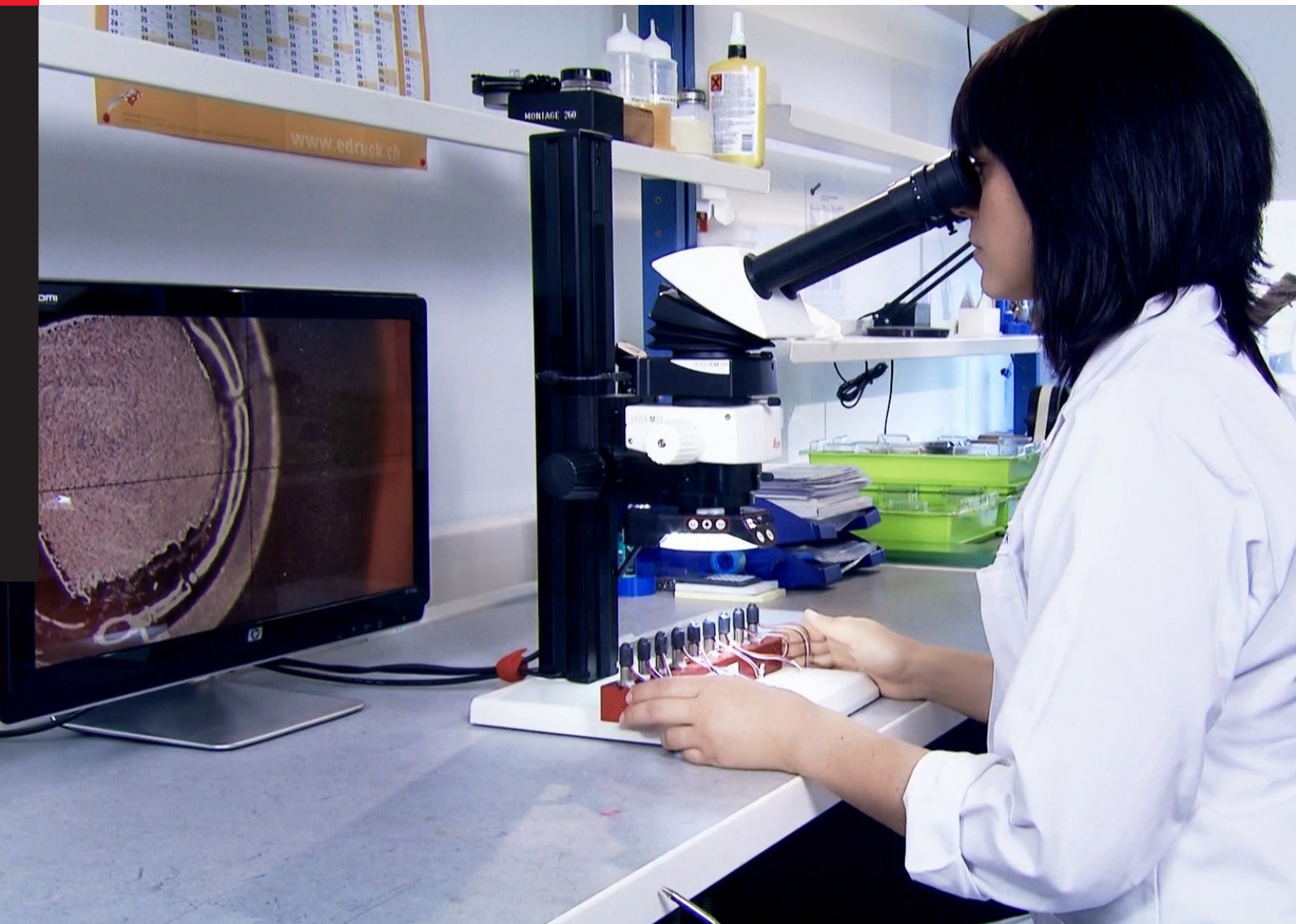


Living up to Life

**Leica**  
MICROSYSTEMS



Manual for Ergonomic Microscope Workstations

**Promoting motivation –  
increasing efficiency**



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# 1. Objective of this Manual

When Leica Microsystems published its first manual on ergonomic microscope workstations in 1998, there was little public focus on the important topic of ergonomic workstation design. Since then, many microscope users have recognized how important ergonomics is for a company's competitive advantage. The discussion regarding general workstation design using monitors and other video display units has strengthened awareness and increased the demand for ergonomic solutions targeting a wider range of applications. Leica Microsystems is accommodating this development by continuously expanding its ergonomic microscope product line.

## EMPLOYEE WELL-BEING AND INCREASED EFFICIENCY

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Ergonomic workstations and efficient workflows are necessary for the well-being and productivity of individual workers in a company. Ergonomics also provides economic benefits to a company because the impact of a people-friendly work layout can increase overall productivity and performance. People tire less quickly, are more alert, make fewer mistakes, and can work more efficiently in an environment based on ergonomics.

Occupational health studies show that workstations comprising optical equipment can place particularly high demands on a person's spinal column, shoulders, and eyes, and when not well designed, can cause health problems. Compared to the widely discussed computer workstations, microscope workstations require even more ergonomic consideration.

## CONSIDER THE POSSIBILITIES

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Please use this manual to learn about the importance and advantages of ergonomic microscope workstations. The contents have been revised with the most up-to-date findings, providing a clear overview of the basics of ergonomics and options for how you can reduce physiological stresses on your employees using a well-designed workstation layout. Leica Microsystems is devoted to developing the widest range of ergonomic products on the market to address these needs.

## PRODUCTION ERGONOMICS: WE PROVIDE ON-SITE CONSULTING

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Leica's services are not limited to the manufacture of ergonomic products. We also provide direct, on-site consulting to optimize the ergonomics and workflow for all laboratory, production, and quality assurance workplaces. You can find our contact information and a fax reply form in the appendix.

## 2. Ergonomics: The Origin and Objectives

The goal of ergonomics is to improve the performance capacity of an entire work system by analyzing and improving the scope of a task, the work environment, and the man-machine interaction.

### OCCUPATIONAL SCIENCE

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Ergonomics is a subarea of occupational science, and so it is useful to briefly touch on the larger context. Occupational science researches and analyzes the conditions of people during work with the goal of improving performance capacity of the entire work system, and reducing stress and strain on people caused by their work. In this context, ergonomics examines the technical design of workstations and tools and their effects on people. The study of ergonomics offers rules and techniques for 'humanizing' work based on the principle of 'adapting work to people'.

### WELL-BEING AND PROFITABILITY

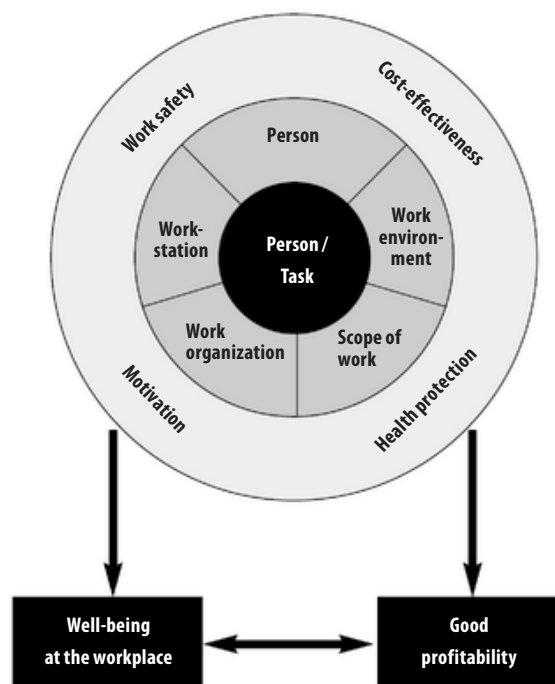
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Ergonomics can do more than just improve employee comfort and satisfaction. Creating an ergonomic workstation layout consistently contributes to profitability. The factors that influence people during work and that can result in improved profitability are found on the 'ergo wheel'. The person and the task are at the center. The action circle contains the actively changing ergonomics areas that, in turn, directly impact the areas of the reaction circle.

## OCCUPATIONAL SCIENCE – CONTENTS AND TASK

The term 'ergonomics' was first used in 1857 by Polish scientist Wojciech Jastrzebowski to designate a scientific discipline. And then in 1949, a group of scientists led by Englishman K. F. H. Murrell coined the term 'ergonomics' from the Ancient Greek words *ergon* (= work) and *nomos* (= natural law), which became widely known. By this they founded a new branch of science concerned with systematically researching the abilities and properties of people with regard to their handling of technical instruments.

The goal was to derive specific information and suggestions for the improved technical design of tools, instruments, and machines. The catalyst was a number of studies conducted during World War II that examined this field. Those studies were considered so important that they became integrated with civilian applications as well.



<sup>1</sup> From: Ergonomics, a Success Factor for Every Company.  
Schweizerische Unfallversicherungsanstalt (SUVA)

# 3. Applied Ergonomics for Improved Microscope Workstations

Countless occupational health studies throughout the world have shown: If ergonomics is applied at the workplace on a scientific basis, it not only has direct effects on the general well-being of employees, but on their performance capacity and thus, on profitability.

Optical tools such as microscopes are necessary for examining microstructures. However working at a microscope for multiple hours per day places high strain on a user's eyes and muscles for posture, as well as the user's ability to concentrate (see Fig. 20, Page 25). These strains are considerably higher than those experienced by users at computer monitor workstations.

