

Human Fungal Diseases and Antifungal Drug Resistance

Closing date:
29th March 2025

Aim of the 37th MiSAC Annual Competition

To develop an understanding among teenagers of the impact of **human fungal diseases and the emerging threat of antifungal drug resistance** across the globe.

Background

The World Health Organization (WHO) has recently published a priority list of fungal pathogens to highlight the need for greater awareness of human fungal diseases and to stimulate further research & development into new ways of diagnosing and treating fungal disease.

The diseases caused by human pathogenic fungi range from mild skin infections (eg, athlete's foot and ringworm), to life-threatening diseases that include allergic lung disease, bloodstream infections (eg, candidaemia) or COVID-associated mucormycosis.

Recognising the impact of human fungal diseases is clearly vital for improving global health. Every year, over 1 billion people experience a fungal infection, making the impact of these pathogens huge. The fungi *Candida albicans*, *Aspergillus fumigatus*, *Cryptococcus neoformans* and *Pneumocystis jirovecii* have a combined mortality similar to HIV, Tuberculosis and Malaria - contributing to approximately 2 million deaths a year across the world, with a higher infection rate and mortality rate in low- and middle-income countries. In South-East Asia, new fungal pathogens are emerging such as *Candida auris*, *Talaromyces* spp. and *Rhizopus arrhizus*.

In hospital settings, a range of antifungal drugs are commonly used to treat fungal infections. However, fungi exposed to antifungal drugs in the environment can readily evolve resistance to these drugs, making infections difficult to control. Some antifungal drugs are sold as over-the-counter medicines (both in the UK or overseas). Their widespread availability, alongside patients failing to apply the drugs properly, their frequent use in cosmetic products and poor regulation of fungicides in agriculture, have contributed to an increase in resistance to treatment.

Fungal pathogens develop resistance to drugs through a range of mechanisms. The drug's target areas on a cell can change so that they no longer bind to the drugs. Increased production of proteins, by the fungus, that pump out the drugs can reduce the drugs' effective concentration. The fungi can also increase the levels of enzymes that break down the drug before it can act. It is therefore important that we develop better strategies to combat fungal disease.

It's clearly time to think more about the importance of fungi that cause human disease and to consider the options we have for treatment...

Object of the competition

You are required to design an illustrated, web-page report for teenagers to raise their awareness of a human fungal disease and outline the problem of antifungal drug resistance.

- Select **one** named human fungal pathogen and its associated named disease. Describe the pathogen, the disease and its symptoms.
- State how common the disease is and its effects on specific groups (eg, HIV patients, cystic fibrosis patients, transplant patients).
- Describe the major antifungal drug treatments that are used to control the disease and their effectiveness.
- Discuss the factors that contribute to antifungal drug resistance and suggest future ways of combatting the emergence of antifungal resistance.

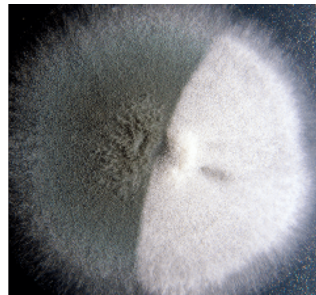
Format of entries

- Your entry must be produced on paper as hard copy on one A3 sheet (or two A4 sheets secured side by side with adhesive tape) using only one side of the paper.
- You may produce your entry either by hand or computer. The entry may be submitted by an individual or a group of not more than four students.

Prizes

Schools: 1st £250 2nd £125 3rd £70
Students: 1st £100 2nd £50 3rd £25

A certificate will be awarded to each student submitting an entry of scientific merit. The results, winning entries and a report of the competition will be published on the MiSAC website competition pages at www.misac.org.uk.



