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Slime Molds
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Myxomycetes and Australian newspapers

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Abstract: Myxomycetes have been mentioned in Australian newspapers since at least 1862, but in a fairly small number of articles, most of which say little. In this note, I give a brief account of what Australian newspapers said about these organisms up to 1950.

Keywords: mycetozoa, slime mold, slime mould, Thomas Whitelegge

Introduction

In the second half of the 1900s the public could find a variety of books or magazines that dealt with the natural history of Australia. Such publications were sold in general bookshops, or newsagents and presented some information about cryptogams, but much more about other organisms. There were far fewer such publications in earlier years. During the 1800s and the earlier 1900s Australian newspapers often reproduced, in whole or in part, information from overseas newspapers or journals. At times, newspapers also reported on meetings of (or papers published by) Australian scientific or natural history societies. Newspaper articles were potentially a cheap source of information about cryptogams for the public. In earlier work I studied an online archive of Australian newspapers for fungal articles published up to the end of 1950 and found numerous stories on a variety of mycological themes. I therefore wondered what a similar search focusing on myxomycetes would produce. I will say something about the database and its limitations and then summarize what newspapers said about myxomycetes.

Materials, methods and limitations

During April 2022 I searched the online newspaper archive created by the National Library of Australia. This page (https://trove.nla.gov.au/help/categories/newspapers-and-gazettes-category) gives general information and this statement of the library's aims: *The National Library of Australia focuses on digitising newspapers published before 1955 on the general understanding that they are out of copyright*. To search the archive, go to https://trove.nla.gov.au/ and choose 'Newspapers & Gazettes' in the 'Advanced search' option. To see a specific issue and page, go to https://trove.nla.gov.au/newspaper/, choose 'Titles'

in 'Browse', click to get to the selection screen and then choose the appropriate item as each column appears.

In my first few searches I used the following terms (with the number of articles found in brackets): slime mould (non-American spelling, 333), slime mold (15), myxomycete (34), mycetozoa (15). The 333 results for 'slime mould' bring me to one of the limitations of the database. The quality of the search results depends on how well the digitisation process (with automated transcription) handles the greatly varying print quality in old newspapers and it is not surprising that some words are mis-read. Those 333 articles included many that dealt with 'slim-moulded' female fashions.

A second search for the phrase 'slime mould' (but excluding the words fashion, woman and women) cut the number to 125 (and I realise that, in theory, I could have excluded a genuine myxomycete article since the word fashion could occur in such a story). A look through those 125 showed that more should be excluded. For example, despite my specifying the phrase 'slime mould' the results still included some articles about 'slim and moulded' clothing and articles that referred to 'slime, mould' in food spoilage. Such articles were outnumbered by those that dealt with organisms no longer thought of as myxomycetes, e.g. *Plasmodiophora brassicae* and *Spongospora subterranea*, the former a disease especially of cabbages, the latter a disease of potatoes. With 'cabbage' and 'potato' added to the excluded words, the results dropped from 125 to 74. Those 74 (as well as the other results noted above) needed more weeding. There were also articles not picked up in those searches. For example, a search for *Physarum* produced 14 articles not found earlier because other words were used to categorize *Physarum* (e.g. myxomyceti or fungus). Various searches (which it would be tedious to list), and subsequent checking yielded 86 articles that made some mention of myxomycetes in today's sense of that word.

More may have been published than I've found since the archive does not contain every issue of every newspaper published in Australia (more likely a problem with issues from the 1800s or with newspapers published in small towns). However, the coverage is already very good and I think there could not be many myxomycete stories in the missing issues. In my fungal study I did find some pages where the print quality was so poor that I could not recognize any words in the digital copy. Perhaps such pages hide myxomycete articles. During that fungal study I looked through several thousand pages and the number of such poor pages was small. Again, I can't see how they'd hide many myxomycete articles. Volunteers correct the automatic transcriptions and a future search could reveal some myxomycete references (in issues already scanned) missed by me because of current transcription flaws. When citing newspaper names I give the place of publication when more than one town or city published a newspaper with the same (or very similar) name. That information will help anyone who wishes to find the relevant newspaper of a particular name in the archive.

Results

In Figure 1, I show the earliest occurrence of any myxmomycete term that I've found, the species name *Reticularia maxima*. The *Chronicle* was published in Melbourne and this extract came from a paper read to the Victorian Horticultural Improvement Society. While a myxomycete species was mentioned, the reader was told nothing about the the nature of the organism (though, given earlier comments, it must be a fungus) but does learn that it produced copious spores. I do not know the source of the words enclosed by the pair of double quotes since those words (or slight variations) appear in various English publications, back to at least 1832.

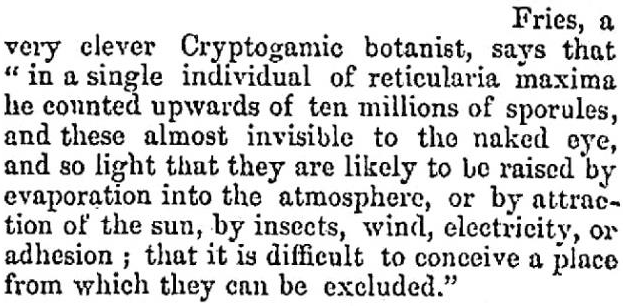

Fries, a very clever Cryptogamic botanist, says that "in a single individual of reticularia maxima he counted upwards of ten millions of sporules, and these almost invisible to the naked eye, and so light that they are likely to be raised by evaporation into the atmosphere, or by attraction of the sun, by insects, wind, electricity, or adhesion; that it is difficult to conceive a place from which they can be excluded."

Figure 1: *The Farmer's Journal and Gardener's Chronicle*, 26 April 1862, page 11.

The year 1870 saw another species name in Australian print, when the *The Sydney Mail* (12 February, page 6) reproduced a report about a paper read to the Athy Farmers' Club in Ireland. The only relevant sentence was: "I have seen the roots of mangel wurzel dotted over with an exceedingly small fungus - *Diderma cyanescens* - which must have resulted from the decaying vegetable manure" and the Sydney paper acknowledged its source as the *Mark Lane Express*, a London weekly.

The next occurrence of a myxomycete term was in 1882, when *The Sydney Morning Herald* (23 December, page 5) repeated an English story in which the only relevant sentence was: "For some time Mr. Whitelegge has been studying the Myxomycetes - an organism which scientific men are as yet unable to classify as animal or vegetable - and has made out a list of 20 species, many of them new to the district".

The phrase 'slime mould' appeared in 1894 in a story about *Plasmodiophora* and 1912 (*The West Australian*, 30 November, page 8) was the first year in which 'slime mould' referred to myxomycetes in today's sense, in these words: "I may just say that in the case of the slime-mould called *flowers of tan* the protoplasm dries to the consistency of hard wax, and can be kept for years in that state, and then revived by moisture into full activity and growth", in an article based on one of Ray Lankester's *Science from an easy chair* essays, published in London. Figure 2 shows the first appearance of the word mycetozoa in an Australian newspaper. It is in a general science article accredited to Dr. J.E. Taylor, who is described as editor of the London magazine *Science Gossip*, though the precise source of this article was not given.

