance that inhibits the action of specific (cholinergic) types of nerves.

anticoagulant-

a substance that prevents blood from clotting.

anticonvulsant-

a substance that prevents or relieves convulsions.

antidote-

a therapeutic substance that counteracts the effects of a poison.

antiemetic-

a substance that prevents or alleviates vomiting.

antifungal-

a substance that kills or inhibits the growth of fungi.

antigen-

a substance that can stimulate an immune response.

antihistamine-

a substance that suppresses the effects of histamine (a substance released in the body during allergic reactions).

anuria-

producing no urine.

anus-

the terminal orifice of the gastrointestinal tract.

aphrodisiac-

a substance that causes sexual excitement.

aplasia-

a lack of development of an organ or tissue.

aqueous-

prepared with water.

aromatic-

having a sweet or pleasant odour; in organic chemistry a molecule containing a ring structure.

arrhythmia-

any variation from the normal heart beat (rhythm).

arrhythmogenic-

a substance provoking an abnormal heart rhythm.

arterial-

pertaining to an artery.

arthralgia-

joint pain.

arthritis-

inflammation of the joints.

ascites-

free fluid within the abdominal cavity.

asphyxiation-

suffocation.

aspiration-

the act of inhaling (usually a liquid or gas) into the lungs; the act of withdrawing fluids from a body cavity by means of suction or siphoning.

AST-

aspartate aminotransferase; an enzyme present in high concentrations in various tissues that is measured to determine the extent of liver damage.

asthma-

a respiratory disease characterised by recurrent attacks of wheezing and difficulty in breathing.

astringent-

a substance that causes tissue contraction, usually locally after topical application.

asymptomatic-

showing no symptoms.

asystole-

no electrical activity in the heart.

ataxia-

failure of muscular co-ordination.

atrial fibrillation-

a type of irregular heart rhythm where the atria beat in a random manner.

atrophy-

wasting away.

autoimmune disease-

an illness caused by, or associated with, the development of an immune response to normal body tissue.

autonomic nervous system-

the part of the nervous system that is involved in controlling the automatic functions of the body (e.g. heart rate).

autonomic neuropathy-

condition affecting the nerves which control the automatic functions of the body.

autosome-

chromosome other than a sex chromosome.

AV (atrioventricular) block, 2nd degree-

partial impairment in heart conduction resulting in missed beats.

avitaminosis B1-

lack of vitamin B1 (thiamine).

axillae-

the armpits.

axillary adenitis-

swelling of lymph nodes (glands) under the armpits.

azotaemic-

the presence of increased nitrogen-containing products in the blood (usually found in kidney failure).

baroreceptor-

a type of receptor in the walls of blood vessels that is stimulated by changes in pressure.

benign-

not malignant; not aggressive in nature.

benzylpenicillin-

an antibiotic.

beta-blocker-

a type of drug which blocks beta receptors in the autonomic nervous system usually causing lowered blood pressure and slowing of the heart.

bidirectional tachycardia-

an abnormal rhythm of the heart.

bigeminy-

an abnormal rhythm of the heart where two beats follow in rapid succession.

bilateral-

affecting both sides.

bile-

bitter, alkaline greenish-yellow fluid secreted by the liver and stored in the gall bladder.

bilirubin-

a pigment largely derived from the breakdown of haemoglobin.

biopsy-

the removal and examination, usually microscopic, of tissue from the living body.

blepharitis-

inflammation of the eyelids.

blepharospasm-

muscle spasm of the eyelids resulting in complete eye closure.

blister-

a small sac containing fluid.

blood gas-

a sample of blood analysed for content of oxygen, carbon dioxide and other substances.

bolus-

a large dose of drug given at once.

bone marrow aplasia-

the absence of blood-manufacturing cells in the bone marrow.

bowel-

the intestine.

brady--

a prefix meaning slow.

bradycardia-

slow heart rate.

bretylium-

a drug used in the treatment of abnormal heart rhythm.

bronchus (plural bronchi)-

one of the two tubes into which the trachea divides at its lower end, one tube going to each lung.

bronchial-

pertaining to the bronchi.

bronchitis-

inflammation of the larger airways in the lung (bronchi).

bronchoconstriction-

narrowing of the airways in the lung (bronchi).

bronchospasm-

uncontrolled contraction of the bronchial muscle resulting in narrowing of the airway.

bulla (plural = bullae)-

a large sac containing fluid.

bullous-

pertaining to bullae.

caecum-

the first part of the large intestine.

cancer-

a general term which covers any malignant growth in any part of the body.

carcinogen-

a cancer-producing substance.

carcinogenic-

pertaining to a carcinogen.

cardiac-

pertaining to the heart.

cardiac arrest-

cessation of blood pumping by the heart.

cardio--

prefix pertaining to the heart.

cardioactive-

having an effect on the heart.

cardiogenic-

originating in the heart.

cardiogenic shock-

disturbance of the circulatory system caused by the heart failing to pump blood adequately.

cardiopulmonary-

pertaining to the heart and lungs.

cardiopulmonary bypass-

used in heart surgery where the heart and lungs are excluded from the blood circulation and replaced by a pump.

cardiorespiratory arrest-

cessation of the pumping action of the heart and of any effort of breathing.

cardiorespiratory function-

the function of the heart and lungs.

cardiotoxic-

damaging to the heart tissue.

cardiovascular-

pertaining to the heart and blood vessels.

carotid sinus-

a section of the carotid artery containing receptors that monitor pressure.

catalysis-

an increase in the rate of a chemical reaction produced by the presence of a catalyst.

catalyst-

an agent which increases the rate of a chemical reaction without being changed itself.

cathartic-

an agent that causes evacuation of the bowels.

cellular respiration-

the chemical process by which a cell uses energy.

cellulitis-

inflammation of connective tissue.

centrilobular-

pertaining to the central portion of a lobule, usually a unit of lung or liver tissue

cerebellar-

pertaining to the cerebellum.

cerebellum-

the part of the brain behind and below the cerebrum. Its main functions are co-ordination of fine voluntary movements and control of posture.

chelating agent-

a substance that binds to metal ions incorporating them within its molecular structure.

chemosis-

swelling of the conjunctiva of the eye.

chloramphenicol-

an antibiotic.

choleretic-

an agent that increases the flow of bile.

cholinesterase-

an enzyme which breaks down the neurotransmitter acetylcholine at nerve endings.

chromatic-

pertaining to colour.

chronic-

persisting over a long time period, as opposed to acute.

chronotrope-

a substance affecting time or rate, such as the heart rate.

ciliary muscle-

the muscle in the eye that controls the shape of the lens when focusing.

circulation-

movement in a regular or circuitous route, as in the movement of the blood through the heart and blood vessels.

cirrhosis-

a severe liver disease characterised by fibrous tissue changes.

clinical-

pertaining to a clinic; refers to the observation and treatment of patients as opposed to theoretical study.

clinical effects-

the signs and symptoms developed by a patient.

coagulopathy-

any disorder of blood clotting.

colic-

acute abdominal pain, characterised by pain increasing and decreasing in waves.

collapse-

a state of extreme prostration.

colon-

the part of the large intestine extending from the caecum to the rectum.

coma-

a state of unconsciousness from which the patient cannot be aroused.

comatose-

in a state of coma.

conductivity (nerves)-

the capacity of the nerve to conduct an electric current.

congenital-

existing at, and usually before, birth.

congestion-

an accumulation of blood in an area.

conjunctiva-

the delicate membrane that lines the eyelids and covers the exposed surface of the sclera.

conjunctival-

pertaining to the conjunctiva.

conjunctivitis-

inflammation of the conjunctiva.

connective tissue-

the tissue which binds together and is the support of the various structures of the body.

constricted pupils-

when the pupils of the eyes are small.

contact dermatitis-

inflammation of the skin due to contact with a chemical.

convulsion-

a violent involuntary contraction or series of contractions of the voluntary muscles.

cornea-

the transparent membrane at the front of the eye.

corneal-

pertaining to the cornea.

cornified-

converted into horny tissue.

coroner-

an officer of the Crown, usually a barrister, solicitor or doctor, who presides over the Coroners Court responsible for determining the cause of death in cases of violent, unexplained or sudden death.

cortex-

the outer layer of an organ e.g. renal cortex.

cortical-

pertaining to the cortex.

corticosteroid-

a group of drugs used for the treatment of inflammation; a hormone produced by the adrenal cortex.

cramp-

spasmodic contraction of a muscle or group of muscles.

creatine kinase-

an enzyme found in brain and muscle tissue.

Crohns disease-

a chronic inflammatory disease involving any part of the gastrointestinal tract, but commonly the bowel.

cross reaction-

usually in allergy testing, the interaction of an antibody with an antigen, the antigen not being specific for that antibody.

cross reactivity-

the degree to which an antibody or antigen participates in cross reactions.

crude extract-

a material in its natural unprocessed state.

CT (computer aided tomography) scan-

computer analysed X-ray used for imaging parts of the body.

cutaneous-

pertaining to the skin.

cyanosis-

blue discoloration, usually referring to the skin and mucous membranes.

cystitis-

inflammation of the bladder.

cyto--

prefix referring to a cell.

cytochrome oxidase-

a group of enzymes involved in cell respiration.

cytochrome P450-

a group of liver enzymes involved in metabolism.

cytolysis-

destruction of cells.

cytomegalovirus (CMV)-

a type of virus.

deactivation-

the process of making inactive.

decoction-

a medicine or other substance made by boiling plants in water and straining the fluid.

decompose-

to break down into basic constituents.

dehydrate-

to remove water.

delirium-

a mental disturbance marked by hallucinations, physical restlessness and incoherence.

demarcated-

having well identified boundaries.

demulcent-

a soothing, mucilaginous or oily fluid that allays irritation.

dependence (drug)-

physical or psychological state where there is a compulsion to take a substance to experience its effects and/or to prevent withdrawal symptoms.

depersonalisation-

alteration in the perception of the self, so that the usual sense of ones own reality is lost or changed.

depigmentation-

removal or loss of pigment.

depilate-

to remove hair.

depolarisation-

the reversal of the resting potential (the difference in potential between the outside and inside of a cell at rest) in excitable cell membranes.

derivative-

a substance derived from another substance by chemical modification.

dermal-

pertaining to the skin (dermis).

dermatitis-

inflammation of the skin (dermis).

dermis-

the layer of the skin below the epidermis.

Descemets membrane-

one of the five layers of the cornea.

desquamation-

the shedding of the superficial layer of the skin.

detoxification-

the process of removing a poison.

diagnosis-

the art or process of distinguishing one disease from another.

dialysis-

separation of substances in solution by virtue of their differing diffusibility through a semipermeable membrane.

diaphragm-

the flat broad muscle between the chest and the abdomen, which is used in breathing.

diarrhoea-

increased frequency and fluidity of stools.

diazepam-

a drug used for sedation or the treatment of convulsions.

DIC-

disseminated intravascular coagulation.

diffusing capacity-

a measure of how well gas travels across the lung into the blood.

digitalis-

a drug derived from Digitalis species (foxglove) used in treatment of abnormal heart rhythms.

dilated pupils-

when the pupils of the eyes are enlarged.

diplopia-

double vision.

disseminated intravascular coagulation (DIC)-

abnormal blood clotting within the blood vessels.

distal-

farthest from any point of reference.

distension-

being enlarged, stretched.

distortion-

being twisted out of normal shape.

disulphide bonds-

a type of chemical bond involving sulphur molecules.

diuretic-

a substance that increases urine output.

DNA-

deoxyribonucleic acid; a compound which occurs mainly in the chromosomes and carries, in coded form, genetic information.

dominant gene-

a gene which expresses its effect even in the presence of other genes.

dorsum-

the back, e.g. of the hand.

double-blind (trial)-

research technique where neither the subject or the observer knows which group the subject is in within the trial.

dropsy-

oedema.

duodenal aspiration-

removal of the contents of the duodenum by means of suction.

duodenum-

the first portion of the small intestine connecting the stomach to the jejunum.

dys--

a prefix meaning difficult, painful, bad, disordered or abnormal.

dyscrasia-

a general term for any pathological condition.

dysfunction-

abnormal functioning of any organ or part.

dysphagia-

difficulty in swallowing.

dysphonia-

impairment of the voice, difficulty in speaking.

dyspnoea-

difficult or laboured breathing.

dysuria-

painful or difficult passing of urine.

ECG-

electrocardiogram; instrument that measures the electrical activity of the heart.

ectopic-

located away from the normal position.

ectopic beats-

beats that occur outside the normal rhythm of the heart.

eczema-

a skin condition characterised by erythema and weeping vesicles, as the skin heals the area becomes scaly.

EEG-

electroencephalogram; instrument that measures the electrical activity of the brain.

effusion-

the escape of fluid into body tissues or cavities.

electrolyte-

a substance that dissociates in fluid, forms charged particles and is capable of conducting electricity.

electrolyte imbalance-

abnormal electrolyte composition of a body fluid.

emesis-

vomiting.

emetic-

a substance which induces vomiting.

encephalopathy-

any disease of the brain.

endocardial-

pertaining to the endocardium; situated or occurring within the heart.

endocardium-

the membrane lining the cavities of the heart and the tissue bed on which it lies.

endocrine-

pertaining to glands that secrete hormones into the blood.

endoplasmic reticulum-

a system of membrane-bound cavities found in cells.

endoscopy-

the process where an instrument is inserted into a hollow body cavity to view the interior.

enema-

the introduction of a liquid into the bowel via the rectum.

enterohepatic circulation-

the excretion and reabsorption of a substance from the gut.

entomologist-

a person who studies insects.

enzymatic hydrolysis-

a chemical reaction, mediated by an enzyme, that involves splitting a compound into fragments by the addition of water.

enzyme-

a protein molecule that catalyses a chemical reactions.

eosinophil-

a type of white blood cell.

eosinophilia-

increased number of eosinophils in the blood.

epidemic-

occurring suddenly in numbers in excess of those expected normally.

epidemiology-

the study of the factors influencing the frequency and distribution of diseases, injury and health-related events.

epidermis-

the outermost layer of the skin.

epigastrium-

the upper, central region of the abdomen.

epinephrine (adrenaline)-

a hormone produced in the body that stimulates the heart and increases blood pressure. epinephrine is the international nomenclature and adrenaline is the UK name.

episclera-

the loose connective tissue between the sclera and the conjunctiva.

epithelial-

pertaining to the epithelium.

epithelium-

the surface layer of cells covering of internal and external surfaces of the body.

erythema-

redness.

erythema multiforme-

a specific skin condition which is characterised by bright red lesions, usually itchy or blistering.

essential oil-

a volatile oil extracted from a plant that contributes to its flavour and fragrance.

eukaryotic-

a cell that contains a nucleus.

euphoria-

an exaggerated sense of well-being.

excretion-

the elimination of waste matter from the body particularly urine and faeces.

expectorant-

a substance that promotes or increases expectoration.

expectoration-

the elimination of secretions from the respiratory tract by coughing.

exposure-

the condition of being subjected to something.

extraocular-

situated outside the eye.

extrasystole-

a premature contraction of the heart.

extrinsic-

coming from or originating from outside.

exudate-

material which has escaped from blood vessels and has been deposited in tissues, usually as a result of inflammation.

faeces-

the waste matter excreted from the bowel.

fasciculation-

visible flickering of muscle.

febrile-

having a fever.

fetal-

relating to the fetus.

fetus-

an unborn child.

fibrinogen-

a blood protein involve in clotting.

fibrosis-

the formation of fibrous tissue.

fissure-

a general term for a cleft or groove.

flaccid-

weak, lax and soft.

flare-

sudden exacerbation of disease; a spreading flush or redness of the skin; the red outermost zone of an urticarial weal reaction.

flecainide-

a drug used in the treatment of abnormal heart rhythm.

fluoroscein-

a dye which glows in ultraviolet light, used to assess corneal injury.

flushed-

transient redness of the face and neck.

formulation-

the specific method of preparation, or the ingredients, of a compound or product.

frusemide-

a drug used to increase urine output, a diuretic.

fulminant-

developing rapidly and with an equally rapid termination.

GABA-

gamma-aminobutyric acid, a neurotransmitter.

galactose-

a type of sugar.

gammaglobulin-

a group of proteins which have antibody activity.

gastric-

pertaining to the stomach.

gastric decontamination-

removal of toxic substances from the stomach.

gastric lavage-

washing out of the stomach

gastritis-

inflammation of the stomach.

gastroenteritis-

acute inflammation of the lining of the stomach and intestines.

gastrointestinal-

pertaining to the stomach and intestines.

gastrointestinal tract-

the passage between the mouth and the anus including the stomach and intestines.

gene-

a segment of a DNA molecule which contains all the information required for synthesis of a product. It is the biological unit of heredity.

genera-

plural of genus.

genetic-

pertaining to genes.

genitalia-

the organs concerned with reproduction.

genus-

a level in the categorisation of organisms.

gingivitis-

inflammation of the gums (gingivae).

gland-

any organ or structure capable of secreting substances not related to their normal needs.

glandular-

pertaining to glands.

glucose-

a type of sugar.

glucose-6-phosphate dehydrogenase (G6PD) deficiency-

lack of the enzyme glucose-6-phosphate dehydrogenase. Patients with this disorder are at increased risk of developing haemolytic anaemia when exposed to certain substances.

glutathione-

an amino acid involved in a number of cellular processes including detoxification reactions in the liver.

glycoprotein-

a protein that has carbohydrate molecules attached to it.

glycoside-

a compound containing a carbohydrate molecule, particularly any such compound found in plants.

goitre-

an enlargement of the thyroid gland.

goitrogen-

a substance that can cause a goitre.

gout-

a metabolic disorder characterised by acute recurrent arthritis caused by elevation in uric acid levels in the body.

grand-mal convulsion-

a convulsion where there is loss of consciousness and tonic-clonic convulsions.

granuloma-

a small nodule of inflammatory cells.

granulomatous-

containing granulomas.

haemagglutinin-

a substance that binds red blood cells together.

haematemesis-

the vomiting of blood.

haematoma-

a localised collection of blood forming a swelling.

haematuria-

blood in the urine.

haemodialysis-

a process where substances are removed from the blood by dialysis.

haemoglobin-

the protein in the blood that carries oxygen.

haemoglobinuria-

haemoglobin in urine.

haemolysis-

disintegration of red blood cells.

haemolytic anaemia-

reduced haemoglobin concentration caused by the rupture of red blood cells.

haemolytic crisis-

severe haemolysis.

haemorrhage-

bleeding.

hallucination-

a false perception occurring without any true sensory stimulus.

hallucinogen-

a substance that induces hallucinations.

heart block-

impairment of heart conduction.

heart block, 1st degree-

the mildest form of heart block in which conduction time is prolonged.

hemiplegia-

weakness or paralysis down one side of the body.

hepatic-

pertaining to the liver.

hepatic first-pass metabolism-

the process whereby a substance absorbed by the gut, is metabolised by the liver, before it has passed into the rest of the circulation.

hepatomegaly-

enlargement of the liver.

hepatosplenomegaly-

enlargement of the liver and spleen.

hepatotoxic-

a substance that can cause damage to the liver.

herbal medicine-

the use of herbs to treat disease.

herbalist-

a practitioner using herbal medicine.

high pressure liquid chromatography (HPLC)-

an analytical technique to separate mixtures of substances.

histamine-

a naturally occurring substance in the body. It has several functions including a role in capillary dilation, gastric acid secretion, smooth muscle contraction and increasing heart rate. it is a mediator of some types of hypersensitivity reactions.

histology-

the study of the minute structure and function of tissues.

histopathology-

the study of the minute structure and function of diseased tissues.

homoeopathic (or homeopathic) medicine-

a system of medicine where diseases are treated by drugs capable of producing symptoms resembling those of the disease to be treated. the drugs are administered in minute doses.

homologous-

corresponding in structure and origin.

hormonal-

pertaining to hormones.

hormone-

a chemical produced by the body that has a specific regulatory effect on certain other organs or cell types.

hyaline cast-

a glassy-looking aggregate formed from protein found in urine.

hydrocortisone-

a corticosteroid produced by the adrenal cortex (or synthetically) that is essential to life.

hydrolysis-

the splitting of a compound into fragments by the addition of water.

hyperaemia-

an excess of blood in an area.

hyperbilirubinaemia-

an increase in bilirubin concentration in the blood.

hyperexcitability-

an excessive response to stimuli.

hypergammaglobulinaemia-

an excess of gammaglobulins in the blood.

hyperglycaemia-

abnormally increased concentration of glucose in the blood.

hyperkalaemia-

abnormally increased concentration of potassium in the blood.

hyperkeratosis-

increased thickness in the horny layer of the skin.

hypernatraemia-

abnormally increased concentration of sodium in the blood

hyperreflexia-

exaggeration of reflexes.

hypersensitivity-

where the body reacts to a foreign substance in an exaggerated fashion.

hypertension-

abnormally increased blood pressure.

hyperventilation-

increased frequency and/or depth of breathing.

hypocalcaemia-

abnormally decreased calcium concentration in the blood.

hypodermic-

beneath the skin (dermis).

hypoglycaemia-

abnormally decreased glucose concentration in the blood.

hypokalaemia-

abnormally decreased potassium concentration in the blood.

hypolipidaemic-

abnormally decreased fat concentration in the blood.

hypomagnesaemia-

abnormally decreased magnesium concentration in the blood.

hyponatraemia-

abnormally decreased sodium concentration in the blood

hypophosphataemia-

abnormally decreased phosphate concentration in the blood

hypopyon-

accumulation of pus in the anterior chamber of the eye.

hypotension-

abnormally low blood pressure.

hypothesis-

a theory.

hypoprothrombinaemia-

low concentration of the clotting protein prothrombin in the blood.

hypothrombinaemia-

low concentration of the clotting protein thrombin in the blood.

hypovolaemia-

abnormally decreased volume of circulating fluid in the body.

hypovolaemic shock-

insufficient delivery of blood to body tissues due to a low blood volume.

hypoxaemia-

decreased oxygen concentration in blood.

hypoxia-

reduction of oxygen supply to tissues.

icterus-

jaundice.

