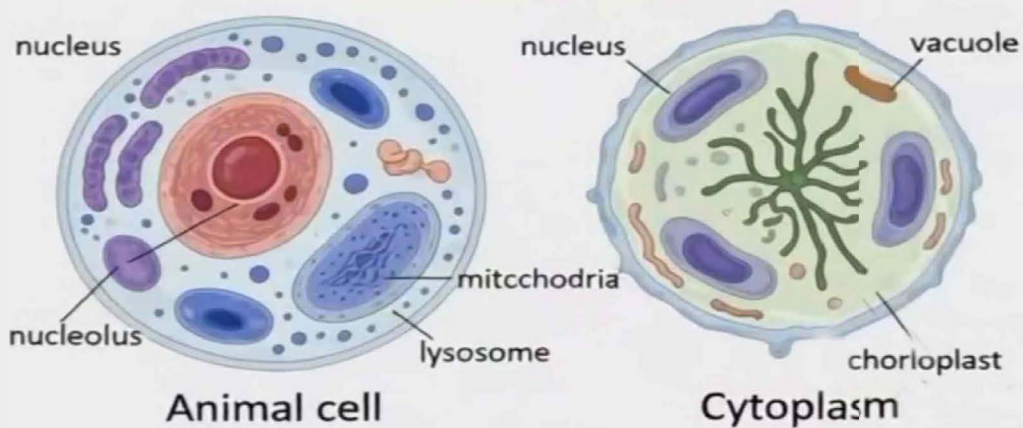
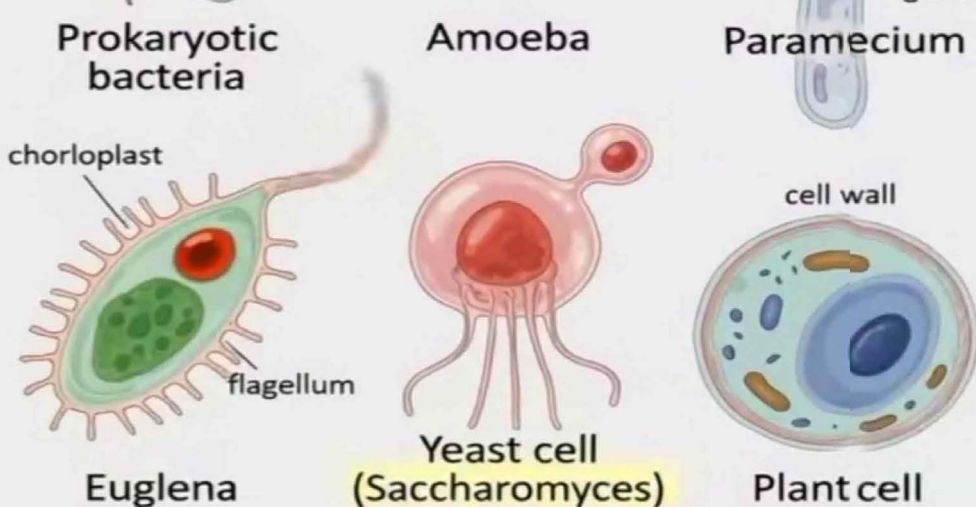
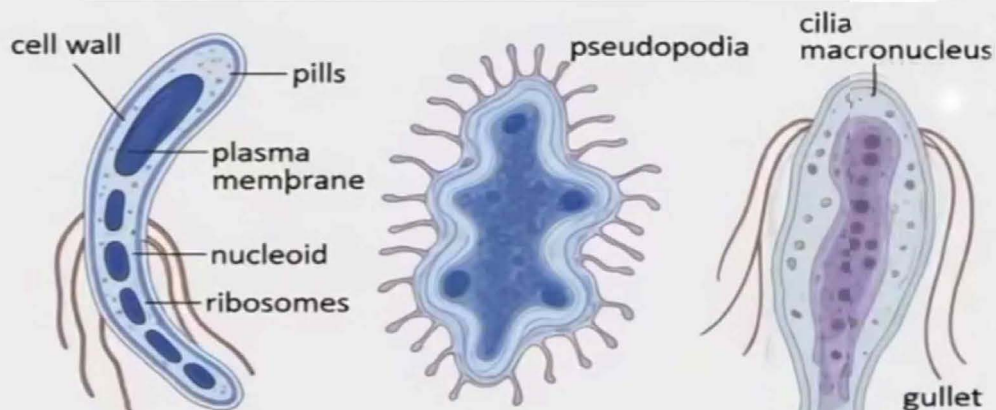


Cellular Organisms



This wantonly misleading plate opens the survey of microbes on the mtishtech site, and must surely qualify as the worst illustration of the microscopic world in the history of science. Their illustrated site claims to offer 'online training' for teachers of biology.