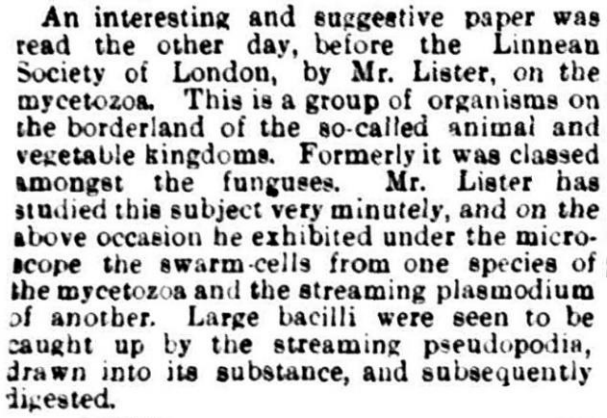

An interesting and suggestive paper was read the other day, before the Linnean Society of London, by Mr. Lister, on the mycetozoa. This is a group of organisms on the borderland of the so-called animal and vegetable kingdoms. Formerly it was classed amongst the funguses. Mr. Lister has studied this subject very minutely, and on the above occasion he exhibited under the microscope the swarm-cells from one species of the mycetozoa and the streaming plasmodium of another. Large bacilli were seen to be caught up by the streaming pseudopodia, drawn into its substance, and subsequently digested.

Figure 2: *The Australasian*, 15 June 1889, page 38.

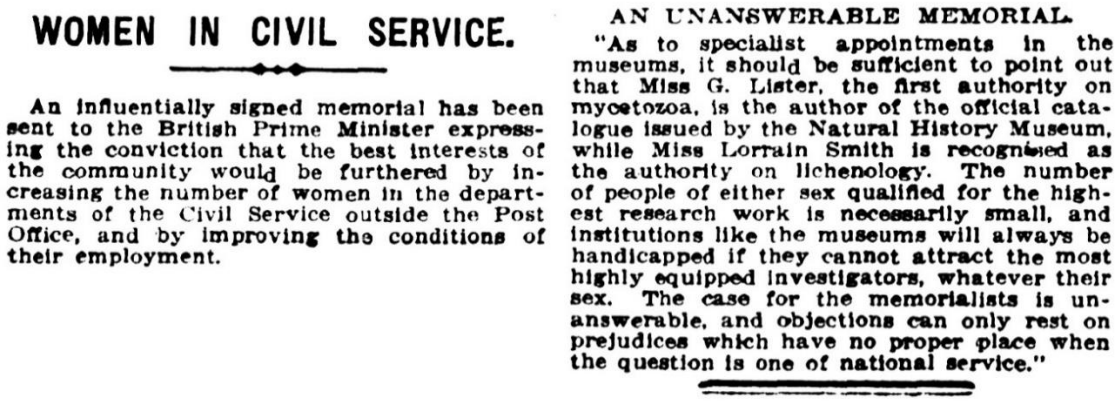
The American spelling 'slime mold' made its first appearance in 1906 (*Liverpool Herald*, 23 June, page 4) in an article headed *Club root of cabbage*, but the writer said that the disease belonged to "a group

known as slime molds, which are chiefly non-parasitic", so there was a hint of myxomycetes in the modern sense.

One thing common to all the passages cited thus far is brevity. Taylor's was the longest and told the reader something about the strange nature (is it animal or vegetable?) and behaviour (streaming and absorption of bacteria) of myxomycetes, while the others said little or nothing. Brevity was the feature common to a large proportion of the myxomycete references in the 86 articles, but there were also a few articles that went well beyond Taylor.

The 86 can be divided into two groups: the uninformative and the informative. The uninformative articles tell the reader nothing about myxomycetes and there are 15 such articles. I've already given one example (the reference to *Diderma cyanescens*) and here are the words from three other examples: an article about plant life said they "show every variation of form, from graceful trees and airy blossoms to unfashioned slime molds"; the report of a meeting noted "Mr Rodway, who presided, gave some interesting information on the Myxomycetes or slime fungi (Fuligo septica)" and (in response to a specimen sent in by a reader) " A fungus sent by Dave Dodson (Lillimur) is known as a slime mould: we do not know much about it".

Two of the uninformative articles were interesting for other reasons. *The Sun* (Sydney, 19 July 1913, page 11) started an article with the words shown on the left in Figure3. The article continued by quoting from the *Westminster Gazette* and I omit the rest, except for the final paragraph, below on the right.



WOMEN IN CIVIL SERVICE.

An influentially signed memorial has been sent to the British Prime Minister expressing the conviction that the best interests of the community would be furthered by increasing the number of women in the departments of the Civil Service outside the Post Office, and by improving the conditions of their employment.

AN UNANSWERABLE MEMORIAL.

"As to specialist appointments in the museums, it should be sufficient to point out that Miss G. Lister, the first authority on mycetozoa, is the author of the official catalogue issued by the Natural History Museum, while Miss Lorrain Smith is recognised as the authority on lichenology. The number of people of either sex qualified for the highest research work is necessarily small, and institutions like the museums will always be handicapped if they cannot attract the most highly equipped investigators, whatever their sex. The case for the memorialists is unanswerable, and objections can only rest on prejudices which have no proper place when the question is one of national service."

Figure 3: Miss G. Lister and women in the civil service.

The Warwick Examiner and Times published a short story, titled *Myxomycetes*, in 1914 (October 26, page 3). The story, by Arthur Morrison (1863-1945), had first been published in the United Kingdom in *The Strand* (September 1914, vol 47, No. 285, pages 336-342) and included three illustrations - but the version in the Australian newspaper was unillustrated. In the second paragraph one character says he'd thought the word an invention "but you will find it in any dictionary or encyclopaedia and you may find myxomycetes itself <*sic*> on an old tree-stump - any number of species of it".

In the story fraudsters aim to gain money with the help of some scientific mumbo-jumbo and they

hire Burridge (a former science teacher) to give the project some scientific plausibility. However, Burridge's aim had always been to make protoplasm, to generate life and he succeeds in creating a synthetic myxomycete. This myxomycete is dormant on glass or metal, but if put onto anything organic it will begin to devour the substrate. As the participants find out, it should not be allowed to get onto hair or clothing. Morrison (a very successful author and keen collector of Japanese art) was friends with the Japanese polymath Minakata Kumagusu (Koyama, 2010), during the latter's years in London in the 1890s. The latter studied myxomycetes and the genus *Minakatella* is named after him. Perhaps conversations with his Japanese friend had put the idea of a myxomycete story into Morrison's head.