ICU-

intensive care unit; a hospital unit where patients undergo specialised resuscitation, monitoring and treatment procedures and are given one-to-one nursing care.

idiosyncratic reaction-

an unusual individual reaction to a substance.

idioventricular-

relating to or affecting the cardiac ventricles.

Ig E-

immunoglobulin E, a type of antibody.

ileum-

the lower portion of the small intestine from the jejunum to the caecum.

ileus-

paralysis of the intestinal muscle.

immune-

the condition of being protected against infectious disease by either specific or non-specific mechanisms; pertaining to the immune system.

immune reaction/response-

a series of reactions by which the body responds to an antigen.

immunity-

the condition of being immune.

immunostimulant-

a substance that stimulates the immune system.

immunosuppressant-

a substance that suppresses the immune response.

impermeable-

not permitting passage.

impetignisation-

the development of impetigo in an area previously affected with some other skin disease.

impetigo-

an inflammatory, pustular skin disease usually caused by *Staphylococcus* bacteria.

in vitro-

literally in glass; in an artificial environment.

in vivo-

within the living body.

incision-

a cut.

incoordination-

inability to produce smooth, harmonious muscular movements.

incontinence-

uncontrolled evacuation of the urinary bladder or bowels.

inducer-

in biosynthesis, something that causes the production of a particular protein.

induration-

the hardening of tissue.

inebriation-

the condition of being drunk.

infarct-

an area of tissue necrosis due to lack of blood supply.

infarction-

the formation of an infarct.

inflammation-

a local protective reaction in response to injury; characterised by heat, swelling and redness.

infusion-

the introduction of a fluid (other than blood) into a vein that flows in by gravity; the steeping of a substance in water to extract its constituents.

ingestion-

the act of taking a substance into the stomach through the mouth.

inhalant-

a substance that may be taken into the body through the lungs.

inhalation-

the drawing of air or other substances into the lung.

inhibit-

to retard, arrest or restrain.

inhibitor-

any substance that interferes with a chemical reaction, growth or other biological activity.

innocuous-

harmless.

inotrope-

a substance that affects the force of muscle contraction, particularly applied to cardiac muscle.

INR-

international normalised ratio, a measure of the time taken for blood to clot.

insecticide-

a substance that kills insects.

insoluble-

a substance that will not dissolve.

interstitial-

pertaining to or situated between parts or in the inter-spaces of a tissue.

intestinal-

pertaining to the intestine.

intestine-

part of the gut from the stomach to the anus.

intracranial-

within the skull (cranium).

intraepidermal-

within the upper layer of skin (epidermis).

intramuscular-

within the muscle.

intraperitoneal-

within the cavity in the abdomen which is surrounded by a membranous lining (peritoneum).

intravenous-

through a vein.

involution-

to turn inward.

iris-

the coloured part of the eye, perforated by the pupil.

iritis-

inflammation of the iris.

irradiation-

treatment by ionizing radiation.

irrigate-

to wash out.

irritant-

an agent which causes irritation.

ischaemia-

deficiency of blood in a part of the body due to constriction or obstruction of a blood vessel.

-itis-

suffix meaning inflammation.

ITU-

intensive therapy unit; a hospital unit where patients undergo specialised resuscitation, monitoring and treatment procedures and are given one-to-one nursing care.

jaundice-

yellow discoloration in the skin and mucous membranes caused by an elevated concentration of bilirubin.

jejunal-

pertaining to the jejunum.

jejunum-

a part of the small intestine between the duodenum and ileum.

keratoconjunctivitis-

inflammation of the conjunctiva and cornea.

labile-

unstable, fluctuating.

lacrimation-

the formation of tears.

lactic acidosis-

an acid blood pH due to the accumulation of lactic acid.

larynx-

the upper part of the airway between the tongue and the trachea.

latent-

hidden, dormant, existing but not developed or manifest.

latex-

a viscid, milky liquid secreted by some plants.

laxation-

the excretion of faeces.

laxative-

a substance which promotes the excretion of faeces.

LD50-

lethal dose 50%, i.e. the dose sufficient to kill 50% of animals tested.

lectin-

a group of haemagglutinating proteins found primarily in plant seeds.

lesions-

any pathological or traumatic discontinuity of tissue, or loss of function.

lethargy-

a condition of drowsiness or indifference.

leuco--

a prefix meaning white.

leucocyte-

white blood cell.

leucocytopenia-

a decreased number of white blood cells in the blood.

leucocytosis-

an increased number of white blood cells in the blood.

leucocyturia-

the presence of white blood cells in the urine.

leukaemia-

a form of cancer involving abnormally increased production of leucocytes.

LFT-

liver function tests; the measurement of a number of enzymes in order to assess liver function.

lichenification-

thickening of the epidermis resulting in exaggeration of the normal skin marking giving a leathery appearance.

lidocaine (lignocaine)-

a drug used as a local anaesthetic or as a treatment for abnormal heart rhythm. Lidocaine is the international nomenclature, lignocaine is the UK name.

liniment-

an oily liquid preparation to be used on the skin.

lipid-

any of mixed group of fats and fat-like substances.

lipid solubility-

the degree to which a substance dissolves in a lipid.

lobe-

a portion of any organ separated from neighbouring sections by a fissure, septum, etc, particularly the brain, lungs, liver or glands.

lobule-

a small lobe.

loin-

the part of the back between the thorax and the pelvis.

lumbosacral-

pertaining to the loin and sacrum.

lumen-

the cavity or channel within a tube.

lymph node-

collection of tissue that contains cells of the immune system, connected by lymph vessels.

lymphocyte-

a type of white blood cell involved in immunity.

lymphocytosis-

an increased number of lymphocytes in the blood.

lysosome-

an intracellular body containing hydrolytic enzymes involved in intracellular digestion.

macropsia-

a disturbance in vision, where objects are seen as larger than they actually are.

magnetic resonance, nuclear (NMR)-

a non-invasive method of imaging the body using a magnetic field.

malaise-

a vague feeling of bodily discomfort.

malodour-

bad, unpleasant smell.

mania-

a phase of mental disorder characterised by elation, over-talkativeness, flight of ideas and increased motor activity.

manic psychosis-

a mental disorder characterised elation, over-talkativeness, flight of ideas and increased motor activity.

mechanical irritant-

a substance that causes irritation by nature of its physical presence, rather than by a chemical effect.

mechanical ventilation-

using a machine to maintain a patients breathing.

median sternotomy-

the operation of cutting through the middle of the sternum (the central part of the chest).

mediastinal drain-

a drainage tube inserted into the mass of tissues between the lungs (the mediastinum).

medullary centre-

part of the brain involved in controlling vital functions e.g. respiration.

melanotic-

pertaining to the dark pigment, melanin.

menses-

menstruation.

menstruation-

the flow of blood from the uterus occurring once a month.

menstruation-inducers-

substances that can induce menstruation.

mesenteric-

pertaining to the mesentery.

mesentery-

the membranous folds attaching various abdominal organs to the body wall.

metabolism-

the chemical processes by which life is maintained. Substances are broken down (catabolism) and new substances produced (anabolism).

methaemoglobinaemia-

the presence of methaemoglobin in the blood.

methaemoglobin-

an abnormal type of haemoglobin which is unable to transport oxygen to the tissues.

micro-organism-

a minute living organism e.g. bacterium, virus, protozoon.

micropsia-

a disturbance in vision, where objects are seen as smaller than they actually are.

micturition-

urination.

mitochondrion (plural = mitochondria)-

a small rod-shaped body found in cells, it is the principal site of the generation of energy within cells .

moiety-

an part or portion, usually of a chemical substance.

monograph-

an essay on one subject.

morbidity-

a diseased condition or state.

mortality-

the number or frequency of deaths.

mucous membrane-

the mucous-producing lining of some organs.

multifocal-

involving more than one site.

multiorgan-

involving more than one organ.

muscle fasciculations-

a small local contraction of muscle fibres, visible through the skin.

musculature-

the muscle apparatus of the body.

mutagenic-

a substance that can induce a change in the DNA sequence of genes.

myalgia-

muscle pain.

myasthenia gravis-

an autoimmune condition where there is progressive muscular weakness.

mydriatic-

a substance that causes dilation of the pupils.

mydriasis-

dilated pupils.

myo--

a prefix referring to muscle.

myocarditis-

inflammation of the heart muscle.

myocardium-

the muscular component of the heart.

myoclonic-

relating to or marked by myoclonus.

myoclonus-

shock-like contractions of individual muscles or groups of muscles.

myopathy-

any disease of the muscle.

narcosis-

a decrease in central nervous system function, resembling deep sleep.

narcotic-

an agent that induces narcosis.

nasal-

pertaining to the nose.

nausea-

an unpleasant sensation that vomiting is about to take place.

necrolysis-

separation or exfoliation of tissue due to necrosis.

necrosis-

localised death of tissue.

neoplasia-

the formation of a new and abnormal growth.

nephritis-

inflammation of the kidney.

nephr(o)-

a prefix pertaining to the kidney.

neuralgia-

pain arising from the direct irritation of nerves.

neurological-

pertaining to the nervous system.

neuromuscular junction-

the region where a nerve cell connects to a muscle cell.

neuron-

nerve cell.

neuropathy-

functional disturbances and/or pathological changes in the peripheral nervous system.

neurotransmitter-

any of a group of substances released from a nerve cell (neuron), that travels across a synaptic cleft and excites or inhibits the electrical activity of the target cell.

non-commensal bacteria-

bacteria that are not normally found living on or within another organism.

non-steroidal anti-inflammatory drug (NSAID)-

a drug that has anti-inflammatory properties.

nuclear-

pertaining to the nucleus.

nuclear magnetic resonance (NMR)-

a non-invasive method of imaging the body using a magnetic field.

nystagmus-

an involuntary, rapid, repetitive movement of the eyeball.

ocular-

pertaining to the eye.

oculomotor-

pertaining to or effecting movements of the eye.

oedema-

abnormal accumulation of fluid into the tissues.

oesophageal-

pertaining to the oesophagus.

oesophagus-

the hollow muscular tube that connects the throat to the stomach for the passage of food and liquid.

oliguria-

excretion of a reduced amount of urine.

opacification-

the development of opacity.

opacity-

the condition of being opaque i.e. impenetrable to sight.

ophthalmologist-

a physician who specialises in diseases of the eye.

opiate-

a narcotic drug derived from opium.

opisthotonus-

a form of spasm where the back arches, such that only the head and heels are in contact with a horizontal surface.

oral-

pertaining to the mouth.

oropharynx-

that part of the throat that lies between the soft palate and the upper part of the larynx.

osteoarthritis-

a non-inflammatory, degenerative joint disease characterised by destruction of the cartilage.

oxygen tension-

the concentration of dissolved oxygen at which its partial pressure is in equilibrium with the liquid.

pacemaker-

a self-discharging muscle, nerve cell or electrical device that sets the pace of discharge of excitable tissue e.g. the heart.

paediatric-

relating to children.

pallor-

being pale.

palpitation-

a subjective sensation of an unduly rapid or irregular heart beat.

pancreatitis-

inflammation of the pancreas.

papule-

small, well defined, solid, raised lesion on the skin.

paresis-

partial or slight paralysis; weakness of a limb.

paraesthesia-

any abnormality of sensation, usually in the form of pins and needles.

paralysis-

partial or complete loss of nervous function to a part of the body, resulting in inability to move.

parameter-

a variable whose measure is indicative of a quantity or function that cannot be measured directly.

paranoia-

a progressive mental condition characterised by increased suspicion or delusions of persecution.

parasympathetic-

pertaining to part of the autonomic nervous system involved in automatic control of various body systems.

parasympathomimetic-

a substance that produces effects similar to those produced by stimulation of the parasympathetic nerves.

parenteral route-

administration of a drug by injection, bypassing the gastrointestinal system.

patch testing-

a method of allergy testing by application to the skin of patches containing different test substances.

peptide chain-

more than one amino acid linked together by a specific type of chemical bond.

perceptual alterations-

changes in the way an individual perceives or senses something.

percutaneous-

through the skin.

peri--

a prefix meaning around.

periocular-

situated around the eyes.

perioral-

situated around the mouth.

periorbital-

situated around the eye sockets.

peripheral nervous system-

the system of nerves that supplies the musculoskeletal system and surrounding tissues.

peripheral neuritis-

inflammation of the peripheral nerves.

peripheral neuropathy-

any disease of the peripheral nerves.

peripheral vasodilation-

the dilatation of blood vessels situated away from the central circulation, e.g. in the skin.

peristalsis-

the rhythmic contraction of the gut that moves ingested food along.

peristaltic contractions-

the rhythmic contraction of the gut that moves ingested food along.

permeable-

permitting the passage of a substance.

perspiration-

sweat.

petechiae-

small, pinpoint purplish spots caused by haemorrhage.

pH-

a measure of the concentration of hydrogen ions expressed as a negative logarithm, providing a measure of the acidity or alkalinity of a substance.

pharmacology-

the study of drugs, their origin, nature, chemistry and effects.

pharmacopoeia-

a book containing a list of drugs used in medicine.

phenytoin-

a drug used to treat convulsions.

photo---

a prefix denoting relationship to light.

photochemotherapy-

treatment by means of a drug that reacts to ultraviolet radiation.

photophobia-

abnormal visual intolerance to light.

photosensitive-

sensitive to light; an abnormal response involving the interaction of photosensitising substances and sunlight.

phototoxic-

pertaining to phototoxicity.

phototoxicity-

a chemically-induced sensitivity to light.

phototoxin-

a naturally occurring phototoxic substance.

physostigmine-

an alkaloid that stimulates the parasympathetic nervous system and can be used to reverse the effects of anticholinergic agents.

phyto--

a prefix denoting relationship to a plant or plants.

phytophotodermatitis-

phototoxic dermatitis caused by exposure to plants containing a photosensitiser.

phytophototoxic-

a phototoxic substance derived from plants.

pigmentation-

the deposition of pigment.

pinpoint pupils-

constriction of the pupils of the eye.

placebo-

an inactive medicinal preparation having no pharmacological activity.

placebo-controlled-

usually pertaining to a trial where one group of individuals are given an active substance and the other are given a placebo, for comparison of the two groups.

plantar-

pertaining to the sole of the foot.

plasma-

the fluid component of blood in which the cells are suspended.

plasmapheresis-

a technique where blood is taken, the plasma removed and the cellular components returned to the patient.

platelet-

a disc shaped component of blood, involved in the blood clotting process.

platelet activating factor (PAF)-

a mediator of inflammation, one of whose functions is to stimulate platelet aggregation.

platelet aggregation-

the clumping together of platelets as a result of their activation.

pleural-

pertaining to the membrane on either side of the chest surrounding the lung (pleura).

polarised-

the presence of an electrical potential across the membrane of an excitable cell.

poliomyelitis virus-

a type of virus that causes polio.

polydipsia-

to drink excessively.

polymerase-

an enzyme that catalyses polymerisation.

polyuria-

excretion of an excessive amount of urine.

portal hypertension-

an increase in the pressure of the blood in the veins leading from the gut to the liver often resulting in the leakage of fluid into the abdominal cavity.

post-mortem-

after death.

post-mortem examination-

the detailed examination of a body after death, including individual organs, in order to determine the cause of death.

post-operative-

after a surgical operation.

posterior-

pertaining to the back of an object/organism.

postganglionic-

pertaining to the cell positioned downstream of a synaptic junction (a group of which are located in a ganglion).

pre-sternal area-

the area in front of the breastbone (sternum).

precursor-

something that precedes.

prednisone-

a synthetic hormone used in the treatment of inflammatory diseases. It is converted to prednisolone in the liver.

procainamide-

a drug used in the treatment of abnormal heart rhythm.

prognosis-

the forecast of the probable outcome of a disease.

prophylaxis-

the prevention of disease.

protein synthesis-

the manufacture of protein by a cell.

proteinuria-

the presence of protein in the urine.

prothrombin time-

a laboratory measurement of the time taken for blood to clot.

pruritus-

itch.

psoriasis-

a chronic, relapsing, inflammatory skin condition.

psychiatric-

pertaining to mental illness.

psychoactive-

capable of exerting an effect upon the mind.

psychotomimetic-

pertaining to, characterised by, or producing manifestations resembling those of psychosis with hallucinations, distortion of perception and schizophrenia-type behaviour.

psychotropic-

capable of changing mental activity.

ptosis-

drooping of the upper eyelid.

pulmonary-

pertaining to the lung.

pulp-

the tissue of the finger tip.

pulse-

the palpable surge of blood through an artery due to the heart beat.

pulse rate-

the number of pulsations of an artery per minute.

purgative-

a substance causing the evacuation of the bowels.

purpura-

a small haemorrhage in the skin, mucous membrane or outer surface.

pustule-

a collection of pus under the skin.

pyoderma-

chronic cellulitus of the skin.

pyrexia-

fever.

radial aspect-

pertaining to the radius.

radiology-

the study and use of x-rays and allied imaging techniques in the diagnosis and treatment of disease.

radius-

the bone on the outer or thumb side of the forearm.

rash-

a temporary eruption of the skin.

receptor-

a structure on the surface of, or within a cell, which binds a specific substance resulting in a change in cellular function.

refractory-

resistant to treatment.

rehydrate-

to restore water or fluid content.

remission-

a period of abatement of a disease.

renal-

pertaining to the kidney.

repolarisation-

the return of a cell membrane to resting state (polarisation) after depolarisation.

respiratory arrest-

cessation of breathing.

respiratory depression-

decreased rate or depth of breathing.

resuscitate-

to restore to life someone who is apparently dead.

reticuloendothelial cells-

a group of cells existing in some organs which have numerous functions including a role in the immune system.

retina-

the innermost lining of the eye.

retinal-

pertaining to the retina.

retro-auricular-

pertaining to the area behind the ear.

retrograde amnesia-

loss of memory for events that occurred before a particular trauma (e.g. a head injury).

rhabdomyolysis-

disintegration of the muscle.

rheumatism-

a general term for a painful condition of the arms, legs or spine; rheumatism of the joints is classified as arthritis.

rhinitis-

inflammation of the mucous membrane of the nose.

rhinorrhoea-

nasal discharge.

ribosome-

cellular structures which synthesise protein.

right bundle branch block-

a form of abnormal electrical conduction in the heart.

rigors-

a feeling of cold accompanied by severe shivering.