This chapter focuses primarily on microscope users and those responsible for setting up microscope workstations. It contains specific information and valuable tips on how to reduce health risks, particularly using:

- Good instrument ergonomics
- Optimum workstation ergonomics
- Varied workflows
- Regular breaks and rest periods
- Adequate personnel qualification
- Training for users
- Awareness of potential issues



## NO TWO PEOPLE ARE ALIKE

An optimal workstation setup differs on an individual basis since every person's size and stature is different. This is why, for instance, the given height of a microscope does not automatically fit the body height of the user; it also depends on the task, accessories, working distance, and sample. Physical discomfort and decreased performance are inevitable with a one-size-fits-all workstation configuration..

A viewing position that is too low forces the observer into a stooped posture. Predictably, this causes muscle tension in the throat and neck area. This is why the viewing angle and height of a microscope should be adjustable and adaptable to the size of the user.

Changing from an upright, straight posture to a relaxed, slightly hunched posture can be achieved by repeatedly adjusting the seat's height, but this is not practical. Compensating for height differences using a variable binocular tube is much easier and more convenient. Dynamic sitting reduces stress on a person's posture to a minimum. User can perform their tasks for longer periods and do not tire as quickly.

A variable viewing height is the most effective measure for avoiding a static, tiring posture at a microscope. It allows the user to have an optimal sitting posture and to change it at any time as natural movement needs dictate.



2



3

2 Perfect sitting height in relation to the workstation

3 This sitting posture is not suitable for long-term work at the microscope.

## ALL CONTROLS IN EASY REACH

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Users should operate frequently used microscope controls such as zoom and focus comfortably and without stress. Firstly, the controls have to be positioned as low as possible on the microscope. Secondly, the user should be able to operate them with propped-up forearms and relaxed shoulders. Furthermore, the user should not fully stretch the arms; this will avoid straining the shoulder girdle. From an ergonomic point of view this means: A horizontal or slightly downward forearm position with the backs of the hands pointing upward is preferred. The adjustment knobs should not be too easy or too difficult to move. It is ideal if the ease-of-movement is entirely configured according to individual needs. When viewing a high magnification levels, fine adjustments ensure more precise focusing.



**4** A knob that allows both coarse/fine adjustment is ideal for fine focusing and makes work easier.

## WORKSTATION MOBILITY

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Workstation ergonomics considers the table and chair in addition to the instrument. While the work instrument with its adjustment options could be said to be responsible for fine-tuning to the work at hand, the worktable and chair allow individualized coarse adjustments. These components, with adjustable height and tilt angle, must ensure that the whole body – from head to toe – is positioned and working with perfect posture. The question of posture is critically important because work at a microscope usually takes a long time and requires a high degree of concentration. Height-adjustable microscope tables that provide sufficient support surface for the arms, and chairs that can be adjusted to the size of the user, provide ideal conditions. A pitch of up to 30° on an ideally tall backrest promotes comfortable, stress-free sitting (see Fig. 23 and 24, Page 27). If an activity requires a forward-leaning position, the user should not have to lean forward more than 20°.

## SPECIFIC SUPPORT FOR THE HANDS AND ARMS

---

Tasks requiring fine motor skills to align, manipulate, and prepare samples require suitable hand supports and armrests without hard edges. The base of the stand itself can actually support the hands. The elbows should not be supported in order to avoid point loads. The appropriate design of additional instruments, such as a soldering iron, is also important. They should not force the hand into a unfavorable position and should not be too heavy.

## **OPTICS SYSTEMS: VIEWED OBJECTIVELY**

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There are numerous documented cases in occupational health literature regarding eye strain during work using a microscope. This discussion requires specialized knowledge of the properties of optical equipment and illumination technology and is outside the scope of this manual. We have provided a separate space for this topic under the section 'Attention to Light and Sight' in Chapter 5. Nevertheless, an important insight can be summed up in one sentence: Investing in a high quality lens system prolongs the duration of visual work and reduces fatigue. High-quality microscopes feature optical and mechanical characteristics that lesser quality instruments cannot provide. One example of this is parfocality, which makes constant refocusing unnecessary. Flat-field (planachromatic) objectives also contribute in the same way, bringing the entire field of view into sharp focus instead of – as is the case with less complex objectives – either the edge or center of the image.

## **THE EYEPiece: CLOSER TO THE USER**

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Eyepieces play an essential role in every microscope and are the visual interface to the user. Widefield eyepieces with an adjustable diopter and adjustable eyecups for eyeglass wearers are always recommended. 'Widefield' observation not only shows a larger area of the sample, observation over time is more effective because the orientation within the sample is easier, and it is easier for the eyes to adapt. Eyepieces for eyeglass wearers have a large exit pupil positioned further in front of the eyepiece lens and allow work with or without glasses. Finally, the eyecups hide ambient light and bothersome reflections on the eyepiece lens coming from the sides.

## AIR AND LIGHT: THE ENVIRONMENT COUNTS

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Work performance and satisfaction do not just depend on the ergonomics of the workstation. They are enhanced by positioning of a workstation within a room as well. Factors such as climate, light, noise, vibrations, and hazardous materials have a direct impact on the well-being and productivity of people during work. The lighting condition in a room and the field of view itself can contribute significantly to reducing eye strain, for instance. Also, the variation in brightness between workstation lighting and the field of view in the microscope must not be too significant. Good visual comfort is achieved with uniform illumination of the field of work and average brightness. Direct glare from light sources, reflections, and shimmer must be avoided, since they cause premature eye fatigue.

## BREAKS FOR MORE VIEWING

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Change also makes work more enjoyable. In other words, well-organized workflows (such as job rotation) are an effective measure for avoiding problems due to repetitive muscle use. Frequent changes between different microscopy tasks and, if possible, working without a microscope at times is recommended. The daily work period should be shortened whenever it is not possible to make the activity more dynamic, and employees should be encouraged to take breaks between periods of work at the microscope. Various studies have shown that frequent, brief pauses can allow the eyes and muscles to recuperate. Work can be observed with a new perspective if these intentional work breaks are also used for relaxation exercises.

People that use microscopes in their work normally have a high degree of responsibility, whether in a research lab or a quality assurance department. Highly qualified employees that are well trained, can concentrate on the work at hand, and are concerned with accurate work, make excellent microscope users. Visual acuity and the load capacity of the musculoskeletal system should receive particular attention.

Stereomicroscope work utilizing fine motor skills does not just require good stereoscopic sight, but a steady hand as well.



**5** A gliding stage helps with positioning the sample – especially at high magnification levels.

## TRAINING AND EXERCISES FOR GOOD POSTURE

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A comprehensive introduction for personnel is especially important for demanding activities – and, in fact, it is really a matter of course. Instruction for working on a microscope should integrate ergonomic, work organization, and optics-related points of view. Continuous occupational health support and consulting are other areas of instruction that are increasingly important.

Knowledge and exercise are the most important ways to reduce physical and visual discomfort when working at a microscope: Knowledge of the options for optimal workstation layout/organization and consistent application of that knowledge. Repeatedly practicing precise microscope settings, such as diopter settings, sharpness, and illumination, comes into play as well.



6 A company medical officer or trained employee should provide instructions for correct posture at a microscope.



## THE PATH TO AN OPTIMAL SITTING POSITION

1. The chair should be configured for the person.

- Tilt the seat forward slightly so that there is  $100^{\circ} \pm 5^{\circ}$  angle between the upright torso and the upper thighs. This allows improved blood circulation to the legs and requires less exertion (see Fig. 25, Page 26).
- Adjust the backrest to the person's (upright) torso. The lumbar support should be precisely in the lumbar area/small of the back.
- Adjust the seat's working height, while keeping in mind that the feet can rest on a raised surface or footstool. The ideal footstool would be adjustable and equipped with a tilt function.

2. Optimize the workstation according to all aspects of work organization. Adjust the microscope based on the sample to be observed. Using a larger stand allows additional clearance (see Leica auxiliary modules in Chapter 8).

- Looking into the microscope should affect the body's verticality as little as possible, during both sitting and standing activity.
- Fine-tune using the armrests and headrest.
- Use angled stands to facilitate easier document reading.

3. Movement is the best aid for healthy posture!

In the following section, we present an effective exercise program that can even be practiced at a workstation to prevent and help to relieve muscular tension. No auxiliary equipment is necessary, but a soft underlay or mat can make the exercises more comfortable.



7



8

7 A footstool is critical for ergonomic posture if the height of the workstation cannot be adjusted.

8 A height-adjustable armrest prevents tension on the arms and shoulders.



## 4. Exercises for Spinal Column Care

### Stretching your thoracic vertebrae

Stretch out both arms horizontally in front of you. Cross your arms and turn your thumbs so they point toward the floor and interlock your fingers.

Now twist your left arm downward until you feel the stretch on the right side of your body. Do the same with your right arm and the left side of your body. Breathe deeply in and out three times each time you reach the end position.

Grab your wrist and bring it over your head until you can feel the stretch in your side.

Breathe deeply in and out three times each time you reach the end position.

*2x per side*

### Stomach, legs, gluteal muscles

Take a large lunging step backwards and guide your knee to the floor. Breathe in during this action. Then, while breathing out, slowly lift your knee until you are standing and your thigh is horizontal to the floor.

*10x per side*

This exercise can be more intensive by using a soft underlay.





### Stretching your neck muscles

Let your head hang loosely and gently swing your head from side to side. Start with small movements, gradually getting bigger until your chin is pointing toward your shoulders.

*10-20x swings*

Turn your head to the side until your chin is above your left shoulder. Nod up and down, slowly covering your full range of motion.

