

# reSOLUTION

EXTRA



## Ergonomics

The science which makes working life more pleasant

*Leica*

# ERGONOMICS – The science which makes working life more pleasant

a recognised, practice-oriented science. Based on knowledge gathered from engineering and human sciences, its goal is to improve the interaction of man and technology for the benefit of the (working) person. In everyday working practice, ergonomics should be both corrective (i.e. the improvement of existing working systems) and conceptual (i.e. the planning of new systems). The objective is to adapt equipment, workplaces, working environments, working processes and the contents of work procedures to the characteristics, activities and requirements of human beings.

Ergonomics is, therefore, not only a matter for production engineers, design engineers, designers or procurement and buying agents who are responsible for providing equipment for workplaces. "Work structuring" also involves works councils, security personnel, works doctors and (theoretically, at least) those who are actually active at the workplaces.

Today in many countries, worker's protection laws oblige not only large industrial concerns but also employers in small companies to provide their employees with adequate medical and safety measures and support.

## Full-time microscopists – a case for occupational medicine

Microscope workplaces constitute a "compulsory programme" for occupational medicine doctors. After all, they place extraordinarily high demands on the visual performance, the precision motoricity and supporting apparatus of the user. In the research laboratory or for industrial quality assurance appli-



Leica ErgoTube™ 10°-50° for the Leica stereomicroscopes of the M series (top).

Optimally placed operating elements for fatigue-free work (right).

Ergonomics is a hybrid term and comes from ancient Greek. "Ergon" means work, effort and power, and "nomus" roughly means law or rule. Ergonomics could therefore be translated as "work structuring". Ergonomics or work structuring – both terms were not widely in use until 1950. Only then did the humanisation of the workplace begin to become "a topic". Today, ergonomics is on everybody's lips and is now

– statistics gathered by various specialist authors show that over 70% of full-time microscopists suffer from headaches, neck and back pain, stiff shoulders and symptoms of eye strain. Since the muscular complaints in the neck and upper extremities (caused by motionless seated activity at the microscope) are so pronounced, ROBINOWITZ and Co. speak of a real "microscope neuralgia". According to



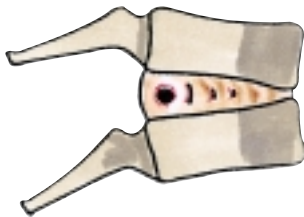
**Main muscle groups:**

Thoracic girdle and back muscles

- rhomboideus muscles
- trapezius
- deltoid
- teres minor
- infraspinatus



The statics of the spinal column with a bad sitting position.



The static of the spinal column with a good sitting position.

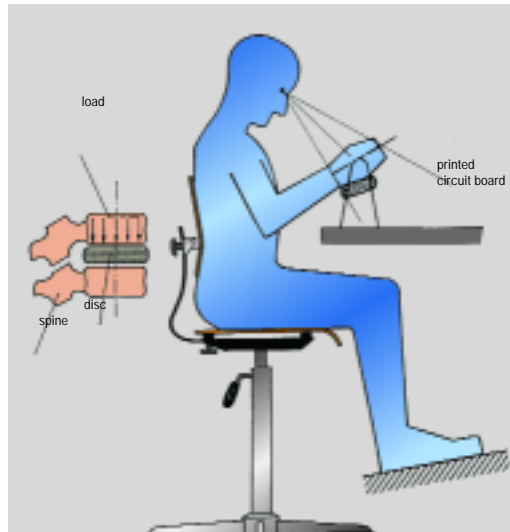
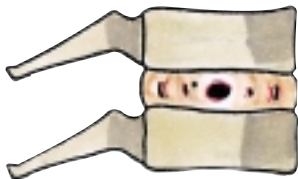


Fig. 1: Hunched sitting position – WRONG!

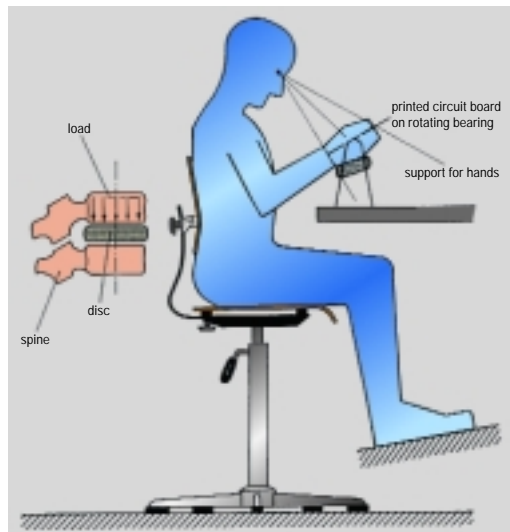
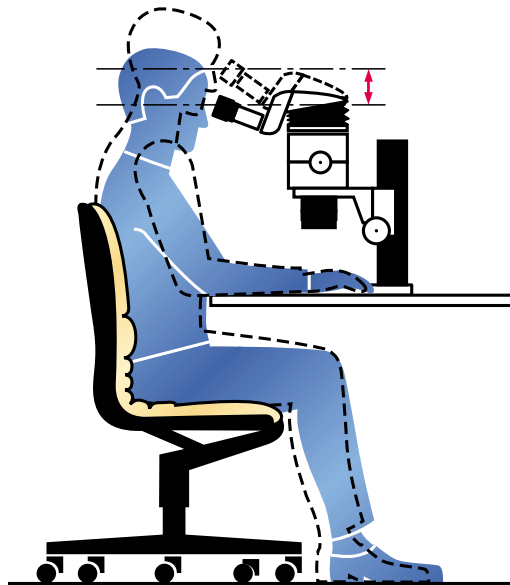


Fig. 2: Strain-free sitting position – CORRECT!



