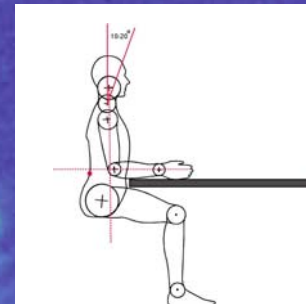
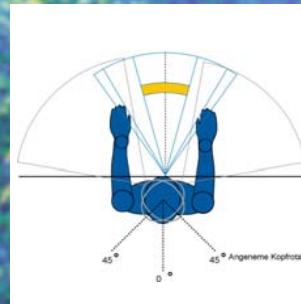


## Ergonomic Design Study

Table microscopes

Microscopy Business Group  
Carl Zeiss



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## 1. Introduction

The present ergonomic design study deals with table microscopes and their fatigue-free, functional and user-friendly operation.

Typical work situations have been examined and evaluated on the basis of relevant ergonomic key data.

From the results and dimensions, solutions have been derived on which future developments in the microscopy area can be based.

One specific focus of the study available here in excerpts is the improvement of the situation of routine users who spend several hours a day at a microscopy workstation.

## 2. Problems in the current situation

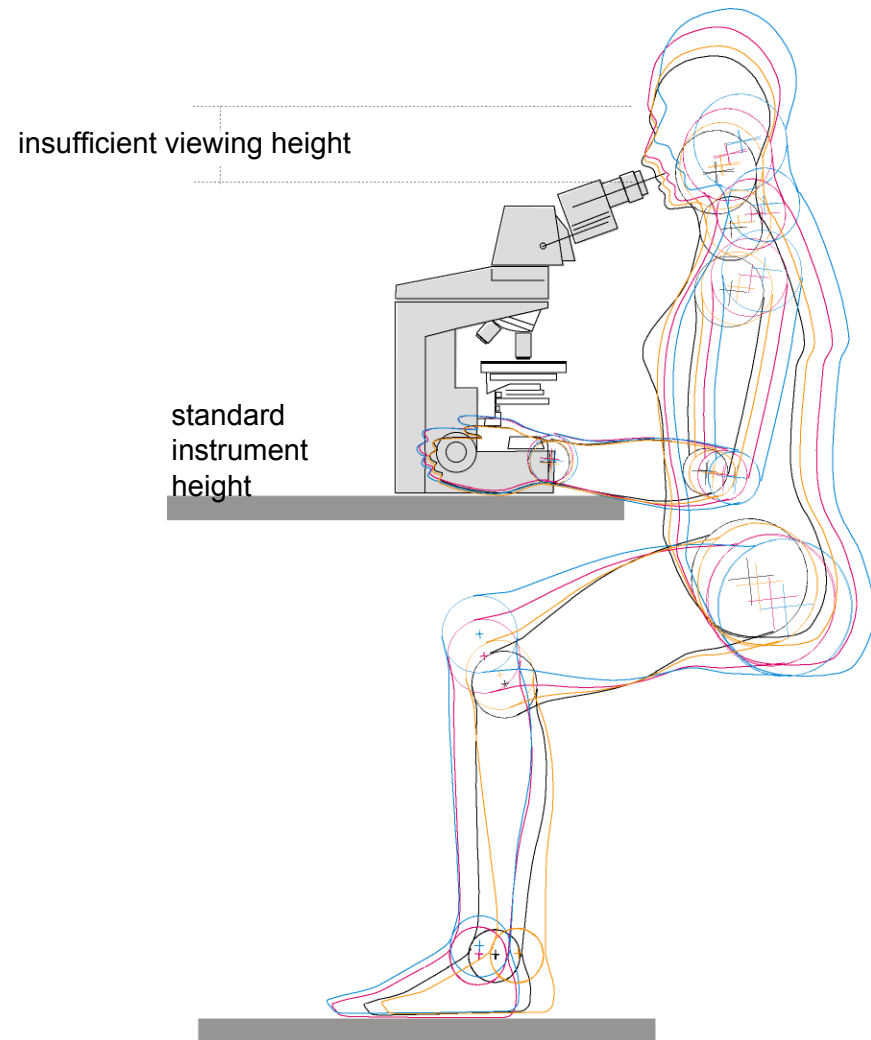
### 2.1 Insufficient instrument height

With an ergonomically correct sitting posture at the table, viewing into the eyepiece is inconvenient for the majority of users.  
(The average body height of the population has been taken as the standard)

Orientation heights in the presentation:

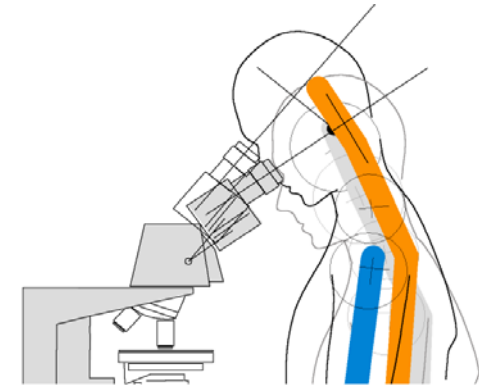
- 95 percentile men
- 50 percentile men
- 50 percentile women
- 5 percentile women