*10x per side*

In order to stretch the muscles in the front of your neck, carefully lean your head back against your neck and hold it there for approximately 15 seconds.

*Repeat 2-3x*



### Stretching your thoracic vertebrae (more)

Place your left hand on your left knee. Place your right hand on the back of your neck and guide your right elbow to your left knee, as you breathe out. As you breathe in, point your elbow to the right and behind you while looking in that direction.

*5x per side*

Change your sitting position often throughout the day.

**Our tip:** Sit on the edge of your chair and roll your hips forward and back.

**Stretching your back and chest muscles**

Place your hands on your knees and deeply breathe in through your nose. Glide your hands along your shins as you breathe out until you reach the floor and leave your head hanging. Return to your initial position as you breathe in.

*5-10x*

Interlock your fingers behind your neck; push your elbows out and your head back as you breathe in. As you breathe out, bring your elbows together in front of your head and bring your chin to your chest.

*5-10x*

This exercise stretches the frequently contracted muscles in the front of your body. Place both of your hands on your hips from behind. While kneeling or standing, push your pelvis as far forward as possible while stretching your head backward.

*2 x 15-30 seconds*



## A HEALTHY OUTLOOK BRINGS SUCCESS

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Lifestyle and personal behavior affect the subjective perception of workload. Getting too little sleep, taking medication or using substances such as caffeine, nicotine, and alcohol can reduce visual acuity and lead to unsteady hands. Strenuous sports activities before work can amplify shaking hands. Regular and moderate sports activities during time off are a good idea – both for general well being and for preventing atrophy or detrition in muscles and joints.

## SUMMARIZED ...

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Ergonomics is highly important for well-being at the workplace. Health risks can be significantly reduced by using microscope workstations that are designed according to fundamental ergonomic principles. This includes designing as many system elements as possible in relation to each other so that people can work productively, without overstraining muscles for posture or their eyes.

In practice, since each person has different physical requirements and each activity presents particular challenges, each workstation has to be checked and set up on an individual basis. Moreover, each workstation should be inspected at regular intervals.

## ... ERGONOMICS PAYS OFF

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Since more and more activities require microscopes, designing these workstations optimally with regard to enhancing performance and reducing discomfort also makes sense for cost-effectiveness. This not only applies to the actual layout of the workplace but to the scope and organization of work, and the microscope itself. Successfully implementing these aspects requires a well-founded, task-related, specialized knowledge about the physiological basis of vision and motor skills. Viewed as a whole, the initial investment in ergonomically well-designed workstations and equipment amortizes quickly and can pay off for all parties involved over the long term in the form of better performance, increased quality and, last but not least, fewer absences for health reasons.

## 5. Attention to Light and Sight

People looking into a microscope all day need more than just a workstation designed optimally in terms of anatomy. Particular conditions have to be created for the eyes as well in order to ensure fatigue-free vision. Light has to be guided to the sample uniformly and without glare. Dazzling light reflections from highly reflective samples (printed circuit boards, electronic components, metals, etc.) should be avoided. Depending on the scope of the task – such as visual inspection of electronic components – the optics should provide a large depth of field, which saves the time spent refocusing on the sample.

In recent years as compared to other microscope manufacturers, Leica Microsystems optimized the largest number of instruments in terms of fatigue-free vision. Moreover, Leica offers additional components for special requirements:

### RING LIGHT ILLUMINATOR

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Adding a ring light illuminator is the perfect solution whenever uniform illumination of the sample is a specific requirement. Thanks to special LEDs, the entire sample area is brightly and uniformly illuminated. Sample details can be clearly, quickly, and reliably detected and assessed.

### POLARIZATION SET

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Quality control work in the electronics industry causes headaches for many employees in the truest sense of the word. Reflective samples like printed circuit boards can often be observed only under the most difficult conditions. Strong light reflections tire out the eyes and make complete visibility difficult. This is extremely fatiguing, costs valuable time, and may cause defects to be missed. A polarization filter set is an optional component of the ring light illuminator mentioned above. The polarization filter can be freely rotated, allowing the perfect ratio of light and sight to be set quickly.

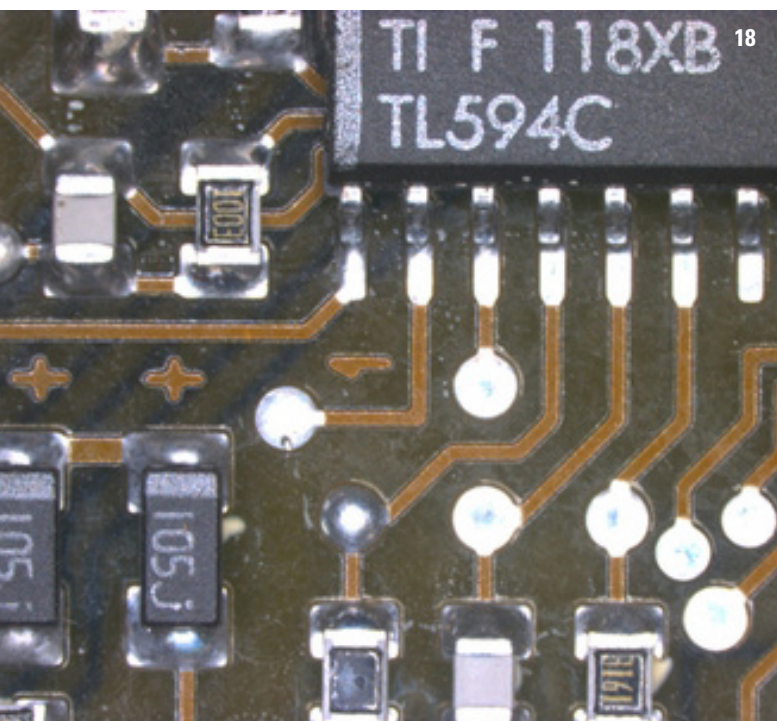




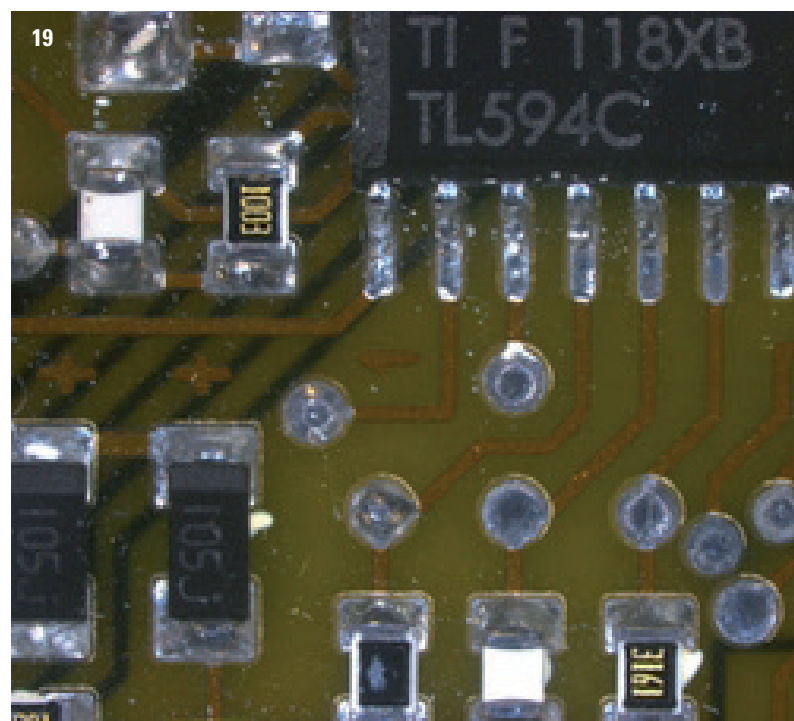
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18



19

**16** LED3000 RL ring illuminator with diffuser for reducing reflections

**17** LED3000 RL ring illuminator with additional polarization set

**18** Printed circuit board under LED incident light. The soldering points are completely overexposed and are full of glare when viewed.

**19** Glare-free viewing is possible by using the polarization set. This causes noticeably less stress on the eyes.

## GREAT DEPTH OF FIELD

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Complete visualization of three-dimensional samples requires the use of optics with the highest possible depth of field. Leica microscopes feature high-quality optics that require minimal refocusing.

## LARGE FIELD OF VIEW

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Quality control often involves the inspection of large parts that cannot be wholly visualized at a single glance due to their size. Leica Microsystems' new generation of stereomicroscopes feature a large object field for this very reason. For instance, increasing the field number from 21 to 23 cm results in a 20 % increase to the field of view. For the user, this means less readjustment, faster inspection, and a noticeable increase in efficiency.

## THE STEREOMICROSCOPE OPTICS SYSTEM: THE BASIS FOR ERGONOMIC WORK

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- The design principle: A main objective and two parallel observation beam paths – for fatigue-free viewing
- High-quality optical glass and multilayer coating for bright, clear images
- High resolution for improved visibility of the finest details
- Pronounced stereoscopic image impression for improved depth perception
- Less focusing work thanks to large depth of field
- Perfectly coordinated optical components for parfocality (constant sharpness from the lowest to highest magnification level)
- Large field of view diameter for improved sample overview
- Flat-field (planachromatic) objectives for sharp imaging of the entire field of view
- Planapochromatic objectives for high-contrast imaging of the finest details with color fidelity



## FREEDOM OF MOVEMENT: RELAXED WORK AT A MONITOR

The relatively new technology of digital microscopy represents an interesting alternative to working with conventional stereomicroscopes having an eyepiece. For certain types of work, an enlarged display on a monitor alone is sufficient. New HD monitors and an HD camera can provide high-resolution images in real time, which can be recorded as individual images or videos as needed.