Microbial masquerade: The rise of the synthetic specimen

Prof. Brian J Ford, Hon FRMS, Hon FLS

Microscopy is the science of seeing for oneself. From Leeuwenhoek's single lenses to the digital instruments of today, its authority rests on the honest recording of what is actually observed under the objective. That authority is now under subtle but serious pressure. A growing volume of synthetic images and videos of faked microorganisms – generated by Artificial Intelligence (AI) and circulated as educational or scientific material – is presenting non-existent or grossly distorted specimens as fact. Students, teachers and the wider public are being shown convincing pictures of cells and microbes that have never existed.

The problem is not illustration itself. Stylised drawings, simplified diagrams and even cartoons have long been used to communicate the world of microscopy and the microbial universe. The difficulty now arises when synthetic images are offered as representations of real organisms.



Fig 1a: The bdelloid rotifer *Philodina* is some 400µm long, and this study by Frank Fox is extensively reproduced online. It appears on his website www.mikro-foto.de and conveys a representative impression of the organism under dark-ground microscopy.



Fig 1b: By the time a typical rotifer is illustrated online by microscopicworld28, it has already acquired ventral abdominal legs, which no rotifer possesses. This image (likely created with Google Veo 3.1 or Kling 3.0) conveys a deceptively realistic appearance.



Fig 1c: The yog-blogs.blogspot site states: 'Drawing a rotifer is hard ... their anatomy is a bit hard to parse' and shows this example as a menacing microscopic monster. The casual individual browsing the web could easily accept this for scientific accuracy.

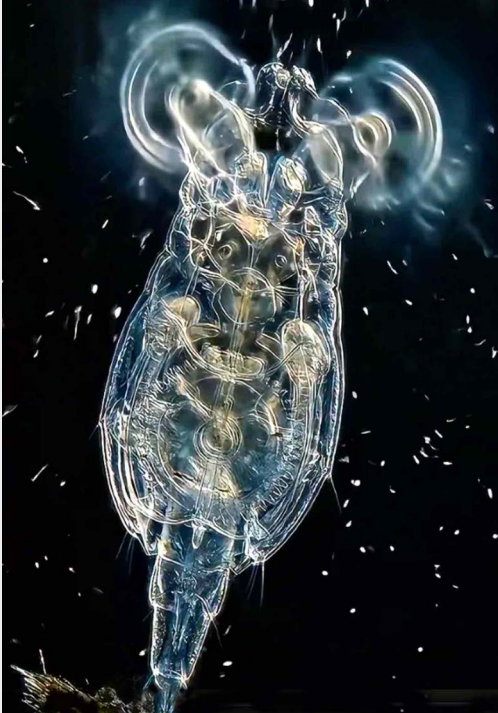


Fig 1d: A rotifer video created by experimen3D has whirling coronal cilia that make it look like a power-tool, the mastax being replaced by gear-wheels and cogs, as if powered by clockwork. The appearance is that of a genuine micrograph, though it is pure fakery.



Fig 2a: Paired nuclei give *Giardia lamblia* the characteristic appearance of a curious face. The cell measures only about $12\mu\text{m}$ long, so in stained preparations little internal detail is resolved. Living *Giardia* have flagella that flutter ceaselessly, as it twists and turns.

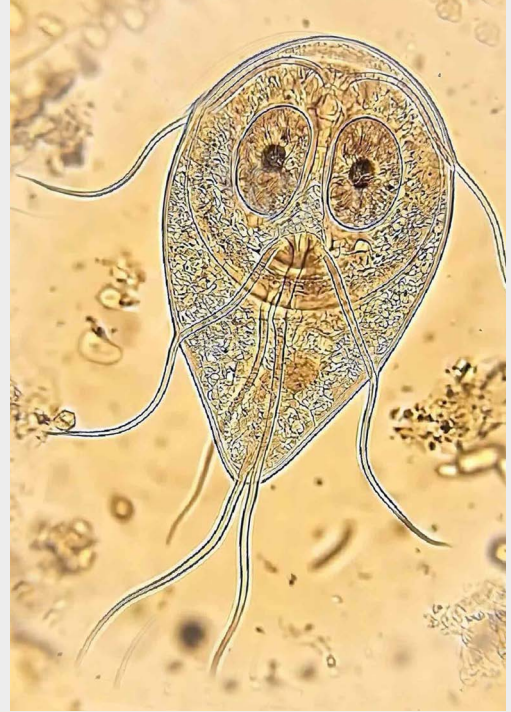


Fig 2b: In the video of *Giardia* created by experimen3D, the detail claimed to be resolved by light microscopy is unachievable. Many Cytological features (the ventral axostyle, anterior rhizoplasts, a parabasal body) are missing, though the simulation is convincing.