RNA (ribonucleic acid)-

genetic material involved in protein synthesis.

salivation-

the secretion of saliva into the mouth.

scabies-

a parasitic skin disease caused by a mite.

schizophrenia-

a mental disorder characterised by disturbance in thought form and content (hallucinations and delusions), mood and sense of self.

sclera-

the white of the eye.

secretion-

the product of a gland.

sedation-

reduction of activity and excitement

sedative-

an agent that exerts a calming effect.

sepsis-

infection.

sequelae-

the consequences of a disease.

serum-

the clear portion of any body fluid; blood serum is the clear liquid which separates when the blood is allowed to clot.

shingles-

a rash caused by the herpes zoster virus.

shock-

the circulatory disturbance produced by severe injury or illness and due mainly to a reduction in blood volume.

sign-

any objective evidence of disease.

sinus arrest-

cessation of electrical cardiac activity due to a problem at the main pacemaker site of the heart.

sinusoids-

a large channel into which blood vessels open in some organs.

slough-

to shed or cast off.

sodium bicarbonate-

an alkaline chemical compound.

sotalol-

a drug used in treatment of abnormal heart rhythm.

spasm-

involuntary muscular contraction.

spasmolytic-

a substance that relieves spasm.

spina bifida-

a congenital condition where there is incomplete formation of the bony spinal column.

spinal cord-

continuation of nerve tissue from the brain down the centre of the spinal column.

spleen-

an organ in the abdomen that is part of the reticuloendothelial system.

sporothrix-

a type of fungus.

sporotricosis-

a fungal infection characterised by nodular lesions in skin.

status epilepticus-

a continuous series of generalised convulsions without a return to consciousness.

stereoisomers-

compounds that have the same chemical structure but differ in their spatial representation.

steroidal-

pertaining to steroids.

steroids-

a group of compounds which contain a common chemical structure including cortisol, oestrogen and testosterone.

stimulus-

anything which excites functional activity in an organ or part.

subcutaneous-

under the skin.

subepidermal vesiculation-

the formation of collections of fluid beneath the upper layer of the skin.

suberosis-

allergic lung condition resulting from exposure to a cork dust contaminated with a particular fungus.

supine-

lying on the back with face upward.

supportive-

maintaining function.

suppuration-

the formation of pus.

supraventricular-

pertaining to the parts of the heart above the ventricles i.e. atria.

symptom-

any subjective evidence of disease.

symptomatic-

exhibiting the particular symptoms of a disease.

synovitis-

inflammation of the synovial membrane which lines the joints.

systemic-

generalised, not related to any one body system.

systolic-

pertaining to the contraction phase of the heart muscle.

T cell lymphomas-

a type of cancer originating in the lymph nodes and involving the T-cells (a type of cell involved in the immune system).

T wave inversion-

a type of abnormality in an electrocardiogram.

tachy--

a prefix meaning fast.

tachyarrhythmias-

abnormal heart rhythms that are faster than normal.

tachycardia-

a fast heart rate.

tachypnoea-

increased frequency of respiration (breathing).

tactile-

pertaining to touch.

tenesmus-

straining to pass urine or faeces that is usually ineffectual.

teratogenic-

a substance capable of disrupting foetal growth and producing malformations.

tetany-

a condition where muscle is hyperexcitable, so that mild stimuli result in cramps and spasms.

theoretical-

pertaining to a formulated hypothesis.

therapy-

treatment.

thiopental (thiopentone)-

an anaesthetic drug. Thiopental is the international nomenclature and thiopentone is the UK name.

thrombocytopaenia-

a reduction of the number of platelets in the blood.

thromboplastin time-

a laboratory measurement of the time taken for blood to clot

thrombosis-

the formation, development or presence of a thrombus.

thrombus-

an aggregation of blood factors, frequently causing obstruction of a blood vessel.

tincture-

an alcoholic solution of a substance.

tissue hypoxia-

lack of oxygen in tissue.

tomography-

a method of imaging the body.

tonic clonic convulsions-

convulsions characterised by firstly increased muscle tension and subsequent twitching of muscles.

tonus-

slight continuous contraction of muscle.

topical-

the local application of substances to the skin or mucous membranes.

torsade de pointes-

a type of arrhythmia.

toxaemia-

generalised poisoning of the body, usually by bacterial products (toxins).

toxicity-

the quality of being poisonous.

toxin-

a poison, usually used to refer to a substance from a plant or animal.

trachea-

the cartilaginous and membranous tube descending from the larynx to the bronchi.

trance-

a sleep-like state with reduced consciousness and activity.

transaminase-

an enzyme that catalyses the transfer of amino groups.

transvenous pacing-

control of the heart rate by an electrical wire, inserted into the heart through a vein.

tremor-

involuntary trembling or shake.

trimester-

a period of three months, usually used in reference to pregnancy.

trypsin-

an enzyme secreted by the gastrointestinal tract for protein digestion.

tumour-

swelling; a new growth of tissue.

ulceration-

the development of a local defect in the surface of an organ or tissue.

ulna-

the inner and larger bone of the forearm.

ulnar aspect-

pertaining to the ulna.

uraemia-

a syndrome caused by kidney failure where there is retention of urea and other nitrogenous substances.

urea-

a nitrogen-containing compound formed from the metabolism of protein. A raised concentration may be due to poor renal function.

-uria-

suffix pertaining to urine.

urinary tract-

the organs involved in the production and excretion of urine.

urticaria-

a skin condition characterised by the presence of wheals.

uterotonic-

a substance that increases the tonus of the uterine muscle.

uvulva-

the small fleshy mass hanging from the soft palate at the back of the throat.

vagotonia-

hyperexcitability of the vagus nerve causing increased parasympathetic effects.

vasculitis-

inflammation of a blood vessel.

vasodilatation-

dilation (increased diameter) of a blood vessel.

vasomotor-

affecting the diameter of blood vessels.

vasopressor-

an agent that stimulates contraction of the muscular tissue of the capillaries and arteries resulting in increased blood pressure.

veno-occlusive disease (VOD)-

disease resulting from the clotting of blood within veins, usually of the legs, with characteristic skin changes.

venous-

pertaining to a vein.

ventricle-

the lower chamber of the heart.

ventricular fibrillation-

a type of arrhythmia where the ventricles beat in a random manner.

vesication-

the process of blistering

vesicle-

a small sac containing liquid.

vitiligo-

skin disease manifested by depigmented central patches surrounded by dark pigmented areas.

volatile-

tendency to evaporate.

wheal-

smooth slightly elevated area which is redder or paler than normal skin and is often itchy.

wheeze-

a whistling sound made in breathing.

whole bowel irrigation-

a method of gut decontamination whereby the entire gastrointestinal contents are emptied by oral administration of an isotonic fluid.

Wolfe-Parkinson White Syndrome-

a condition caused by an abnormal conducting pathway in the heart, resulting in changes in heart rhythm.

xanthopsia-

visual abnormality where objects appear yellow.

xerosis-

abnormal dryness.

xerostomia-

dry mouth.

All names

This is a list of names for the fungi described in *Poisonous Fungi...* including accepted Latin names (in italics), alternative Latin names, such as synonyms, and common names. Scroll down the left-hand column to find the name that you know. The corresponding name in the right-hand column is the Latin name used in *Poisonous Fungi...* To access photographic images, a description and toxicity information for that fungus, exit from Help and return to the Question Screen. Select the **Latin names** item from the **Help** menu. Scroll down the list of suspects that is presented until you find the name that you are looking for, hightlight it and click on the **View** button.

Note: The list of common names may not be complete because many different common names may be applied to one fungus. You should also be aware that common names can be used incorrectly.

All names	Name used in *Poisonous Fungi...*
Agaric, Broad-Gilled	*Megacollybia platyphylla*
Agaric, Clouded	*Lepista nebularis*
Agaric, Fly	*Amanita muscaria*
Agaric, Hemispheric	*Agrocybe pediades*
Agaric, Rose-Coloured Waxy	*Laccaria*
Agaric, Spring	*Agrocybe praecox*
Agaric, Tall	*Amanita excelsa*
Agaric, Verdigris	*Stropharia aeruginosa*
Agaric, Yellow Cottony	*Leucocoprinus birnbaumii*
Agaricus	*Agaricus*
Agaricus arvensis	*Agaricus*
Agaricus augustus	*Agaricus*
Agaricus bisporus	*Agaricus*
Agaricus campestris	*Agaricus*
Agaricus macrosporus	*Agaricus*
Agaricus meleagris	*Agaricus xanthoderma*
Agaricus placomyces	*Agaricus xanthoderma*
Agaricus praeclaresquamosus	*Agaricus xanthoderma*
Agaricus silvaticus	*Agaricus silvaticus*
Agaricus xanthoderma	*Agaricus xanthoderma*
Agaricus, Yellow-Foot	*Agaricus xanthoderma*
Agrocybe pediades	*Agrocybe pediades*
Agrocybe praecox	*Agrocybe praecox*
Agrocybe semiorbicularis	*Agrocybe pediades*
Alcohol Ink Cap	*Coprinus atramentarius*
Aleuria aurantia	*Aleuria aurantia*
Amanita ceciliae	*Amanita ceciliae*
Amanita citrina	*Amanita citrina*
Amanita citrina var. alba	*Amanita citrina*
Amanita excelsa	*Amanita excelsa*
Amanita fulva	*Amanita* sect. *Vaginatae*
Amanita gemmata	*Amanita gemmata*
Amanita inaurata	*Amanita ceciliae*

Amanita junquillea	*Amanita gemmata*
Amanita mappa	*Amanita citrina*
Amanita muscaria	*Amanita muscaria*
Amanita pantherina	*Amanita pantherina*
Amanita phalloides	*Amanita phalloides*
Amanita porphyria	*Amanita porphyria*
Amanita rubescens	*Amanita rubescens*
Amanita rubescens var. annulosulphurea	*Amanita rubescens*
Amanita sect. *Vaginatae*	*Amanita* sect. *Vaginatae*
Amanita spissa	*Amanita excelsa*
Amanita vaginata	*Amanita* sect. *Vaginatae*
Amanita vaginata var. fulva	*Amanita* sect. *Vaginatae*
Amanita verna	*Amanita virosa*
Amanita virosa	*Amanita virosa*
Amanita, Citron	*Amanita citrina*
Amanita, Stout Stalked	*Amanita excelsa*
Amanita, Tall	*Amanita excelsa*
Amanitopsis fulva	*Amanita* sect. *Vaginatae*
Amanitopsis strangulata	*Amanita ceciliae*
Amanitopsis vaginata	*Amanita* sect. *Vaginatae*
Amethyst Deceiver	*Laccaria*
Armillaria mellea	*Armillaria mellea*
Armillariella mellea	*Armillaria mellea*
Auricularia auricula-judae	*Auricularia auricula-judae*
Auricularia auricula	*Auricularia auricula-judae*
Autumn Chanterelle	*Cantharellus tubiformis*
Autumn Galerina	*Galerina*
Bay Bolete	*Boletus badius*
Beechwood Sickener	*Russula*
Big Laughing Gymnopilus	*Gymnopilus junonius*
Bishops Mitre	*Helvella*
Bitter Bolete	*Tylopilus felleus*
Black Helvella	*Helvella*
Black Morel	*Morchella*
Black Staining Polypore	*Meripilus giganteus*
Black Trumpet	*Craterellus cornucopioides*
Bladder Cup	*Peziza*
Blood Red Cortinarius	*Dermocybe sanguinea*
Blue-Leg	*Lepista*
Bluing Psilocybe	*Psilocybe cyanescens*
Blusher, The	*Amanita rubescens*
Bolete, Bay	*Boletus badius*
Bolete, Bitter	*Tylopilus felleus*
Bolete, Brown Birch	*Leccinum*
Bolete, Chestnut	*Gyroporus castaneus*
Bolete, Devils	*Boletus satanas* group
Bolete, Dotted Stem	*Boletus luridus* group
Bolete, Granulated	*Suillus*
Bolete, King	*Boletus edulis*
Bolete, Orange Birch	*Leccinum*

Bolete, Red Stalked	*Boletus luridus* group
Bolete, Red-Cracking	*Xerocomus chrysenteron*
Bolete, Satans	*Boletus satanas* group
Boletus albidus	*Boletus radicans*
Boletus badius	*Boletus badius*
Boletus bovinus	*Suillus*
Boletus calopus	*Boletus calopus*
Boletus castaneus	*Gyroporus castaneus*
Boletus chrysenteron	*Xerocomus chrysenteron*
Boletus edulis	*Boletus edulis*
Boletus erythropus	*Boletus luridus* group
Boletus felleus	*Tylopilus felleus*
Boletus granulatus	*Suillus*
Boletus luridiformis	*Boletus luridus* group
Boletus luridus	*Boletus luridus* group
Boletus luridus group	*Boletus luridus* group
Boletus luteus	*Suillus*
Boletus pachypus	*Boletus calopus*
Boletus piperatus	*Chalciporus piperatus*
Boletus radicans	*Boletus radicans*
Boletus satanas	*Boletus satanas* group
Boletus satanas group	*Boletus satanas* group
Boletus satanoides	*Boletus satanas* group
Boletus scaber	*Leccinum scabrum*
Boletus splendidus	*Boletus satanas* group
Boletus versipellis	*Leccinum versipelle*
Boletus, Peppery	*Chalciporus piperatus*
Bootlace Fungus	*Armillaria mellea*
Brain Fungus	*Sparassis crispa*
Broad Gilled Agaric	*Megacollybia platyphylla*
Brown Birch Bolete	*Leccinum*
Brown Hay Cap	*Panaeolina foenisecii*
Brown Roll Rim	*Paxillus involutus*
Buff Meadow Cap	*Hygrophorus pratensis*
Burnt Tricholoma	*Tricholoma*
Calocybe gambosa	*Calocybe gambosa*
Calvatia excipuliformis	*Handkea excipuliformis*
Calvatia gigantea	*Calvatia gigantea*
Camarophyllus niveus	*Camarophyllus virgineus*
Camarophyllus pratensis	*Camarophyllus pratensis*
Camarophyllus virgineus	*Camarophyllus virgineus*
Cantharellus cibarius	*Cantharellus cibarius*
Cantharellus cornucopioides	*Craterellus cornucopioides*
Cantharellus infundibuliformis	*Cantharellus tubiformis*
Cantharellus tubiformis	*Cantharellus tubiformis*
Cauliflower Fungus	*Sparassis crispa*
Cep	*Boletus edulis*
Chalciporus piperatus	*Chalciporus piperatus*
Changing Pholiota	*Kuehneromyces mutabilis*
Chanterelle	*Cantharellus cibarius*
Chanterelle, Autumn	*Cantharellus tubiformis*

Chanterelle, False	*Hygrophoropsis aurantiaca*
Chanterelle, Trumpet	*Cantharellus tubiformis*
Charcoal Pholiota	*Pholiota highlandensis*
Chestnut Bolete	*Gyroporus castaneus*
Chestnut Parasol	*Lepiota*
Chicken Of The Woods	*Laetiporus sulphureus*
Citron Amanita	*Amanita citrina*
Clathrus ruber	*Clathrus ruber*
Clavaria formosa	*Ramaria*
Clayey Hebeloma	*Hebeloma*
Clitocybe	*Clitocybe*
Clitocybe candicans	*Clitocybe*
Clitocybe clavipes	*Clitocybe clavipes*
Clitocybe connata	*Lyophyllum connatum*
Clitocybe dealbata	*Clitocybe*
Clitocybe flaccida	*Lepista flaccida*
Clitocybe geotropa	*Clitocybe geotropa*
Clitocybe gigantea	*Leucopaxillus giganteus*
Clitocybe inversa	*Lepista flaccida*
Clitocybe laccata	*Laccaria*
Clitocybe luscina	*Lepista luscina*
Clitocybe maxima	*Clitocybe geotropa*
Clitocybe mellea	*Armillaria mellea*
Clitocybe nebularis	*Lepista nebularis*
Clitocybe olearia	*Omphalotus olearius*
Clitocybe phyllophila	*Clitocybe*
Clitocybe pithyophila	*Clitocybe*
Clitocybe rivulosa	*Clitocybe*
Clitocybe, Clouded	*Lepista nebularis*
Clitocybe, Flat Footed	*Clitocybe clavipes*
Clitocybe, Giant	*Leucopaxillus giganteus*
Clitocybe, Ivory	*Clitocybe*
Clitocybe, Trumpet	*Clitocybe geotropa*
Clitopilus prunulus	*Clitopilus prunulus*
Clouded Agaric	*Lepista nebularis*
Clouded Clitocybe	*Lepista nebularis*
Clouded Funnel Cap	*Lepista nebularis*
Club Foot Funnel Cap	*Clitocybe clavipes*
Coconut-Scented Milk-Cap	*Lactarius*
Collybia aquosa	*Collybia dryophila*
Collybia dryophila	*Collybia dryophila*
Collybia platyphylla	*Megacollybia platyphylla*
Collybia, Oak-Loving	*Collybia dryophila*
Common Earthball	*Scleroderma*
Common Ink Cap	*Coprinus atramentarius*
Common Morel	*Morchella*
Common Scaber Stalk	*Leccinum*
Common Stinkhorn	*Phallus impudicus*
Common Truffle	*Tuber aestivum*
Common Veiled Fairy Cake	*Hebeloma*
Common Violet Milk-Cap	*Lactarius*

Common White Fibre Head	*Inocybe*
Common White Helvella	*Helvella*
Common White Inocybe	*Inocybe*
Common White Saddle	*Helvella*
Common Yellow Russula	*Russula*
Conical Blackening Wax Cap	*Hygrocybe conica*
Conical Slimy Cap	*Hygrocybe conica*
Conical Wax Cap	*Hygrocybe conica*
Conocybe filaris	*Conocybe filaris*
Conocybe, Deadly	*Conocybe filaris*
Coprinus acuminatus	*Coprinus atramentarius*
Coprinus atramentarius	*Coprinus atramentarius*
Coprinus comatus	*Coprinus comatus*
Coprinus disseminatus	*Coprinus disseminatus*
Coprinus micaceus	*Coprinus micaceus*
Coprinus ovatus	*Coprinus comatus*
Coprinus picaceus	*Coprinus picaceus*
Coprinus, Non-Inky	*Coprinus disseminatus*
Cortinarius cinnabarinus	*Dermocybe sanguinea*
Cortinarius gentilis	*Cortinarius* subgenus *Leprocybe*
Cortinarius orellanoides	*Cortinarius* subgenus *Leprocybe*
Cortinarius orellanus	*Cortinarius* subgenus *Leprocybe*
Cortinarius sanguineus	*Dermocybe sanguinea*
Cortinarius semisanguineus	*Dermocybe sanguinea*
Cortinarius speciosissimus	*Cortinarius* subgenus *Leprocybe*
Cortinarius splendens	*Cortinarius splendens*
Cortinarius subgenus *Leprocybe*	*Cortinarius* subgenus *Leprocybe*
Cortinarius, Blood Red	*Dermocybe sanguinea*
Cortinarius, Deadly	*Cortinarius* subgenus *Leprocybe*
Cortinarius, Foxy Orange	*Cortinarius* subgenus *Leprocybe*
Craterellus cornucopioides	*Craterellus cornucopioides*
Cultivated Mushroom	*Agaricus*
Cuphophyllus pratensis	*Camarophyllus pratensis*
Cystoderma amianthinum	*Cystoderma amianthinum*
Cystoderma, Pungent	*Cystoderma amianthinum*
Deadly Conocybe	*Conocybe filaris*
Deadly Cortinarius	*Cortinarius* subgenus *Leprocybe*
Death Cap	*Amanita phalloides*
Deceiver	*Laccaria*
Dermocybe cinnabarina	*Dermocybe sanguinea*
Dermocybe sanguinea	*Dermocybe sanguinea*
Dermocybe semisanguinea	*Dermocybe sanguinea*
Destroying Angel	*Amanita virosa*