- 20** Ergonomic viewing of a sample on a monitor if a 3D image is not needed.
- 21** Regularly switch between a sitting and standing position if possible.
- 22** Changing observation between 2D (on a monitor) and 3D (on a stereomicroscope) helps create more movement at a workstation.

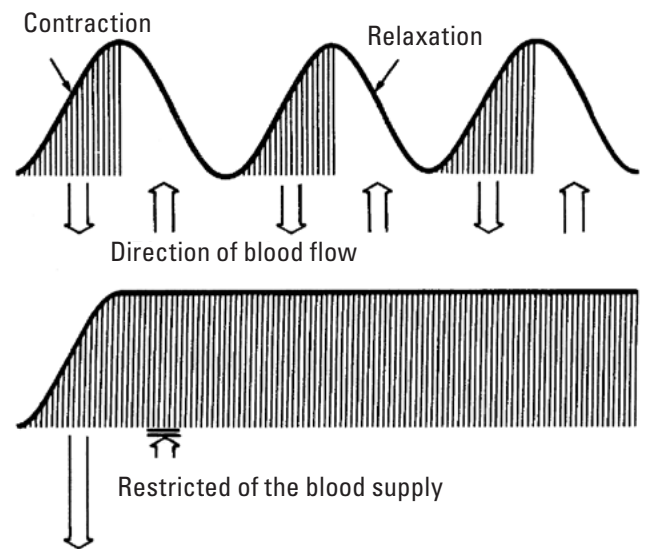


## 6. Ergonomics: Images and Tables

Graphics from: Fitting the Task to the Man. Etienne Grandjean

### DYNAMIC AND STATIC MUSCLE WORK

Dynamic muscle work is characterized by rhythmically tensing and relaxing muscles to create more blood circulation and better blood flow. Dynamic work can be performed at a suitable rhythm for long periods of time without fatigue. Static muscle work (holding work), on the other hand, that microscopy requires causes tensing of muscles for long periods of time. Accordingly, there is less blood circulation than with dynamic tasks. The muscles receive less energy and less oxygen, which results in intramuscular acidemia and can cause a sensation of pain. The better the posture, the less muscle tension is required to hold the posture.

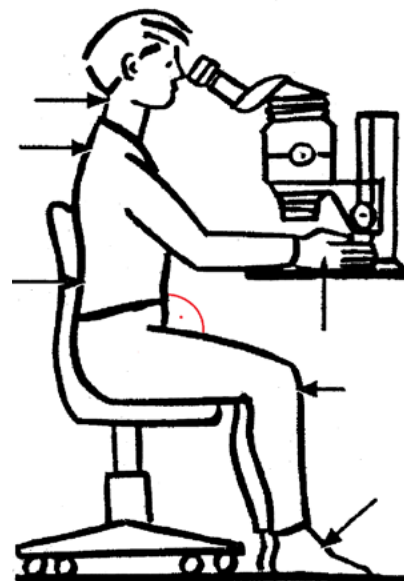


**23** Dynamic work operates like a motor pump for supplying blood to muscles. Static work restricts the blood supply.

### PHYSICAL DISCOMFORT

Discomfort is compounded when workstation layout is poor:

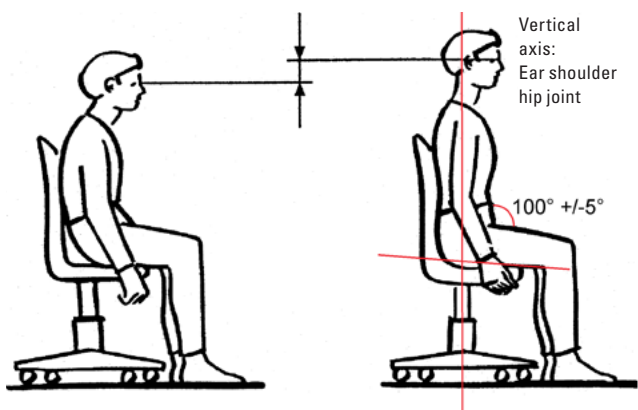
- Pain in the back and neck, in the shoulders, knees, and feet
- Headaches
- Temporomandibular joint pains due to grinding or pressing
- Tinnitus (ringing in the ears)
- Reduced oxygen inhalation
- Venous thrombosis
- Reduced diaphragmatic breathing
- Lymphostasis



**24** Physical discomfort during sitting activities

## UPRIGHT AND RELAXED SITTING

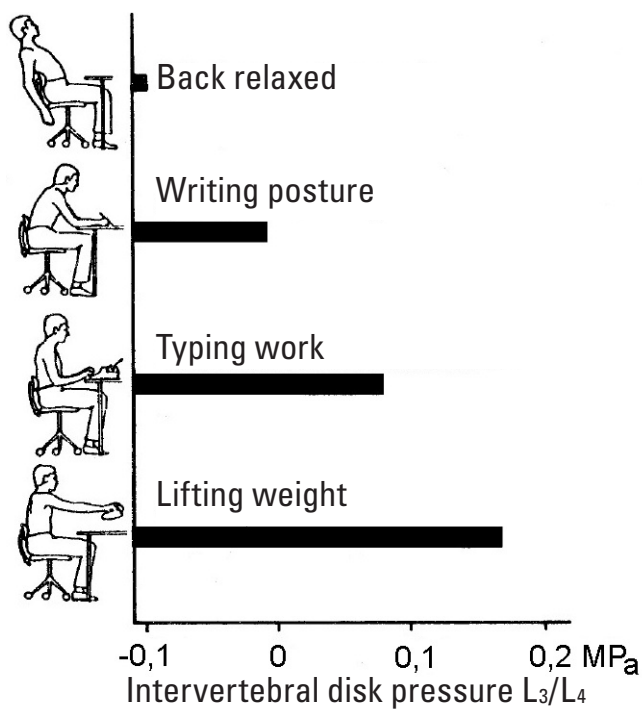
- Sitting upright requires less holding work from the back muscles, which tire and tense less (heavy contraction of the muscles compresses the blood vessels).
- With a relaxed posture and leaning forward slightly, the weight of the trunk balances on itself. Less stress is placed on the back muscles over time.



25 Upright and relaxed sitting

## INTERVERTEBRAL DISK PRESSURE

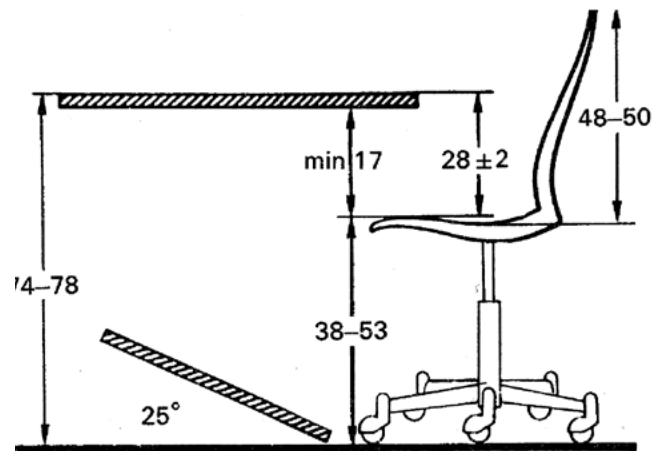
- Intervertebral disk pressure is lowest when the trunk is relaxed and slightly tilted backward.
- A backrest with a lumbar pad removes tension from the intervertebral disks better than a straight backrest.



26 Effects of different sitting postures on intervertebral disk pressure.  
Lumbar vertebrae L<sub>3</sub>/L<sub>4</sub>. Mpa = 10.2 kp/cm

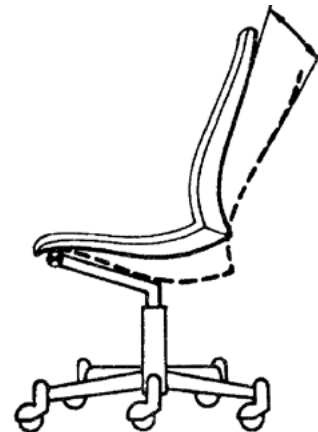
## TABLE AND CHAIR

- In general, the table and chair should be adjustable to a specific user in various ways.
- A tall backrest requires less muscular holding work. A backrest that is slightly concave at the top front and distinctly convex in the lumbar region prevents the user's back from sagging. A tall backrest relieves stress on the intervertebral disks, minimizing back discomfort.



27 Table and chair, adjustable in various ways

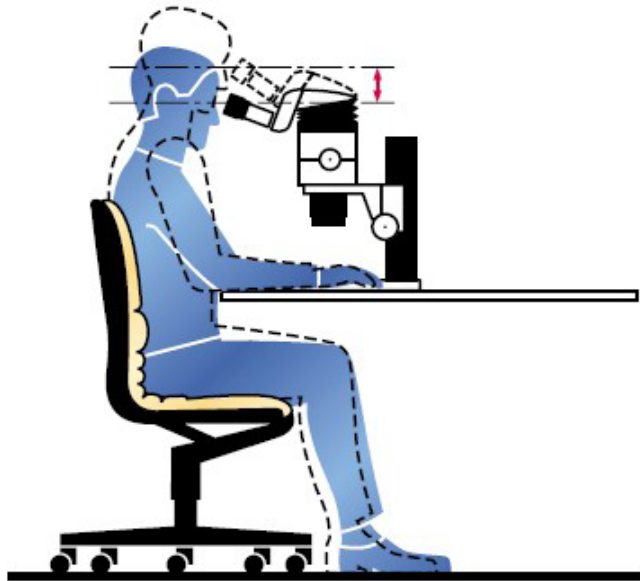
Stress on the intervertebral disks is low for a backrest that is slightly inclined backward (approx. 115° to 120°). This should provide the back with a relaxed position. The user can incline his or her position at various times, such as when adjusting the microscope or changing the sample.