Fig 2c: A vivid version of *Giardia* posted by microscopicworld28 lacks many details (axostyle, rhizoplasts) and its movement is erroneously embodied. Their *Giardia* glides gently along with graceful, balletic flagella and slowly turns head to tail, all remote from reality.

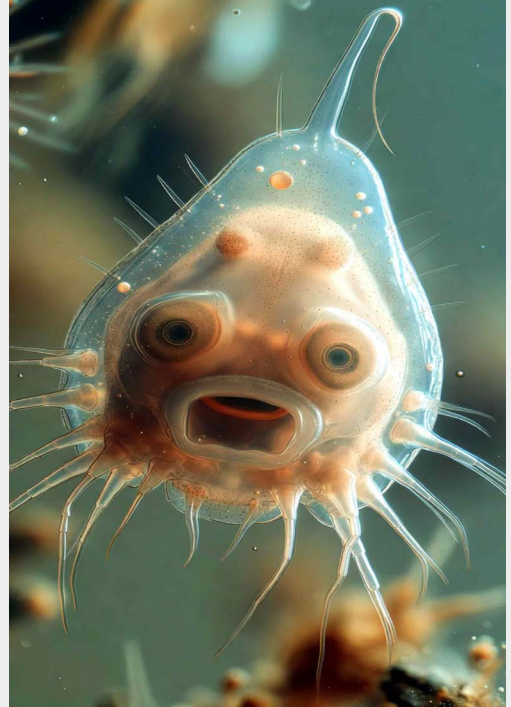


Fig 2d: Most bizarre is the version envisaged by the AI Grok. Using published digital images as references, it renders the nuclei as eyes, the flagella as appendages, and creates a dorsal fin from the caudal flagella. Rather than a protozoan, it looks more like a startled fish.



Fig 3a: The abundant aquatic chlorophyte alga *Chlamydomonas* is an ovoid cell some $15\mu\text{m}$ long, with flagella of bacterial thinness ($0.2\mu\text{m}$). It is principally characterised by its red anterior eyespot and its morphology, somewhat reminiscent of a chicken's egg.

A Longer History of Invention

Fictitious microscopical images are not new. In 1694 he published an engraving of a homunculus curled inside a sperm head that he claimed to have observed as an illustration of the spermist hypothesis (1). Later writers amplified the idea, and in the twentieth century, educational cartoons such as Harry Wilmer's Huber the Tuber (2) and wartime animations deliberately anthropomorphised bacteria. These were recognised as teaching devices or entertainment. What is different now is the volume suddenly appearing online, their photorealistic quality, and the frequent absence of any indication that the image is synthetic.

The rise of AI heralded the creation of images of spurious authority. The first paper to raise the warning flag appeared late last year in *Nature Nanotechnology* (3), when Nadiia Davydiuk and her team presented images of authentic-looking mineral structures that were created by AI using nothing but text prompts. There was little to suggest that these fictitious creations were not genuine.

When such material is presented as "real science powered by AI for educational visual learning" then the boundary between observation and invention becomes compromised. The optical signature of the

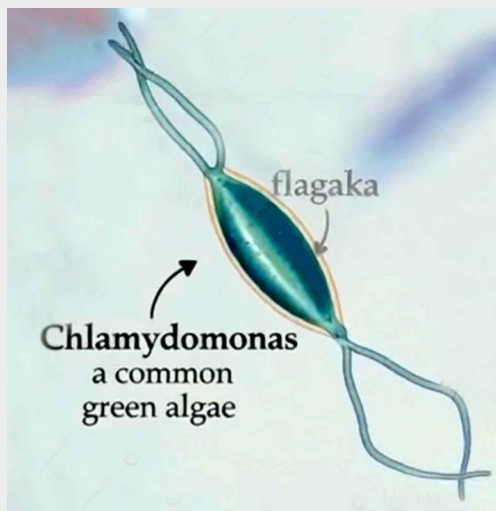


Fig 3b: By the time the mtishtech site have prepared their pluralised version for teachers, it has acquired twice as many (mis-spelt) flagella, situated them at opposite poles of the cell, dispensed with its eyespot altogether, and acquired the shape of a cigar.

microscope in biology – its inherently restricted depth of field, its translucency, its living motion – is supervened by the trivial aesthetics of digital illustration.