Devils Bolete	*Boletus satanas* group
Dingy Tricholoma	*Tricholoma*
Dirty Tricholoma	*Tricholoma*
Disciotis venosa	*Disciotis venosa*
Dog Stinkhorn	*Phallus impudicus*
Dotted Stem Bolete	*Boletus luridus* group
Dryophila carbonaria	*Pholiota highlandensis*
Dryophila squarrosa	*Pholiota squarrosa*
Dung Roundhead	*Stropharia semiglobata*
Early Cup Fungus	*Peziza*
Earthball, Common	*Scleroderma*
Earthball, Leopard Spotted	*Scleroderma*
Earthball, Pig Skin Poison	*Scleroderma*
Earthball, Scaly	*Scleroderma*
Emetic Russula	*Russula*
English Truffle	*Tuber aestivum*
Entoloma	*Entoloma*
Entoloma aprile	*Entoloma*
Entoloma clypeatum	*Entoloma*
Entoloma incanum	*Entoloma incanum*
Entoloma lividum	*Entoloma sinuatum*
Entoloma nidorosum	*Entoloma*
Entoloma rhodopolium	*Entoloma*
Entoloma rhodopolium f. nidorosum	*Entoloma*
Entoloma sericeum	*Entoloma*
Entoloma sinuatum	*Entoloma sinuatum*
Entoloma, Livid	*Entoloma sinuatum*
Entoloma, Roman Shield	*Entoloma*
Entoloma, Rosy	*Entoloma*
Entoloma, Strong Scented	*Entoloma*
Fairies Bonnet	*Coprinus disseminatus*
Fairy Cake Mushroom	*Hebeloma*
Fairy Ring Champignon	*Marasmius oreades*
False Chanterelle	*Hygrophoropsis aurantiaca*
False Death Cap	*Amanita citrina*
False Morel	*Gyromitra esculenta*
False Morel	*Helvella*
Field Blewit	*Lepista*
Field Mushroom	*Agaricus*
Flammula carbonaria	*Pholiota highlandensis*
Flammula penetrans	*Gymnopilus penetrans*
Flat Footed Clitocybe	*Clitocybe clavipes*
Fluted White Helvella	*Helvella*
Fly Agaric	*Amanita muscaria*
Foxy Orange Cortinarius	*Cortinarius* subgenus *Leprocybe*
Freckle Flame Cap	*Gymnopilus penetrans*
Freckle-Gill Gymnopilus	*Gymnopilus penetrans*
Fringed Hay Cap	*Panaeolus sphinctrinus*
Fungus, Bootlace	*Armillaria mellea*

Fungus, Brain	*Sparassis crispa*
Fungus, Cauliflower	*Sparassis crispa*
Fungus, Early Cup	*Peziza*
Fungus, Hedgehog	*Hydnum*
Fungus, Honey	*Armillaria mellea*
Fungus, Magpie	*Coprinus picaceus*
Fungus, Orange Peel	*Aleuria aurantia*
Fungus, Red Cage	*Clathrus ruber*
Fungus, Styptic	*Panellus stipticus*
Fungus, Turban	*Gyromitra esculenta*
Fungus, Yellow Knight	*Tricholoma*
Fungus, Yellow Tipped Coral	*Ramaria*
Funnel Cap	*Clitocybe*
Galera marginata	*Galerina*
Galerina	*Galerina*
Galerina autumnalis	*Galerina*
Galerina marginata	*Galerina*
Galerina mutabilis	*Kuehneromyces mutabilis*
Galerina unicolor	*Galerina*
Galerina, Autumn	*Galerina*
Galerina, Marginate	*Galerina*
Garland Stropharia	*Stropharia coronilla*
Gas Works Tricholoma	*Tricholoma*
Giant Clitocybe	*Leucopaxillus giganteus*
Giant Flame-Cap	*Gymnopilus junonius*
Giant Polypore	*Meripilus giganteus*
Giant Puffball	*Calvatia gigantea*
Girdled Panaeolus	*Panaeolus subbalteatus*
Girolle	*Cantharellus cibarius*
Glistening Ink Cap	*Coprinus micaceus*
Golden Cap	*Psilocybe cubensis*
Granulated Bolete	*Suillus*
Great Orange Elf Cup	*Aleuria aurantia*
Green Stropharia	*Stropharia aeruginosa*
Grey Mottle Gill	*Panaeolus sphinctrinus*
Grifola frondosa	*Grifola frondosa*
Grifola gigantea	*Meripilus giganteus*
Grisette	*Amanita* sect. *Vaginatae*
Grisette, Rose Gilled	*Volvariella gloiocephala*
Grisette, Tawny	*Amanita* sect. *Vaginatae*
Gymnopilus junonius	*Gymnopilus junonius*
Gymnopilus penetrans	*Gymnopilus penetrans*
Gymnopilus spectabilis	*Gymnopilus junonius*
Gymnopilus, Big Laughing	*Gymnopilus junonius*
Gymnopilus, Freckled-Gilled	*Gymnopilus penetrans*
Gyromitra esculenta	*Gyromitra esculenta*
Gyroporus castaneus	*Gyroporus castaneus*
Handkea excipuliformis	*Handkea excipuliformis*
Hay Cap	*Panaeolina foenisecii*
Hebeloma	*Hebeloma*
Hebeloma crustuliniforme	*Hebeloma*

Hebeloma edurum	*Hebeloma*
Hebeloma mesophaeum	*Hebeloma*
Hebeloma radicosum	*Hebeloma*
Hebeloma sacchariolens	*Hebeloma*
Hebeloma sinapizans	*Hebeloma*
Hebeloma, Clayey	*Hebeloma*
Hebeloma, Fairy Cake	*Hebeloma*
Hebeloma, Pine	*Hebeloma*
Hebeloma, Rooting	*Hebeloma*
Hebeloma, Scented	*Hebeloma*
Hedgehog Fungus	*Hydnum*
Helvella	*Helvella*
Helvella acetabulum	*Helvella acetabulum*
Helvella crispa	*Helvella*
Helvella elastica	*Helvella*
Helvella lacunosa	*Helvella*
Helvella leucomelaena	*Helvella leucomelaena*
Helvella, Black	*Helvella*
Helvella, Common White	*Helvella*
Helvella, Fluted White	*Helvella*
Helvella, Smooth Stalked	*Helvella*
Hemispheric Agaric	*Agrocybe pediades*
Hen Of The Woods	*Grifola frondosa*
Hirneola auricula-judae	*Auricularia auricula-judae*
Honey Fungus	*Armillaria mellea*
Horn Of Plenty	*Craterellus cornucopioides*
Horse Mushroom	*Agaricus*
Hydnum	*Hydnum*
Hydnum repandum	*Hydnum*
Hydnum repandum var. rufescens	*Hydnum*
Hydnum rufescens	*Hydnum*
Hygrocybe conica	*Hygrocybe conica*
Hygrocybe nivea	*Camarophyllus virgineus*
Hygrocybe virginea	*Camarophyllus virgineus*
Hygrophoropsis aurantiaca	*Hygrophoropsis aurantiaca*
Hygrophorus conicus	*Hygrocybe conica*
Hygrophorus pratensis	*Camarophyllus pratensis*
Hypholoma fasciculare	*Hypholoma fasciculare*
Ink Cap, Alcohol	*Coprinus atramentarius*
Ink Cap, Common	*Coprinus atramentarius*
Ink Cap, Glistening	*Coprinus micaceus*
Ink Cap, Magpie	*Coprinus picaceus*
Ink Cap, Shaggy	*Coprinus comatus*
Ink Cap, Smooth	*Coprinus atramentarius*
Inocybe	*Inocybe*
Inocybe bongardii	*Inocybe*
Inocybe cookei	*Inocybe*
Inocybe corydalina	*Inocybe*
Inocybe fastigiata	*Inocybe*
Inocybe flocculosa	*Inocybe*

Inocybe gausapata	*Inocybe*
Inocybe geophylla	*Inocybe*
Inocybe geophylla var. lilacina	*Inocybe*
Inocybe godeyi	*Inocybe*
Inocybe haemacta	*Inocybe*
Inocybe lanuginosa	*Inocybe*
Inocybe maculata	*Inocybe*
Inocybe napipes	*Inocybe*
Inocybe patouillardii	*Inocybe*
Inocybe rimosa	*Inocybe*
Inocybe, Common White	*Inocybe*
Inocybe, Peaked	*Inocybe*
Inocybe, Red Staining	*Inocybe*
Inocybe, Turnip Foot	*Inocybe*
Inocybe, Woolly	*Inocybe*
Ivory Clitocybe	*Clitocybe*
Jack O Lantern	*Omphalotus olearius*
Jews Ear	*Auricularia auricula-judae*
King Bolete	*Boletus edulis*
Krombholziella scabrum	*Leccinum*
Krombholziella versipelle	*Leccinum*
Kuehneromyces mutabilis	*Kuehneromyces mutabilis*
Laccaria	*Laccaria*
Laccaria amethystea	*Laccaria*
Laccaria amethystina	*Laccaria*
Laccaria laccata	*Laccaria*
Laccaria laccata var. amethystina	*Laccaria*
Laccaria laccata var. proxima	*Laccaria*
Laccaria proxima	*Laccaria*
Lacrymaria lacrymabunda	*Lacrymaria velutina*
Lacrymaria pyrotricha	*Lacrymaria velutina*
Lacrymaria velutina	*Lacrymaria velutina*
Lactarius	*Lactarius*
Lactarius aspideus	*Lactarius*
Lactarius blumii	*Lactarius*
Lactarius chrysorheus	*Lactarius*
Lactarius deliciosus	*Lactarius* sect. *Dapetes*
Lactarius deterrimus	*Lactarius* sect. *Dapetes*
Lactarius glyciosmus	*Lactarius*
Lactarius helvus	*Lactarius*
Lactarius necator	*Lactarius*
Lactarius pubescens	*Lactarius*
Lactarius repraesentaneus	*Lactarius*
Lactarius rufus	*Lactarius*
Lactarius sect. *Dapetes*	*Lactarius* sect. *Dapetes*
Lactarius torminosus	*Lactarius*
Lactarius turpis	*Lactarius*
Lactarius uvidus	*Lactarius*
Lactarius, Moist	*Lactarius*
Laetiporus sulphureus	*Laetiporus sulphureus*

Langermannia gigantea	*Calvatia gigantea*
Large Spored Mushroom	*Agaricus*
Lawn Puffball	*Vascellum pratense*
Lawyers Wig	*Coprinus comatus*
Leccinum	*Leccinum*
Leccinum scabrum	*Leccinum*
Leccinum testaceoscabrum	*Leccinum*
Leccinum versipelle	*Leccinum*
Leopard Spotted Earthball	*Scleroderma*
Lepiota	*Lepiota*
Lepiota amianthina	*Cystoderma amianthinum*
Lepiota brunneoincarnata	*Lepiota*
Lepiota castanea	*Lepiota*
Lepiota cristata	*Lepiota*
Lepiota eyrei	*Melanophyllum eyrei*
Lepiota helveola	*Lepiota*
Lepiota ignipes	*Lepiota*
Lepiota leucothites	*Leucoagaricus leucothites*
Lepiota lutea	*Leucocoprinus birnbaumii*
Lepiota naucina	*Leucoagaricus leucothites*
Lepiota procera	*Macrolepiota procera*
Lepiota rhacodes	*Macrolepiota rhacodes*
Lepiota subincarnata	*Lepiota*
Lepiota, Smooth	*Leucoagaricus leucothites*
Lepista	*Lepista*
Lepista flaccida	*Lepista flaccida*
Lepista inversa	*Lepista flaccida*
Lepista luscina	*Lepista luscina*
Lepista nebularis	*Lepista nebularis*
Lepista nuda	*Lepista*
Lepista panaeola	*Lepista luscina*
Lepista personata	*Lepista*
Lepista saeva	*Lepista*
Lepista sordida	*Lepista*
Leptonia incana	*Entoloma incanum*
Leptopodia elastica	*Helvella*
Leucoagaricus leucothites	*Leucoagaricus leucothites*
Leucoagaricus naucinus	*Leucoagaricus leucothites*
Leucocoprinus birnbaumii	*Leucocoprinus birnbaumii*
Leucocoprinus luteus	*Leucocoprinus birnbaumii*
Leucopaxillus giganteus	*Leucopaxillus giganteus*
Liberty Cap	*Psilocybe semilanceata*
Lilac Mycena	*Mycena pura*
Liquorice Milk-Cap	*Lactarius*
Livid Entoloma	*Entoloma sinuatum*
Luminescent Panellus	*Panellus stipticus*
Lycoperdon depressum	*Vascellum pratense*
Lycoperdon excipuliforme	*Handkea excipuliformis*
Lycoperdon giganteum	*Calvatia gigantea*
Lycoperdon hyemale	*Vascellum pratense*
Lyophyllum connatum	*Lyophyllum connatum*

Lyophyllum georgii	*Calocybe gambosa*
Macrolepiota procera	*Macrolepiota procera*
Macrolepiota rhacodes	*Macrolepiota rhacodes*
Magic Mushroom	*Psilocybe semilanceata*
Magpie Fungus	*Coprinus picaceus*
Magpie Ink Cap	*Coprinus picaceus*
Maitake	*Grifola frondosa*
Malodorous Parasol	*Lepiota*
Man On Horseback	*Tricholoma*
Marasmius dryophilus var. aquosus	*Collybia dryophila*
Marasmius oreades	*Marasmius oreades*
Marginate Galerina	*Galerina*
Meadow Puffball	*Vascellum pratense*
Meadow Snow Cap	*Camarophyllus virgineus*
Meadow Wax Cap	*Camarophyllus pratensis*
Megacollybia platyphylla	*Megacollybia platyphylla*
Melanophyllum eyrei	*Melanophyllum eyrei*
Meripilus giganteus	*Meripilus giganteus*
Mica Cap	*Coprinus micaceus*
Milk-Cap, Coconut-Scented	*Lactarius*
Milk-Cap, Common Violet	*Lactarius*
Milk-Cap, Liquorice	*Lactarius*
Milk-Cap, Pink Fringed	*Lactarius*
Milk-Cap, Red-Hot	*Lactarius*
Milk-Cap, Rufous	*Lactarius*
Milk-Cap, Saffron	*Lactarius* sect. *Dapetes*
Milk-Cap, Ugly	*Lactarius*
Milk-Cap, Woolly	*Lactarius*
Milk-Cap, Yellow	*Lactarius*
Miller, The	*Clitopilus prunulus*
Moist Lactarius	*Lactarius*
Morchella	*Morchella*
Morchella elata	*Morchella*
Morchella esculenta	*Morchella*
Morchella vulgaris	*Morchella*
Morel, Black	*Morchella*
Morel, Common	*Morchella*
Morel, False	*Gyromitra esculenta*
Morel, False	*Helvella*
Morel, Round	*Morchella*
Morel, Yellow	*Morchella*
Mowers Mushroom	*Panaeolina foenisecii*
Mushroom, Cultivated	*Agaricus*
Mushroom, Fairy Cake	*Hebeloma*
Mushroom, Field	*Agaricus*
Mushroom, Horse	*Agaricus*
Mushroom, Large Spored	*Agaricus*
Mushroom, Magic	*Psilocybe semilanceata*
Mushroom, Mowers	*Panaeolina foenisecii*
Mushroom, Oyster	*Pleurotus ostreatus*

Mushroom, Parasol	*Macrolepiota procera*
Mushroom, Platterful	*Megacollybia platyphylla*
Mushroom, Red Staining	*Agaricus silvaticus*
Mushroom, Scaly Wood	*Agaricus silvaticus*
Mushroom, St. Georges	*Calocybe gambosa*
Mushroom, Sweetbread	*Clitopilus prunulus*
Mushroom, Verdigris	*Stropharia aeruginosa*
Mushroom, Yellow Staining	*Agaricus xanthoderma*
Mutinus caninus	*Phallus impudicus*
Mycena pura	*Mycena pura*
Mycena, Lilac	*Mycena pura*
Mycena, Pink	*Mycena pura*
Naematoloma fasciculare	*Hypholoma fasciculare*
Nolanea sericea	*Entoloma*
Nolanea, Silky	*Entoloma*
Non-inky Coprinus	*Coprinus disseminatus*
Oak-loving Collybia	*Collybia dryophila*
Omphalotus olearius	*Omphalotus olearius*
Orange Birch Bolete	*Leccinum*
Orange Peel Fungus	*Aleuria aurantia*
Orange Pholiota	*Gymnopilus junonius*
Orange Slime Cap	*Stropharia aurantiaca*
Oudemansiella platyphylla	*Megacollybia platyphylla*
Oyster Mushroom	*Pleurotus ostreatus*
Panaeolina foenisecii	*Panaeolina foenisecii*
Panaeolus campanulatus var. sphinctrinus	*Panaeolus sphinctrinus*
Panaeolus foenisecii	*Panaeolina foenisecii*
Panaeolus sphinctrinus	*Panaeolus sphinctrinus*
Panaeolus subbalteatus	*Panaeolus subbalteatus*
Panellus stypticus	*Panellus stypticus*
Panellus, Luminescent	*Panellus stypticus*
Panther Cap	*Amanita pantherina*
Panus stypticus	*Panellus stypticus*
Parasol Mushroom	*Macrolepiota procera*
Parasol, Chestnut	*Lepiota*
Parasol, Malodorous	*Lepiota*
Parasol, Pinkish	*Lepiota*
Parasol, Pungent	*Cystoderma amianthinum*
Parasol, Saffron	*Cystoderma amianthinum*
Parasol, Shaggy	*Macrolepiota rhacodes*
Parasol, Stinking	*Lepiota*
Paxillus involutus	*Paxillus involutus*
Paxillus, Poison	*Paxillus involutus*
Paxina acetabulum	*Helvella acetabulum*
Paxina leucomelas	*Helvella leucomelaena*
Peaked Inocybe	*Inocybe*
Penny Bun	*Boletus edulis*
Peppery Boletus	*Chalciporus piperatus*
Pestle-Shaped Puffball	*Handkea excipuliformis*
Peziza	*Peziza*

Peziza aurantia	*Aleuria aurantia*
Peziza badia	*Peziza*
Peziza succosa	*Peziza*
Peziza vesiculosa	*Peziza*
Phallus impudicus	*Phallus impudicus*
Pholiota carbonaria	*Pholiota highlandensis*
Pholiota filaris	*Conocybe filaris*
Pholiota highlandensis	*Pholiota highlandensis*
Pholiota junonia	*Gymnopilus junonius*
Pholiota marginata	*Galerina*
Pholiota mutabilis	*Kuehneromyces mutabilis*
Pholiota praecox	*Agrocybe praecox*
Pholiota radicosa	*Hebeloma*
Pholiota spectabilis	*Gymnopilus junonius*
Pholiota squarrosa	*Pholiota squarrosa*
Pholiota unicolor	*Galerina*
Pholiota, Changing	*Kuehneromyces mutabilis*
Pholiota, Charcoal	*Pholiota highlandensis*
Pholiota, Orange	*Gymnopilus junonius*
Pholiota, Rooting	*Hebeloma*
Pholiota, Shaggy	*Pholiota squarrosa*
Pholiota, Two Toned	*Kuehneromyces mutabilis*
Pholiotina filaris	*Conocybe filaris*
Pigs ears	*Peziza*
Pig Skin Poison Earthball	*Scleroderma*
Pine Hebeloma	*Hebeloma*
Pink Crown	*Sarcosphaera crassa*
Pink Fringed Milk-Cap	*Lactarius*
Pink Mycena	*Mycena pura*
Pinkish Parasol	*Lepiota*
Platterful Mushroom	*Megacollybia platyphylla*
Pleurotus columbinus	*Pleurotus ostreatus*
Pleurotus ostreatus	*Pleurotus ostreatus*
Pleurotus salignus	*Pleurotus ostreatus*
Poison Paxillus	*Paxillus involutus*
Poison Pie	*Hebeloma*
Polyporus giganteus	*Meripilus giganteus*
Polyporus sulphureus	*Laetiporus sulphureus*
Prince, The	*Agaricus*
Psalliota	*Agaricus*
Psalliota silvatica	*Agaricus silvaticus*
Psalliota xanthoderma	*Agaricus xanthoderma*
Psathyrella disseminata	*Coprinus disseminatus*
Psathyrella lacrymabunda	*Lacrymaria velutina*
Psathyrella pyrotricha	*Lacrymaria velutina*
Psathyrella velutina	*Lacrymaria velutina*
Psilocybe cubensis	*Psilocybe cubensis*
Psilocybe cyanescens	*Psilocybe cyanescens*
Psilocybe semilanceata	*Psilocybe semilanceata*
Psilocybe, Bluing	*Psilocybe cyanescens*
Puffball, Giant	*Calvatia gigantea*