General height distribution within a population group

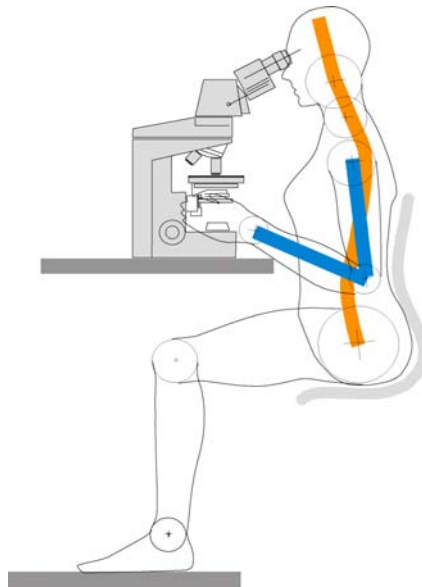


## 2. Problems in the current situation

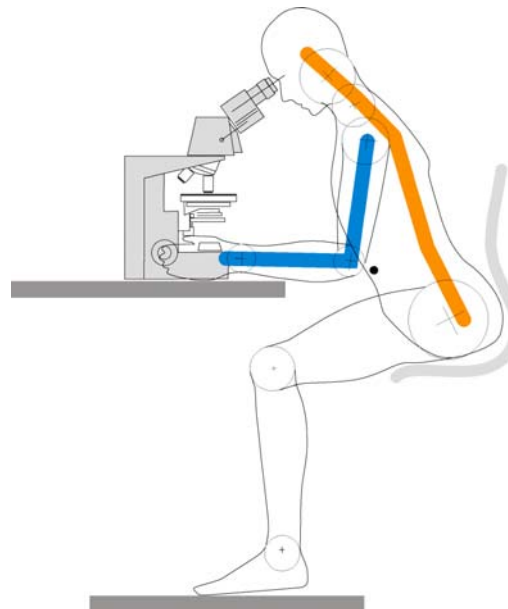
### 2.2 Ergonomically awkward adaptation of the body posture when the viewing height is too low



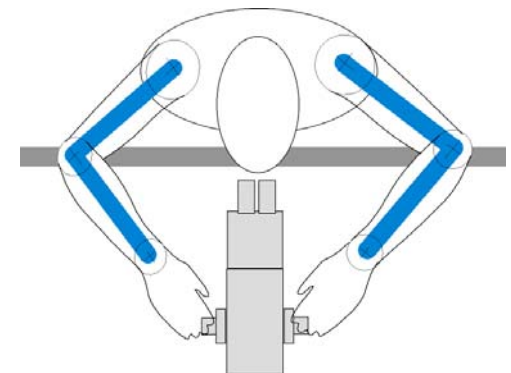
- Adaptation to height via adjustable eyepieces
- = changed viewing angle after height adaptation and unfavorable neck posture in the upper height positions



- Unfavorable support of lower arm on the table plate
- = aching pressure points and clumsy operation of controls