28 An inclined backrest removes pressure on the intervertebral disks.

## POSTURE

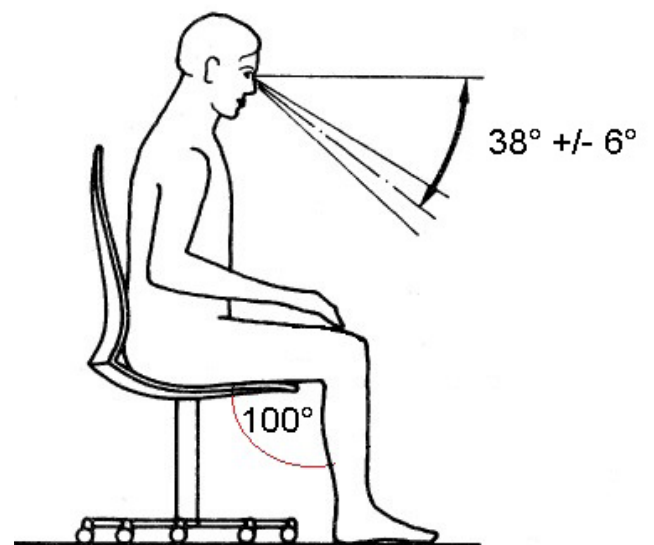
A microscope observation tube with adjustable viewing angle allows very simple adjustment to adapt to a person's body height and changes to posture during work (dynamic sitting). The legs should not be crossed. It is best to keep the knees slightly apart. There should not be any bothersome objects in the back pockets, such as a cell phone or wallet.



**29** Relaxed body and head posture, comfortably supported arms, sufficient room for the legs, good use of the chair

## VIEWING ANGLE

The field of work continuously visualized by the eyes must be located so that the person can assume a comfortable head posture. Angles pointing too far down or up lead to signs of fatigue in the neck muscles over time.



**30** Favorable viewing angle

## MONOTONY OF WORK

Humans reacts to monotonous work with fatigue, lethargy, discomfort, and loss of attentiveness. This results from prolonged activities with few changes that have a low degree of difficulty or during monitoring work with few interesting developments.

### REPETITIVE, MONOTONOUS WORK VIEWED FROM VARIOUS SCIENCES:

| From the view of     | Potential consequences                                     |
|----------------------|------------------------------------------------------------|
| Medicine             | Atrophy (shrinkage) of mental and physical organ systems   |
| Work physiology      | Monotony; risk of mistakes and accidents increases         |
| Work psychology      | Low work satisfaction                                      |
| Ethics               | Development of human abilities is impaired                 |
| Occupational science | Absence from work increases; open positions are not filled |

## SKILLED WORK

Using a microscope requires rapid and fine-tuned muscle contractions, coordinated and precise muscle movements, and vision with a high degree of concentration.

### FACILITATING INDIVIDUAL PROCESSES FOR SKILLED OPERATIONS:

| Processes         | Measures                                                                                                                                                                                                                                    |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Perception        | <ul style="list-style-type: none"> <li>• Working with visual inspection</li> <li>• Optimal visibility of the task</li> <li>• Adequate lighting and color availability</li> </ul>                                                            |
| Attentiveness     | <ul style="list-style-type: none"> <li>• Prevention of distractions</li> <li>• Noise control</li> <li>• Clear arrangement of objects at the workstation</li> <li>• Logical work organization</li> </ul>                                     |
| Movement sequence | <ul style="list-style-type: none"> <li>• Rhythmic movement sequences</li> <li>• Avoiding the use of force in multiple ways simultaneously</li> <li>• Ergonomic arrangement of the work area</li> <li>• Optimization of workflows</li> </ul> |

## 7. Quick Test: Should I Invest in Ergonomics?

You can determine the benefits and importance of ergonomics for your company by answering the following questions:

| Does your company want to                         | YES | NO |
|---------------------------------------------------|-----|----|
| Increase work safety                              |     |    |
| Reduce illness-related absences (back problems!)  |     |    |
| Increase employee motivation                      |     |    |
| Improve employee well-being                       |     |    |
| <b>Does your company have problems with</b>       |     |    |
| Increasing manufacturing costs                    |     |    |
| Increasing maintenance and repair costs           |     |    |
| Decreasing manufacturing quality                  |     |    |
| Susceptibility to failure of production equipment |     |    |
| Meeting deadlines                                 |     |    |
| Customer satisfaction                             |     |    |
| <b>Is the company planning</b>                    |     |    |
| To restructure workstations                       |     |    |
| New facilities                                    |     |    |
| New production processes and equipment            |     |    |

If you checked "Yes" multiple times, there is a good chance your company could use ergonomic improvements. The following actions could be the first steps in the right direction:

1. Determine and analyze the weak points of affected workstations using the questionnaire in Chapter 10.
2. Formulate goals.
3. Create an action plan.
4. Determine cost investment and create a comparative analysis.

## ERGONOMICS – WHAT CAN IT DO FOR MY COMPANY?

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### **Well-being at the workplace**

Ensuring that the workplace as a whole (scope of work, organization of work, work environment, and workstation) takes the capabilities and well-being of people into account is the prerequisite for the best possible work satisfaction.

### **Fewer work absences and sick days**

There can be fewer accidents and illnesses at ergonomically-designed workstations and thus fewer days with absent employees.

### **Increased productivity**

A people-friendly workstation layout is the basis for increased motivation and performance capacity for employees.

### **Improved profitability**

Comprehensive inspection of the workplace and subsequent implementation of ergonomic design can contribute to increasing profitability.

### Why invest in the Leica ergonomics program?

Investment in the occupational health design of microscope workstations is successful for employees and the company if all those involved – users, parties responsible for workstation layout and organization, occupational scientists, occupational physicians, and microscope manufacturers – together create solutions for reducing specific stresses on employees that work at a microscope every day. As a microscope manufacturer, Leica Microsystems can reduce the health impact on the user and contribute to better performance through the design of its instruments. We have addressed these issues more intensively than any other microscope manufacturer through the development of the Leica ergonomics program. An investment in ergonomic working conditions can pay off through more satisfied and healthier employees and through increased productivity and performance.



## THE LEICA ERGONOMICS PROGRAM – AN ASSET FOR USERS AND COMPANIES

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### **The Leica ergonomics program**

- Prevents forced incorrect and rigid posture and reduces fatigue, decreased performance, and physical discomfort
- Provides better and healthier viewing conditions by adapting the microscope's viewing position to the individual and his or her changing posture at any time
- Reduces stress on the user's muscles during work involving fine motor skills since the arms and hands can be supported
- Improves visual clarity since the high-quality optics system does not require any accommodative effort and protects the eye
- Enables the user to work with concentration, increased safety, and speed, which can improve well-being, motivation, and performance capacity

### **For the company, this can result in**

- Increased productivity
- Better quality
- Lower costs
- Less downtime
- Improved safety
- Increased reliability
- Competitiveness
- Better profitability

## 8. The Leica Ergonomics Program

Leica Microsystems offers the largest product range of various binocular tubes and ErgoModules. These components and accessories allow every Leica stereomicroscope user to assume an optimal sitting posture and to easily change position at any time. Rigid, awkward posture is relieved with dynamic, less stressful sitting.

The height-adjustable connecting pieces (bellows) and binocular tubes with a continuous working angles represent a range of options for the best ergonomic microscope workstation.



**31** Simple microscope upgrade using ergonomic modules from Leica Microsystems



### IN EVERY PRODUCT AND PROCESS

- Leica Microsystems has an internationally recognized ISO 9001 standard quality certificate ensuring quality management and a quality system at the highest level.
- The high quality and security standard meets strict requirements for product liability and helps to minimize risks and lower costs.
- Investment costs are reduced by the high degree of safer function in Leica products and their reliability and durability even under extreme stress.
- Comprehensive, user-friendly product documentation logically structured for learning and conforming to liability requirements simplifies and shortens the training phase, helps resolve operating questions, and provides safer instrument handling.
- The availability of Leica after-sales service in more than 100 countries ensures professional consulting and quick service.



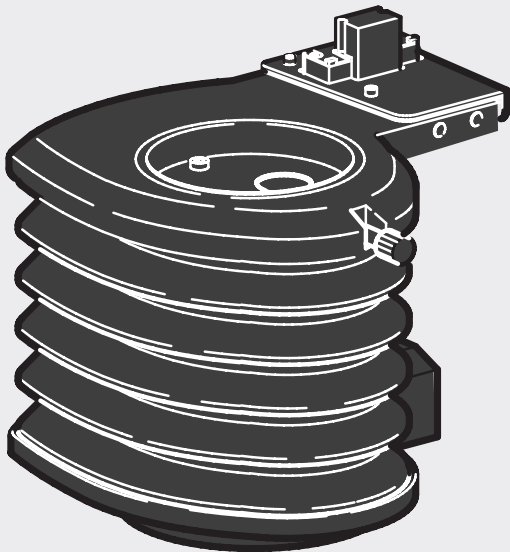
## VARIABLE MODULES

---

### **ErgoWedge™ 5°-25°**

Article No. 10 446 123

Spacer that changes the viewing angle of the binocular tube being used continuously by 5° to 25°. Viewing point relocated up to 65 mm closer to the observer. Better viewing conditions with various binocular tubes. Made from antistatic material.