Puffball, Lawn	*Vascellum pratense*
Puffball, Meadow	*Vascellum pratense*
Puffball, Pestle-Shaped	*Handkea excipuliformis*
Pungent Parasol	*Cystoderma amianthinum*
Ramaria	*Ramaria*
Ramaria formosa	*Ramaria*
Ramaria stricta	*Ramaria*
Red Cage Fungus	*Clathrus ruber*
Red Staining Inocybe	*Inocybe*
Red Staining Mushroom	*Agaricus silvaticus*
Red Stalked Bolete	*Boletus luridus* group
Red-Cracking Bolete	*Xerocomus chrysenteron*
Red-Hot Milk-Cap	*Lactarius*
Reddish Wood Urchin	*Hydnum*
Rhodopaxillus nudus	*Lepista nuda*
Rhodophyllus aprilis	*Entoloma aprile*
Rhodophyllus clypeatus	*Entoloma*
Rhodophyllus incanus	*Entoloma incanum*
Rhodophyllus lividus	*Entoloma sinuatum*
Rhodophyllus rhodopolius	*Entoloma rhodopolium*
Ribbed Saddle	*Helvella acetabulum*
Ribbed Stalked Cap	*Helvella acetabulum*
Roman Shield Entoloma	*Entoloma*
Rooting Fairy Cake	*Hebeloma*
Rooting Hebeloma	*Hebeloma*
Rooting Pholiota	*Hebeloma*
Rose Gilled Grisette	*Volvariella gloiocephala*
Rose-Coloured Waxy Agaric	*Laccaria*
Rosy Entoloma	*Entoloma*
Round Morel	*Morchella*
Rufous Milk-Cap	*Lactarius*
Russet Tough Shank	*Collybia dryophila*
Russula	*Russula*
Russula acrifolia	*Russula*
Russula betularum	*Russula*
Russula densifolia	*Russula*
Russula emetica	*Russula*
Russula emetica var. betularum	*Russula*
Russula luteotacta	*Russula*
Russula mairei	*Russula*
Russula ochroleuca	*Russula*
Russula, Common Yellow	*Russula*
Russula, Emetic	*Russula*
Saffron Milk-Cap	*Lactarius* sect. *Dapetes*
Saffron Parasol	*Cystoderma amianthinum*
Salmon Wax Cap	*Hygrophorus pratensis*
Sarcosphaera coronaria	*Sarcosphaera coronaria*
Sarcosphaera crassa	*Sarcosphaera coronaria*
Sarcosphaera eximia	*Sarcosphaera coronaria*
Satans Bolete	*Boletus satanas* group

Scaly Earthball	*Scleroderma*
Scaly Wood Mushroom	*Agaricus silvaticus*
Scented Hebeloma	*Hebeloma*
Scleroderma	*Scleroderma*
Scleroderma areolatum	*Scleroderma*
Scleroderma aurantium	*Scleroderma*
Scleroderma citrinum	*Scleroderma*
Scleroderma verrucosum	*Scleroderma*
Scleroderma vulgare	*Scleroderma*
Shaggy Ink Cap	*Coprinus comatus*
Shaggy Mane	*Coprinus comatus*
Shaggy Parasol	*Macrolepiota rhacodes*
Shaggy Pholiota	*Pholiota squarrosa*
Sickener, The	*Russula*
Silky Grey Knight Cap	*Tricholoma*
Silky Grey Tricholoma	*Tricholoma*
Silky Nolanea	*Entoloma*
Silky Volvar	*Volvariella bombycina*
Silky Volvariella	*Volvariella bombycina*
Slimy Volvar	*Volvariella gloiocephala*
Slippery Jack	*Suillus*
Smooth Ink Cap	*Coprinus atramentarius*
Smooth Lepiota	*Leucoagaricus leucothites*
Smooth Stalked Helvella	*Helvella*
Smooth Thimble Cap	*Verpa conica*
Smooth Volvariella	*Volvariella gloiocephala*
Snowy Wax Cap	*Camarophyllus virgineus*
Sparassis crispa	*Sparassis crispa*
Sparassis laminosa	*Sparassis crispa*
Spring Agaric	*Agrocybe praecox*
Spring Field Cap	*Agrocybe praecox*
St. Georges Mushroom	*Calocybe gambosa*
Sticky Dung Roundhead	*Stropharia semiglobata*
Stinkhorn, Common	*Phallus impudicus*
Stinkhorn, Dog	*Phallus impudicus*
Stinking Parasol	*Lepiota*
Stout Stalked Agaric	*Amanita excelsa*
Straight-Branched Coral	*Ramaria*
Straw Coloured Fibre Head	*Inocybe*
Strong Scented Entoloma	*Entoloma*
Stropharia aeruginosa	*Stropharia aeruginosa*
Stropharia aurantiaca	*Stropharia aurantiaca*
Stropharia caerula	*Stropharia aeruginosa*
Stropharia coronilla	*Stropharia coronilla*
Stropharia cyanea	*Stropharia aeruginosa*
Stropharia semiglobata	*Stropharia semiglobata*
Stropharia, Garland	*Stropharia coronilla*
Stropharia, Green	*Stropharia aeruginosa*
Styptic Fungus	*Panellus stypticus*
Suillus	*Suillus*
Suillus bovinus	*Suillus*

Suillus granulatus	*Suillus*
Suillus luteus	*Suillus*
Suillus piperatus	*Chalciporus piperatus*
Sulphur Bracket	*Laetiporus sulphureus*
Sulphur Knight Cap	*Tricholoma*
Sulphur Polypore	*Laetiporus sulphureus*
Sulphur Shelf	*Laetiporus sulphureus*
Sulphur Tricholoma	*Tricholoma*
Sulphur Tuft	*Hypholoma fasciculare*
Summer Truffle	*Tuber aestivum*
Sweetbread Mushroom	*Clitopilus prunulus*
Tall Agaric	*Amanita excelsa*
Tall Amanita	*Amanita excelsa*
Tawny Funnel Cap	*Lepista flaccida*
Tawny Grisette	*Amanita* sect. *Vaginatae*
The Blusher	*Amanita rubescens*
The Miller	*Clitopilus prunulus*
The Prince	*Agaricus*
The Sickener	*Russula*
Thread Cone Cap	*Conocybe filaris*
Tree Volvariella	*Volvariella bombycina*
Tricholoma	*Tricholoma*
Tricholoma acerbum	*Tricholoma*
Tricholoma albobrunneum	*Tricholoma*
Tricholoma album	*Tricholoma*
Tricholoma equestre	*Tricholoma*
Tricholoma flavovirens	*Tricholoma*
Tricholoma focale	*Tricholoma*
Tricholoma gambosum	*Calocybe gambosa*
Tricholoma georgii	*Calocybe gambosa*
Tricholoma inamoenum	*Tricholoma*
Tricholoma lascivum	*Tricholoma*
Tricholoma nudum	*Lepista*
Tricholoma panaeolum	*Lepista luscina*
Tricholoma portentosum	*Tricholoma*
Tricholoma saevum	*Lepista*
Tricholoma sordidum	*Lepista*
Tricholoma striatum	*Tricholoma*
Tricholoma sulphureum	*Tricholoma*
Tricholoma ustale	*Tricholoma*
Tricholoma virgatum	*Tricholoma*
Tricholoma, Burnt	*Tricholoma*
Tricholoma, Dingy	*Tricholoma*
Tricholoma, Dirty	*Tricholoma*
Tricholoma, Gas Works	*Tricholoma*
Tricholoma, Silky Grey	*Tricholoma*
Tricholoma, Sulphur	*Tricholoma*
Tricholomopsis platyphylla	*Megacollybia platyphylla*
Trooping Crumble Cap	*Coprinus disseminatus*
Truffle, Common	*Tuber aestivum*
Truffle, English	*Tuber aestivum*

Truffle, Summer	*Tuber aestivum*
Trumpet Chanterelle	*Cantharellus tubiformis*
Trumpet Clitocybe	*Clitocybe geotropa*
Trumpet Of Death	*Craterellus cornucopioides*
Tuber aestivum	*Tuber aestivum*
Turban Fungus	*Gyromitra esculenta*
Turnip Foot Inocybe	*Inocybe*
Two Toned Pholiota	*Kuehneromyces mutabilis*
Two Toned Wood Tuft	*Kuehneromyces mutabilis*
Tylopilus felleus	*Tylopilus felleus*
Ugly Milk-Cap	*Lactarius*
Urchin Of The Woods	*Hydnum*
Vascellum depressum	*Vascellum pratense*
Vascellum pratense	*Vascellum pratense*
Veined Cup	*Disciotis venosa*
Verdigris Agaric	*Stropharia aeruginosa*
Verdigris Mushroom	*Stropharia aeruginosa*
Verpa conica	*Verpa conica*
Vinegar Cup	*Helvella acetabulum*
Volvar, Silky	*Volvariella bombycina*
Volvar, Slimy	*Volvariella gloiocephala*
Volvaria bombycina	*Volvariella bombycina*
Volvaria speciosa	*Volvariella gloiocephala*
Volvariella bombycina	*Volvariella bombycina*
Volvariella gloiocephala	*Volvariella gloiocephala*
Volvariella speciosa	*Volvariella gloiocephala*
Volvariella, Silky	*Volvariella bombycina*
Volvariella, Smooth	*Volvariella gloiocephala*
Volvariella, Tree	*Volvariella bombycina*
Wax Cap, Conical	*Hygrocybe conica*
Wax Cap, Conical Blackening	*Hygrocybe conica*
Wax Cap, Meadow	*Camarophyllus pratensis*
Wax Cap, Salmon	*Camarophyllus pratensis*
Wax Cap, Snowy	*Camarophyllus virgineus*
Weeping Fairy Cake	*Hebeloma*
Weeping Widow	*Lacrymaria velutina*
White Fibre Head	*Inocybe*
Witches Hat	*Hygrocybe conica*
Wood Blewit	*Lepista*
Wood Hedgehog	*Hydnum*
Woolly Inocybe	*Inocybe*
Woolly Milk-Cap	*Lactarius*
Xerocomus badius	*Boletus badius*
Xerocomus chrysenteron	*Xerocomus chrysenteron*
Yellow Cottony Agaric	*Leucocoprinus birnbaumii*
Yellow Knight Fungus	*Tricholoma*
Yellow Milk-Cap	*Lactarius*
Yellow Morel	*Morchella*
Yellow Stainer	*Agaricus xanthoderma*
Yellow Staining Mushroom	*Agaricus xanthoderma*
Yellow Tipped Coral Fungus	*Ramaria*

Yellow-Foot Agaricus *Agaricus xanthoderma*

Bibliography

Toxicity

Aboul-Enein, H. Y. (1974). Psilocybin: a pharmacological profile. American Journal of Pharmacy 146: 91-95.

Adachi, K., Nanba, H. and Kuroda, H. (1989). Potentiation of host-mediated antitumor activity in mice by beta-glucan obtained from Grifola frondosa (maitake). Chemistry and Pharmaceutical Bulletin 35: 262-270.

Albin, R. L., Albers, J. W., Greenberg, H. S., Townsend, J. B., Lynn, R. B., Burke, J. M., Jr. and Alessi, A. G. (1987). Acute sensory neuropathy-neuronopathy from pyridoxine overdose. Neurology 37: 1729-1732.

Alder, A. E. (1966). Die Pilzvergiftungen in der Schweiz im Jahre 1963. [Mushroom poisonings in Switzerland in 1963.] Schweizerische Zeitschrift für Pilzkunde 44: 33-44.

Andary, C., Privat, G. and Bourrier, M.-J. (1985). Variations of monomethylhydrazine content in Gyromitra esculenta. Mycologia 77: 259-264.

Andary, C., Rapior, S., Delpech, N. and Huchard, G. (1989). Laboratory confirmation of Cortinarius poisoning. [Letter]. Lancet 1: 213.

Andres, R. Y., Frei, W., Gautschi, K. and Vonderschmitt, D. J. (1986). Radioimmunoassay for amatoxins by use of a rapid, 125I-tracer-based system. Clinical Chemistry 32: 1751-1755.

Anke, H., Bergendorff, O. and Sterner, O. (1989). Assays of the biological activities of quaiane sesquiterpenoids isolated from the fruit bodies of edible Lactarius species. Food and Chemical Toxicology 27: 393-397.

Anon. (1983). Gyromitrin (acetaldehyde formylmethylhydrazone): 163-170. In: Evaluation of the Carcinogenic Risk of Chemicals to Humans: Some Food Additives, Feed Additives and Naturally Occurring Substances. International Agency for Research on Cancer Monograph No. 31.

Anon. (1990). Mushroom mixup at San Francisco restaurant. Mycena News. (Mycological Society of San Francisco).

Appleton, R. E., Jan, J. E. and Kroeger, P. D. (1988). Laetiporus sulphureus causing visual hallucinations and ataxia in a child. Canadian Medical Association Journal 139: 48-49.

Arora, D. (1979). Mushrooms Demystified. Ten Speed Press: Berkeley, California.

Back, K. C. and Pinkerton, M. K. (1967). Toxicology and pathology of repeated doses of monomethylhydrazine in monkeys. Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, Report No. AMRL-TR-66-199.

Badalyan, S. M., Rapior, S., Quang, J. le, Doko, L., Jacob, M., Andary, C. and Serrano, J. J. (1995). Investigation of fungal metabolites and acute toxicity studies from fruit-bodies of Hypholoma species (Strophariaceae). Cryptogamie Mycologie 16(2): 79-84.

Badham, C. D. (1863). A Treatise on the Esculent Funguses of England. L. Reeve and Co.: London.

Barla, J. B. (1859). Les Champignons de la Province de Nice. [Mushrooms of Nice Province.] Imprimerie Canis frères: Nice.

Bartels, O. (1976). Pilzvergiftungen. Neue Therapiemoeglichkeiten. [Mushroom poisoning. New possibilities for treatment.] Fortschritte der Medizin 94(10): 539-544.

Bartoloni St Omer, F., Giannini, A., Botti, P., Caramelli, L., Ledda, F., Peruzzi, S. and Zorn, M. (1985). Amanita poisoning: a clinical-histopathological study of 64 cases of intoxication. Hepato-Gastroenterology 32: 229-231.

Becker, C. E., Tong, T. G., Boerner, U., Roe, R. L., Scott, R. A. T., MacQuarrie, M. B. and Bartter, F. (1976). Diagnosis and treatment of Amanita phalloides-type mushroom poisoning: use of thioctic acid. Western Journal of Medicine 125: 100-109.

Bedry, R., Pillet, O., Sentilhes, A., Desusclade, S., Richard, J. M., Creppy, E. E. and Favarel-Garrigues, J. C. (1993). Lethal rhabdomyolysis contemporaneous with a Cortinarius intoxication. [Abstract]. European Association of Poison Centres and Clinical Toxicologists Scientific Meeting, Metabolic Complications of Poisoning, Birmingham, 26-28 May, 1993.

Belliardo, F., Massano, G. and Accomo, S. (1983). Amatoxins do not cross the placental barrier. [Letter]. Lancet 1: 1381.

Benjamin, C. (1979). Persistent psychiatric symptoms after eating psilocybin mushrooms. British Medical Journal 1: 1319-1320.

Benjamin, D. R. (1992). Mushroom poisoning in infants and children: the Amanita pantherina/muscaria group. Clinical Toxicology 30: 13-22.

Benjamin, D. R. (1995). Mushrooms: Poisons and Panaceas. W. H. Freeman and Company: New York.

Bennell, A. P. and Watling, R. (1983). Mushroom poisonings in Scotland. Bulletin of the British Mycological Society 17: 104-105.

Bergner, H. and Oettel, R. (1971). Vergiftung durch Düngerlinge. [Poisoning by Panaeolus subbalteatus.] Mykologisches Mitteilungsblatt 15(3): 61-64.

Bergoz, R. (1971). Trehalose malabsorption causing intolerance to mushrooms. Report of a probable case. Gastroenterology 60(5): 909-912.

Bernheimer, A. W. and Avigad, L. S. (1979). A cytolytic protein from the edible mushroom, Pleurotus ostreatus. Biochimica et Biophysica Acta 585: 451-461.

Bessette, A. and Sundberg, W. J. (1987). Mushrooms: A Quick Reference Guide to Mushrooms of North America. Macmillan: New York.

Bessette, A. E., Bessette, A. R. and Fischer, D. W. (1997). Mushrooms of Northeastern North America. Syracuse University Press: New York.

Beug, M. W. (1984). A case of Scleroderma poisoning in the Pacific Northwest. McIlvainea 6(2): 33.

Beug, M. W. and Bigwood, J. (1982). Psilocybin and psilocin levels in twenty species from seven genera of wild mushrooms in the Pacific Northwest, U.S.A. Journal of Ethnopharmacology 5: 271-285.

Biggio, G., Brodie, B. B., Costa, E. and Guidotti, A. (1977). Mechanisms by which diazepam, muscimol, and other drugs change the content of cGMP in cerebellar cortex. Proceedings of the National Academy of Sciences of the United States of America 74: 3592-3596.

Bigwood, J. and Beug, M. W. (1982). Variation of psilocybin and psilocin levels with repeated flushes (harvests) of mature sporocarps of Psilocybe cubensis (Earle) Singer. Journal of Ethnopharmacology 5: 287-291.

Bivins, H. G., Knopp, R., Lammers, R., McMicken, D. B. and Wolowodiuk, O. (1985). Mushroom ingestion. Annals of Emergency Medicine 14: 1099-1104.

Bon, M. (1987). The Mushrooms and Toadstools of Britain and North-western Europe. Hodder and Stoughton: London.

Borowiak, K. S., Ciechanowski, K. and Waloszczyk, P. (1998). Psilocybin mushroom (Psilocybe semilanceata) intoxication with myocardial infarction. Journal of Toxicology - Clinical Toxicology 36: 47-49.

Bosman, C. K., Berman, L., Isaacson, M., Wolfowitz, B. and Parkes, J. (1965). Mushroom poisoning caused by Amanita pantherina: report of 4 cases. South African Medical Journal 39: 983-986.

Bosman, E. (1979). A report of mushroom poisoning caused by Tricholomopsis playphylla. Spore Print 5(5), July/Aug. (Newsletter of the Conn. Valley Mycol. Soc.)

