MICROSCOPY TODAY

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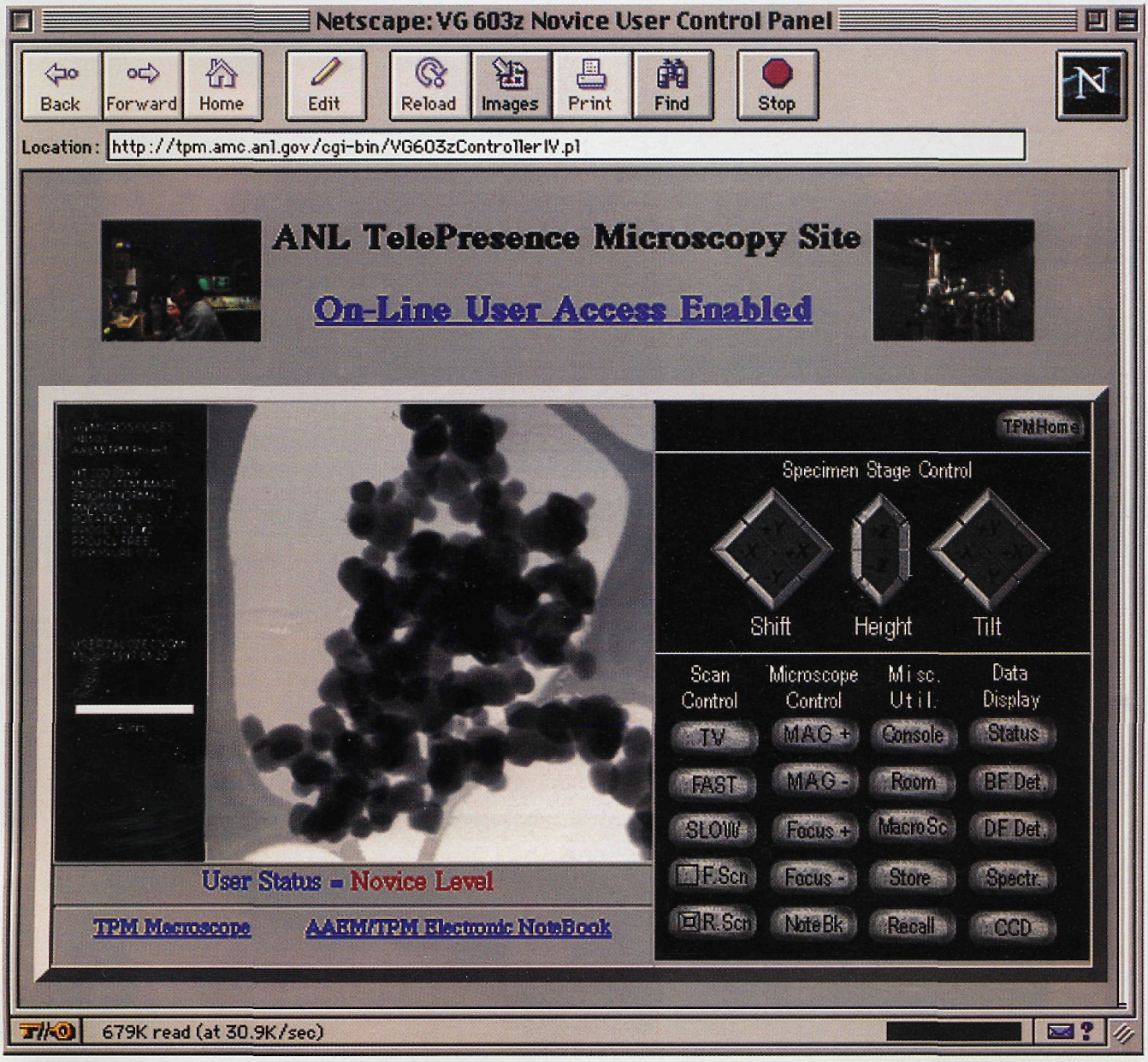

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WERE THE FIRST MICROSCOPES REALLY THAT GOOD?

Stephen W. Carmichael,[1] Mayo Clinic

When I see a drawing by an early microcopist, I am often impressed by the amount of detail they illustrated. I am frequently amazed by the resolution they apparently were able to achieve with primitive (by today's standards) uncorrected optics. Were their instruments and observational skills really that good, or were they just lucky, correctly guessing what was beneath their lens? In an amazing pictorial published in the April issue of *Scientific American,*[2] Brian Ford convincingly answers this question.