The remaining 71 informative articles varied greatly in their level of information. Sometimes an article contained just one fact and I have already given two examples: a single *Reticularia maxima* produces "upwards of ten millions of sporules" and "scientific men are as yet unable to classify [myxomycetes] as animal or vegetable". In *The Western Mail* (Perth, 28 August 1930, page 36) a single-fact story corrected a misconception. A reader's observation that "I have on several occasions found species of Mycetozoa (Myxomycetes) slime fungi in water troughs", prompted this response: "Your letter surprised me, because according to several text books that I have consulted, the myxomycetes are not aquatic fungi". The answer was given in a column conducted by William Catton Grasby, an agricultural journalist and educationist. Some single facts were quite striking. Readers of *The Argus* (20 February 1890, page 8) found that the "minimum amount of oxygen pressure for the streaming movements in the plasmodia of myxomycetes, and in the cells of hairs, &c, varies from one millimetre to three". A story about movement in plants (*The Telegraph*, Brisbane, 17 April 1929, page 13) included just one reference to myxomycetes: "The spores of a slime fungus (Fuligo), which move at a rate of about 10 feet per hour, are probably the most active". I could not find the sources of these two statements.

I move on to articles with more information (and the Taylor extract given earlier is one example). Readers of *The Herald* (Melbourne, 8 January 1935, page 22) were told that "out of the rotting bark and cracked wood crept forth glorious masses of slime moulds - those remarkable custard-like fungi, on the borderland between plants and animals, some were flat and scarlet, some golden and nodular, and others clear as crystal with tiny pinnacles of powdered whiteness rising out of a colorless <*sic*> jelly". In non-technical language the reader was told about slime mould consistency (custard-like), forms &colours and is introduced to the question of their plant/animal nature. A small number of articles were more technical and over the next three pages I will discuss them, in chronological order.

The story in Figure 4 was a passage originally from the March 1899 issue of the British magazine *Knowledge: An Illustrated Magazine of Science*. The 1899 issues of *Knowledge* presented a series of well-illustrated articles about myxomycetes by the Frys (the first had appeared in January). The same Australian newspaper gave an equally brief extract from another of the Frys' installments, on page 1402 of the 17 June issue (and I did search carefully for more stories based on the Frys' material, without success). Neither extract was long but each went into some depth on a specific aspect.

Thomas Whitelegge (mentioned in passing early in this section) arrived in Sydney in 1883, already with a broad knowledge of natural history and with good microscopy skills. He wrote six articles about *Australian Objects for the Microscope* (which appeared in January and February of 1911) and one was devoted to the mycetozoa. I show the entire article (*Australian Town and Country Journal*, 1 February 1911, page 35) in Figure 5. This was the only myxomycete article and the *To be continiued* note at the foot of the page refered to the series, not the topic of this instalment. The central illustration is a copy of

Plate VI in Massee (1889), the upper right figure is a copy of an illustration found in one of the Frys' *Knowledge* instalments and also in Fry& Fry (1899), but I don't know the source of the lower left figure. Whitelegge was a significant Australian biologist and Baker & Lowry (2006) gives an account of his life.

Sir Edward Fry and Miss Agnes Fry, in the March number of "Knowledge," continue their interesting story of the Mycetozoa—living things which we know not how to distinguish, whether plants or animals. As to how these objects catch their food, these writers say: "The habits of swarm spores in the pursuit or capture of their food have been very successfully observed by Mr. Lister. In the case of Perichœna corticalis he observed a swarm spore with four vacuoles, each stuffed with from six to eight bacilli; and in the course of 12 minutes he saw four bacilli drawn in by the projecting parts, or pseudopodia of the swarm spore. In the case of Didymium (or Chondrioderma) difforme, he observed that the capture of a bacillus is sometimes effected by pseudopodia. More often, a funnel-shaped aperture was formed in the posterior part of the swarm spore, and when at bacillus was unwary enough to enter, it it was enclosed by a folding over of the lips of the funnel. The bacilli thus captured were seen to dissolve in the vacuoles, but no refuse matter was observed to be rejected; probably the whole bacillus was of absolutely digestible matter."

Figure 4: *The Sydney Mail and New South Wales Advertiser*, 20 May 1899, page 1162. I have re-arranged the columns slightly.

I found just one newspaper article with a photograph (Figure 6) of a myxomycete fruiting body in situ. Though the heading is *The slime fungus*, a term almost always connected with *Plasmodiophora* in newspapers, that taxon was not mentioned. This anonymous article and Whitelegge's were the only accounts of such length. All others are much shorter.

Whitelegge's newspaper columns were few, since they had a limited aim. In the 1900s various newspapers published regular columns devoted to science or nature, but I found few that mentioned myxomycetes. *Science and Nature* was the name of a column that appeared in *The Brisbane Courier* and it featured myxomycetes once (12 September 1925, page 18). It was written by their science correspondent (who used the pseudonym Achernar Major) and mentioned plasmodia, sporangia, spores and the plant or animal puzzle.

Achernar Major noted that "within the sporangia are developed a mass of spores, and frequently a mass of fibres which serve, on the rupture of the wall of the sporangium, to scatter the spores" and that germinating spores generate motile forms that fuse to form the plasmodium. The only other, non-trivial, references to myxomycetes in such a column were written by H.H. Scott and E.O.G Scott. The former was director of the Queen Victoria Museum in Launceston, Tasmania, the latter his son and for short biographies see Hamilton (2012) and Plomley (2006). I show one account in Figure 7 and I know of only one other, largely a rumination on the plant/animal question, in the same paper in the issue of 27 December 1932, page 12. These appeared in a weekly *Nature and Science* column that the Scotts wrote.

Australian Objects for the Microscope.

NO. III.

THE MYCETOZOA—FUNGUS ANIMALS.

BY THOMAS WHITELEGGE.

This group of organisms remained for a long time in dispute as to whether they were animals or plants. In their early stages they move about and take in solid particles of food. In this respect they differ, plants which must have their food in solution. Being on the borderland of the animal and vegetable kingdoms they are of the greatest interest to the microscopist and the biological student. They are fairly common, and may be found on rotten wood, bark, dead leaves, or mosses, in wet or damp situations. They afford a wide field for investigation, and can be cultivated, and their life history followed through all its varied phases. When the spores are placed in water they germinate within about twenty-four hours, and if kept in a moist chamber can be studied at leisure for a considerable time, or fresh spores may be sown as required, spores that have been in the dried state for several years have been germinated, in many instances. The student, by means of the developing spores, may study problems pertaining to the lower forms of life, such as Amœba, and even of man himself. The swarm spores of the Mycetozoa are similar to the white corpuscles of the blood (Phagocytes). The latter, in case of injury, or the presence of dangerous microbes, swarm around the affected places, and not only envelope but digest the harmful microbes. The swarm-spores feed on microbes, and may be cultivated by supplying such as food.

After the spores are placed in water, they become distended and more transparent, the first sign of germination is the rupture of the cell wall, and the gradual emergence of the germ, the spherical form is retained for a few seconds, after which it begins to emit fine hyaline threads of protoplasm, gradually it becomes elongate and somewhat pear-shaped with a thread as long as the body at the narrow end. This process is the flagellum or whip, when this stage is reached, the swarm-spore begins to move rapidly and begins a sort of wriggling or dancing motion, which is quite peculiar and quite different to that of any of the flagellate infusoria. These active movements continued for some time, and were succeeded by creeping snail like, and using the flagellum as a feeler instead of a whip to lash the water. Frequently some individuals withdraw the organ of locomotion and assume the spherical form, surrounded by a transparent wall. In this condition (encysted) they may be dried, if again placed in water they revive, cast off the cyst-wall and repeat the swarm-spore phases. Other swarm-spores, after wandering and feeding, commence a process of cell division or bipartition. When complete, each is similar to the germ derived from the spore; it is provided with a short flagellum, a nucleus, several vacuole, numerous granules, and a delicate hyaline envelope which is constantly emitting fine processes at the broad end of the body. These threads of protoplasm capture food particles and convey them into the interior substance.

