

Instructions for Safe Use of Microscopes

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Looking through a microscope for extended periods is not what we were designed for - it requires holding our bodies in an unnaturally rigid position. This can cause cramped muscles and strained tendons and ligaments in the head, neck, back, shoulders, arms and wrists. Also, repetitive movements associated with microscope work can cause strain injuries. There are specific health and safety regulations for computer use. Yet, you are tied much more to a microscope than to a computer, because of the eye-piece requirements.

Main problem - microscopists know how to align their microscope but few align themselves! Many users are "slumpers", and need training to avoid problems later.

Main requirements:

The bench height is important, and ideally it should be adjustable so that eyepiece height is adjustable, but this is often not practicable due to cost. What follows will be based on a fixed bench height.

Microscopy requires a good seating position in an adjustable, ergonomically-designed chair. The back should be high enough to support the shoulder blades and be adjustable for height and angle, with the most prominent part being the lumbar support. The seat should be low enough to have the back perfectly straight to see through the oculars. Then move the chair towards the bench so that the chair fully supports the back - this feels unnatural at first. Most people have the seat too high, which results in hunching. Sitting for long periods in such a position places strain on the lower back.

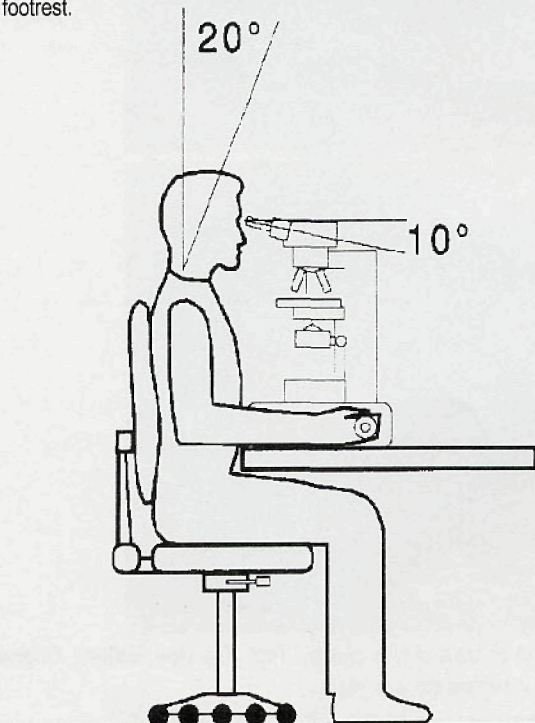
An alternative chair is the Swedish or Scandinavian chair. First, get the

posture right in the chair, then adjust the table/microscope height until the oculars meet the eyes.

Sitting position:

- 1) Have you been shown how to use the microscope, including the alignment of the optical path so as to optimize performance? If not, stop at this point and seek this training.
- 2) Adjust chair height so that your feet sit comfortably on the floor.
 - a) get an even pressure along the back of the thighs.
 - b) it may be advantageous to tilt the seat slightly down at the front (to eliminate pinch behind the knees). Sit in the chair. Do not tuck the feet underneath the chair or on its base, this tilts the hips away from the backrest. The position of the feet should be varied from time to time, to spread the load on the back and leg muscles. NB: adjust the chair for comfort without regard to the height of the microscope.
- 3) Adjust the microscope so that you can see into the oculars without leaning significantly forward. This requires two adjustments:
 - a) set the horizontal position of the microscope so that it is close to the front edge of the bench with the eye-pieces no further away from you than the front edge of the bench
 - b) set the vertical position of the microscope so that it is a little high for comfort. This normally means elevating the microscope on some type of stand on the bench.

The purpose of this is to force yourself to straighten your back as you draw up to the microscope, so that your head is in an upright position. Look down the eyepieces by letting your eyes view at a downward angle so that you are, in effect, looking straight ahead into the microscope. Do not bend your neck. Sometimes it is necessary to adjust chair height so that you can just see into the eye-pieces because the bench has a fixed height. Then, you may need a footrest.



Workstation Set-Up For Microscopy

1. Oculars level with eyes, raise bench or microscope to suit.
2. Oculars over front edge of bench, move microscope to suit.
3. Upright posture with major joints at near right-angles.
4. Ergonomic chair adjusted to support back and thighs.
5. Forearms supported, not under long periods of static load.
6. Wrists straight, hands in "shake-hands" position.
7. Feet comfortably supported by floor or footrest.
8. Few of us fit the work station, the workstation must fit us.

