Microscopes - 1

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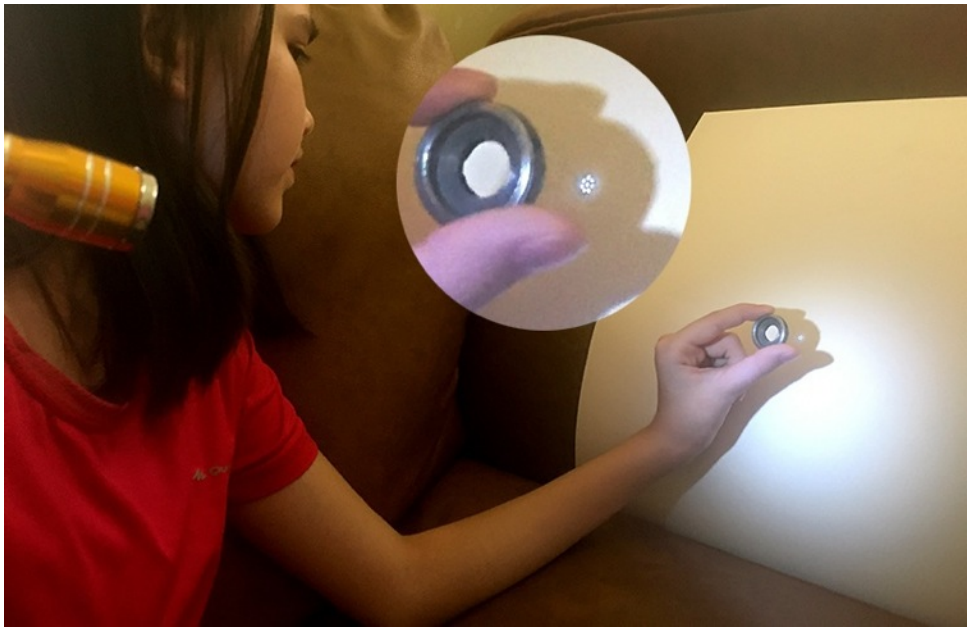
That's a binocular microscope. I know what it does and I can use it but how does it work?

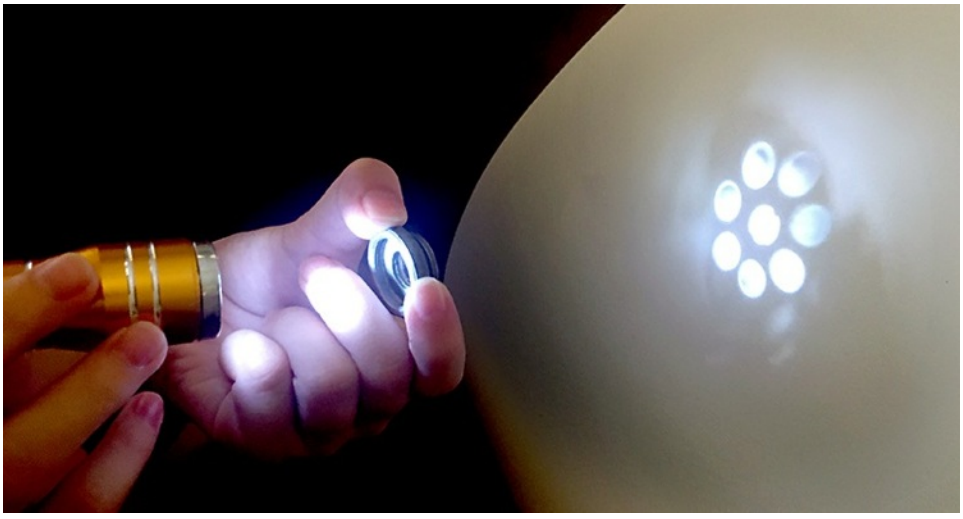
I'm told that's a bit complicated, so we will make a microscope first first and ask questions later.

A simple microscope has an objective lens at the bottom (near the object) and an eye-piece at the top (near the eye).

The objective is a small convex lens (fat in the middle) with a short focal length. The focal length is the distance from the lens to the small image when the object is a long way from the lens.