When the swarm-spores cease active motion, they assume the amœboid character, gradually creeping along, and pushing capturing threads out from any part of the body. As they move they take in any kind of organic food, either dead or living. If two or more individuals meet, they coalesce, others also join the colony, and finally form what is termed the plasmodium. This stage of the development is even of greater interest than the earlier phases, inasmuch as it is visible to the naked eye, and exhibits many features of importance, which can be observed without anything in the way of preparation. All that is needed is a moist chamber. The plasmodium is variable in color; it may be white, yellow, green, pink, or purple. It consists of a jelly-like substance, in the form of small cushions, or spread out into a complicated network. A fine example is now before the writer. It was obtained at Vaucluse on a piece of bark. During three days it has been in active motion, wandering up and down both sides of the bark, and covering an area of about 4in by 3in with delicate tracery, similar to the venation of the under-surface of the leaf of the common dahlia, but more irregular. There are a series of primary veins radiating from the base, these giving rise to a set of smaller ones, which are lost in the growing margin. The aerolae between the veins are filled in with films of protoplasm. Throughout the whole structure there is a rhythmic flow of the plasma, from the base to the growing border, and back again, at fairly regular intervals.

The circulation is forced along the veins to the outer margin, the latter is pushed up, and forms a thickened wavy outline which is advanced at each rhythmic return of the current. By this means food is taken in, and the plasmodium is moved along. The specimen under observation travelled about one inch in an hour. Advantage may be taken on this onward flow, by placing a cover glass in front with a little water, in a short time it will be covered, and may be examined under the microscope. When viewed with a ⅓-inch objective the growing margin is seen to consist of a series of bubble-like processes, some transparent, and others full of granules and food material. Every time the rhythmic flow arrives these bubbles are further inflated and others formed, the result is a series of wavy ridges extending all along the growing margins. It frequently happens that the plasmodium is arrested before it is ready to proceed to the plant-like stage, in this case the body is dried and becomes hard like gelatine. In this state it may be kept for years, and still revive if placed in water. Here it will be noted from the preceding remarks, that there are three stages in the life history, where a halt may be brought about by drying. First the spores must be dried before they germinate, second the swarmspore after living on active life for some time, can form a cell wall around itself and remain in the dried state for a lengthened period, and again begin life where it left off, if supplied with the requisite amount of water. The third rest in case of emergency is plainly visible, and may be induced by rapid drying, and kept dry for years until required. This, when placed under suitable conditions, will start afresh and proceed to the mature plant-like state. The change from mobile to the stationary condition is only a matter of a few hours. The plasmodium, during the greater part of its existence, lives in the wood, under bark or dead leaves, and prefers darkness, until the time arrives when it is preparing to pass into the spore-bear stage, then it seeks the light, and may frequently be seen emerging from cracks or crannies in the bark, rotten wood, creeping over leaves or twigs in open daylight. Any examples in this condition, if kept moist for a few days will furnish good specimens with an abundance of spores. Some of the changes taking place in the transitory stages may be noted with the naked eye, others require examination under the microscope. One of the first indications is a change in color; in the specimens under observation, the greenish yellow was followed by canary yellow, and finally became blackish purple. During these changes the whole of the non-organic matter is cleared out of the body. This accounts for the difference in color.

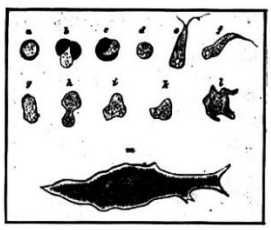
The sporophore or spore-bearing body is generally furnished with a short stalk which supports the spore chamber and its framework; in shape they vary greatly, being either globular, cylindrical, or elongate, each with one chamber to a stem or several on a single stalk. The order of formation is as follows: The outer envelope forms first, then the internal framework, and lastly the spores. The framework or capillitium, as it is termed, consists of a series of fibres of many different kinds; some are like double-twisted whips, others like cord, rope, tape, or irregular strands twisted or coiled in various ways. The structures exhibited by these fibres are interesting objects, as tests as to the defining power of objectives. The fibres may be branched, and form a complicated web or network, or consist of two unbranched fibres twisted together. The function of the capillitium is to assist in the dissemination of the spores as well as a support to the sporophore. The unbranched, threads with two strands are more or less spirally disposed, and when the outer covering is ruptured, they are liberated, and act like springs to scatter the spores quickly. These are similar in structure and function to the "elaters" produced in the fruiting capsules of the liver worts or scale mosses. In those forms which have the capillitium netlike, the spores are disseminated gradually, the wind sways the miniature trees about, and some of the spores escape through the meshes of the net as each puff passes along, thus allowing the spores to emerge by degrees.

The Mycetozoa are widely distributed over the world. In Australia we have over 30 genera, and a very large number of species. They may be found almost anywhere after rain, in the bush, or even the city, on rotten wood, bark, or dead leaves, in wet localities. The writer collected about a dozen species in the grounds of the Australian Museum. They are not difficult to distinguish by the unaided eye; their form and color is fairly constant in the different species. There are two common species found in and around Sydney. Stemonitis ferruginea, as its name indicates, is rusty-iron color; the plasmodium is almost like thick starch; Arcyria nutans is yellow in both stages; the capillitium is pendant or nodding, hence the name nutans; the form is oblong, and ¼in or more in length. The stemonitis is cylindrical to within a short distance from the apex, the total height, stalk included, is often over ½in; it resembles a miniature Norfolk Island pine. In collecting either state of the Mycetozoa, they should be placed in small tubes or pinned in pill boxes. To cultivate the spores, place in water on glass slip, and a cover-glass resting on a strand of silk thread, to avoid pressure on the spores; this should be placed in a box with a pad of wet blotting paper, and kept in a moist chamber until germination begins; when not in use, replace the slide in the box. If it is desired to mount plants for the microscope, when thoroughly dry, they should be soaked in oil of cloves; when saturated, draw off the oil with blotting paper; add a drop or two of Canada balsam, place on the cover gently, allowing it to fall from a slant, until it reaches and covers the balsam.

(To Be Continued.)

A, portion of the plasmodium of Didymium leucopus; st, the more granular central part of the threads (x350)—Several species of this genus are recorded for Australia.