Bouget, J., Bousser, J., Pats, B., Ramee, M.-P., Chevet, D., Rifle, G., Giudicelli, C.-P. and Thomas, R. (1990). Acute renal failure following collective intoxication by Cortinarius

orellanus. Intensive Care Medicine 16: 506-510.
Bowden, K., Drysdale, A. C. and Mogey, G. A. (1965). Constituents of Amanita muscaria. Nature 206(4991): 1359-1360.
Brady, L. R., Benedict, R. G., Tyler, V. E., Stuntz, D. E. and Malone, M. H. (1975). Identification of Conocybe filaris as a toxic Basidiomycete. Journal of Natural Products (Lloydia) 38: 172-173.
Breitenbach, J. and Kränzlin, F. (eds) (1984). Fungi of Switzerland, Vol. 1: Ascomycetes. Verlag Mykologia: Lucerne, Switzerland.
Breitenbach, J. and Kränzlin, F. (eds) (1986). Fungi of Switzerland, Vol. 2: Non-Gilled Fungi. Edition Mykologia: Lucerne, Switzerland.
Breitenbach, J. and Kränzlin, F. (eds) (1991). Fungi of Switzerland, Vol. 3: Boletes and Agarics Part 1. Edition Mykologia: Lucerne, Switzerland.
Breitenbach, J. and Kränzlin, F. (eds) (1995). Fungi of Switzerland, Vol. 4: Agarics Part 2. Edition Mykologia: Lucerne, Switzerland.
Bresinsky, A. and Besl, H. (1990). A Colour Atlas of Poisonous Fungi: A Handbook for Pharmacists, Doctors, and Biologists. Wolfe Publishing Ltd.: London.
Bringhurst, L. S., Byrne, R. N. and Gershon-Cohen, J. (1959). Respiratory disease of mushroom workers. Journal of the American Medical Association 171: 101-104.
Bruhn, J. N. and Soderberg, M. D. (1991). Allergic contact dermatitis caused by mushrooms. A case report and literature review. Mycopathologia 115: 191-195.
Buck, R. W. (1961). Mushroom toxins - a brief review of the literature. New England Journal of Medicine 265: 681-686.
Buck, R. W. (1967). Psychedelic effect of Pholiota spectabilis. New England Journal of Medicine 267: 391-392.
Buck, R. W. (1969). Mycetism. [Letter]. New England Journal of Medicine 280: 1363.
Budmiger, H. and Kocher, F. (1982). Hexenröhrling (Boletus luridus) mit Alkohol. Ein kasuistischer Beitrag. [Boletus luridus with alcohol. A report of cases.] Schweizerische Medizinische Wochenschrift 112(34): 1179-1181.
Busi, C., Fiume, L., Constantino, D., Langer, M. and Vesconi, S. (1979). Amanita toxins in gastroduodenal fluid of patients poisoned by the mushroom, Amanita phalloides. [Letter]. New England Journal of Medicine 300: 800.
Buttenwieser, S. and Bodenheimer, W. (1924). Über den Übertritt des Knollenblätterschwammgiftes in dies Brustmilch. [On the occurrence of Amanita poison in breast milk.] Deutsche Medizinische Wochenscrift 50: 607.
Caley, M. J. and Clark, R. A. (1977). Cardiac arrhythmia after mushroom ingestion. British Medical Journal 2: 1633.
Child, G. P. (1952). The inability of coprini to sensitize man to ethyl alcohol. Mycologia 44: 200-202.
Chilton, W. S. (1975). … and a touch of cyanide. McIlvainea 2(1): 11-12.
Chilton, W. S. (1994). The chemistry and mode of action of mushroom toxins: 165-231. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Christensen, C. M. (1965). The Molds and Man: An Introduction to the Fungi, Rev. Ed. University of Minnesota Press: Minneapolis.
Christensen, C. M. (1975). Molds, Mushrooms and Mycotoxins. University of Minnesota Press: Minneapolis.
Cochran, K. W. (1978). Interaction of Clitocybe clavipes and alcohol. McIlvainea 3(2): 32-35.
Cochran, K. W. (1986). NAMA mushroom poisoning case registry cases reported in 1985. McIlvainea 7(2): 35-38.
Cochran, K. W. (1987). Poisonings due to misidentified mushrooms. McIlvainea 8(1): 27-30.
Cochran, K. W. (1988). Mushroom poisoning case registry: cases reported in 1987. McIlvainea

8(2): 30-32.
Cochran, K. W. and Cochran, M. W. (1978). Clitocybe clavipes: Antabuse-like reaction to alcohol. Mycologia 70: 1124-1126.
Coldwell, B. B., Genest, K. and Hughes, D. W. (1969). Effect of Coprinus atramentarius on the metabolism of ethanol in mice. Journal of Pharmacy and Pharmacology 21: 176-179.
Constantino, D., Falzi, G., Langer, M. and Rivolta, E. (1978). Amanita-phalloides-related nephropathy. Contributions to Nephrology 10: 84-97.
Cooke, M. C. (1862). A Plain and Easy Account of British Fungi. R. Hardwicke: London.
Cooles, P. (1980). Abuse of the mushroom Panaeolus foenisecii. British Medical Journal 280: 446-447.
Cooper, R. (1980). A Guide to British Psilocybin Mushrooms. Red Shift Books: London.
Couchet, S. and Latil, J. P. (1977). Several cases of poisoning by Paxillus involutus. McIlvainea 3(1): 42.
Coulet, M. and Guillot, J. (1982). Poisoning by Gyromitra: a possible mechanism. Medical Hypotheses 8: 325-334.
Courtecuisse, R. and Duhem, B. (1995). Mushrooms and Toadstools of Britain and Europe. Collins Field Guide. HarperCollins Publishers: London.
Cox, A., Folgering, H. T. M. and van Griensven, L. J. L. D. (1988). Extrinsic allergic alveolitis caused by spores of the oyster mushroom Pleurotus ostreatus. European Respiratory Journal 1: 466-468.
Curry, S. C. and Rose, M. C. (1985). Intravenous mushroom poisoning. Annals of Emergency Medicine 14: 900-902.
Curtis, D. R., Lodge, D. and McLennan, H. (1979). The excitation and depression of spinal neurones by ibotenic acid. Journal of Physiology 291: 19-28.
Dardenne, G., Casimir, J. and Marlier, M. (1974). Acide 2(R)-amino-3-butenoique (vinylglycine) dans les carpophores de Rhodophyllus nidorosus. [2(R)-amino-3-butenoic acid (vinylglycine) in the fruitbodies of Rhodophyllus nidorosus.] Phytochemistry 13: 1897-1900.
De Bernardi, M., Fronza, G., Gianotti, M. P., Mellerio, G., Vidari, G. and Vita-Finzi, P. (1983). Fungal metabolites XIII: new cytotoxic triterpine from Hebeloma species (Basidomycetes). Tetrahendron Letters 24(15): 1635-1638.
Dearness, J. (1911). The personal factor in mushroom poisoning. Mycologia 3: 75-78.
DeFeudis, F. V. (1980). Binding studies with muscimol: relation to synaptic gamma-aminobutyrate receptors. Neuroscience 5: 675-688.
Doepel, M., Isoniemi, H., Salmela, K., Penttilä, K. and Höckerstedt, K. (1994). Liver transplantation in a patient with Amanita poisoning. Transplantation Proceedings 26: 1801-1802.
Dudová, V., Kubicka, J. and Veselský, J. (1980). Thioctic acid in the treatment of Amanita phalloides intoxication: 190-191. In: Faulstich, H., Kommerell, B. and Weiland, T. (eds), Amanita Toxins and Poisoning. International Amanita Symposium, Heidelberg, 1-3 November, 1978. Verlag Gerhard Witzstrock: Baden-Baden.
Duffy, T. J. and Vergeer, P. P. (1977). California Toxic Fungi. Mycological Society of San Francisco Toxicology Monograph 1: 1-29.
Eisen, T. F. (1988). Mushrooms, part II. Ibotenic acid-muscimol - group II. Clinical Toxicology Review 10(10): 1-2.
Ellenhorn, M. J. and Barceloux, D. G. (1988). Mushrooms: 1324-1351. In: Ellenhorn, M. J. and Barceloux, D. G. (eds), Medical Toxicology: Diagnosis and Treatment of Human Poisoning. Elsevier: New York.
Enjalbert, F., Gallion, C., Jehl, F., Monteil, H. and Faulstich, H. (1992). Simultaneous assay for amatoxins and phallotoxins in Amanita phalloides Fr. by high-performance liquid chromatography. Journal of Chromatography 598: 227-236.

Evans, D. A. P. (1968). Genetic variations in the acetylation of isoniazid and other drugs. Annals of the New York Academy of Science 151: 723-733.
Farr, D. F. (1983). Mushroom industry: diversification with additional species in the United States. Mycologia 75: 351-360.
Faulstich, H. (1979). New aspects of Amanita poisoning. Klinische Wochenshcrift 57: 1143-1152.
Faulstich, H. and Cochet-Meilhac, M. (1976). Amatoxins in edible mushrooms. FEBS Letters 64: 73-75.
Faulstich, H. and Zilker, T. R. (1994). Amatoxins: 233-248. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Faulstich, H., Talas, A. and Wellhöner, H. H. (1985). Toxicokinetics of labeled amatoxins in the dog. Archives of Toxicology 56: 190-194.
Favre-Bonvin, J., Gluchoff-Fiasson, K. and Bernillon, J. (1982). Structure du stéaryl-velutinal, sesquiterpénoïde naturel de Lactarius velutinus Bert. [Structure of stearyl-velutinal, natural sesquiterpene of Lactarius velutinus Bert.] Tetrahedron Letters 23: 1907-1908.
Fineschi, V., Di Paolo, M. and Centini, F. (1996). Histological criteria for diagnosis of Amanita phalloides poisoning. Journal of Forensic Sciences 41: 429-432.
Fischer, O. E. (1971). Mushroom poisoning. In: Kauffman, C. H. (ed.), The Gilled Mushrooms of Michegan and the Great Lakes Region (Dover reprint). Dover: New York.
Flammer, R. (1983). Hämolyse bei Pilzvergiftungen: Fakten und Hypothesen. [Haemolysis in fungal poisoning: facts and hypotheses.] Schweizerische Medizinische Wochenschrift 113: 1555-1561.
Floersheim, G. L. (1985). Treatment of mushroom poisoning. [Letter]. Journal of the American Medical Association 253: 3252.
Floersheim, G. L. (1987). Treatment of human amatoxin mushroom poisoning: myths and advances in therapy. Medical Toxicology 2: 1-9.
Ford, W. W. (1911). The distribution of haemolysins, agglutinins and poisons in fungi, especially the Amanitas, the Entolomas, the Lactarius and the Inocybes. Journal of Pharmacology and Experimental Therapeutics 2: 285-318.
Francis, J. and Murray, V. S. G. (1983). Review of enquiries made to the NPIS concerning Psilocybe mushroom ingestion, 1978-1981. Human Toxicology 2: 349-352.
French, A. L. and Garrettson, L. K. (1988). Poisoning with the North American Jack olantern mushroom, Omphalotus illudens. Journal of Toxicology - Clinical Toxicology 26: 81-88.
Fugmann, B. and Steglich, W. (1984). Unusual components of the toadstool Lyophyllum connatum (Agaricales). Angewandte Chemie International Ed. in English 23: 72-73.
Gartz, J. (1985). Dünnschichtchromatografische Analyse der Inhaltsstoffe von Pilzen der Gattung Stropharia. [Thin-layer chromatographic analysis of the constituents of fungi of the genus Stropharia.] Pharmazie 40: 134-135.
Gerault, A. (1976). Les Champignons Superieurs et Leurs Intoxications. [Larger Fungi and Their Poisoning Cases.] PhD Thesis. University of Reenes: France.
Gillman, L. (1994). Identification of common poisonous mushrooms: 97-129. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Giusti, G. V. and Carnevale, A. (1974). A case of fatal poisoning by Gyromitra esculenta. Archives of Toxicology 33: 49-54.
Goos, R. D. (1984). Another case of mushroom poisoning involving Tricholomopsis platyphylla. Mycologia 76: 350-351.
Goos, R. D. (1986). Big Laughing Gym lives up to its name. McIlvainea 7(2): 34.
Goos, R. D. and Shoop, C. R. (1980). A case of mushroom poisoning caused by Tricholomopsis platyphylla. Mycologia 72: 433-435.

Göttl, L. (1976). Blausäurebilende Basidiomyzeten. Hat Cyanogenese einen taxonomischen Wert? [Cyanogenic Basidiomycetes. Has cyanogenesis any taxonomic value?] Zeitschrift für Pilzkunde 42: 185-194.
Grimes, G. L. (1994). Principles of mushroom identification: 65-95. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Groves, J. W. (1964). Poisoning by morels when taken with alcohol. Mycologia 56: 779-780.
Groves, J. W. (1979). Edible and Poisonous Mushrooms of Canada, Rev. Ed. Research Branch, Agriculture Canada.
Grzymala, S. (1965). Etude clinique des intoxications par les champignons du genre Cortinarius orellanus Fr. [Clinical picture of poisoning with Cortinarius orellanus Fr.] Bulletin de Medecine Legale et de Toxicologie Medicale 8: 60-70.
Gudmand-Hoyer, E. and Skovbjerg, H. (1996). Disaccharide digestion and maldigestion. Sandinavian Journal of Gastroenterology Supplement 216: 111-121.
Gulden, G. (1992a). Calocybe Donk: 101-103. In: Hansen, L. and Knudsen, H. (eds), Nordic Macromycetes, Vol. 2: Polyporales, Boletales, Agaricales, Russulales. Nordsvamp: Copenhagen.
Gulden, G. (1992b). Lepista (Fr.) W.G. Smith: 132-135. In: Hansen, L. and Knudsen, H. (eds), Nordic Macromycetes, Vol. 2: Polyporales, Boletales, Agaricales, Russulales. Nordsvamp: Copenhagen.
Gulden, G. (1992c). Kuehneromyces Sing. and Smith: 258-259. In: Hansen, L. and Knudsen, H. (eds), Nordic Macromycetes, Vol. 2: Polyporales, Boletales, Agaricales, Russulales. Nordsvamp: Copenhagen.
Habtemariam, S. (1996). Cytotoxicity of extracts from the mushroom Paxillus involutus. Toxicon 34(6): 711-713.
Hadley, G. (1980). Panaeolus foenisecii as a psychotropic fungus. Bulletin of the British Mycological Society 14: 138-140.
Hall, A. H. and Hall, P. K. (1994). Ibotenic acid/muscimol-containing mushrooms: 265-278. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Harati, Y. and Niakan, E. (1986). Hydrazine toxicity, pyridoxine therapy, and peripheral neuropathy. [Letter]. Annals of Internal Medicine 104: 728-729.
Harries, A. D. and Evans, V. (1981). Sequelae of a magic mushroom banquet. Postgraduate Medical Journal 57: 571-572.
Hatfield, G. M. and Schaumberg, J. P. (1975). Isolation and structural studies of coprine, the disulfiram-like constituent of Coprinus atramentarius. Journal of Natural Products (Lloydia) 38(6): 489-496.
Hatfield, G. M. and Schaumberg, J. P. (1978). The disulfiram-like effects of Coprinus atramentarius and related mushrooms: 181-186. In: Rumack, B. H. and Salzman, E. (eds), Mushroom Poisoning: Diagnosis and Treatment. CRC Press: West Palm Beach, Florida.
Hatfield, G. M., Valdes, L. J. and Smith, A. H. (1978). The occurrence of psilocybin in Gymnopilus species. Journal of Natural Products (Lloydia) 41: 140-144.
Heath, A., Delin, K., Edén, E., Mårtensson, E., Selander, D., Wickström, I. and Ahlmén, J. (1980). Hemoperfusion with Amberlite resin in the treatment of self-poisoning. Acta Medica Scandinavicum 207: 455-460.
Heim, R. (1963). Les champignons toxiques et hallucinogènes. [Toxic and hallucinogenic mushrooms.] Éditions N. Boubée: Paris.
Heim, R., Hofmann, A. and Scherter, H. (1966). Sur une intoxication collective a syndrome psilocybin causee en France par un Copelandia. [On a group poisoning with psilocybin syndrome caused in France by Copelandia.] Comptes Rendus Hebdomadaires des

Seances de lAcademie des Sciences. D: Sciences Naturelles 262: 519-523.
Heinemann, P. (1949). Observations sur les Basidomycètes à acide cyanohydrique II. Observations on Basidiomycetes containing hydrocyanic acid II.] Lejeunia 13: 99-100.
Herbich, J., Lohwag, K. and Rotter, R. (1966). Tödliche Vergiftung mit dem grünblättrigen Schwefelkopf. [Fatal poisoning with the green-leaf sulphur cap.] Archiv für Toxikologie 21: 310-320.
Herrmann, M. (1973). Der Rettichhelming - Mycena pura (Pers. ex Fr.) Kumm. - ist giftig! [Mycena pura (Pers. ex Fr.) Kumm. is poisonous.] Mykologisches Mitteilungsblatt 17: 17-18.
Herrmann, M. (1976). Erkrankungen nach dem Genuß der Gartenform des Safran-Schirmlings. [Diseases after the use of garden forms of Macrolepiota rhacodes.] Mykologisches Mitteilungsblatt 20: 16-17.
Herrmann, M. (1986). Vergiftungen mit dem Dickschaligen Kartoffelbovist - Scleroderma citrinum. [Poisoning by the common earthball - Scleroderma citrinum.] Mykologisches Mitteilungsblatt 29(2): 50.
Herrmann, W. (1983). Neuere Erkenntnisse über die Giftigkeit einiger Pilzarten. [Update on the toxicity of some fungal species.] Mykologisches Mitteilungsblatt 26(1): 1-10.
Hoffman, A., Heim, R., Brack, R. and Kobel, H. (1958). Psilocybin, ein psychotroper Wirkstoff aus dem mexikanischen Rauschpilz Psilocybe mexicana Heim. [Psilocybin, a psychotropic substance from the Mexican mushroom Psilocybe mexicana Heim.] Experientia 14: 107-109.
Holden, M. (1965). A possible case of poisoning by Panaeolina foenisecii. News Bulletin of the British Mycological Society 25: 9-10.
Hollister, L. E. (1961). Clinical, biochemical and psychologic effects of psilocybin. Archives Internationales de Pharmacodynamie et de Therapie 130: 42-52.
Holmdahl, J. and Blohmé, I. (1992). Renal transplantation after Cortinarius speciosissimus poisoning. [Abstract]. European Association of Poison Centres and Clinical Toxicologists XV Congress, Istanbul, Turkey, 24-27 May, 1992: 102.
Holmdahl, J., Mulec, H. and Ahlmen, J. (1984). Acute renal failure after intoxication with Cortinarius mushrooms. Human Toxicology 3: 309-313.
Hölzl, B., Regele, H., Kirchmair, M. and Sandhofer, F. (1997). Acute renal failure after ingestion of Cortinarius speciocissimus [sic.]. Clinical Nephrology 48: 260-262.
Homann, J., Rawer, P., Bleyl, H., Matthes, K.-J. and Heinrich, D. (1986). Early detection of amatoxins in human mushroom poisoning. Archives of Toxicology 59: 190-191.
Horita, A. and Weber, L. J. (1961). Dephosphorylation of psilocybin to psilocin by alkaline phosphatase. Proceedings of the Society for Experimental Biology and Medicine 106: 32-34.
Horn, S., Horina, J. H., Krejs, G. J., Holzer, H. and Ratschek, M. (1997). End-stage renal failure from mushroom poisoning with Cortinarius orellanus: report of four cases and review of the literature. American Journal of Kidney Diseases 30: 282-286.
Hotson, J. W. (1934). Mushroom poisoning at Seattle. Mycologia 26: 194-195.
Hyde, C., Glancy, G., Omerod, P., Hall, D. and Taylor, G. S. (1978). Abuse of indigenous psilocybin mushrooms: a new fashion and some psychiatric complications. British Journal of Psychiatry 132: 602-604.
Ikeda, M., Sato, Y., Izawa, M., Sassa, T. and Miura, Y. (1977). Isolation and structure of fasciculol A, a new plant growth inhibitor from Naematoloma fasciculare. Agricultural and Biological Chemistry 41(8): 1539-1541.
Isbell, H., Wolbach, A. B., Wikler, A. and Miner, E. J. (1961). Cross tolerance between LSD and psilocybin. Psychopharmacologia 2: 147-159.
Ishihara, Y. and Yamaura, Y. (1992). [Descriptive epidemiology of mushroom poisoning in Japan.] (in Japanese). Nippon Eiseigaku Zasshi 46(6): 1071-1078.