The leg-well should be clear.

Bench thickness should be minimal to give clearance for thighs.

Obtain forearm-rests so that you do not constantly keep lifting your arms off the bench to adjust the microscope. These may be best if they are sloping. Consider getting a permanent support made for the microscope. It won't cost much and will make an enormous difference to working comfort and productivity. The most comfortable position for the hands is in the mid-range position (as when shaking hands).

Practice continuously focusing, as this is essential to minimize eye strain. Proper setting of the inter-pupillary distance and eye-piece parfocality also minimize eye strain.

Take breaks away from the microscope, perhaps ideally every half-hour for a couple of minutes. Get up, walk around, stretch arms, neck, back and legs.

Appendix - selected information from Haines, H. and L. McAtamney.1993. Applying ergonomics to improve microscopy work. *Microscopy and Analysis*, July 1993, pages 15-17.

Visual demands:

- 1) Eyestrain is due variously to microscope design parameters, length of work period, pre-existing eye problems and inappropriate lighting conditions.
- 2) Design of microscopes: beyond the scope of these instructions. See references cited in article.
- 3) Length of work period: work/rest schedules should be appropriate. It is important to take breaks away from the microscope to counteract the build-up of postural and visual fatigue. A well-designed job will incorporate both microscope and non-microscope tasks. Frequent short breaks are preferable to occasional long breaks. This enables relief from the static, maintained working posture and a chance to look around and vary the accommodation of the eyes. Computer users are recommended to take 5 minutes every hour away from the computer; it may be preferable to take half-hourly breaks away from the microscope. Bending and stretching exercises are recommended (see *Microscopy and Analysis* article).
- 4) Pre-existing eye problems: visual strain is pronounced for operators with uncorrected astigmatism and fusion insufficiency (poor eye co-ordination). It is important to treat these problems - see an optician.
- 5) Inappropriate lighting conditions: eye fatigue is minimized in a well-designed visual environment. Where possible, avoid high light levels and high contrast in the microscope in comparison to the room surroundings. Minimize glare and reflections in the work area. Glare can be reduced by removing light sources from the visual field. This can be done by repositioning rig workstations, using blinds or curtains, removing highly reflective surfaces or by using shielding screens.

Environmental factors:

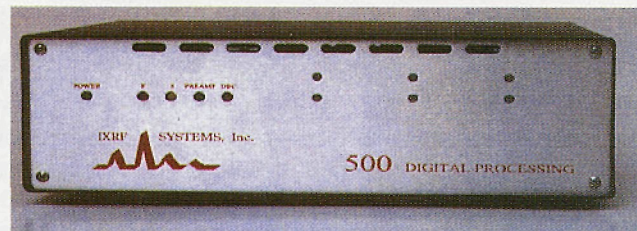
Sedentary workers are particularly susceptible to the effects of their work environment. Draughts, temperature extremes, poor air quality, inadequate lighting and noise affect comfort and performance. It is important to consider the needs and preferences of the individual.

Temperature, humidity and air movement: the recommended temperature range is 19° to 23° C. Low humidity dries the eyes and produces discomfort, relative humidity should be maintained between 40 and 60% (watering plants fulfills this need in offices). Draughts should be minimized.

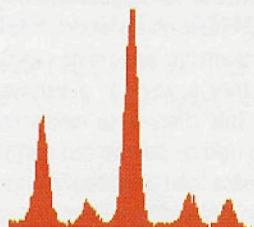
Acknowledgements: this assessment document was compiled with reference to the UK Health & Safety (Display Screen Equipment) Regulations 1992 and the article "Applying ergonomics to improve microscopy work" by Helen Haines and Lyn McAtamney, as cited above. I am also grateful to members of the "Safety", "Sorehand", "Microscopy" and "Histonet" Internet Lists for helpful comments, particularly from Bob Chiovetti (E. Licht Co., USA), Barbara Foster (Pres., Microscopy/Microscopy Education, Springfield, MA, USA), Bob Morency (R&D Ergonomics), Phillip Oshel (*Microscopy Today*, Champaign, IL, USA), Sue Reilly (James Cook Univ. NQ, Australia), John Shane (McCrone Research Institute, USA), and especially from Stephen Shaffer (MicroDataware, Berkeley, CA, USA).

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