

Don't judge a book by its dust

**How can microscopy add to our
understanding of Medieval books?**

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Electron microscopy by Lorelei Robertson (Electron Microscopy Technician, Nanoscale and Microscale Research Centre, University of Nottingham).

Manuscripts and Special Collections at the University of Nottingham holds over 800 years of historical material that tells the stories of Nottinghamshire's people, land, and estates. Among this, the Wollaton Library Collection houses rare medieval texts, once part of the private library of Wollaton Hall, a stately home just a short walk from the University's main campus.

Caring for Medieval manuscripts is a real privilege and provides opportunities to find out more about the historic practices of writing, reading, and creating. This is where there is exciting potential for microscopy to reveal new insights into the material, not just informing archives' conservation activities, but also telling us about the people, places and practices of textual production that have shaped the world we live in and provide inspiration for future generations.

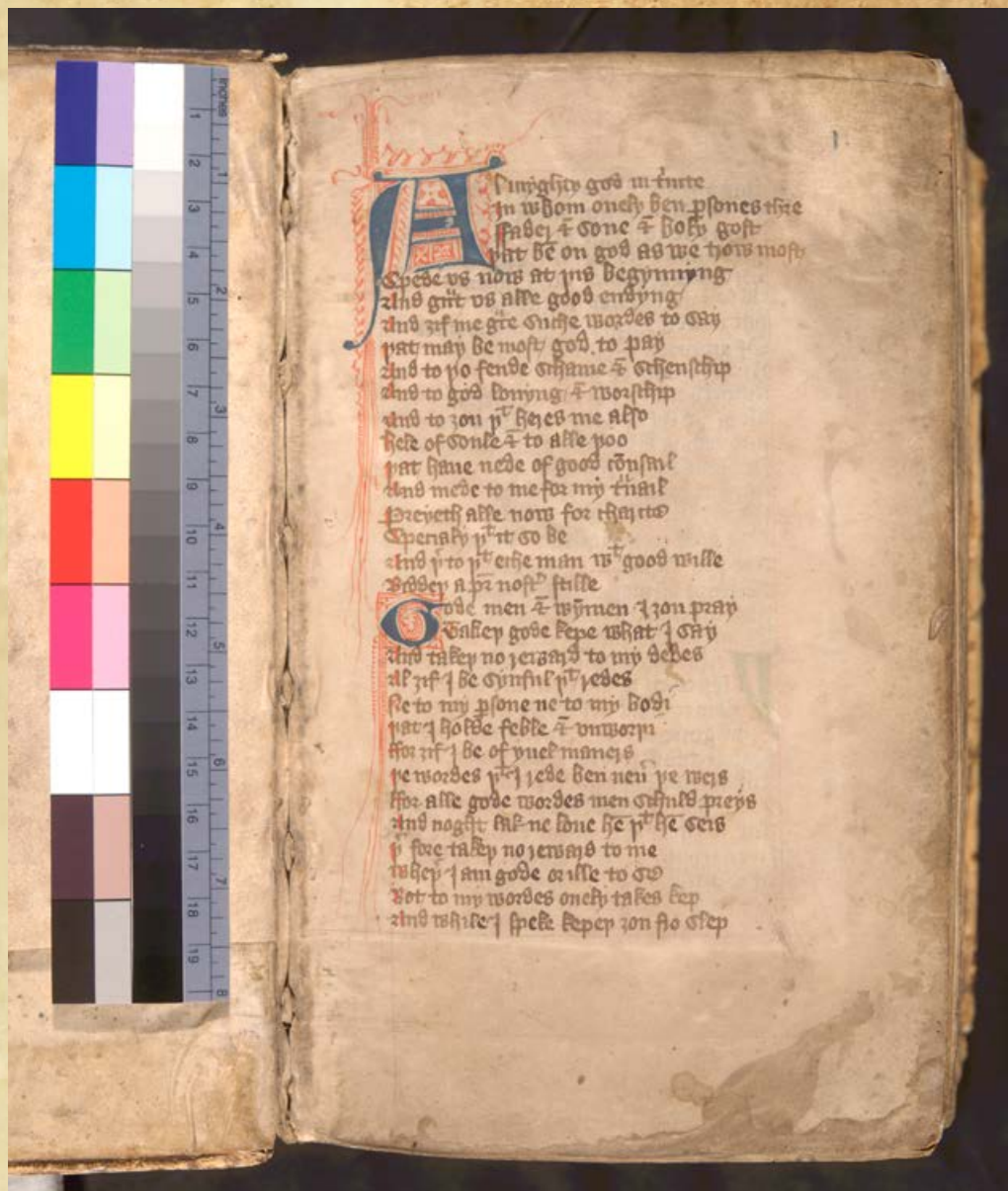
An important work of the Wollaton Library Collection that has been re-examined recently is the *Speculum Vitae*, a text dating from the early 1400s which retains an early and perhaps original binding which shared with another text, *The Lay Folks' Catechism*, a shorter form of doctrinal instruction than the *Speculum vitae*. The *Speculum* is an illuminated copy of a text ascribed to William of Nassington who died in 1354. The title translates from Latin to English as 'Mirror of Life'.