### **ErgoModule™ 30 mm to 120 mm**

Article No. 10 446 171

The ErgoModule™ 30 mm to 120 mm enlarges low-built stereomicroscopes and enables users of different heights to optimally configure the viewing position when sharing a single instrument. Made from antistatic material.

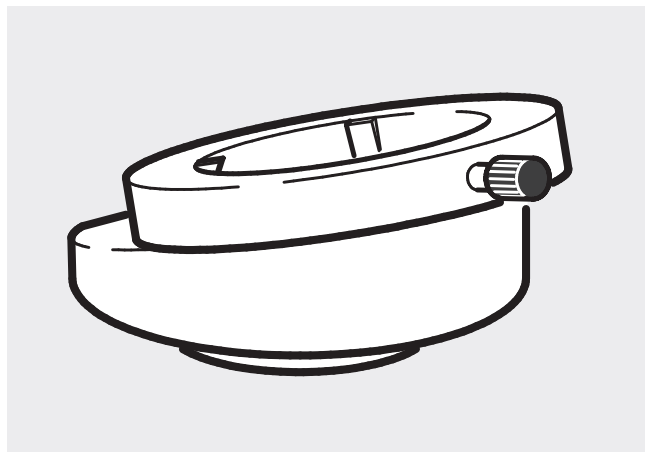
## FIXED MODULES

---

### **ErgoWedge™ ±15°**

Article No. 10 346 910

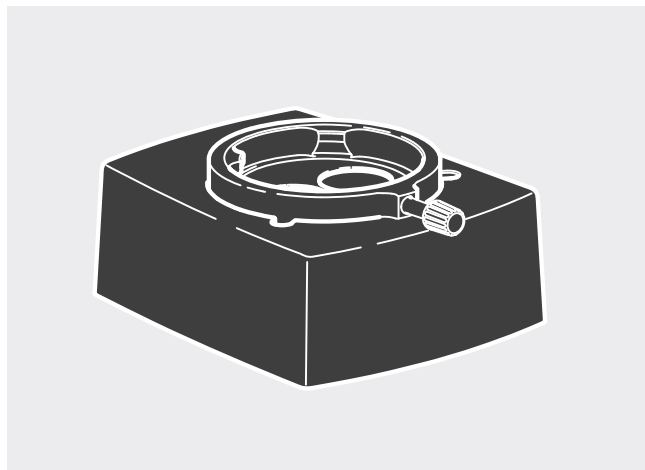
Fixed spacer that changes the viewing angle of the binocular tube being used by two angles, +15° and -15°. Better viewing conditions for various equipment configurations.



### **ErgoModule™ 50 mm**

Article No. 10 450 303

Fixed spacer sets the viewing height of the binocular tube being used 50 mm higher. Better viewing conditions for taller users.



## VARIABLE TUBES

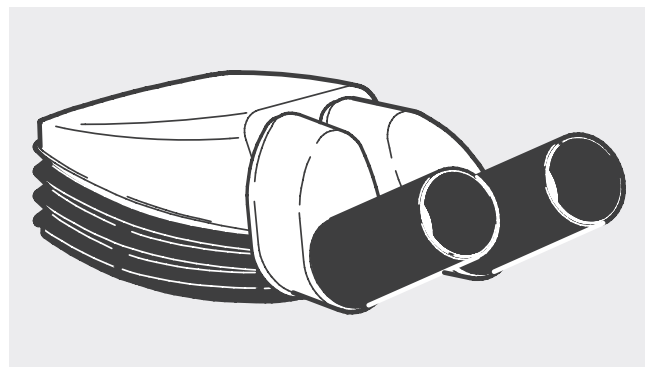
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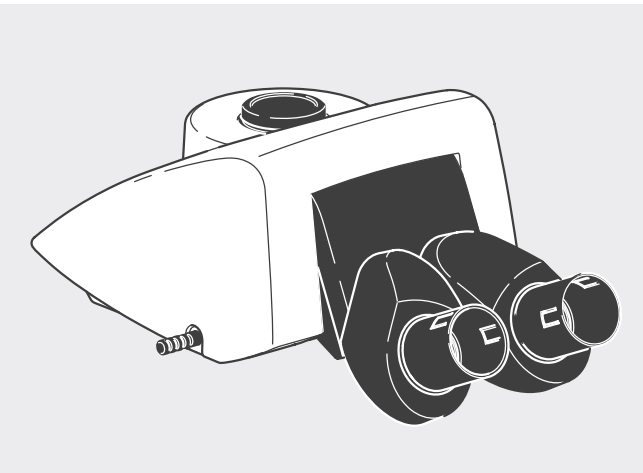
### **ErgoTube™ 10°-50°**

Article No. 10 450 158

Observation tube with variable viewing angle, continuous 10° to 50° adjustment range.

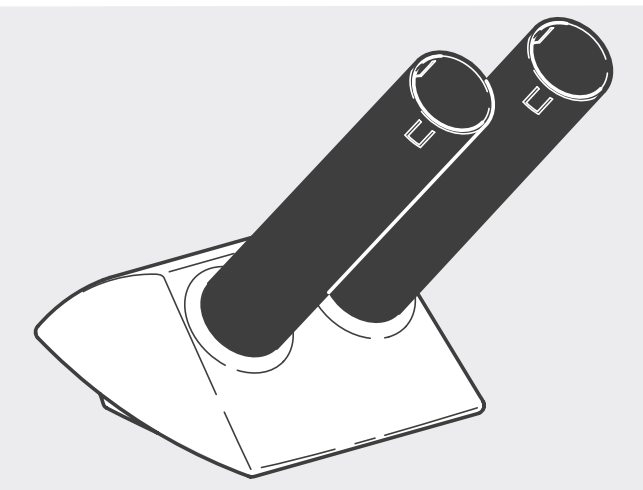
Low viewing angle, large extension. Better viewing conditions for short and tall people for various equipment configurations. Apochromatically corrected. Made from antistatic material.



**Trinocular ErgoTube™ 5°-45°**

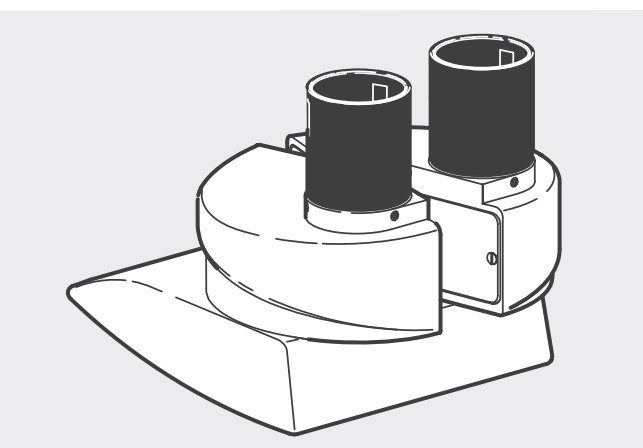
Article No. 10 450 044

Combination observation/photo tube (0 %/100 %) with variable viewing angle, continuous 5° to 45° adjustment range. Optionally with low or high viewing angle. Perfect viewing conditions, for tall and short people, particularly for taller equipment configurations.

**FIXED TUBES****ErgoTube™ 45°**

Article No. 10 450 156

Upright posture due to viewing point moved 65 mm closer to the observer, and 65 mm higher. Interpupillary distance up to 90 mm, 1.6x magnification factor. Made from antistatic material.

**Straight binocular tube**

Article No. 10 450 157

Straight eyepiece for work with an inclined stereomicroscope on a swing-arm stand or bonder.

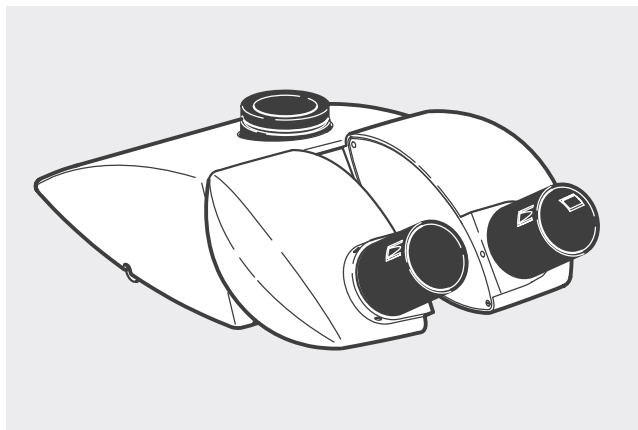
## FIXED TUBES (CONTINUED)

### **Trinocular video/photo tube**

Article No. 10 450 042, 50 % or

10 450 043, 100 %

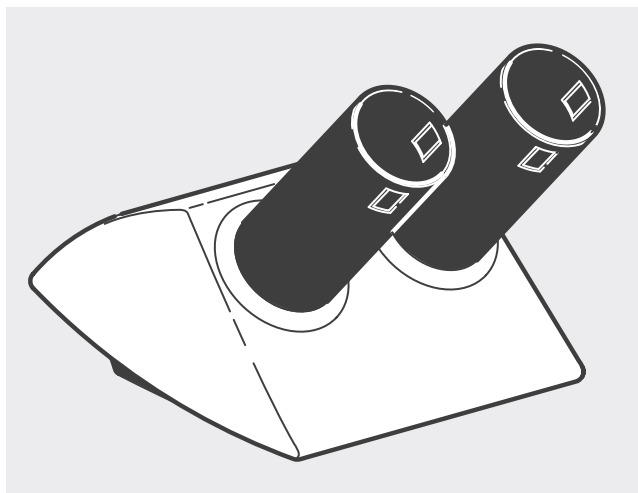
Combination observation/photo tube with low viewing height. Better viewing conditions for taking photos with additional accessories.