The torch has a metal disc with seven holes over the LED's. When the torch is held back the image is a tiny seven spot 'flower' on the paper about 3 cm from the lens. The focal length of the lens is ~3 cm.



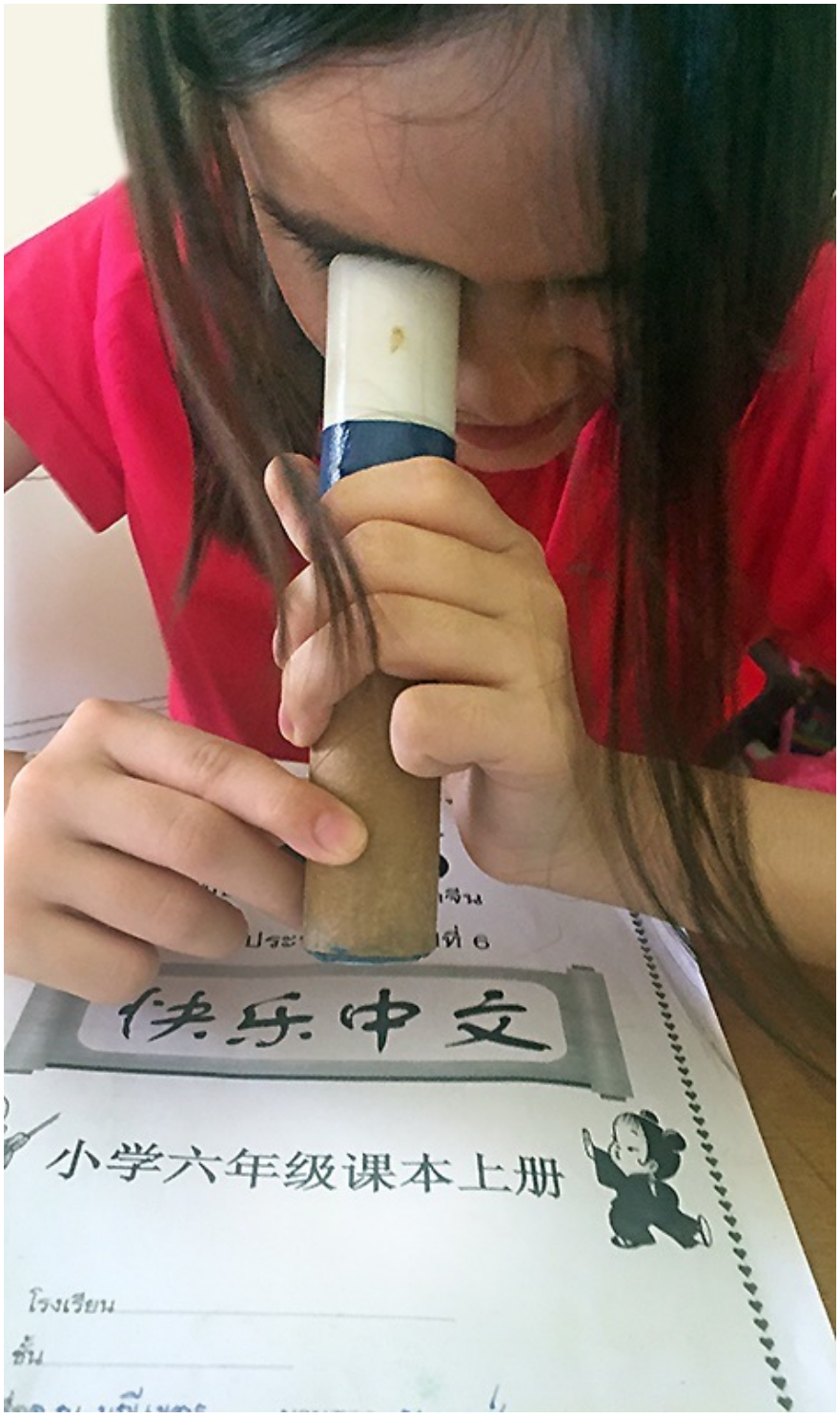
When the torch is moved closer to the lens the image gets bigger and the lens must be pulled back further from the paper to get a sharp focussed image. The focussed image is magnified x2.