Jackson, E. and Welch, K. M. (1970). Mushroom workers lung. Thorax 25: 25-30.
Jaeger, A. (1994). Orellanine mushrooms: 249-264. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Jaeger, A., Flesch, F., Jehl, F., Sauder, Ph. and Kopferschmitt, J. (1988). Les intoxications par champignons. [Mushroom poisoning.] Journal de Médecine de Strasbourg 19(7): 381-384.
Jaeger, A., Jehl, F., Flesch, F., Sauder, P. and Kopferschmitt, J. (1993). Kinetics of amatoxins in human poisoning: therapeutic implications. Journal of Toxicology - Clinical Toxicology 31: 63-80.
Jansen, K. L. R. (1988). Magic mushrooms: a fast growing problem. Journal of General Practice 5: 7-10.
Jehl, F., Gallion, C., Birckel, P., Jaeger, A., Flesch, F. and Minck, R. (1985). Determination of alpha-amanitin and beta-amanitin in human biological fluids by high-performance liquid chromatography. Analytical Biochemistry 149: 35-42.
John, A. (1943). Deutsche Blätter für Pilzkunde 5(5/6): 53-54.
Johnston, G. A. R., Curtis, D. R., Groat, W. C. de and Duggan, A. W. (1968). Central actions of ibotenic acid and muscimol. Biochemical Pharmacology 17: 2488-2489.
Jordan, M. (1995). Evidence of severe allergic reactions to Laetiporus sulphureus. Mycologist 9: 157-158.
Josserand, M. (1968). Intoxication collective tres probablement causee par Hygophorus croceus (= H. constans Lange). [Group poisoning probably caused by Hygophorus croceus (= H. constans Lange).] Bulletin Mensuel de la Société Linnéenne de Lyon 37(2): 65-67.
Kabir, Y., Yamaguchi, M. and Kimura, S. (1987). Effect of shiitake (Lentinus edodes) and maitake (Grifola frondosa) mushrooms on blood pressure and plasma lipids of spontaneously hypertensive rats. Journal of Nutritional Science and Vitaminology 33: 341-346.
Kalberer, F., Kreis, W. and Rutschmann, J. (1962). The fate of psilocin in the rat. Biochemical Pharmacology 11: 261-269.
Kaufmann, M., Müller, A., Paweletz, N., Haller, U. and Kubli, F. (1978). Fetale Schädigung bei einer Knollenblätterpilzvergiftung der Mutter in der Frühschwangerschaft. [Fetal damage due to mushroom poisoning with Amanita phalloides during the first trimester of pregnancy.] Geburtshilfe und Frauenheilkunde 38: 122-124.
Kawamura, S. (1954-1955). [Icones of Japanese Fungi, 8 vol.] (in Japanese). Kazama shobo: Tokyo.
Kirklin, J. K., Watson, M., Bondoc, C. C. and Burke, J. F. (1976). Treatment of hydrazine-induced coma with pyridoxine. New England Journal of Medicine 294: 938-939.
Kiwitt, U. and Laatsch, H. (1994). Coprin in Boletus torosus: Beruht die angebliche Alkoholunverträglichkeit durch den Verzehr des Netzstieligen Hexenröhrlings (Boletus luridus) auf einer Verwechslung? [Coprine in Boletus torsus: Is the alleged alcohol hypersensitivity by ingestion of Boletus luridus caused by a mistake?] Zeitschrift für Mykologie 60: 423-430.
Klemm, G. (1961). Beobachtungen uber den Verlauf einer Massenvergiftung mit dem Bruchkreizker - Lactarius helvus Fries. [Observations on the course of a mass poisoning with Lactarius helvus Fries.] Mykologisches Mitteilungsblatt 5: 1-4.
Knudsen, H. (1992). Boletus Dill. ex L.: Fr.: 56-63. In: Hansen, L. and Knudsen, H. (eds), Nordic Macromycetes, Vol. 2: Polyporales, Boletales, Agaricales, Russulales. Nordsvamp: Copenhagen.
Korstanje, M. J. and van de Staak, W. J. B. M. (1990). A case of hand eczema due to mushrooms. Contact Dermatitis 22: 115-116.
Kretz, O., Creppy, E. E. and Dirheimer, G. (1991). Characterization of bolesatine, a toxic protein

from the mushroom Boletus satanus Lenz and its effects on kidney cells. Toxicology 66: 213-224.
Kretz, O., Creppy, E. E., Boulanger, Y. and Dirheimer, G. (1989). Purification and some properties of bolesatine, a protein inhibiting in vitro protein synthesis, from the mushroom Boletus satanas Lenz (Boletaceae). Archives of Toxicology Supplement 13: 422-427.
Krieger, L. C. C. (1911). Note on the reputed poisonous properties of Coprinus comatus. Mycologia 3: 200-202.
Krieglsteiner, G. J. and Schwöbel, H. (1982). Mycena diosma spec. nov. und der Mycena-pura-Formenkreis in Mitteleuropa. [Mycena diosma spec. nov. and the Mycena pura group in Central Europe.] Zeitschrift für Mykologie 48: 25-34.
Kubicka, J. and Veselský, J. (1978). Mycena rosea (Bull.) ex Sacc. et Dalla Costa ist giftig. [Mycena rosea (Bull.) ex Sacc. and Dalla Costa is poisonous.] Ceská Mykologie 32: 167-168.
Kubo, I., Matsumoto, A., Kozuka, M. and Wood, W. F. (1985). Calmodulin inhibitors from the bitter mushroom Naematoloma fasciculare (Fr.) Karst. (Strophariaceae) and absolute configuration of fasciculols. Chemical and Pharmaceutical Bulletin 33(9): 3821-3825.
Kunkel, D. B. and Connor, D. A. (1994). Coprine-containing mushrooms: 303-307. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Laatsch, H. and Matthies, L. (1991). Fluorescent compounds in Cortinarius speciosissimus: investigation for the presence of cortinarins. Mycologia 83: 492-500.
Lahtiperä, S., Naukkarinen, A. and Collan, Y. (1986). Mushroom poisoning due to Cortinarius speciosissimus: electron microscope study in rats. Archives of Toxicology Supplement 9: 315-319.
Lampe, K. F. (1977). Mushroom poisoning in children updated. Paediatrician 6: 289-299.
Lampe, K. F. (1978). Pharmacology and therapy of mushroom intoxications: 125-169. In: Rumack, B. H. and Salzman, E. (eds), Mushroom Poisoning: Diagnosis and Treatment. CRC Press: West Palm Beach, Florida.
Lampe, K. F. (1979). Toxic fungi. Annual Review of Pharmacology and Toxicology 19: 85-104.
Lampe, K. F. (1989). NAMA poisoning registry 1988. McIlvainea 9(1): 28-30.
Lampe, K. F. and McCann, M. A. (1987). Differential diagnosis of poisoning by North American mushrooms, with particular emphasis on Amanita phalloides-like intoxication. Annals of Emergency Medicine 16: 956-962.
Lee, T. M., West, L. G., McLaughlin, J. L., Brady, L. R., Lowe, J. L. and Smith, A. H. (1975). Screening for N-methylated tyramines in some higher fungi. Journal of Natural Products (Lloydia) 38(5): 450-452.
Lehrer, S. B., Lopez, M., Butcher, B. T., Olson, J., Reed, M. and Salvaggio, J. E. (1986). Basidomycete mycelia and spore-allergen extracts: skin test reactivity in adults with symptoms of respiratory allergy. Journal of Allergy and Clinical Immunology 78: 478-485.
Lincoff, G. and Mitchel, D. H. (1977). Toxic and Hallucinogenic Mushroom Poisoning: A Handbook for Physicians and Mushroom Hunters. Van Nostrand Reinhold Company: New York.
List, P. H. and Luft, P. (1967). Gyromitrin, das Gift der Fruehjahrslorchel, Gyromitra (Helvella) esculenta Fr. [Gyromitrin, the toxin of the spring lorchel, Gyromitra (Helvella) esculenta.] Tetrahedron Letters 20: 1893-1894.
List, P. H. and Reith, H. (1960). Der Faltentintling, Coprinus atramentarius Bull., und seine dem Tetraethylthiuramdisulf ähnliche Wirkung. [The mushroom Coprinus atramentarius and its tetraethylthiuramdisulfide-like action.] Arzneimittel-Forschung 10: 34-40.
Madzarovova-Nohejlova, J. (1973). Trehalase deficiency in a family. Gastroenterology 65(1): 130-133.

Maki, T., Takahashi, K. and Shibata, S. (1985). Isolation of vomiting principles from the mushroom Rhodophyllus rhodopolius. Journal of Agricultural and Food Chemistry 33: 1204-1205.
Marchand, A. (1976). Champignons du Nord et du Midi, Vol. 4. Aphyllophorales (fin), Hydnaceae, Gasteromycetes, Ascomycetes. Société Mycologique des Pyrénées Méditerranéennes: Perpignan, France.
Marchner, H. and Tottmar, O. (1978). A comparative study on the effects of disulfiram, cyanamide and 1-aminocyclopropanol on the acetaldehyde metabolism in rats. Acta Pharmacologica et Toxicologica 43(3): 219-232.
Maretic, Z. (1967). Poisoning by the mushroom Clitocybe olearia Maire. Toxicon 4: 263-267.
Maretic, Z., Russell, F. E. and Golobic, V. (1975). Twenty-five cases of poisoning by the mushroom Pleurotus olearius. Toxicon 13: 379-381.
Markham, J. D. and Hoff, E. C. (1953). Toxic manifestations in the antabuse-alcohol reaction: study of electrocardiographic changes. Journal of the American Medical Association 152: 1597-1600.
Matthies, L. and Laatsch, H. (1992). Ungewöhnliche Pilzvergiftungen: Coprin, ein Hemmstoff des Alkohol-Abbaus. [An unusual mushroom mycotoxin: coprine, a deterrent to alcohol abuse.] Pharmazie in Unserer Zeit 21: 14-20.
Matzinger, P., Catalfomo, P. and Eugster, C. H. (1972). Isolation of gamma-hydroxynorvaline from Boletus satanus. Helvetica Chimica Acta 55: 1478.
Mayer, J. H., Herlocher, J. E. and Parisian, J. (1971). Esophageal rupture after mushroom-alcohol ingestion. [Letter]. New England Journal of Medicine 285: 1323.
McCawley, E. L., Brummett, R. E. and Dana, G. W. (1962). Convulsions from Psilocybe mushroom poisoning. Proceedings of the Western Pharmacology Society 5: 27-33.
McClain, J. L., Hause, D. W. and Clark, M. A. (1989). Amanita phalloides mushroom poisoning: a cluster of four fatalities. Journal of Forensic Sciences 34: 83-87.
McCormick, D. J., Avbel, A. J. and Gibbons, R. B. (1979). Nonlethal mushroom poisoning. Annals of Internal Medicine 90: 332-335.
Michael, F., Hennig, B. and Kreisel, H. (1973). Handbuch für Pilzfreunde, Ed. 3. [Handbook for the mushroom lover.] VEB Gustav Fisher Verlag: Jena.
Michelot, D. and Tebbett, I. (1990). Poisoning by members of the genus Cortinarius - a review. Mycological Research 94: 289-298.
Michelot, D. and Toth, B. (1991). Poisoning by Gyromitra esculenta - a review. Journal of Applied Toxicology 11: 235-243.
Midland, S. L., Izac, R. R., Wing, R. M., Zaki, A. I., Munnecke, D. E. and Sims, J. J. (1982). Melleolide, a new antibiotic from Armillaria mellea. Tetrahedron Letters 23(25): 2515-2518.
Miller, O. K., Jr. (1972). Mushrooms of North America. E. P. Dutton Inc.: New York.
Mitchel, D. H. (1976). Mushroom poisoning in Colorado 1972-1975. McIlvainea 2(2): 59-65.
Mitchel, D. H. and Rumack, B. H. (1978). Symptomatic diagnosis and treatment of mushroom poisoning: 171-179. In: Rumack, B. H. and Salzman, E. (eds), Mushroom Poisoning: Diagnosis and Treatment. CRC Press: West Palm Beach, Florida.
Mortara, M. and Marinetti, L. (1955). Seltene Vergiftungsfälle des Hypholoma fasciculare. [Rare cases of poisoning by Hypholoma fasciculare.] Medicina Internazionale 63(5): 180-183.
Moser, M. (1968). Gibt es giftige Saftlinge? [Are these poisonous Hygrocybe species?] Zeitschrift für Pilzkunde 34: 183-184.
Moser, M. (1972). Die Gattung Dermocybe (Fr.) Wünsche (Die Hautköpfe). [Dermocybe (Fr.) Wünsche species.] Schweizerische Zeitschrift fur Pilzkunde 50: 153-167.
Musso, H. (1982). Über die Farbstoffe des Fliegenpilzes. Aufgaben und Ziele der Naturstoffchemie heute. [The pigments of Amanita muscaria. Current tasks and aims in the chemistry of natural substances.] Naturwissenschaften 69: 326-331.

Mycological Society of San Francisco, Inc. Toxicology committee report of questionnaire survey, 1975.
Nagy, I., Pogátsa-Murray, G., Zalányi, S., Jr., Komlósi, P., László, F., Jr. and Ungi, I. (1994). Amanita poisoning during the second trimester of pregnancy: a case report and a review of the literature. Clinical Investigations 72: 794-798.
Narita, D. (1956). Poisoned case by Naematoloma fasciculare. (in Japanese). Transactions of the Mycological Society of Japan 1(2): 6.
Neuhoff, W. (1959). Ein giftiger rotbrauner Ritterling. [A poisonous reddish brown Tricholoma.] Westfälische Pilzbriefe 2(3): 33-36.
Nicholls, D. W., Hyne, B. E. B. and Buchanan, P. (1995). Death cap mushroom poisoning. [Letter]. New Zealand Medical Journal 108: 234.
Nieminen, L. (1976). Effects of drugs on mushroom poisoning induced in the rat by Cortinarius speciosissimus. Archiv für Toxicologie 35: 235-238.
Nieminen, L. and Pyy, K. (1976). Individual variation in mushroom poisoning induced in the male rat by Cortinarius speciosissimus. Medical Biology 54: 156-158.
Nieminen, L., Möttönen, M., Tirri, R. and Ikonen, S. (1975). Nephrotoxicity of Cortinarius speciosissimus: a histological and enzyme histochemical study. Experimentelle Pathologie 11: 239-246.
Nikonorow, M., Grzybowska, J. and Karkocha, I. (1967). [Polish poisonous mushrooms. I. Chemical examination of Scleroderma aurantium.] (in Polish). Roczniki Panstwowego Zakladu Higieny 18(3): 277-281. In: Chemical Abstracts 67: no. 88323z.
Noordeloos, M. E. (1992). Entolomataceae Kotl. and Pouz.: 341-459. In: Hansen, L. and Knudsen, H. (eds), Nordic Macromycetes, Vol. 2: Polyporales, Boletales, Agaricales, Russulales. Nordsvamp: Copenhagen.
Odenthal, K. P., Seeger, R., Braatz, R., Petzinger, E., Moshaf, H. and Schmitz-Dräger, C. (1982). Damage in vitro to various organs and tissues by rubescenslysin from the edible mushroom Amanita rubescens. Toxicon 20: 765-781.
Ohenoja, E., Jokiranta, J., Makinen, T., Kaikkonen, A. and Airaksinen M. M. (1987). The occurrence of psilocybin and psilocin in Finnish fungi. Journal of Natural Products (Lloydia) 50: 741-744.
Oldridge, S. G., Pegler, D. N. and Spooner, B. M. (1989). Wild Mushroom and Toadstool Poisoning. Royal Botanic Gardens: Kew.
Page, L. (1975). Poisoning due to Amanita gemmata. Boston Mycological Club Bulletin No. 3.
Parashos, A. J. (1976-7). The psilocybin-induced state of drunkenness in normal volunteers and schizophrenics. Behavioural Neuropsychiatry 8: 83-86.
Peden, N. R. and Pringle, S. D. (1982). Hallucinogenic fungi. [Letter]. Lancet 1: 396-397.
Peden, N. R., Bisset, A. F., Macaulay, K. E. C., Crooks, J. and Pelosi, A. J. (1981). Clinical toxicology of 'magic mushroom' ingestion. Postgraduate Medical Journal 57: 543-545.
Peden, N. R., Pringle, S. D. and Crooks, J. (1982). The problem of psilocybin mushroom abuse. Human Toxicology 1: 417-424.
Pegler, D. (1990). Kingfisher Field Guide to the Mushrooms and Toadstools of Britain and Europe. Kingfisher Books: London.
Pegler, D. and Spooner, B. (1992). The Mushroom Identifier. The Apple Press: London.
Pegler, D. N. (1981). The Mitchell Beazley Pocket Guide to Mushrooms and Toadstools. Mitchell Beazley Publishers: London.
Pegler, D. N. (1999). The Easy Edible Mushroom Guide: Britain and Europe. Aurum Press: London.
Pegler, D. N. and Watling, R. (1982). British toxic fungi. Bulletin of the British Mycological Society 16(1): 66-75.
Pegler, D. N., Laessøe, T. and Spooner, B. M. (1995). British Puffballs, Earthstars and Stinkhorns: An Account of the British Gasteroid Fungi. Royal Botanic Gardens: Kew.

Pegler, D. N., Roberts, P. J. and Spooner, B. M. (1997). British Chanterelles and Tooth Fungi: An Account of the British Cantharelloid and Stipitate Hydnoid Fungi. Royal Botanic Gardens: Kew.
Pegler, D. N., Spooner, B. M. and Young, T. W. K. (1993). British Truffles: A Revision of British Hypogeous Fungi. Royal Botanic Gardens: Kew.
Phillips, R. (1981). Mushrooms and Other Fungi of Great Britain and Europe. Pan Books Ltd.: London.
Pilat, A. (1951). Mushrooms. Spring Books: London.
Piomelli, D. (1991). One route to religious ecstasy. [Letter]. Nature 349: 362.
Piqueras, J. (1989). Hepatotoxic mushroom poisoning: diagnosis and management. Mycopathologia 105: 99-110.
Pohle, W. (1995). Paxillus involutus a dangerous mushroom? Czech Mycology 48(1): 31-38.
Pollock, S. H. (1974). A novel experience with Panaeolus: a case study from Hawaii. Journal of Psychedelic Drugs 6: 85-89.
Pollock, S. H. (1976). Psilocybian mycetismus with special reference to Panaeolus. Journal of Psychedelic Drugs 8: 43-57.
Pomerleau, R. and Potvin, L. (1983). A case of Scleroderma poisoning in Quebec. McIlvainea 6(1): 8.
Pouchet, A. (1927). Troubles circulatoires causés par l'absorption consécutive de Coprins et de vin. [Circulatory disturbances caused by the consecutive consumption of Coprinus and wine.] Bulletin Mensuel de la Société Linnéenne de Lyon 1927: 59-61.
Prager, M. H. and Goos, R. D. (1984). A case of mushroom poisoning from Suillus luteus. Mycopathologia 85: 175-176.
Prast, H. and Pfaller, W. (1988). Toxic properties of the mushroom Cortinarius orellanus II. Impairment of renal function in rats. Archives of Toxicology 62: 89-96.
Prast, H., Werner, E. R., Pfaller, W. and Moser, M. (1988). Toxic properties of the mushroom Cortinarius orellanus I. Chemical characterization of the main toxin of Cortinarius orellanus (Fries) and Cortinarius speciosissimus (Kühn and Romagn) and acute toxicity in mice. Archives of Toxicology 62: 81-88.
Price, H. W. (1927). Mushroom poisoning due to Hebeloma crustuliniforme. American Journal of Diseases of Children 34: 441-442.
Pyysalo, H. (1975). Some new toxic compounds in false morels, Gyromitra esculenta. Naturwissenschaften 62: 395.
Pyysalo, H. (1976). Tests for gyromitrin, a poisonous compound in false morel Gyromitra esculenta. Zeitschrift für Lebensmittel-Untersuchung und -Forschung 160: 325-330.
Rapior, S., Andary, C. and Privat, G. (1988). Chemotaxonomic study of orellanine in species of Cortinarius and Dermocybe. Mycologia 80: 741-747.
Reynolds, W. A. and Lowe, F. E. (1965). Mushrooms and a toxic reaction to alcohol: report of four cases. New England Journal of Medicine 272: 630-631.
Richard, J.-M., Louis, J. and Cantin, D. (1988). Nephrotoxicity of orellanine, a toxin from the mushroom Cortinarius orellanus. Archives of Toxicology 62: 242-245.
Rinaldi, A. and Tyndalo, V. (1974). The Complete Book of Mushrooms. Crown: New York.
Robbers, J. E., Tyler, V. E. and Ola'h, G. M. (1969). Additional evidence supporting the occurrence of psilocybin in Panaeolus foenisecii. Journal of Natural Products (Lloydia) 32(3): 399-400.
Rumack, B. H. (1994). Symptomatic diagnosis and treatment of mushroom poisoning: 149-163. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Rumack, B. H. and Salzman, E. (eds) (1978). Mushroom Poisoning: Diagnosis and Treatment. CRC Press: West Palm Beach, Florida.
Rumack, B. H., Rider, P. K. and Gelman, C. R. (eds) (1998). POISINDEX® System.