### **Inclined binocular tube 45°**

Article No. 10 450 252

Observation tube with 45° eyepiece for standard equipment configurations. Fits ErgoModules and accessories such as video/phototubes, drawing tube, coaxial illuminator. Made of antistatic material.



### **Widefield eyepieces for eyeglass wearers, distortion-free**

Article No. 10 450 630 (10x), 10 450 631 (16x)

10 450 632 (25x), 10 450 633 (40x)

Work with or without eyeglasses, adjustable eyecups, distortion-free imaging. Diopter settings adjustable from +5 to -5.



## FOR ERGONOMIC OPERATION

### Motorized focus system

Article No. 10 450 502 motorized focus with column (420 mm) and power supply for incident light and transmitted light bases.

Article No. 10 450 503 motorized focus with column (620 mm) and power supply for incident light and transmitted light bases.

Effortless operation without applying force by using manual control, a footswitch or computer. Hands-free for procedures that benefit from the use of a footswitch. Increased flexibility for work posture. Uniform ease of movement in both adjustment directions, even with heavy equipment configurations. Saves time by quickly moving to saved positions.

### Focus drive

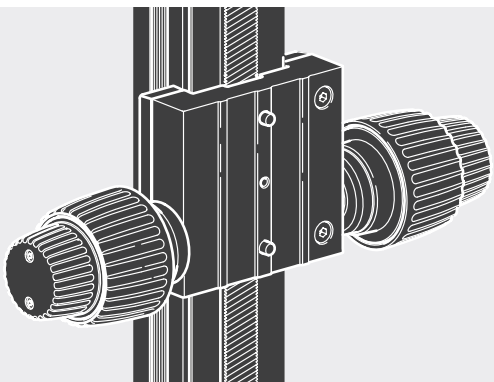
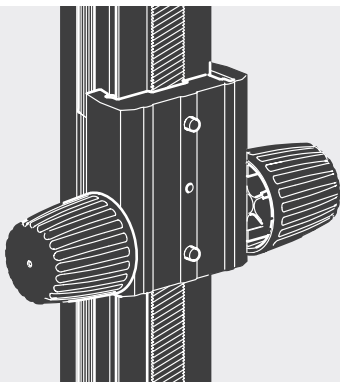
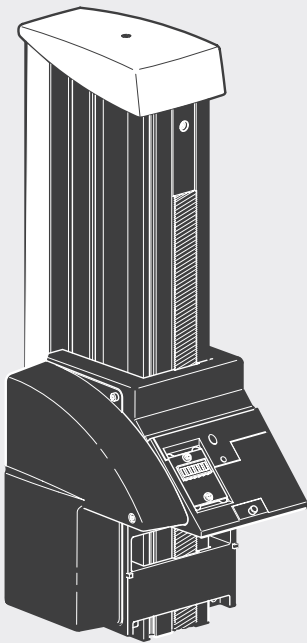
Article No. 10 450 171 (300 mm)  
10 450 172 (500 mm)

Drive knobs with individually adjustable ease of movement on both sides, low positioning, convenient operation with propped-up hands.

### Focus drive, coarse/fine

Article No. 10 450 299 (300 mm)  
10 450 300 (500 mm)

Fine focus for high magnification level drive knobs on both sides, low positioning, convenient operation with propped-up hands.





**Transmitted light base**

Article No. 10 450 541 (Leica TL5000 Ergo)

Ergonomically optimized transmitted light base. The low height and generously designed work surface enable pleasant bright-field and darkfield work. With integrated oblique illumination for low-contrast transmitted light samples.

Article No. 10 447 431 (ErgoRest™)

Leica ErgoRest™ Handrest for working on the Leica TL3000 and TL4000 transmitted light base for long periods.

**ADAPTABLE STAGES**

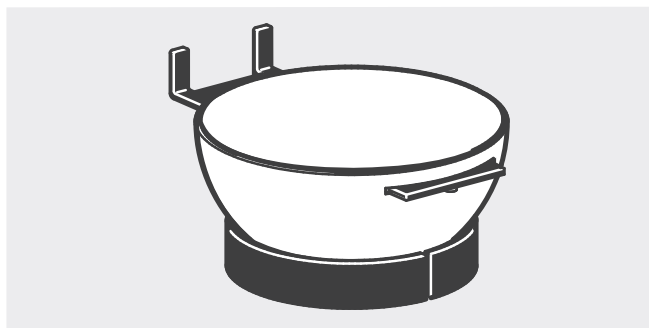
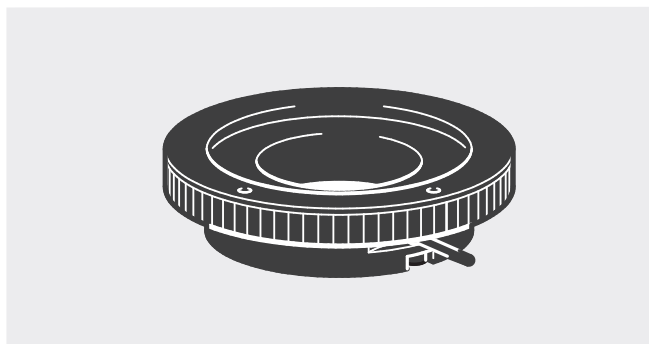
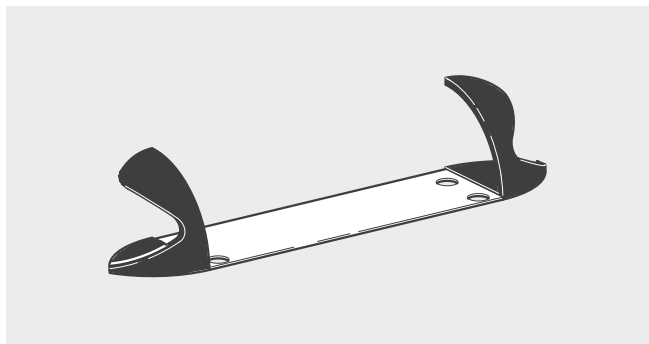
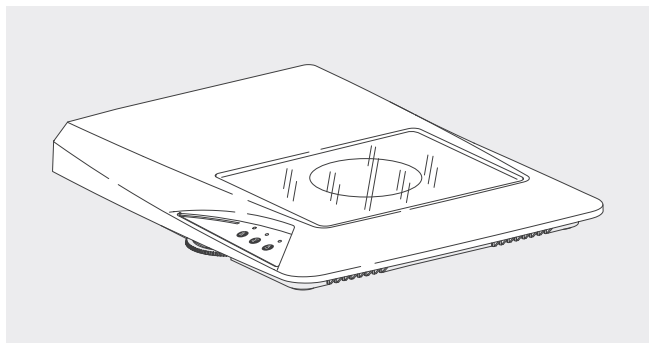
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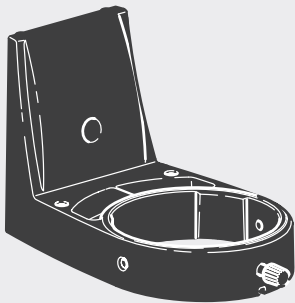
**Gliding stage** Article No. 10 446 301

Facilitates sample handling. Sensitive movement of samples. Use on incident and transmitted light stands, with stage plate, black and white, glass insert or cup stage.

**Cup stage** Article No. 10 446 303

Obtain new insights when simultaneously rotating and tilting a sample. Easy and intuitive operation.

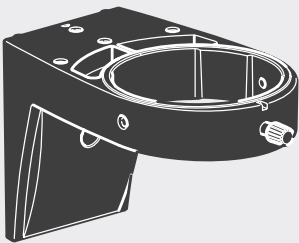




### Microscope carrier

Article No. 10 450 173

Microscope carrier can be installed for two base heights (high/low) depending on the sample size and working distance. This always keeps the focus drive in an ergonomically favorable position.



### Revolving optics carrier

Leica M50 / M60 / M80

Optics carrier can revolve 360° in the side of the microscope carrier. Adjustment of the viewing direction to the work situation. Comfortable observation without tiring head rotation.

## 9. List of Ergonomics Literature

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- Drury, C.G., Bhatnager, V.: Microscope inspection standards.
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# 10. Questionnaire for Ergonomic Workstation Layout

The following questionnaire is intended to serve as an aid for the systematic review of workstation layout.

The questionnaire has been revised in parts and is taken from:

*Conrady, P., Krueger, H., Zülch, J. et al. Etienne Grandjean. Untersuchung der Belastung bei Lupen- und Mikroskopierarbeiten.*

(A more detailed questionnaire for checking off items can be found there).

Fitting the Task to the Man.

## PART 1: QUESTIONS ON WORK ORGANIZATION

---

### Personal characteristics

- Do you wear glasses?
- Do you wear glasses while working at the microscope?