This plate, reproduced from the "Journal of the Royal Microscopical Society," shows:—Figure 14. Trichia fragilis, Rost., 14a, elater; 14b, tip of elater; 14c, spore. Figure 15. Trichia carlyleana, Mass., 15a, plants nat. size; 15a, plants; 15b, inner wall of spore chamber; 15c, tip of elater; 15d, spore. Figure 16. Trichia heterotrichia, Balf., 16a tip of elater; 16, spore. Figure 17, Trichia varia, Rost., 17, 17a, spores; 17b, spore; a, epispore; b, protoplasm; c, nucleus; 17c, spore germinating after 22 hours; a, epispore; b, endospore; d, swarm spore, with flagellum, nucleus, e, and contratile vacuole, d; 17d, elater; 17e, tip of elater; 17f, inner wall of spore chamber. Figure 18. Trichia minima, Mass., 18, spore; 18a, top view of plants. Figure 19. Alwisa bombarda, B. and Br., 19a-b, plants; 19c, threads of capillitium. Figure 20. Oligonema minutula, Mass., 20, plants; 20a, spore; 20b, tip of elater.



A, spore; b, c, spore case rupturing and permitting the protoplasmic contents to escape; d, rounded mass, which becomes ciliated, e, f; g, h, i, k, l, m, amœboid state after loss of cilia—A greenhouse pest in Sydney, often covering plants with a yellow slime.

Figure 5: Whitelegge's article.

THE SLIME FUNGUS.

It became necessary recently to remove an old garden seat. The rains of some past few weeks had thoroughly saturated the wood, and much of the back portion was in a state of decay. Here and there the dull brown of the timber was relieved by patches of the most brilliant chrome yellow. On closer examination these areas were seen to be composed of masses of gelatinous material, spreading in an irregular fashion over the woodwork. My gardener was staggered when I pointed out to him that this growth was some of the most interesting stuff in the world. He would be more astonished still if he could understand that the jelly-like matter is the puzzle of the scientific community. The wisest man in the world does not know whether this organism is an animal or a plant, although for the sake of convenience, it is generally referred to as the slime fungus. Of course, the growth has been burdened with a long name—Myxomycete—which is satisfactory to the scientist in that it is non-committal.

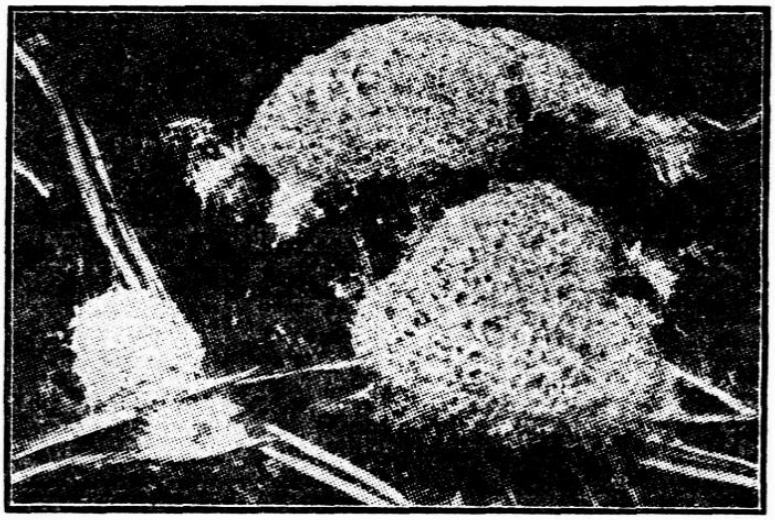
The animal characteristics of the slime fungus are very pronounced. We may suppose the mass of yellow matter to be altogether inert, but this is by no means the case. The organism is continually spreading over the surface of the wood, not after the manner of a plant growing, but as an animal searching for food. The movement is of course slow, but it is very deliberate, and a microscopical examination at the edge of the mass shows that special feelers are put forward in order that the creature —if one may use the term—may be able to direct its course. Some very interesting experiments have been conducted to show the purposeful way in which the slime fungus sets about its journeys. A piece of wood on which a specimen had spread its yellow mass was moistened on one side; in quite a short time the matter moved towards the damp portion. When in the stage which is under consideration, the slime fungus avoids the light. If it is placed in a box with holes in the side, through which the light is streaming the organism travels away from the illumination. Even more strange is the way in which the slime fungus goes after its food. The particular species under consideration, which is named Badhamia, feeds on living fungi. Now place a portion of a toadstool, for instance, within the reach of a Badhamia, and a very astonishing thing happens. First of all the margin of the slime fungus spreads towards the prey, and, finally, it is not long before the whole yellow mass moves in the same direction. The process does not cease until the toadstool has been completely enclosed. Then the business of feeding starts to take place. The way in which the Badhamia consumes its food is strangely like that of an animal. Portions of the toadstool are enclosed by the slime fungus and digested. Certain parts of the solid food are taken into the organism: these are absorbed, and the unwanted matter is thrown out. Thus the Badhamia leaves behind it a track of waste substances. It should be pointed out that in no case do plants behave in this manner. All the food materials which plants take up from the soil through their roots is absorbed in a state of solution. Not all the slime fungi feed on toadstools, and, indeed, most of them prey upon dead substances, such as bark, wood, or even decaying leaves. In all instances, however, the organisms take in the food in a solid form, and deliberately hunt after their prey like animals.

On the grounds mentioned, the scientist would have no hesitation in declaring the slime fungi to belong to the animal kingdom. But when we consider the manner in which the organism is reproduced, a fresh difficulty arises. Sooner or later in the career of the slime fungus, the time comes when it undergoes a remarkable change. At this point the behaviour of the organism is very singular. If placed in a box with holes the mass of matter spreads towards the point of illumination. Contrary to its behaviour on a former occasion, the slime fungus moves away from any damp spot and endeavors to get into as dry a position as possible. All this is leading up to the second stage in the life of this puzzling organism, which is concerned with the reproduction of the species.

Within a few hours the whole appearance of the slime fungus is altered. It is no longer the gelatinous mass it was a few days previously, seeing that it has transformed itself into countless groups of little rounded cases. These are borne on a stalk, and are often found in great numbers attached to the under-side of dead leaves and pieces of timber. When opened they are seen to contain spores! Now, the astonishing thing is that reproduction by spores is an essential feature in the life of about a third of all plants. The ferns, the fungi, the mosses, and the seaweeds are increased through the agency of these tiny specks of living matter. In its general formation the spore of the slime fungus is not essentially different from those produced by plants. In a dry state the spores of the organism keep for an indefinite period, and it is not until they have settled in a damp place that they commence to undergo the series of changes which result in the gelatinous patches already mentioned.

From a purely scientific point of view the slime fungi are of very special interest. When in the condition which is prior to the fruiting stage the organism consists of a mass of naked protoplasm—vital matter in its simplest form. There is no living thing known which presents a greater accumulation of vital matter.