SIMONS and Co., the frequent headaches are caused by asthenopic complaints, i.e. impaired near vision and statomuscular overexertion. Additional inflammation of the eye and impairment of binocular vision frequently have a detrimental effect on the well-being and productivity of the affected individual. It is therefore necessary for occupational medicine doctors to first give employees an eye test which, if visual impairment is discovered, must be followed by an examination by an ophthalmologist.

Microscopists with chronically recurring complaints in the neck area, incorrect positioning of the cervical vertebral column, circulatory disturbances in the arms and legs pose orthopaedic problems. Apart from problems affecting the supporting apparatus, brachialgia also occurs, especially if the focusing knob of a microscope is too high and no support is provided for the ulnar edge of the hand. Carpal tunnel syndrome is an other frequent condition. Although, as experience has shown, eye complaints diminish after an initial period, this is by no means the case for afflictions of the supporting apparatus and locomotor system.

**Intervertebral discs also want the right nourishment**

In over 50% of their activities, microscopists assume a forward sitting position. Although this relieves the stress placed on the muscular apparatus, it is a position which can lead to back complaints (Fig. 1). The gelatinous core of intervertebral discs (nucleus pulposus) is slowly displaced dorsally, i.e. towards the back. When the microscopist sits up straight, acute impaction may result. An erect sitting position with support of the back is therefore desirable (Fig. 2). During brief breaks, the rear sitting position should be assumed. The changing load placed on the vertebral column nourishes the intervertebral discs following the same principle as a diffusion pump

The affected individual can take steps against complaints in the shoulder/neck area by shoulder-rolling and nodding exercises. Wrist-stretching exercises and finger massaging exercises are advisable for countering problems associated with the lower arm. Such self-help exercises are very effective and can be performed any time at the workplace by all microscopists. However, they are just a drop in the ocean if the problem actually lies with the microscope workplace.

### The sitting behaviour of 378 office workers

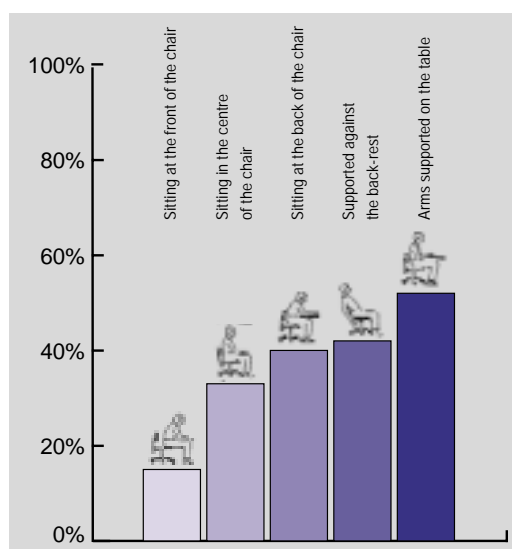
The sitting behaviour of 261 men and 117 women, all occupied with normal office work, was analysed with the help of multimoment photographs. Part of the results from the multimoment photographs is shown in the figure opposite.

The values in percent correspond to the work time that was spent in the respective sitting positions.

### Everything under control

Zoom and focus, the microscope controls most frequently used, must meet one clearly defined requirement: they must be positioned as low as possible so that they can be operated when the user is supporting himself on his forearms and with relaxed shoulders. In addition, they should also be located such that excessive forward stretching is avoided and that no unnecessary stress is placed on the shoulder girdle.

It should be possible to move the operating knobs of the microscope optimally at any time (they should be neither too loose nor too stiff). Ideally, the ease of gear movement should be adjustable to the requirements of the individual user.



### Posture from head to toe

Although the microscope enables a certain amount of fine tuning with regard to the correct body position, the seat and work table are responsible for the basic posture of the individual. Adjustability of height and inclination must ensure an optimum sitting and working position "from head to toe". Height-adjustable microscope tables with an adequate space for the user's arms as well as chairs which can be adapted to the size of the individual user are ideal. Chairs with permanently tilting seats and backrests with a tilt angle of up to 120° allow comfortable and relaxed sitting. If work requires a forward-tilted position, users should not have to lean forward more than 20°.

### Support for hands and arms

The precise movements involved in alignment, manipulation and preparation of microscope specimens are a challenge to hands and arms. Appropriate hand and arm rests which should not have any hard edges provide support. The pressure-sensitive elbow joint should always be clear.

### High-quality optics - objectively better

Selecting a less expensive optical system will prove to be the wrong decision, not only with regard to the working results but also from an ergonomic point of view.

### And finally: the eyepiece

In every microscope, eyepieces are the visual interface to the users. We strongly recommend wide-angle high-point eyepieces with adjustable dioptics and adjustable eyecups. They allow the entire object to be examined more effectively over a relatively long period of time since the eye is no longer constantly forced to adapt.

High-point eyepieces have a large exit pupil which is located further in front of the eyepiece lens and allows work with or without eyeglasses. The eyecups are used to prevent light from the surrounding environment from entering at the side and producing annoying reflections on the eyepiece lens.

### In the right light

Generally, the difference between the brightness of the workplace lighting and the illumination of the microscope field of view should not be too great, i.e. a ratio of between 1:6 and 1:10. A good level of "visual comfort" is achieved if the working area has constant illumination and an average luminance of 100-150 cd/m<sup>2</sup> (by way of comparison, a white sheet of paper has a luminance of 130-150 cd/m<sup>2</sup>). Dazzling caused by light sources such as lamps and also windows, reflections or flickering light must be avoided – this inevitably leads to premature eye fatigue. For the microscope user, "ergonomics" means making sure that the microscope is always used "in the right light".

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