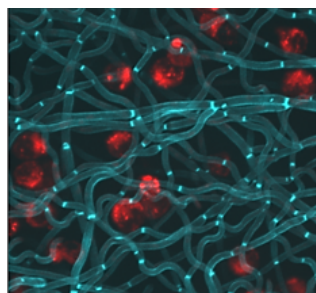
Radial growth of the fungus *Aspergillus fumigatus* on agar
Mark Stappers / MRC-CMM



Aspergillus infection in the lungs
https://www.flickr.com/photos/pulmonary_pathology/5390379081



Candida albicans colonies on agar
https://en.m.wikipedia.org/wiki/File:Candida_albicans_PHL_3192_lores.jpg



Candida albicans hyphae.
Tina Bedokovic (MRC-CMM)



Mucormycosis affecting sight
<https://en.wikipedia.org/wiki/Mucormycosis>

Sponsored by:



British Mycological Society promoting fungal science

Five top tips

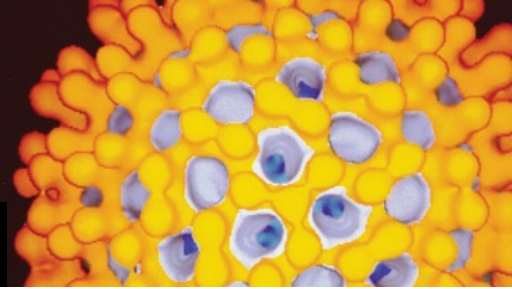
1. Use the scientific name of any pathogens you mention.
2. Don't forget that the first name (genus) begins with an upper-case letter and the second name (species) has a lower-case initial letter (eg *Candida albicans*). This can be abbreviated, for example, to *C. albicans* after its first use.
3. Use italics for the scientific name - or underline it if your entry is hand-written.
4. Use your own words because plagiarism (which is cheating) will be penalised.
5. For data and other material used to illustrate your entry, provide information about the sources you have used.

What makes a good web page?

Effective web pages rely on being not only informative but attractive, lively, well-designed and often amusing, in order to make an immediate and memorable impact. This can be achieved by using photographs, diagrams, drawings, plus data and sources of further information. Make the presentation of your entry entertaining for its intended audience - teenagers.

Website articles

- https://misac.org.uk/article-downloads/MiSAC-briefings_6.pdf
- <https://www.who.int/publications/i/item/9789240060241>
- <https://thefungalthreat.com/>
- <https://www.cdc.gov/fungal/index.html>
- <https://fungalinfectiontrust.org/treatment/important-antifungal-resistance-problems/>
- <https://asm.org/Articles/2023/November/Breakthroughs-and-Challenges-in-Fungal-Vaccine-Dev>
- <https://asm.org/Articles/2022/November/Combating-Antifungal-Resistance>
- <https://www.scientificamerican.com/article/deadly-fungi-are-the-newest-emerging-microbe-threat-all-over-the-world/>
- <https://www.adelaide.edu.au/mycology/>
- <https://gaffi.org/>



Promoting microbiology in schools and colleges since 1969

Rules

- Judging will be based on two entry groups: Key Stage 3 (S1/2) and Key Stage 4 (S3/4).
- Each entry must be submitted on paper, on **one A3 sheet** (or two A4 sheets taped together) using one side of the paper only, and may be produced either by hand or by computer.
- Entries may be created either by individuals or groups of no more than 4 students.
- A maximum of 10 entries per school in each entry group is permitted.
- Account will be taken of originality, presentation and effectiveness in communicating with the intended audience.
- Only entries that conform to the competition rules and show scientific merit will be considered; note the requirements and consider the suggestions given on the front page.
- Evidence of plagiarism, such as downloading text directly from web sites without modification and interpretation, will result in disqualification. (MiSAC recommends only reputable sites for research; see www.open.ac.uk/webguide for tips on using the internet.)
- Each entry must be clearly labelled on the back with the name and address of the school, the teacher's name, the full name of each contributing student and the entry group, i.e. Key Stage 3 or S1/2 and Key Stage 4 or S3/4.
- Entries cannot be returned and may be used for promotional purposes by MiSAC.

Check list for teachers

Please tick before submitting entries

- Students' name/s on entry? []
- School name on entry? []
- School address on entry? []
- Teacher's name/Email on entry? []
- Key stage on entry? []
- Entry form completed? []

Sponsor of the 2025 competition



British Mycological Society promoting fungal science

Closing date: 29th March 2025

Entry Form

Please download the entry form from the competition page of the MiSAC web site:

www.misac.org.uk/competition.html



The form will allow you to **type in** school contact details & students' names, particularly for group entries, and **then** print this out for submission with the competition entries.

Don't forget to keep a copy of the rules and entry form!

* Personal data for use only by MiSAC in connection with the MiSAC Annual Competition

Address for entries: MiSAC Competition, c/o NCBE, University of Reading, 2 Earley Gate, Whiteknights Road, Reading RG6 6AU