The eyepiece is a loupe (a magnifying glass without a handle).

The loupe is used for looking at stamps and photographic negatives. It has two lenses and is focussed when it rests on the paper. It magnifies four times. We are using a two lens loupe because that gives less distortion of the final image than the single lens eyepieces that were used in the 1650's when microscopes were first invented.

The image formed by the objective (inside the tube) is focussed in just in the right place to be magnified four times by the loupe.

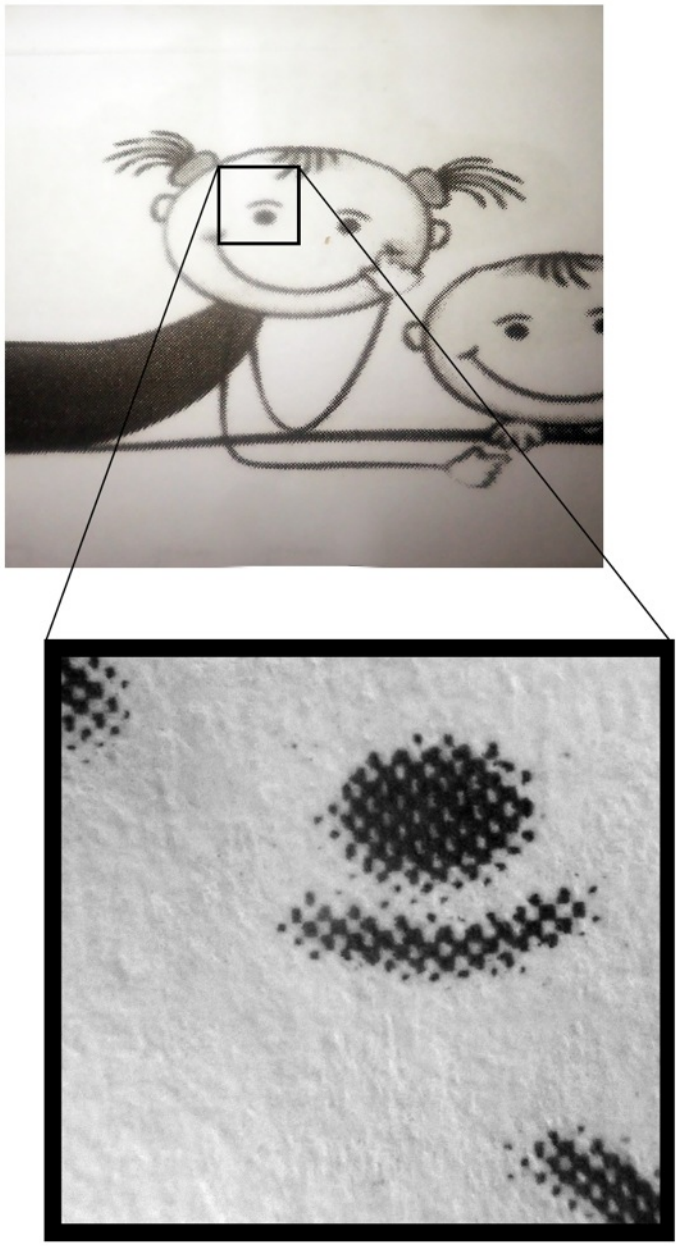
That’s a real compound microscope I’m looking through.



The tube must be held at just the right distance from the paper for the objective to put a bright image near the top of the tube to be magnified by the loupe.

The magnification is 2 x 4 = 8 times.

This is what I see when I look at a printed page.