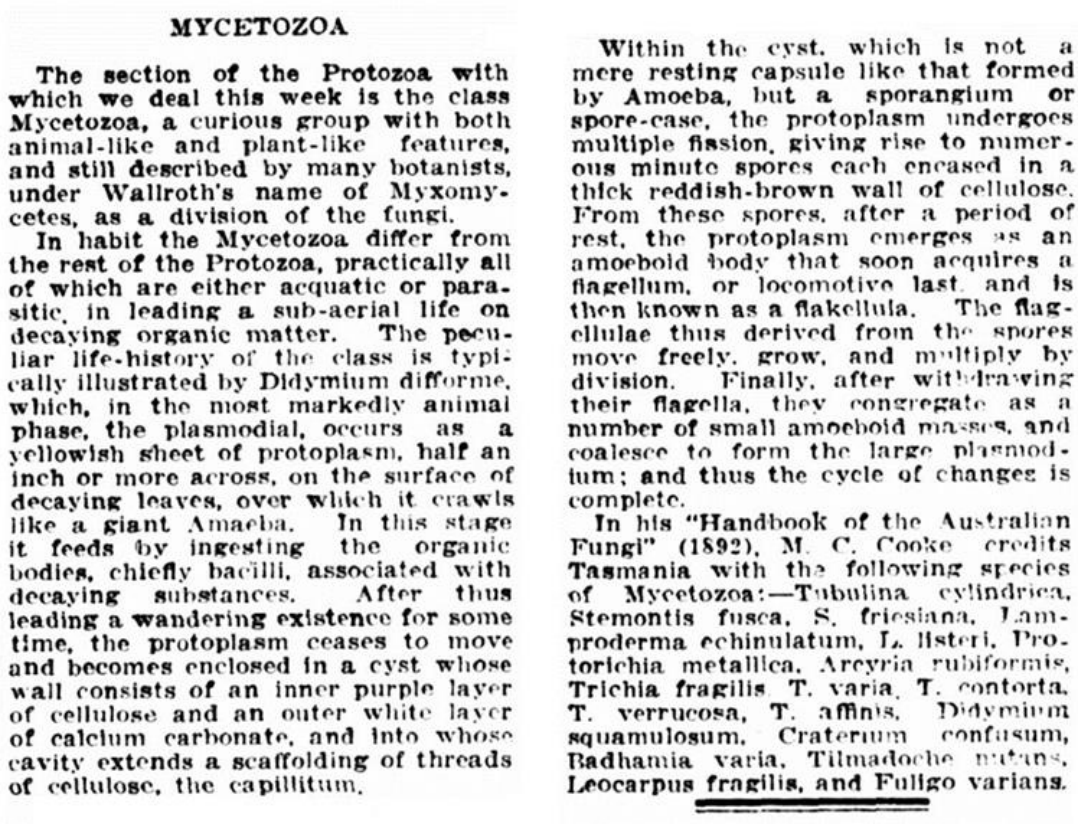
The perplexity of the scientist in placing the slime fungi is well illustrated by the position which these organisms occupy in the text-books. Leading botanists such as Cooke and Massee (writes the "Field") claim the slime fungi as vegetables, declaring that they are really allied to the true fungi. On the other hand, the eminent De Bary, the great German student of plant life, declared that the slime fungi were "outside the limits of the vegetable kingdom." More recently Mr. A. Lister was asked by the authorities at the British Museum to write a monograph on the slime fungi, and in this they are treated as animals. Strange to say, however, the specimens which Lister collected are shown in the plant gallery at South Kensington! The tendency of modern thought is that the slime fungi cannot be placed definitely in either the vegetable or the animal kingdom, but that they represent an interesting connecting link between the two living worlds.



A Typical Slime Fungus (Baphamia).

This species is of a bright yellow color, and is usually found on damp wood.

Figure 6: *The Express and Telegraph* (Adelaide), 25 July 1914, page 4. I have re-arranged the columns.



MYCETOZOA

The section of the Protozoa with which we deal this week is the class Mycetozoa, a curious group with both animal-like and plant-like features, and still described by many botanists, under Wallroth's name of Myxomycetes, as a division of the fungi.

In habit the Mycetozoa differ from the rest of the Protozoa, practically all of which are either acquatic or parasitic, in leading a sub-aerial life on decaying organic matter. The peculiar life-history of the class is typically illustrated by Didymium difforme, which, in the most markedly animal phase, the plasmodial, occurs as a yellowish sheet of protoplasm, half an inch or more across, on the surface of decaying leaves, over which it crawls like a giant Amaeba. In this stage it feeds by ingesting the organic bodies, chiefly bacilli, associated with decaying substances. After thus leading a wandering existence for some time, the protoplasm ceases to move and becomes enclosed in a cyst whose wall consists of an inner purple layer of cellulose and an outer white layer of calcium carbonate, and into whose cavity extends a scaffolding of threads of cellulose, the capillitum.

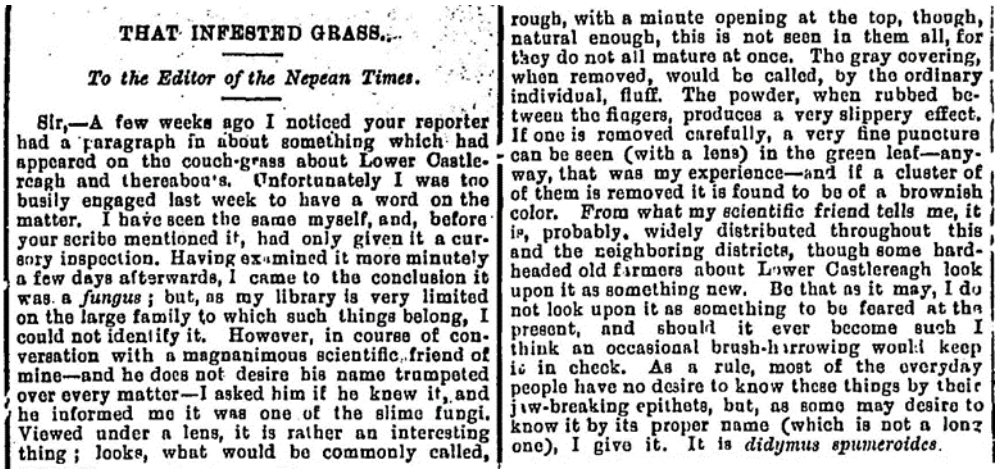
Within the cyst, which is not a mere resting capsule like that formed by Amoeba, but a sporangium or spore-case, the protoplasm undergoes multiple fission, giving rise to numerous minute spores each encased in a thick reddish-brown wall of cellulose. From these spores, after a period of rest, the protoplasm emerges as an amoeboid body that soon acquires a flagellum, or locomotive last, and is then known as a flakellula. The flagellulae thus derived from the spores move freely, grow, and multiply by division. Finally, after withdrawing their flagella, they congregate as a number of small amoeboid masses, and coalesce to form the large plasmodium; and thus the cycle of changes is complete.

In his "Handbook of the Australian Fungi" (1892), M. C. Cooke credits Tasmania with the following species of Mycetozoa:—Tubulina cylindrica, Stemontis fusca, S. friesiana, Lamproderma echinulatum, L. listeri, Protorichia metallica, Arcyria rubiformis, Trichia fragilis T. varia, T. contorta, T. verrucosa, T. affinis, Didymium squamulosum, Craterium confusum, Badhamia varia, Tilmadoche nutans, Leocarpus fragilis, and Fuligo varians.