Micromedex Inc.: Englewood, Colorado (Edition expires 30/06/98)
Sabeel, A. I., Kurkus, J. and Lindholm, T. (1995). Intensive hemodialysis and hemoperfusion treatment of Amanita mushroom poisoning. Mycopathologia 131: 107-114.
Sakula, A. (1967). Mushroom workers lung. British Medical Journal 3: 708-710.
Sanderson, W., Kullman, G., Sastre, J., Olenchock, S., OCampo, A., Musgrave, K. and Green, F. (1992). Outbreak of hypersensitivity pneumonitis among mushroom farm workers. American Journal of Industrial Medicine 22: 859-872.
Sanford, J. H. (1972). Japans laughing mushrooms. Economic Botany 26: 174-181.
Sanz, P., Reig, R., Borrás, L., Martínez, J., Máñez, R. and Corbella, J. (1988). Disseminated intravascular coagulation and mesenteric venous thrombosis in fatal Amanita poisoning. Human Toxicology 7: 199-201.
Saupe, G. (1986). Vergiftungen mit dem Dickschaligen Kartoffelbovist - Scleroderma citrinum. [Poisoning by the common earthball - Scleroderma citrinum.] Mykologisches Mitteilungsblatt 29(2): 49.
Schmidlin-Mészáros, J. (1974). Gyromitrin in Trockenlorcheln (Gyromitra esculenta sicc.). [Gyromitrin in dried morels (Gyromitra esculenta sicc.).] Mitteilungen aus dem Gebiet der Lebensmitteluntersuchung und -Hygiene 65: 453-465.
Schmidt, J., Hartmann, W., Wurstlin, A. and Deicher, H. (1971). Akute Nierenversagen durch immunhamolytische Anamie nach Genuss des Kahlen Kremplings (Paxillus involutus). [Acute kidney failure due to immunohaemolytic anaemia following consumption of the mushroom Paxillus involutus.] Deutsche Medizinische Wochenschrift 96: 1188-1191.
Schumacher, T. and Høiland, K. (1983). Mushroom poisoning caused by species of the genus Cortinarius Fries. Archives of Toxicology 53: 87-106.
Schwartz, R. H. and Smith, D. E. (1988). Hallucinogenic mushrooms. Clinical Pediatrics 27: 70-73.
Shaffer, C. B. and Wands, R. C. (1973). Guides for short-term exposure limits to hydrazines. Proceedings of the Fourth Annual Conference on Environmental Toxicology, 16-18 October 1973. Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, Report No. AMRL-TR-73-125: 235-242.
Shaffer, R. L. (1965). Poisoning by Pholiota squarrosa. Mycologia 57: 318-319.
Sharman, M., Patey, A. L. and Gilbert, J. (1990). A survey of the occurrence of agaritine in U.K. cultivated mushrooms and processed mushroom products. Food Additives and Contaminants 7(5): 649-656.
Shaw, M. (1985). Personal communication. Memo on mushroom report sent to NAMA concerning Grifola frondosa. Colorado Mycological Society.
Shaw, M. (1991). Personal communication. Memo on mushroom report sent to NAMA concerning Leccinum mushrooms. Colorado Mycological Society.
Shaw, M. (1994). Amateur opportunity: 9-38. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Short, A. I. K., Watling, R., MacDonald, M. K. and Robson, J. S. (1980). Poisoning by Cortinarius speciosissimus. Lancet 2: 942-943.
Simons, D. M. (1971). The mushroom toxins. Delaware Medical Journal 43: 177-187.
Simons, D. M. (1978). The mushroom toxins from a chemical point of view. Syllabus, Toxic Mushroom Workshop. New York Botanical Garden: Bronx, New York.
Sivyer, G. and Dorrington, L. (1984). Intravenous injection of mushrooms. [Letter]. Medical Journal of Australia 140: 182.
Smolinske, S. C. (1994). Psilocybin-containing mushrooms: 309-324. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Southcott, R. V. (1975). Notes on some poisonings and other clinical effects following ingestion

of Australian fungi. South Australian Clinics 6: 441-478.
Spoerke, D. G. (1994a). Mushroom field tests: 131-148. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Spoerke, D. G. (1994b). Gastrointestinal irritant mushrooms: 347-366. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Spoerke, D. G. (1994c). Miscellaneous mushroom toxins: 391-398. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Spoerke, D. G. and Hall, A. H. (1990). Plants and mushrooms of abuse. Emergency Medicine Clinics of North America 8: 579-593.
Spoerke, D. G. and Rumack, B. H. (eds) (1994). Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Spoerke, D. G., Rumack, B. and Spoerke, S. E. (1985). Rocky Mountain high. [Letter]. Annals of Emergency Medicine 14: 828-829.
Spooner, B. and Laessøe, T. (1992). Mushrooms and Other Fungi. Hamlyn Tracker Young Nature Guides. Reed International Books Ltd.: London.
Stadelmann, R. J., Müller, E. and Eugster, C. H. (1976). Über die Verbreitung der stereomeren Muscarine innerhalb der Ordnung der Agaricales. [Investigations on the distribution of the stereoisomeric muscarines within the order of Agaricales.] Helvetica Chimica Acta 59(7): 2432-2436.
Stallard, D. and Edes, T. E. (1989). Muscarinic poisoning from medications and mushrooms. A puzzling symptom complex. Postgraduate Medicine 85: 341-345.
Steglich, W., Steffan, B., Stroech, K. and Wolf, M. (1984). Pistillarin, ein charakteristischer Inhaltsstoff der Herkuleskeule (Clavariadelphus pistillaris) und einiger Ramaria-Arten (Basidiomycetes). [Pistillarin, a characteristic constituent of Clavariadelphus pistillaris and a Ramaria species (Basidomycetes).] Zeitschrift fur Naturforschung. Section C. Journal of Biosciences 39: 10-12.
Sterner, O. and Anke, H. (1995). Toxic terpenoids isolated from higher fungi. Czech Mycology 48(1): 39-52.
Sterner, O., Bergman, R., Kesler, E., Nilsson, L., Oluwadiya, J. and Wickberg, B. (1983). Velutinal esters of Lactarius vellereus and L. necator: the preparation of free velutinal. Tetrahedron Letters 24: 1415-1418.
Stevenson, J. A. and Benjamin, C. R. (1961). Scleroderma poisoning. Mycologia 53: 438-439.
Stijve, T. (1987). Vorkommen von Serotonin, Psilocybin und Harnstoff in Panaeoloideae. [Occurrence of serotonin, psilocybin and urea in Panaeoloideae.] Beitrage zur Kenntnis der Pilze Mitteleuropas 3: 229-234.
Stijve, T. (1995). Worldwide occurrence of psychoactive mushrooms an update. Czech Mycology 48(1): 11-19.
Stijve, T. and Kuyper, T. W. (1985). Occurrence of psilocybin in various higher fungi from several European countries. Planta Medica 51: 385-387.
Stijve, T., Hischenhuber, C. and Ashley, D. (1984). Occurrence of 5-hydroxylated indole derivatives in Panaeolina foenisecii (Fries) Kuehner from various origin. Zeitschrift für Mykologie 50: 361-368.
Suzuki, K., Une, T. and Yamazaki, M. (1988). [Studies on the toxic components of Rhodophyllus rhodopolius. II. Partial purification and properties of the hemolysin from Rhodophyllus rhodopolius: examination on the condition of the hemolysis.] (in Japanese). Yakugaku Zasshi 108: 221-225.
Suzuki, K., Une, T., Yamazaki, M. and Takeda, T. (1990). Purification and some properties of a hemolysin from the poisonous mushroom Rhodophyllus rhodopolius. Toxicon 28: 1019-

1028.
Svrcek, M. (1988). The Illustrated Book of Mushrooms and Fungi. Octopus Publishing Group: London.
Takahashi, A., Kusano, G., Ohta, T., Ohizumi, Y. and Nozoe, S. (1989). Fasciculic acids A, B and C as calmodulin antagonists from the mushroom Naematoloma fasciculare. Chemical and Pharmaceutical Bulletin 37(12): 3247-3250.
Takemoto, T. and Nakajima, T. (1964). [Isolation of the insecticidal constituent from Tricholoma muscarium.] (in Japanese). Yakugaku Zasshi 84: 1230-1232.
Tanaka, M., Hashimoto, K., Okuno, T. and Shirahama, H. (1993). Neurotoxic oligoisoprenoids of the hallucinogenic mushroom, Gymnopilus spectabilis. Phytochemistry 34(3): 661-664.
Tebbett, I. R. and Caddy, B. (1984). Mushroom toxins of the genus Cortinarius. Experientia 40: 441-446.
Testa, E. (1983). Un fenomeno poco noto in Micotossicologia: l'intolleranza ai funghi eduli. [A rare phenomenon in mycotoxicology: intolerance to edible fungi.] Schweizerische Zeitschrift für Pilzkunde 61(2): 8-10.
Thiers, H. D. (1994). Boletes and their toxins: 339-345. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Thomas, H. W., Mitchel, D. H. and Rumack, B. W. (1977). Poisoning from the mushroom Stropharia coronilla (Bull. ex Fr.) Quel. Journal of the Arkansas Medical Society 73(8): 311-312.
Toth, B. and Erickson, J. (1986). Cancer induction in mice by feeding of the uncooked cultivated mushroom of commerce Agaricus bisphorus. Cancer Research 46(8): 4007-4011.
Tottmar, O. and Lindberg, P. (1977). Effects on rat liver acetaldehyde dehydrogenases in vitro and in vivo by coprine, the disulfiram-like constituent of Coprinus atramentarius. Acta Pharmacologica et Toxicologica 40(4): 476-481.
Trestrail, J. H., III (1991). Mushroom poisoning case registry North American Mycological Association report 1989-90. McIlvainea 10(1): 36-39.
Trestrail, J. H., III (1992). Mushroom poisoning case registry North American Mycological Association report 1991. McIlvainea 10(2): 51-55.
Trestrail, J. H., III (1993). Mushroom poisoning case registry North American Mycological Association report 1992. McIlvainea 11(1): 51-55.
Trestrail, J. H., III (1994a). Monomethylhydrazine-containing mushrooms: 279-287. In: Spoerke, D. G. and Rumack, B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Trestrail, J. H., III (1994b). Mushroom poisoning case registry North American Mycological Association report 1993. McIlvainea 11(2): 87-91.
Trestrail, J. H., III (1995). Mushroom poisoning case registry: NAMA report 1994. McIlvainea 12(1): 68-73.
Trestrail, J. H., III (1996). Mushroom poisoning case registry: NAMA report 1995. McIlvainea 12(2): 98-104.
Trestrail, J. H., III (1997). Mushroom poisoning case registry: NAMA report 1996. McIlvainea 13(1): 63-67.
Trestrail, J. H., III (1998). 1997 annual report of the North American Mycological Association's mushroom poisoning case registry. McIlvainea 13(2): 86-91.
Tyler, V. E., Jr. (1963). Poisonous mushrooms. Progress in Chemical Toxicology 1: 339-384.
Tyler, V. E., Jr. and Gröger, D. (1964). Investigation of the alkaloids of Amanita species II. Amanita citrina and Amanita porphyria. Planta Medica 12: 397-402.
Tyler, V. E., Jr. and Smith, A. H. (1963). Protoalkaloids of Panaeolus species. Abhandlungen der Deutschen Akademie der Wissenschaften zu Berlin. Klasse für Chemie, Geologie und Biologie 4: 45-54.

Ueda, H., Kojima, K., Saitoh, T. and Ogawa, H. (1999). Interaction of a lectin from Psathyrella velutina mushroom with N-acetylneuraminic acid. FEBS Letters 448: 75-78.
Vanden Hoek, T. L., Erickson, T., Hryhorczuk, D. and Narasimhan, K. (1991). Jack olantern mushroom poisoning. Annals of Emergency Medicine 20: 559-561.
Vergeer, P. P. (1983). Poisonous fungi: mushrooms: 373-412. In: Howard, D. H. and Howard, L. F. (eds), Fungi Pathogenic for Humans and Animals. Part B. Pathogenicity and Detection. Marcel Dekker: New York.
Vesconi, S., Langer, M., Iapichino, G., Constantino, D., Busi, C. and Fiume, L. (1985). Therapy for cytotoxic mushroom intoxication. Critical Care Medicine 13: 402-406.
Veselský, J. and Dvoøák, J. (1981). Über den Verlauf einer Vergiftung durch den Schwefelgelben Ritterling - Tricholoma sulphureum (Bull. ex Fr.) Kumm. [Poisoning by Tricholoma sulphureum.] Èeská Mykologie 35(2): 114-115.
von Kreybig, T., Preussmann, R. and von Kreybig, I. (1970). Chemische Konstitution und teratogene Wirkung bei der Ratte. 3. N-Alkylcarbonhydrazide, noeitere Hydrazinderivate. [Chemical constitution and teratogenic effects in rats. 3. N-alkylcarbonhydrazides and other hydrazine derivatives.] Arzneimittel-Forschung 20(3): 363-367.
von Strahlenburg, F. J. (1730). An historic-geographic description of the North and Eastern parts of Europe and Asia. Stockholm.
von Wright, A., Niskanen, A. and Pyysalo, H. (1981). Amelioration of toxic effects of ethylidene gyromitrin (false morel poison) with pyridoxine chloride. Journal of Food Safety 3: 199-203.
Walters, M. B. (1965). Pholiota spectabilis, a hallucinogenic fungus. Mycologia 57: 837-838.
Wasiljkow, B. P. (1963). Die Vergiftungsfälle des Büscheligen Schwefelkopfes, Hypholoma fasciculare (Fr.) Quél. [Cases of poisoning by the Sulphur Tuft, Hypholoma fasciculare (Fr.) Quél.] Schweizerische Zeitschrift für Pilzkunde 41(8): 117-121.
Wason, S., Lacouture, P. G. and Lovejoy, F. H., Jr. (1981). Single high-dose pyridoxine treatment for isoniazid overdose. Journal of the American Medical Association 246: 1102-1104.
Watling, R. (1979). Studies in the genera Lacrymaria and Panaeolus. Notes from the Royal Botanic Garden Edinburgh 37: 369-379.
Watling, R. (1995). Children and Toxic Fungi: The Essential Medical Guide to Fungal Poisoning in Children. Royal Botanic Garden: Edinburgh.
Wieland, T. (1983). The toxic peptides from Amanita mushrooms. International Journal of Peptide and Protein Research 22: 257-276.
Wier, J. K. and Tyler, V. E., Jr. (1960). An investigation of Coprinus atramentarius for the presence of disulfiram. Journal of the American Pharmaceutical Association 49(7): 426-429.
Wilson, D. (1947). Poisoning by Inocybe fastigiata. British Medical Journal 2: 297.
Winkelmann, M., Borchard, F., Stangel, W. and Grabensee, B. (1982). Tödliche verlaufene immunhämolytishe Anämie nach Genuss des Kahlen Kremplings (Paxillus involutus). [Fatal immunohaemolytic anaemia after eating the mushroom Paxillus involutus.] Deutsche Medizinische Wochenschrift 107: 1190-1194.
Winkelmann, M., Stangel, W., Schedel, I. and Grabensee, B. (1986). Severe hemolysis caused by antibodies against the mushroom Paxillus involutus and its therapy by plasma exchange. Klinische Wochenschrift 64(19): 935-938.
Winterstein, D. (2000). Plädoyer für die Giftigkeit der Nebelkappe. [Evidence for the toxicity of Clitocybe nebularis.] Pharmazeutische Zeitung 145: 577-580.
Yoshioka, Y., Tabeta, R., Saito, H., Uehara, N. and Fukuoka, F. (1985). Antitumor polysaccharides from Pleurotus ostreatus (Fr.) Quél.: isolation and structure of a beta-glucan. Carbohydrate Research 140: 93-100.
Young, A. (1994). Muscarine-containing mushrooms: 289-301. In: Spoerke, D. G. and Rumack,

B. H. (eds), Handbook of Mushroom Poisoning: Diagnosis and Treatment. CRC Press: Boca Raton, Florida.
Zeitlmayr, L. (1968). Wild mushrooms: an illustrated handbook. A translation of: Zeitlmayr, L. (1955). Knaurs Pilzbuch. Droemer Knaur Verlag. Translated and adapted from the German, with mushroom recipes, by Otto Gregory; with illustrations by Claus Caspari. Frederick Muller Ltd.: London.

Descriptions

Bon, M. (1987). The Mushrooms and Toadstools of Britain and North-western Europe. Hodder and Stoughton: London.
Breitenbach, J. and Kränzlin, F. (eds) (1984). Fungi of Switzerland, Vol. 1: Ascomycetes. Verlag Mykologia: Lucerne, Switzerland.
Breitenbach, J. and Kränzlin, F. (eds) (1986). Fungi of Switzerland, Vol. 2: Non-Gilled Fungi. Edition Mykologia: Lucerne, Switzerland.
Breitenbach, J. and Kränzlin, F. (eds) (1991). Fungi of Switzerland, Vol. 3: Boletes and Agarics Part 1. Edition Mykologia: Lucerne, Switzerland.
Breitenbach, J. and Kränzlin, F. (eds) (1995). Fungi of Switzerland, Vol. 4: Agarics Part 2. Edition Mykologia: Lucerne, Switzerland.
Corner, E. J. H. (1966). A Monograph of Cantharoid Fungi: Annals of Botany Memoirs No. 2. Oxford University Press: UK.
Courtecuisse, R. and Duhem, B. (1995). Mushrooms and Toadstools of Britain and Europe. Collins Field Guide. HarperCollins Publishers: London.
Dickson, G. (1990). The Concise Guide to Mushrooms and Toadstools. New Holland (Publishers) Ltd.: London.
Hansen, L. and Knudsen, H. (eds). (1992). Nordic Macromycetes, Vol. 2. Polyporales, Boletales, Agaricales, Russulales. Nordsvamp: Denmark.
Hawksworth, D. L., Kirk, P. M., Sutton, B. C. and Pegler, D. N. (1995). Ainsworth and Bisbys Dictionary of the Fungi, Ed. 8. CAB International: Surrey.
Largent, D., Johnson, D. and Watling, R. (1977). How to Identify Mushrooms to Genus, III: Microscopic Features. Mad River Press: California.
Oldridge, S. G., Pegler, D. N. and Spooner, B. M. (1989). Wild Mushroom and Toadstool Poisoning. Royal Botanic Gardens: Kew.
Pegler, D. N. (1981). The Mitchell Beazley Pocket Guide to Mushrooms and Toadstools. Mitchell Beazley Publishers: London.
Pegler, D. (1990). Kingfisher Field Guide to the Mushrooms and Toadstools of Britain and Europe. Kingfisher Books: London.
Pegler, D. and Spooner, B. (1992). The Mushroom Identifier. The Apple Press: London.
Pegler, D. N., Laessøe, T. and Spooner, B. M. (1995). British Puffballs, Earthstars and Stinkhorns: An Account of the British Gasteroid Fungi. Royal Botanic Gardens: Kew.
Pegler, D. N., Roberts, P. J. and Spooner, B. M. (1997). British Chanterelles and Tooth Fungi: An Account of the British Cantharelloid and Stipitate Hydnoid Fungi. Royal Botanic Gardens: Kew.
Pegler, D. N., Spooner, B. M. and Young, T. W. K. (1993). British Truffles: A Revision of British Hypogeous Fungi. Royal Botanic Gardens: Kew.
Phillips, R. (1981). Mushrooms and Other Fungi of Great Britain and Europe. Pan Books Ltd.: London.
Snell, W. H. and Dick, E. A. (1957). A Glossary of Mycology. Harvard University Press: Massachusetts.
Sterry, P. (1991). Fungi of Britain and Ireland. Chancellor Press: London.
Watling, R. (1970). British Fungus Flora, Part 1. Boletaceae: Gomphidiaceae: Paxillaceae.

HMSO: Edinburgh.
Watling, R. and Gregory, N. M. (1987). British Fungus Flora, Part 5. Strophariaceae and Coprinaceae p.p. Royal Botanic Gardens: Edinburgh.
Watling, R., Gregory, N. M. and Orton, P. D. (1993). British Fungus Flora, Part 7. Cortinariaceae p.p. Royal Botanic Gardens: Edinburgh.