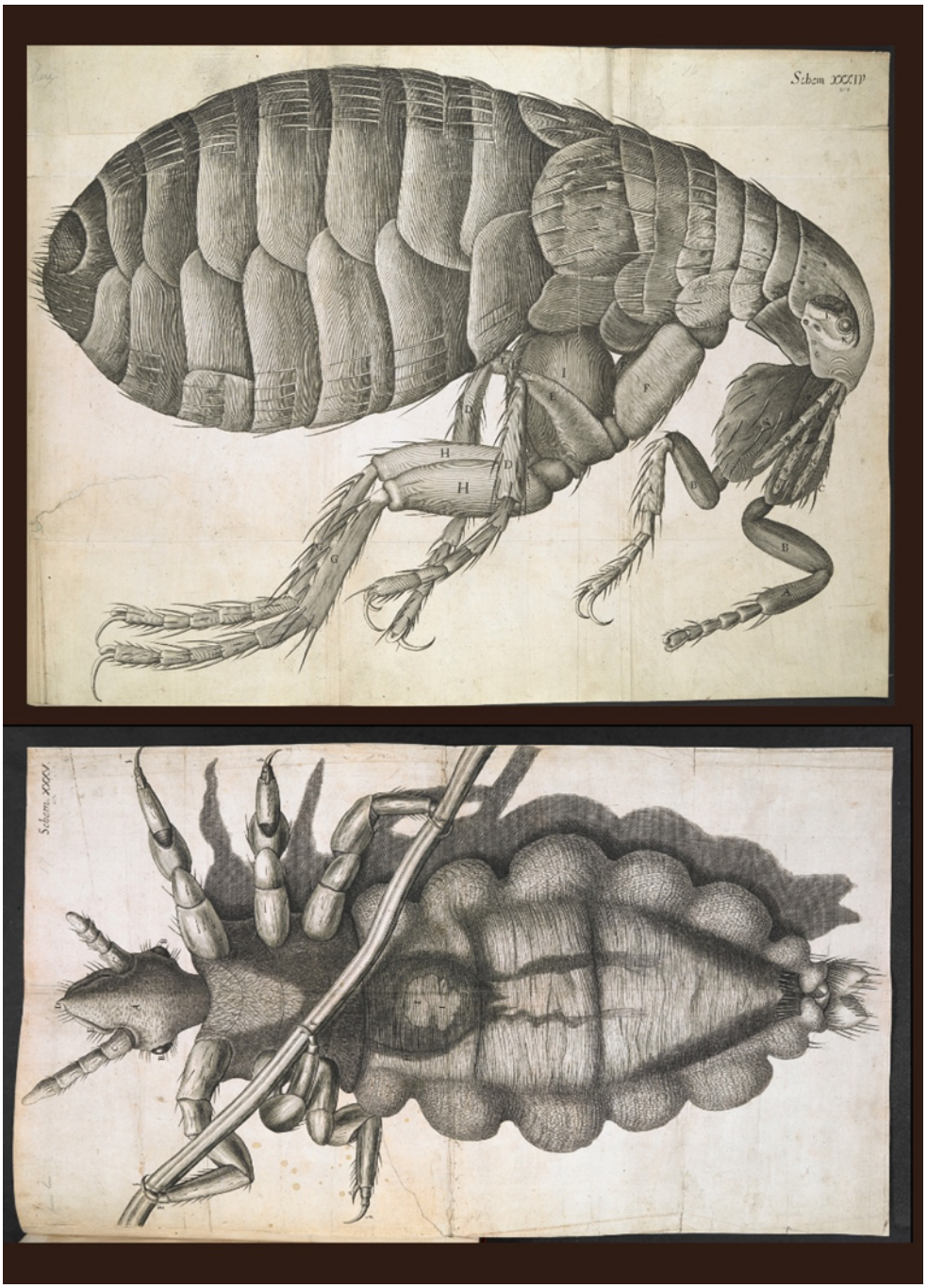
The magnification is 2x4 = 8

The image in the microscope is upside down and moves in the opposite direction to any movement of the paper or the tube.

To increase the magnification we could use a fatter convex lens as the objective and a more powerful eyepiece. If the new objective magnified x5 and the eyepiece x10 the magnification would be x50.

Make to of these and we would have a binocular microscope.

A simple compound microscope was made for Hooke in the 1660's.



Hooke's handmade drawings of a human flea and a human head-louse were converted by hand to engravings on A3 copper plates for printing. Hooke's book, *Micrographia,* was a sensation: everyone wanted to see his drawings. Hooke's microscope was made with single lenses and the image was distorted. He compensated for that as he drew a small part at a time. He could not have used a camera even if he had had one.