Compromising Knowledge

There are now growing numbers of online resources, aimed specifically at teachers and science students, that falsify reality. There is no malice in this; they are not bent on distortion as an end in itself, but they display the lack of insight into the microscopic world that our educational systems perpetuate (4). Each seeks to assure the reader that they have the key to understanding, and there is a sense of confident assurance on each site that is not matched by what they convey.

Experimen3D makes bold claims. 'Discover the secrets of biology, physics, and the human body. Real science powered by AI for incredible, educational visual learning,' states the site. The videos are visually compelling, with clearly delineated intracellular features created with vivid contrast in exquisite detail. To the tyro, there is a startling sense of reality. Regrettably, the structures are fiction, and the portrayal of living cells bears scant resemblance to any microbe. Their video of *Amoeba* shows it with

five pseudopodia, the anterior one with a distinct hint of a head, and the two on either side acting as permanent limbs. It moves like a swimming sloth. There is nothing remotely amoeboid about it. I sent a message asking about the images, but received no reply.

Microscopicworld28 is described as ‘an engaging content creator and social media channel dedicated to showcasing the fascinating, invisible universe of microorganisms’. Their page boasts of: ‘The things you were never meant to see. Discover the hidden world of microorganisms through cinematic microscope-inspired visuals. Learn fascinating science in under one minute.’ Their videos are eye-catching and vivid, with crystal clear imagery showing pin-sharp organelles, every appendage in perfect focus and crisp cell walls sharply delineated – thereby lies the problem. Under the microscope, that’s not how microorganisms appear.

Whereas real *Giardia* flutters like a leaf in the breeze, tumbling and turning, its flagella beating

like an egg-whisk, theirs glides majestically across the slide, its flagella slowly undulating with balletic precision, and not remotely like the living organism. Yet the commentary omits any suggestion of AI: ‘Did you know,’ it intones in an authoritative voice, ‘this is a live *Giardia lamblia* trophozoite under the microscope ...’ with no hint that this might be an idealised cartoon, a tarted-up twist on reality. I sent them an enquiry too. They blocked me.

By far the worst of all is the mtishtech_international site, and I make no apology for saying so. Mickey Mouse is closer to *Mus musculus* than any of their organisms are to living microbes. They claim to offer ‘Online Training’ with ‘AI for Smart Teachers’ and they ask: ‘What if your lessons could come alive in seconds?’ It is a valid question, though the unmatched abominations they have created would not provide the answer. They are approaching 70,000 followers after 11 years online, and boast one single response (a four star rating).

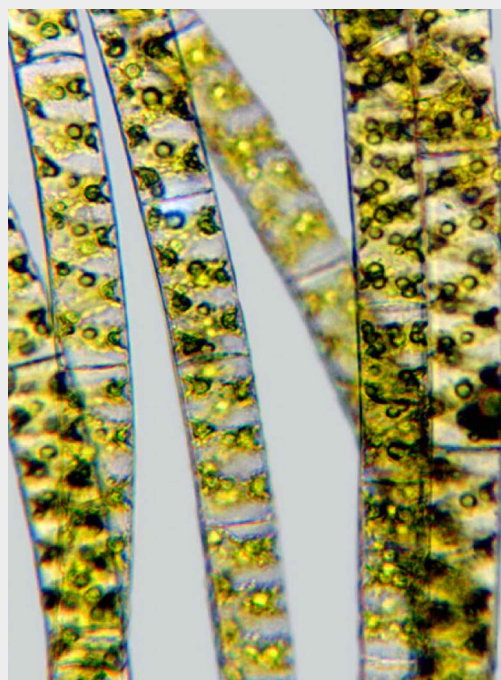


Fig 4a: My earliest research publication on *Spirogyra*, which hangs like hair in ponds, concerned the connection between the pyrenoids in each spiral chloroplast and the centrally-disposed nucleus (6). This alga is instantly recognisable to all microscopists.