Figure 7: *The Examiner* (Launceston), 6 May 1931, page 4. The original is in a single column.

Thus far I have been focussing largely on length of story, though the extracts that I have reproduced show that a variety of subjects were covered. Two that have featured several times already are the feeding behaviour of myxomycetes and the contrast between the mobile and stationary stages - both of which would be expected in any basic descriptive account of myxomycetes. The question *What is a myxomycete?* has also come up in the previous pages and 18 of the 71 informative articles note that there was debate as to whether myxomycetes were plants, animals or in-between. However, a surprisingly common subject was myxomycetes found growing over lawns or on other small plants and this aspect appeared in 29 of those 71 articles.

If identified, the species usually given was *Physarum cinereum* and mostly the advice was that the myxomycete was harmless - but with lime-sulphur spraying recommended in one instance and burning in another. *The Tamworth Daily Observer* (17 February 1912, page 3) attempted humour when it said that the organism was called myxomyceti physarum cinereum (all in lower case) and that "the name is sufficient to kill any decent grass!" (their exclamation mark). I give one of the more interesting reports in Figure 8 (most of a letter by someone who signed simply as FARMER). On page 4 in the 20 December issue of the same newspaper there is a short letter from the same correspondent saying that the "name of the slime fungus should have read *Didymum Spumaroids*, not *Didymus*, etc". I don't know if the new spelling error was FARMER's or was introduced by the typesetter.



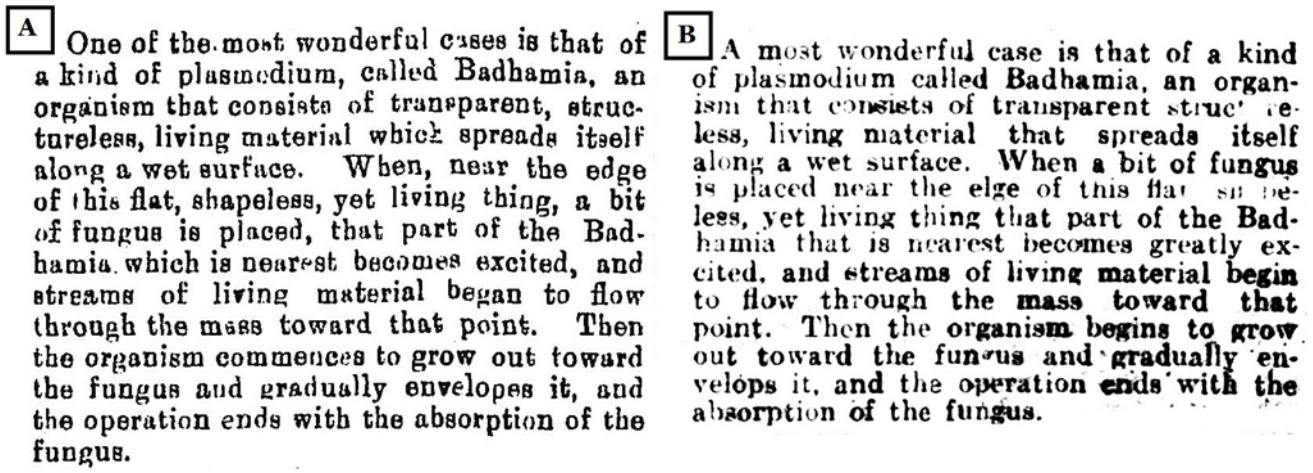
THAT INFESTED GRASS.

To the Editor of the Nepean Times.

Sir,—A few weeks ago I noticed your reporter had a paragraph in about something which had appeared on the couch-grass about Lower Castlereagh and thereabou's. Unfortunately I was too busily engaged last week to have a word on the matter. I have seen the same myself, and, before your scribe mentioned it, had only given it a cursory inspection. Having examined it more minutely a few days afterwards, I came to the conclusion it was a *fungus*; but, as my library is very limited on the large family to which such things belong, I could not identify it. However, in course of conversation with a magnanimous scientific friend of mine—and he does not desire his name trumpeted over every matter—I asked him if he knew it, and he informed me it was one of the slime fungi. Viewed under a lens, it is rather an interesting thing; looks, what would be commonly called, rough, with a minute opening at the top, though, natural enough, this is not seen in them all, for they do not all mature at once. The gray covering, when removed, would be called, by the ordinary individual, fluff. The powder, when rubbed between the fingers, produces a very slippery effect. If one is removed carefully, a very fine puncture can be seen (with a lens) in the green leaf—anyway, that was my experience—and if a cluster of of them is removed it is found to be of a brownish color. From what my scientific friend tells me, it is, probably, widely distributed throughout this and the neighboring districts, though some hard-headed old farmers about Lower Castlereagh look upon it as something new. Be that as it may, I do not look upon it as something to be feared at the present, and should it ever become such I think an occasional brush-harrowing would keep it in check. As a rule, most of the everyday people have no desire to know these things by their jaw-breaking epithets, but, as some may desire to know it by its proper name (which is not a long one), I give it. It is *didymus spumeroides*.

Figure 8: *The Nepean Times*, 13 Dec 1902, page 5, originally in one column.

In my study of fungal articles I found that the same story could appear in many newspapers, spread over a large distance and over many years. The same has happened with myxomycete stories, though to a greatly lesser degree, given the much smaller number of references to myxomycetes. The 1882 Sydney story about Thomas Whitelegge, that I mentioned early in this section, appeared also in two Victorian newspapers: *Mount Alexander Mail*, 28 December 1882, page 2 and *Geelong Advertiser*, 2 January 1883, page 4. In Figure 9 I show two almost identical paragraphs, which appeared 19 years apart. Each was part of virtually the same longer article (with no other mention of myxomycetes).



A One of the most wonderful cases is that of a kind of plasmodium, called Badhamia, an organism that consists of transparent, structureless, living material which spreads itself along a wet surface. When, near the edge of this flat, shapeless, yet living thing, a bit of fungus is placed, that part of the Badhamia which is nearest becomes excited, and streams of living material began to flow through the mass toward that point. Then the organism commences to grow out toward the fungus and gradually envelopes it, and the operation ends with the absorption of the fungus.

B A most wonderful case is that of a kind of plasmodium called Badhamia, an organism that consists of transparent struc' re-less, living material that spreads itself along a wet surface. When a bit of fungus is placed near the elge of this flat sh pe-less, yet living thing that part of the Badhamia that is nearest becomes greatly excited, and streams of living material begin to flow through the mass toward that point. Then the organism begins to grow out toward the fungus and gradually envelops it, and the operation ends with the absorption of the fungus.

Figure 9: The same story, years apart. **A)** *The Maitland Weekly Mercury*, 26 May 1894, page 12; **B)** *The Leader* (Melbourne), 30 August 1913, page 48.