Front cover of 'Speculum Vitae'.



Binding on the spine of 'Speculum Vitae'.



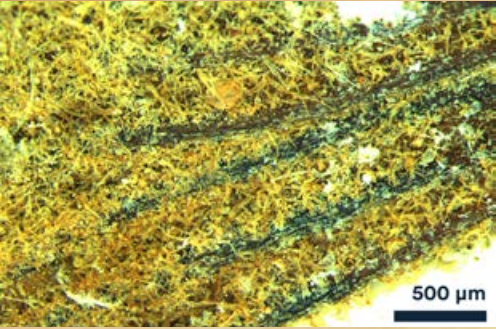
First folio of 'Speculum Vitae'.

The text itself is a 16,000 line Middle English commentary on the Lord's prayer and is referred to as 'a monument of scholastic erudition and a breathtaking synthesis of moral philosophy' in the Oxford Dictionary of National Biography entry for Nassington.

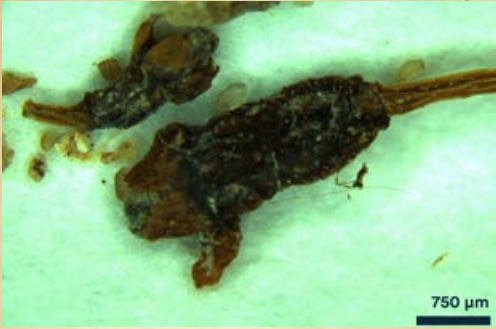
In the extensive study and survey of the Wollaton Library Collection undertaken by Ralph Hanna and Thorlac Turville-Petre (York Medieval Press, 2010), it is suggested that the *Speculum vitae* was brought

into the Wollaton Library Collection through the marriage of Elizabeth Fitzhugh to Henry Willoughby in 1491, evidenced by a dedication to her at the end of the volume by William Fletcher, possibly Elizabeth's Chaplain. Hanna's *Reading Edition* of the *Speculum vitae* (Oxford University Press, 2008) also notes that this is one of 45 currently existing manuscript versions of the text, many in libraries in Cambridge, Oxford (the Bodleian library houses 11) and the British Library among others. All copies

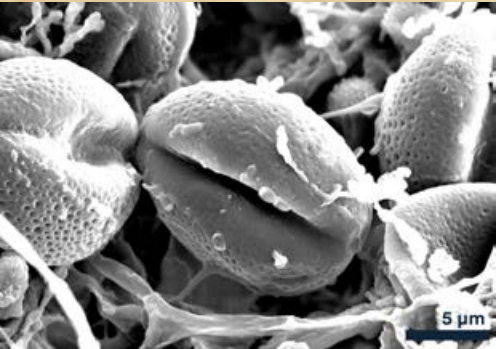
Images from nmRC



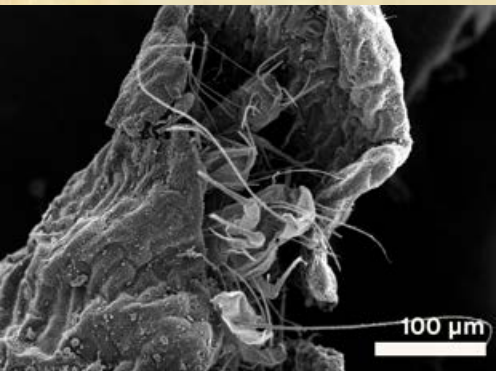
Plant material imaged using light microscopy showing the colours present.



Dried flower sections imaged using light microscopy.



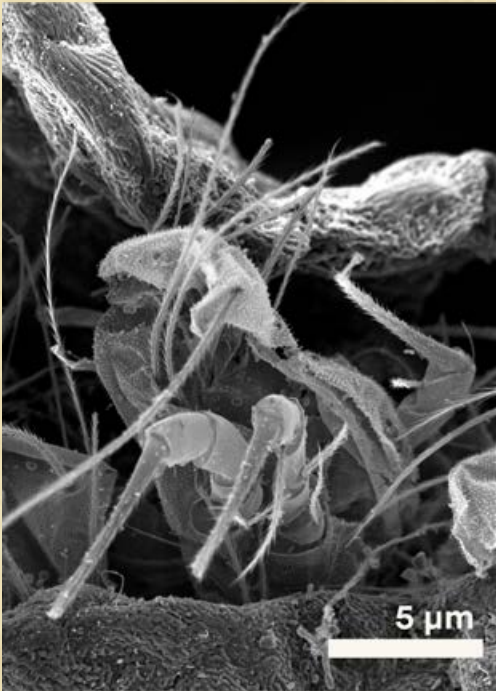
SEM image of pollen grains found.