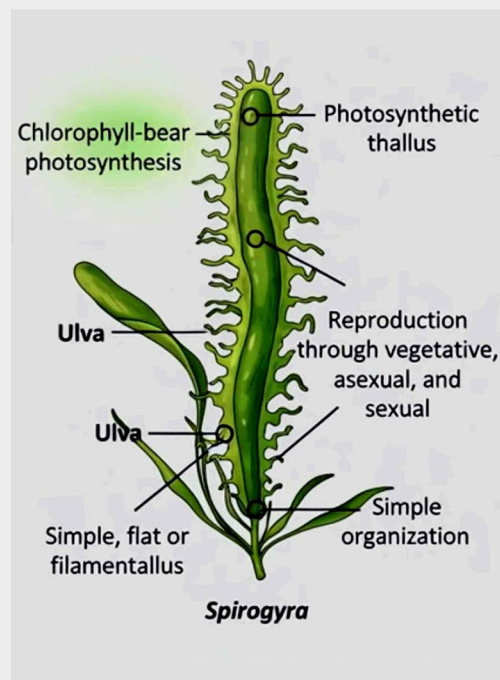


Fig 4b: Once the mtishtech video artists get to work, the fine filaments of *Spirogyra* are replaced with a bizarre concoction showing a ‘filamentous’ organisation carrying out ‘chlorophyll-bear photosynthesis’ as it slowly twists and undulates unrealistically in water.

This site features an amoeba swimming with fins like a fish, a curious *Chlamydomonas* with twice as many flagella as it should, and *Spirogyra* looking like seaweed. They offer no link to send a direct message, which did not matter to me; there was nothing I could possibly have said.

Integrity at Stake

Public understanding of microorganisms has always been limited. Television natural-history programmes rarely show real microbes (5). When they appear they are usually crude computer graphics, and the new generation of AI images compounds the problem. Students learn to recognise mythical forms rather than the organisms they will actually encounter under the microscope. Teachers who lack extensive microscopical experience may themselves be misled. The cumulative effect is a progressive contamination of the visual language of cell biology.

The inner strength of microscopy has always been its insistence on recording what the microscopist can see. Photographs and videos have traditionally been optimised for lighting, contrast and colour balance so that they can more accurately convey the observer's view. Retouching to remove artefacts or to clarify structure is legitimate when the aim is fidelity. Fabrication of imaginary structures is not.

A Practical Response

The remedy is straightforward and within the traditions of the Royal Microscopical Society. Clear labelling should be routinely incorporated for any AI-generated or heavily stylised image used in teaching, outreach or publication. Online platforms and journals can require this; individual microscopists can emphasise it.

Training at every level should include the characteristic appearance of living specimens under the microscope – the artifice of limited depth of field, the texture of living membranes, the coordinated motion of cilia and flagella, the disposition in life of organelles. Genuine photomicrographs – with all the artifice of imperfection – remain more informative

and more aesthetically attractive than this synthetic perfection. They should always be given prominence in educational resources. The Society has long set benchmarks for microscopical practice and for the communication of results. Extending those standards to the use of synthetic imagery is a natural continuation of that role.

AI is a powerful tool for visualisation and for explaining complex processes. Used openly and accurately it can illuminate complex characteristics and exemplify the extraordinary. But when misused without acknowledgement to invent spurious organisms, it erodes the very foundation of microscopical science: the disciplined observation of the real. The living microbial world, recorded honestly under the lens, is infinitely more astonishing than any synthetic substitute. Defending that record is now part of the responsibility of every microscopist.

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Brian J Ford is a research biologist, author, lecturer and broadcaster whose research has spanned decades at the frontier of microscopy and cell biology. A Fellow of Cardiff University and former Visiting Professor at the University of Leicester and Fellow at the Open University, he has published over 30 books – including *The Revealing Lens*, the *Optical Microscope Manual*, and *Genes, the Fight for Life*, alongside hundreds of scientific papers ranging from algal ultrastructure, haemostatic mechanisms, and the history of microscopical observation. His pioneering research, ranging from Antony van Leeuwenhoek to cell intelligence, has been highly influential. Ford is a passionate advocate for microscopy, and presented the annual 'Evening with Brian' at the Inter/Micro conference in Chicago for some 40 years. He has recently turned his critical eye to the rise of generative artificial intelligence, warning that photorealistic synthetic imagery threatens to erode the empirical foundations of biological teaching. He lives in Cambridgeshire,

where he continues to write, lecture, and research, championing the primacy of direct observation in an age of digital illusion.



Contacting the Royal Microscopical Society

The offices of the Royal Microscopical Society are at:
37/38 St Clements, Oxford, OX4 1AJ, UK

Tel: +44 (0) 1865 254760

For general enquiries email info@rms.org.uk

For information about meetings and courses email events@rms.org.uk

For membership enquiries email membership@rms.org.uk

www.rms.org.uk