### Activity, tasks

1. Describe the task at the microscope (assembly, monitoring, analysis, other).
2. Primary job:
3. Secondary job:
4. Do you use a binocular microscope/stereomicroscope?
5. Were you trained how to use the microscope at the beginning of your employment?
6. Body position (sitting, standing, hunched)

**Muscle work**

7. Does the work require substantial static muscle work?
8. Can this be made easier using hand supports?
9. Is there strenuous dynamic work?

**Work period, breaks**

10. How long have you been employed at this workstation?
11. On average, how many hours per day do you work at the microscope?
12. Do you have to look through the microscope non-stop for 1-2 hours?

**Tasks during microscopy**

13. Do you mostly perform the same task at the microscope?
14. Do you usually have the same posture at the microscope?

**Shift work**

15. Is your work at the microscope part of shift operations?

**PART 2: QUESTIONS ABOUT PHYSICAL DISCOMFORT**

---

**Musculoskeletal system discomfort**

1. Have you had physical discomfort before, during or after work?
2. If yes, where do the individual instances of discomfort occur: left/right/middle, torso, legs, arms, neck?
3. Specify the type of discomfort, e.g., stiffness, burning sensation, pins and needles, pain.
4. Is the discomfort persistent or able to be relieved with movement, or only able to be relieved with a relaxed posture?

**Visual discomfort/eye problems**

5. Is your discomfort triggered by work at a microscope?
6. If yes, please answer the following questions; otherwise continue with Part 4.

7. Do you have the following symptoms:
  - Tiredness, heavy eyelids.
  - Eyes that itch, sting, burn, are watery or painful.
  - A sensation of sand in your eye.
  - Red eye.
  - Pain from bright light.
  - Blurry vision.
  - Seeing flashing lights.
  - Is your vision blurry when your focus changes from nearby objects to distant objects?
  - Do you see better if you close one eye?
  - Headaches?
8. How often does the discomfort listed above occur?
  - Almost daily (more than 2 days per week).
  - Occasionally (multiple times per month).
  - Rarely.
9. How long have you had the discomfort listed above?
10. Have you visited a doctor due to the discomfort listed above?
11. Did you have problems back when you started your work? What kind?

### PART 3: EVALUATION OF THE MICROSCOPE BEING USED

---

#### **Optical properties**

1. Can the magnification be properly set?
2. Can the sharpness be properly set?
3. Does the image shake?
4. Is the entire image field in focus?
5. Do you see double images when looking through the microscope for the first time?
6. Does the image become blurry during observation?
7. Do the edges of your glasses cause problems when working while wearing glasses?

#### **Microscope illumination**

8. Can the brightness of the image be properly set?
9. Do you adjust the brightness to your own specifications when starting work?
10. Are there problems with ambient light?

**Microscope ergonomics**

11. The microscope is too tall/just right/too short.
12. The microscope is too far away/just right/too close.
13. The eyepiece is too high/just right/too low.
14. The viewing direction is too steep/just right/too flat.
15. Are the controls arranged so that my natural posture is ensured at all times?
16. Are the controls functional?
17. Is strength required to handle the controls?
18. The drive knobs for focusing are too high/just right/too low in relation to the height of the table.
19. The drive knobs for focusing are too far away/just right/too close.
20. Is there enough freedom of movement?
21. Do visual work and gauges permit natural head posture?

**Instructions for using the instrument**

22. Have you received and read the instrument's User Manual?
23. Is the User Manual easy to understand, technically correct, and complete?

**PART 4: EVALUATION OF THE WORKSTATION**

---

**Workstation ergonomics**

1. Can you adjust the height of the table according to your needs?
2. Does the table top have enough space?
3. Do you have sufficient/insufficient space for your legs and feet under the table?
4. Is the chair ergonomically adjustable? Comfortable/not comfortable? Does the seat cause discomfort?
5. Do you have the option of adjusting the chair to your needs?
6. When you sit at your workstation, do you adjust the height of the seat according to your needs?  
Sometimes/No/Seat height is not adjustable?
7. Does the backrest provide good support/no support for your entire back?
8. Are you able/unable to use your chair to assume a comfortable, natural, relaxed posture?
9. Is a footrest required?



**Environment**

10. Are you distracted by noise or other audible stimuli?
11. Are you distracted by the activities of other people?
12. Are you distracted by operations at the same workstation?
13. Are you interrupted by vibrations?

**Room climate**

14. Is the air too dry? Does the relative humidity match physiological requirements?
15. Does the room climate cause (for you):
  - Eye irritation
  - Rheumatism
  - Fatigue
  - Susceptibility to illness
  - Sensitivity to weather
  - Circulation problems
  - Stuffy nose
  - Colds
  - Other
  - None

**Illumination conditions in the room**

25. Is the brightness in the room sufficient in general? Is there enough light during the day?
26. Are there reflections or mirroring effects at the workstation?
27. Do the light sources provide uniform light (no shimmering from tubes)?

# 11. Up-to-date Information



Order posters at [www.leica-microsystems.com/ergo](http://www.leica-microsystems.com/ergo)

## YOUR MESSAGE TO US

---

**Fax:** +41 71 726 33 99

**Online:** [www.leica-microsystems.com/contact-support/contact-us-online/](http://www.leica-microsystems.com/contact-support/contact-us-online/)

Re: Leica ergonomics program

I would like to take advantage of Leica ergonomics modules

☐ I would like to learn about the following ergonomics modules:

|                                           | Number     |
|-------------------------------------------|------------|
| No. 10 446 123 ErgoWedge™ 5°– 25°         | _____ pcs. |
| No. 10 446 171 ErgoModule™ 30 mm – 120 mm | _____ pcs. |
| No. 10 450 303 ErgoModule™ 50 mm          | _____ pcs. |
| No. 10 346 910 ErgoWedge™ ±15°            | _____ pcs. |
| No. 10 450 158 ErgoTube™ 10°– 50°         | _____ pcs. |
| No. 10 450 156 ErgoTube™ 45°              | _____ pcs. |
| No. _____                                 | _____ pcs. |

☐ I would like to upgrade my stereomicroscope. Model: Leica M \_\_\_\_\_  
Please call me; best time: \_\_\_\_\_ o'clock

Company \_\_\_\_\_

Name/First name \_\_\_\_\_

Street/No. \_\_\_\_\_

Postal code/Town \_\_\_\_\_

Phone \_\_\_\_\_

Fax \_\_\_\_\_

E-mail \_\_\_\_\_

Application area of the microscope \_\_\_\_\_

Date \_\_\_\_\_

Signature \_\_\_\_\_

### Microscopes

Light microscopes  
Stereomicroscopes  
Surgical microscopes  
Laser scanning microscopes  
Photomicrography  
Video microscopy  
Measuring microscopes

### Advanced systems

Image analysis  
Spectral photometry  
Automated  
inspection systems  
Measuring systems  
Electron beam  
lithography systems

### Laboratory equipment

Tissue processors  
Embedding systems  
Routine and  
immunostaining instruments  
Coverslipping machines  
Refractometers

### Microtomes

Sledge and  
rotary microtomes  
Cryostats  
Ultramicrotomes  
EM preparation

The productive cooperative effort "with the user, for the user" has always been the basis for the innovative strength of Leica Microsystems. On this, we have developed our five corporate values: pioneering, high-end quality, team spirit, dedication to science, and continuous improvement. We call making these values reality Living up to Life.

### INDUSTRY DIVISION

The Leica Microsystems Industry Division's focus is to support customers' pursuit of the highest quality end result by providing the best and most innovative imaging systems for their needs to see, measure, and analyze microstructures. Its solutions are used in routine and research industrial applications, in materials science and quality control, in forensic science investigations, and educational applications.

Leica Microsystems – an international company with a strong worldwide customer service network:

| Internationally active                 |      | Phone          | Fax            |
|----------------------------------------|------|----------------|----------------|
| Australia · North Ryde                 | +61  | 2 8870 3500    | 2 9878 1055    |
| Belgium · Groot Bijgaarden             | +32  | 2 790 98 50    | 2 790 98 68    |
| Denmark · Ballerup                     | +45  | 4454 0101      | 4454 0111      |
| Germany · Wetzlar                      | +49  | 64 41 29 40 00 | 64 41 29 41 55 |
| England · Milton Keynes                | +44  | 800 298 2344   | 1908 246312    |
| France · Nanterre Cedex                | +33  | 811 000 664    | 1 56 05 23 23  |
| Italy · Milan                          | +39  | 02 574 861     | 02 574 03392   |
| Japan · Tokyo                          | +81  | 3 5421 2800    | 3 5421 2896    |
| Canada · Concord/Ontario               | +1   | 800 248 0123   | 847 405 0164   |
| Korea · Seoul                          | +82  | 2 514 65 43    | 2 514 65 48    |
| The Netherlands · Rijswijk             | +31  | 70 4132 100    | 70 4132 109    |
| Austria · Vienna                       | +43  | 1 486 80 50 0  | 1 486 80 50 30 |
| Portugal · Lisbon                      | +351 | 21 388 9112    | 21 385 4668    |
| Sweden · Kista                         | +46  | 8 625 45 45    | 8 625 45 10    |
| Switzerland · Heerbrugg                | +41  | 71 726 34 34   | 71 726 34 44   |
| Singapore                              | +65  | 6779 7823      | 6773 0628      |
| Spain · Barcelona                      | +34  | 93 494 95 30   | 93 494 95 32   |
| USA · Buffalo Grove/Illinois           | +1   | 800 248 0123   | 847 405 0164   |
| People's Republic of China · Hong Kong | +852 | 2564 6699      | 2564 4163      |
| · Shanghai                             | +86  | 21 6387 6606   | 21 6387 6698   |