The first appeared in a paper published a little north of Sydney and the other in a Melbourne paper. In between those years much the same article (and hence paragraph) had appeared in *The Evening News* (Sydney, 8 June 1907, page 12), *The Albury Banner and Wodonga Express* (published about halfway

between Sydney and Melbourne, 14 June 1907, page 18) and *The Kalgoorlie Miner* (on the other side of the country, 21 June 1907, page 1). I assume the article was copied from an overseas publication, but I have found it only in three American papers that post-date the first Australian appearance (*The Banner-Democrat*, Louisiana, 2 June 1894, page 1; *The Sunday Star*, i.e. the Sunday edition of Washington DC's *Evening Star*, 17 March 1907, page 8; *The Virginia Star*, 3 April 1924, page 11). I also assume that the writer of the original article based that paragraph on Sanderson (1893) who, in his presidential address to the British Association, referred to Lister's work with *Badhamia* and said: "[I] will ask you to imagine an expansion of living material, quite structureless, spreading itself along a wet surface; that this expansion of transparent material is bounded by an irregular coastline, and that somewhere near the coast there has been placed a fragment of the material on which the Badhamia feeds. The presence of this bit of stereum produces an excitement at the part of the plasmodium next to it. Towards this centre of activity streams of living material converge. Soon the afflux leads to an outgrowth of the plasmodium, which in a few minutes advances towards the desired fragment, envelops, and incorporates it". A curious point: the Louisiana and Virginia paragraphs were the **A** version that I show above; the Albury/Wodonga, Sydney, Kalgoorlie and Washington paragraphs were the **B** version (except for the word 'greatly' being absent from the second sentence). Given the timing, it is possible that the Albury/Wodonga version was copied from *The Evening News*. Newspapers published in state capitals circulated widely and the rail line to Albury could have allowed a Sydney paper to be there within two days of publication.

In Perth *The West Australian* (13 September 1913, page 8) published a report of film pictures from the microscope, in which streaming in a myxomycete plasmodium was mentioned. On the other side of the country *The Herald* (Melbourne, 17 December 1913, page 1) published a similar report. Neither gave a precise source, though both had Ray Lankester's name in the byline and the Perth paper included *Science from an easy chair* in the heading. The *Newcastle Morning Herald and Miners' Advocate* (27 December 1913, page 2) published a similar article, gave Lankester as the writer and acknowledged Melbourne's *Herald* as the source.

Finally, a piece of trivia.The *The Sun* (Sydney, 28 April 1942, page 10) presented a crossword in which one clue for an 8-letter word was: Sub-order of Mycetozoa. Instead of giving the answer immediately I will give a clue (it starts and ends with A). To find the rest of the answer, take every third letter from this cryptic string: BDCOCRDIAEFSGRIUTD

Discussion

I had not expected a large number of newspaper references to myxomycetes, but was surprised at how few I found and also at how short most are. Given what appeared in other literature that was available in Australia, more would have been possible. For example, what the Frys had written would easily have provided material for more (and longer) stories. In my study of fungal stories in newspapers I found that, over almost a century, numerous articles repeated a few themes, that were very likely to strike the public as amazing (e.g. the large size of the bolete *Phlebopus marginatus* and the look of stinkhorns). Often such stories were short and had no depth but they were easy to write and the same could easily have been done with myxomycetes, possible themes being "is it animal or plant?", the transformation from soft/mobile to powdery/stationary and the striking appearance of *Fuligo septica*.

Certainly, such themes were repeated - but the question is: Why were they not repeated far more often? Despite most stories being short I have shown that a few with some depth were published in

Adelaide, Brisbane, Launceston and Sydney but two things stand out. First, the lack of any continuation in the publication of such stories and, second, the absence of Melbourne from that list. Between 1900 and 1950 several Melbourne newspapers published some excellent articles about fungi, at times with help from members of the active Field Naturalists Club of Victoria - but nothing remotely similar about myxomycetes. Near the end of the previous section I gave several instances of a particular story appearing in more than one newspaper with proof that, in at least one case, one Australian newspaper copied a story from another Australian newspaper. I find it puzzling that there was not much more intra-Australian copying of myxomycete stories.

Apart from the paucity of stories another striking contrast with the newspaper treatment of fungi is the virtual absence of myxomycete illustrations, despite there being comments as to their beauty in some of the newspaper stories. I have shown all that I've found, whereas newspapers included numerous illustrations of fungi, which varied from simple to realistic and with many being originals. If it were thought too difficult to produce original illustrations of myxomycetes, it should have been possible to copy them from other works (e.g. as Whitelegge had copied from Massee and the Frys) and two other potential sources were the plates in Cooke (1892) and Lister (1894, or the later editions). Even the simple but very effective monochrome drawings in the latter's keys to genera would have sufficed to show the variation in myxomycete form.

At least 14 of the 71 informative articles came from oveseas publications, but remember that most said little. For example, I have mentioned Ray Lankester a couple of times. Several Australian newspapers reproduced long articles of his that had been published in England. Each covered a range of subjects and presented just one or two observations about myxomycetes. I say "at least 14", since that is the count of articles where a source is acknowledged (e.g. *Knowledge* magazine in the case of the Frys and the *Science from an easy chair* in the headings of Lankester's). There are others where a source is not acknowledged and where I have not been able to find an overseas source but where I think it very likely that the article had been copied from an overseas publication. One example is the *Badhamia* story in Figure 9. It is a paragraph embedded in an article headed "Wonders of the Bacteria" and, given the content of the entire article, I strongly suspect it was written overseas, rather than by someone in Australia in 1894. One could add another 6 'highly likely' candidates to the 14 - and probably even a few more, but it is harder to judge those that say little about myxomycetes.

On removing those 20 (or slightly more) one is left with 51 (or slightly fewer) informative articles ostensibly written in Australia. Certainly there is no doubt about many of them but, as should be clear from what I've just said, it would be hard to be sure of all of the 51 or so. Obviously those by Whitelegge (Figure 5) and the Scotts (Figure 7) were written in Australia. A little while ago I noted that 29 articles provided information about myxomycetes on grass or other plants (and at times also dealt with other aspects) and that information was supplied by some local authority (e.g. an agriculture department or university). Most of the others give general information about myxomycetes and could have been written in Australia by someone who had consulted a basic textbook that discussed myxomycetes (and, naturally, one could argue that they could have been written overseas by someone who had consulted a basic textbook that discussed myxomycetes).

The 71 informative articles mostly presented generalities (e.g. plasmodium, feeding behaviour, sporangia, is it plant/animal?) with almost nothing said about particular myxomycetes. In the last paragraph of Figure 5 Whitelegge describes two common species of the Sydney area that are "not difficult to distinguish with the naked eye"; there are brief descriptions of *Physarum cinereum* in some newspapers;

FARMER (Figure 8) tells the reader something about "*didymum spumeroides*" and *Fuligo* is another taxon that gets a descriptive sentence or two in various newspapers. The Scotts (Figure 7) list the 18 species that Cooke (1892) had recorded for Tasmania but do not tell the reader what any of them look like. This is a contrast to the case with fungi. Many newspaper articles contain descriptions of particular fungal genera or species. The number of taxa is not huge and descriptions are brief, but examples of agarics, boletes, Nidulariaceae, clavarioids, polypores, earthstars, puffballs, stinkhorns, truffles and *Cordyceps* appear.

Acknowledgements

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