Botanic Microscopes

Les May, UK
stockdove at protonmail dot com

The years 1760 to 1840 bracket the heyday of the Botanic or Aquatic Microscope. Their basic layout of a stand with an adjustable mirror near the base, an optical system at the top and a stage between the two remains the standard configuration of microscopes today. Focusing was provided either by moving the lens support up and down a vertical tube topped or lined with cork[1] or by a rack and pinion[2] mechanism. A 'toy' microscope I owned in my late teens had a similar friction focus adjustment and was easily usable at 40x magnification. My 1960s Lomo microscope with a non-functional fine focus is quite usable at more than 100x magnification using only the rack and pinion.

Ford[3] has emphasised that microscopes from this period often had high power lenses which provided an image superior to the existing non-achromatic compound microscopes and allowed phenomena like Brownian motion and cytoplasmic streaming to be seen. Plant taxonomy, the naming and classification of plants, was developing during this period as were ideas on flower structure. Neither of these required a microscope capable of high magnification.

Detail of the magnification available with these instruments has been published but is incomplete. An instrument[4] from the 1760s with an optical system of three simple lenses which can be used single or in combination has a claimed power of x3 to x15. Ford[3] gives only the range for two instruments.
A range of x5 to x170 spread over six individual lenses is given for a pre 1820 microscope used by Robert Brown and a range of x8.5 to x135 from seven lenses, for a microscope used by William Hooker, a Director of Kew from 1841 to 1865. He also gives magnifications of 19.6 and x170 for two lenses of a microscope used by George Bentham who with Joseph Hooker, son of William, who wrote *Genera Plantarum*.

The diameter, thickness and radius of curvature of the surfaces for five of the six lenses of a Bancks microscope from 1825 instrument similar to the one illustrated by Ford[3] have been published[5]. Using the Edmund Optics[6] online calculator these values can be used to estimate the focal length and from this the magnifying power. From lowest to highest these are about x12, x24, x33, x45, and x70. If the ratio between powers of about 1.4 to 1.6 is maintained for the missing lens this suggests that the highest power lens was about x100.

An instrument[7] of this type priced at $6 was marketed in the USA in 1880 as a 'school microscope' and gave a range of about x5 to x40 by means of three lenses which could be used in various combinations. This is equivalent to about $145 dollars at present day prices.

The lower powers for all these instruments are within the range we normally associate with hand lenses, but it is rarely possible to get the best from these if both the object being observed and the lens are being hand held. The fixed

relationship between lens and object which these simple microscopes permitted not only allowed more detailed observation, but made it easier to record observations by drawing.

For many purposes an instrument of this type could replace my cumbersome Russian stereo microscope. It would certainly take up less room on the bench.

1. The Microscope of Linnaeus and His Blind Spot. Ford. 2009.

2. Charles Darwin and Robert Brown – their microscopes and the microscopic image. Ford 2009

3. Single Lens. Ford 1985.

4. http://golubcollection.berkeley.edu/18th/241.html

5. http://www.cryptolithus.com/microscopy/Bancks/bancks.html

6. https://www.edmundoptics.com/resources/tech-tools/focal-length

7. http://www.antique-microscopes.com/photos/The_School_Microscope.htm

Genera Plantarum can be downloaded from the Biodiversity Heritage library at:

https://www.biodiversitylibrary.org/item/14680#page/1/mode/1up

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