SEM image of pollen grains found.

of the *Speculum vitae* are distinct, and the University of Nottingham's copy has a section of deleted lines that are present elsewhere.

Scholarly work has revealed so much about the content and language of the text and its owners, readers and possible writer, but further knowledge of the material artefact can shed more light on its environment and potential uses throughout the centuries. This is where microscopy and imaging



SEM image of one of the creatures at higher magnification.

can offer new perspectives – literally – on our understanding of this Medieval text.

During conservation work on the *Speculum vitae*, sweepings from the binding of the text had been kept by the professional conservator to retain as much original material as possible for future study and insight. And after a chance encounter by two Knowledge Exchange Fellows in 2022, Dr Luke Norman from the Nanoscale and Microscale Research Centre (nmRC) and Dr Charlotte May from Manuscripts and Special Collections identified

a unique collaboration that could identify a never-before-seen aspect of this important manuscript. The sweepings, which to the naked eye resembled little more than standard dust, were first imaged using light microscopy at the nmRC. Almost immediately, they were revealed to be plant material — a mix of shrivelled flowers and petals, dried and partially decomposed with age. Hints of green, yellow, and orange remained visible in the fragments. But what were plants doing in the binding of a 14th-century manuscript? One plausible answer lies in medieval reading habits — it was common for readers to use leaves, flowers, or other natural materials from their surroundings as bookmarks.

After identifying the plant material through light microscopy, scanning electron microscopy (SEM) was used for its ability to reveal finer details and structural aspects at high magnification, which would be essential for investigating the complex, microscopic features of the sweepings. SEM's versatility allowed us to image the samples at a range of magnifications, from 60x to over 25,000x, revealing exquisite structural details. Prior to imaging, the samples were coated in gold to create a conductive surface, enabling the electron beam to interact effectively with the material.

The findings could be broadly grouped into four categories: plant fibres, pollen grains, fungal spores, and — most intriguingly — creatures.

Pollen grains provided the most direct link to potential plant species. Several morphologies were observed, but the most common type was elliptical, with a net-like (reticulate) surface texture and two to three apertures. Fortunately, the Nanoscale and Microscale Research Centre (nmRC) has built an internal reference library of pollen images, enabling comparison. Based on these characteristics, the grains most closely matched those of the *Ranunculus* genus — specifically buttercups. Re-examining the light microscopy images of the floral material, this identification seemed consistent: the fragments showed small petals, now yellow to brown, matching the colour palette of aged buttercups. It's easy to imagine a medieval reader sitting in a field, plucking a buttercup, and slipping it between the pages. The “creatures” discovered within the sweepings

presented a more mysterious challenge. Nestled inside a curled petal — like a tiny protective burrito — were at least three insect fragments. No complete bodies remained; all examples were partial, complicating identification. Each measured approximately 50 µm wide, slightly thinner than a human hair, with multiple segmented antennae (at least seven observed), bristled appendages, and hair-covered surfaces resembling plant trichomes.

While our initial suspects included common manuscript pests like silverfish or booklice, the remains didn't quite align. Silverfish, known for their tapered bodies, were ruled out. The fragmented head structure shared some similarities with a book louse but differed in scale and antenna count. Unfortunately, these insect fragments remain enigmatic — their precise identity lost to time, but their presence offers a tantalising hint of the book's long and complex life.

Microscopy has offered us an extraordinary glimpse into the micro-history of this manuscript — not just the words written, but the lives and habits of those who handled it centuries ago. Trapped within its binding, these fragile traces — petals, pollen, spores, and creatures — speak of meadows, hands turning pages, and the passage of time. This project highlights how scientific imaging techniques can illuminate the invisible stories hidden in our cultural heritage, deepening our understanding of the objects that connect us to the past.

This work formed part of the nmRC's Under the Microscope public engagement initiative powered by JEOL, designed to open up the fascinating world of microscopy to new audiences. If you're interested in discovering more hidden worlds, we invite you to get in touch and suggest items to image — there's so much more still waiting to be seen.

If you have a project in mind using archives and printed items, you can find out more about Manuscripts and Special Collections here: <https://www.nottingham.ac.uk/manuscriptsandspecialcollections/>

<https://www.nottingham.ac.uk/nmrc/under-the-microscope.aspx>