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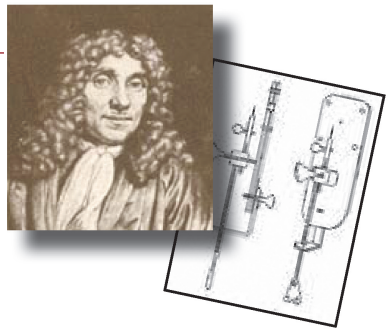
Pioneers in Optics: Benjamin Martin



From the website Molecular Expressions created by the late Michael Davidson and now maintained by Eric Clark, National Magnetic Field Laboratory, Florida State University, Tallahassee, FL 32306

eclark@magnet.fsu.edu

Benjamin Martin
(1704–1782)

Benjamin Martin, an eighteenth-century English instrument maker, is considered one of the greatest designers and manufacturers of microscopes of his time. He had a significant influence on the development of the microscope and optical instruments in general. Martin was born in 1704 and started his career as a schoolmaster and also published books on mathematics and microscopy. He eventually opened a scientific instruments shop on Fleet Street in London where he developed his numerous microscope designs.

Martin's First Universal microscope, developed in 1738, was a dramatic improvement in the versatility of portable microscopes. It was the first in a series of microscopes intended to be portable and have a wide spectrum of applications. Martin also developed a Pocket microscope, the design of which became very popular and was later copied throughout Europe in several variations known collectively as the "drum" microscopes. The Pocket microscope is relatively small, being only about six inches tall when fully extended. The Second Universal microscope was introduced by Martin in 1742 as an improvement over his previous microscopes. The new design allowed for additional freedom of movement of the specimen stage and increased illumination.

English optical instruments, during most of the eighteenth century, were constructed of simple lenses that suffered from chromatic aberrations, causing distortion of images. In 1733, the amateur optician, Chester Moor Hall, developed an achromatic lens by combining a convex crown glass lens with a concave lens made of new lead-containing flint glass, which corrected the problem. The new lenses were intended for making achromatic telescopes. Martin was the first, in 1774, to use achromatic lenses in a microscope. This led to a significant improvement of microscope images and new designs for microscope objectives.

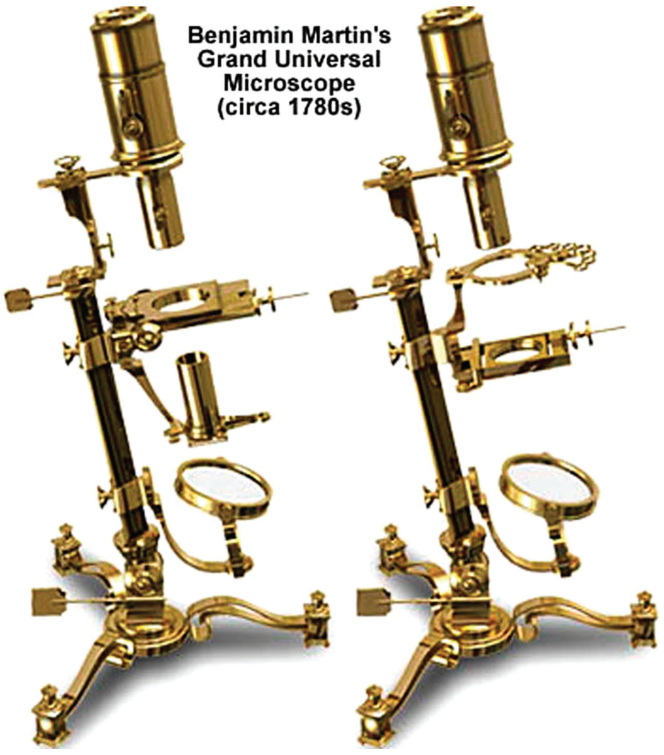
In or about the year 1780, Martin developed the Grand Universal Microscope. This microscope was one of Martin's finest achievements, consisting of numerous adjustment knobs and controls used for fine-tuning the two-foot-tall microscope.

The Microscopes of Benjamin Martin

First Universal microscope. The simple construction of the First Universal microscope allowed for a great amount of flexibility in mounting samples with respect to both vertical and horizontal observation. Central to the construction of this microscope is a threaded pillar upon which both the stage and body tube are mounted. This microscope was the first in a series of Universal microscopes first created by Benjamin Martin in 1738. It outlined a new style of microscope that was intended to be portable and have a wide spectrum of applications.

Second Universal microscope. The Second Universal microscope was introduced by Benjamin Martin in 1742 as an improvement over his First Universal microscope; it also was an innovation of the time period. The major improvement of the Second Universal microscope over the first version was removal of the threads on the central pillar and the addition of a wooden base to stabilize the microscope. Positioning of the specimen stage could now be accomplished by sliding it up and down on the pillar and securing it with a small clamp screw.

Grand Universal microscope. The craftsmanship of the Grand Universal microscopes was superb, each having a triangular limb that is inclined by application of a worm and pinion gear at the base. To provide full aquatic motion, Martin added a worm wheel and rack work to the body tube, and he even provided



rack and pinion gears for the mirror and stage. The eyepiece is composed of two plano-convex lenses that are adjustable with another rack and pinion gear set. The most complex part of the Grand Universal microscope is the elaborate stage, which is really two stages connected together by means of a "U"-shaped bar. See: micro.magnet.fsu.edu/primer/museum/granduni.html

The Pocket microscope. Benjamin Martin designed and built this microscope in the middle of the eighteenth century and named it the Pocket microscope because of its small size and portability. This design became very popular and was later copied throughout Europe in several variations known collectively as the "drum" microscopes.

Martin Drum microscope. A derivative of the Pocket microscope, Martin's Drum microscope is made of lignum vitae, pasteboard, rayskin, and brass. Martin autographed the microscope prominently on the body tube between the wooden nosepiece and eyecup. The body tube slides up and down to focus the specimen through a single brass objective mounted in the nosepiece. A stage in the lower portion of the drum accommodates the specimen, which is illuminated through the base of the microscope.

Solar microscope. Benjamin Martin's Solar microscope was designed to fit into an opening in a window shutter and was used to project a large image on a screen, enabling several investigators to simultaneously examine specimens at high magnification. Sunlight is employed to illuminate the specimen and provide image-forming light rays. The base of the microscope contains a large mirror (to reflect sunlight into the microscope), which can be adjusted for tilt and rotation to optimize illumination.

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