Ford describes the controversies surrounding descriptions by Antony van Leeuwenhoek in 1674 and Robert Brown in 1827. Both of these pioneer microscopists were often dismissed by their contemporaries and ignored for many years after their deaths. Leeuwenhoek was considered to be a man of fertile imagination whose observations of "animalcules" in pond slime were not appreciated until the time of Louis Pasteur. It was considered by scientists, even recently, that Brown's microscope was incapable of observing Brownian motion or the cell nucleus, two discoveries credited to Brown. Interestingly, whereas Brown is known for identifying and naming the cell nucleus, it was drawn by Leeuwenhoek a century and a half earlier.

As you can well imagine, the "Materials and Methods" section of Leeuwenhoek's and Brown's publications were of no help. Ford took great care to re-create the original experiments and to painstakingly adjust the microscopes. He used one of the more than 500 microscopes that Leeuwenhoek made, which is now kept at the University of Utrecht in The Netherlands. He also made similar single-lens microscopes himself. He also utilized microscopes used by Brown, which are now in the collection at Kew Gardens in London and at the Linnean Society (where Ford became prominent as Zoological Secretary).

The highlight of Ford's article is a series of eight unenhanced micrographs taken through these and related microscopes. They ranged in magnification from 110 x to 1,200 x. Red blood cells are clearly seen through Leeuwenhoek's microscope, in spite of the fact that detractors have claimed that these could not have been visualized with this instrument. Brown's detractors were saying even earlier this century, that he could not have resolved the nucleus, but Ford was able to resolve much smaller organdlles, mitochondria, with Brown's microscope. Ford's admiration for Leeuwenhoek is apparent in the caption for the micrograph at the highest magnification; it is emphasized that the light and the focus had to be exactly right, a sign of a skilled investigator. I hope that my admiration for Ford comes through as well.

So our question has been definitively answered. Yes, these early microscopes really were that good. But in addition to their talent for building microscopes, what is impressive about these early scientists is that they found structures that nobody knew were there. And, in addition, they described these structures with uncanny accuracy. Was there some luck involved? I don't think so. It was all skill.

1 The author gratefully acknowledges Dr. Brian Ford for reviewing this article.

2 Ford, B.J., The Earliest Views, *Scientific American 278(4):50-53, 1998.*

Front Page Image
TelePresence Microscopy & Collaboration via the Internet

A virtual electronic laboratory, the Materials MicroCharacterization Collaboratory (MMC URL=http://tpm.amc.anl.gov/mmc) is linking some of the nation's best experts and microscopes at several laboratories across the country. The MMC is a prototype of next generation research facility that transcends geographic, discipline and organizational boundaries. Funded, in part, by the U.S. Department of Energy DOE 2000 project, it is in the process of developing tools that qualitatively improve the ability of the Department of Energy to accomplish its missions and set the standard for scientific R & D organizations in the 21st century. These tools will attempt to eliminate physical distance and organizational structure as limits to collaboration. They can lead to a system-wide culture change in sharing resources, and will engender superior ways of doing science, engineering, research collaboration and management. By enabling collective use of resources far in excess of those available in a single facility, significant cost savings can also be realized.

This TelePresence Collaboratory brings together major materials characterization expertise, instruments and technology at Argonne National Laboratory, the University of Illinois, the National Institute of Standards and Technology, and Lawrence Berkeley National Laboratory and Oak Ridge National Laboratory together through a national computer network. Work is initially focussing on linking the laboratories' internationally recognized expertise and instruments through the Internet and creating software to let researchers share the instruments, data and audio/video communication from their desktops anywhere in the world.

The MMC industrial partners include: EMiSPEC Systems Inc., Gatan Inc., Graham Technology Solutions, Hitachi Instruments Inc., Japan Electron Optics Laboratories-USA, Philips Electronic Instruments, R.J. Lee Group and SUN MicroSystems.

You can observe the work firsthand by visiting the project's World Wide Web at http://tpm.amc.anl.gov/mmc/TPMLVideoCollab.html. All you will need is a copy of NetScape Navigator and a link to the Internet. From this multi-site page you can subsequently link directly to an individual laboratory. Since these sites are broadcasting live video, a high speed connection is highly recommended.

Image and description provided by Dr. Nestor Zalluzec, Argonne National Laboratory

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