- Awkward posture of back and head
- = tension of back and head muscles



- wide arms position
- = unfavorable operation of controls

### 3. Ergonomically correct sitting position at the workstation

#### 3.1 Body posture and sitting position

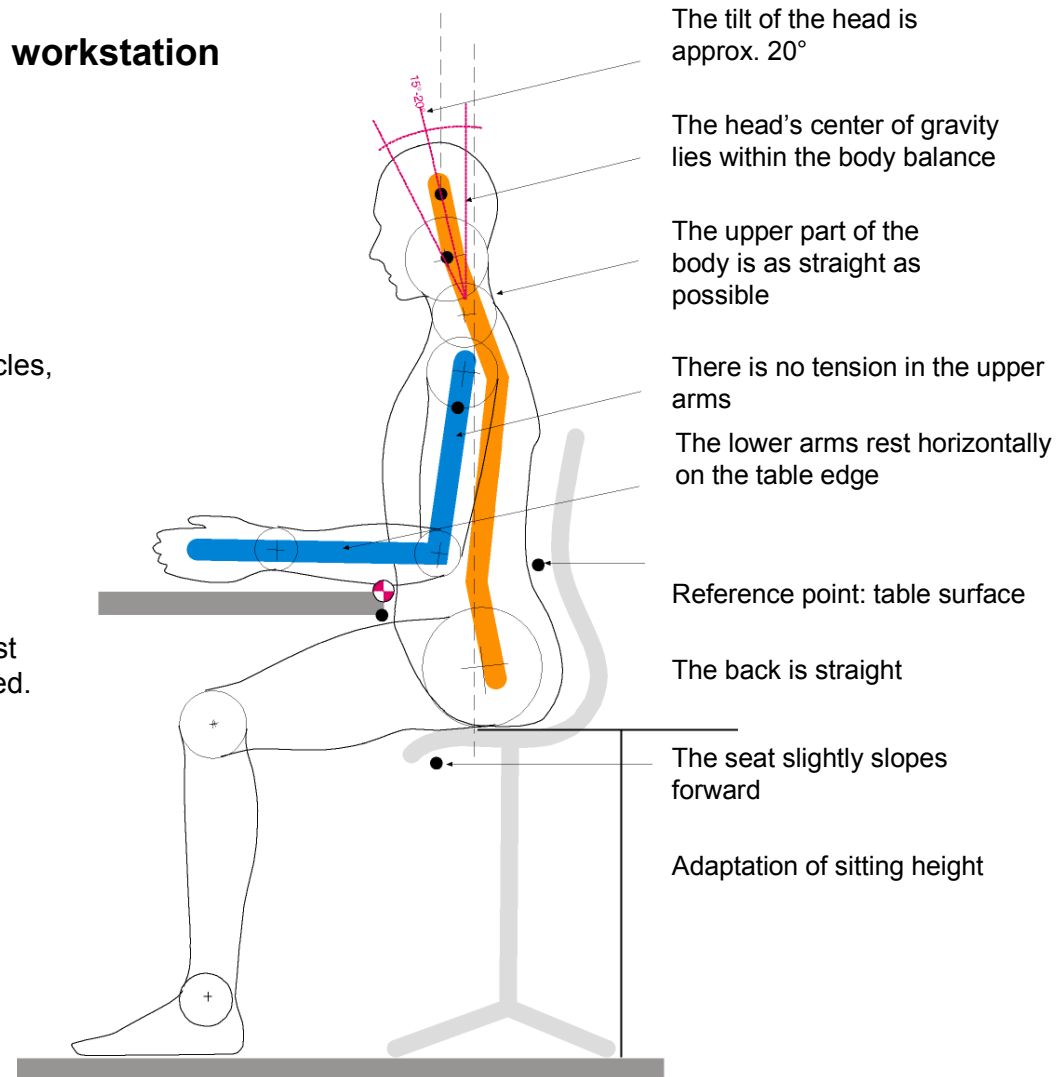
The shown sitting position provides ideal conditions for fatigue-free microscopy at a table microscope.

To avoid unnecessary strain to the neck and shoulder muscles, the forward tilt of the head should be approx. 20 degrees. An upright head posture would be ideal.

When the user looks into the eyepieces, his head is tilted in accordance with the position of the pupil in his eye.

The height of the chair should be set in accordance with personal requirements in such a way that the lower arms rest horizontally on the table plate and the upper arms are relaxed.

Normally, the thighs are slightly below the table plate when this posture is taken.

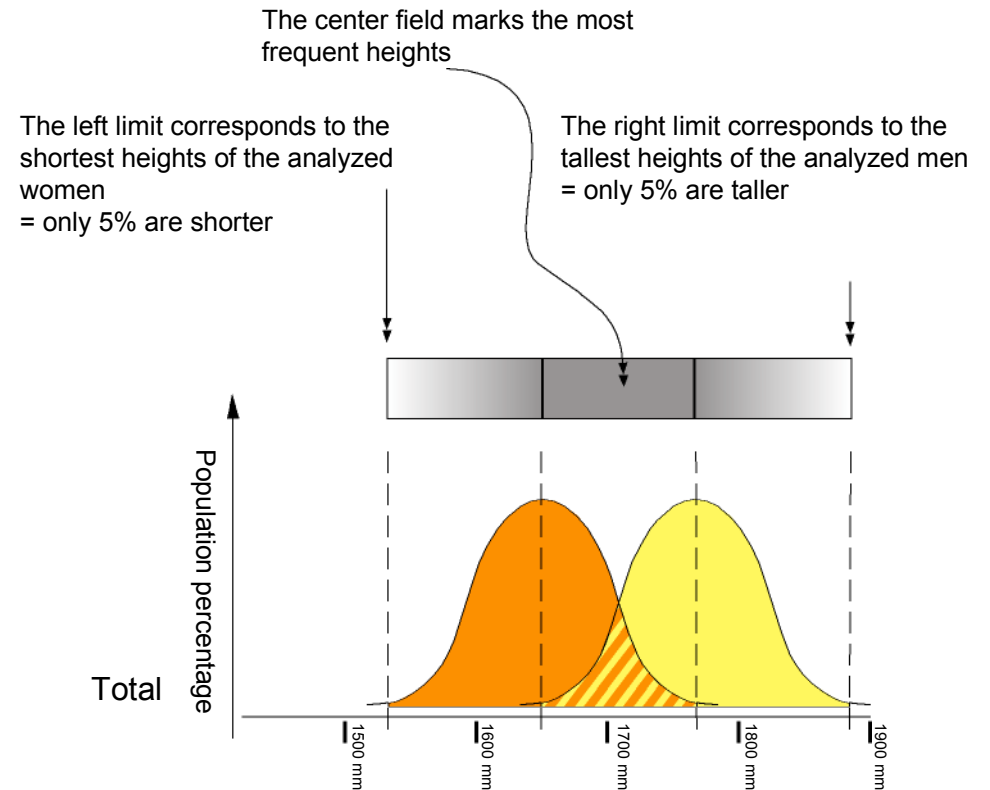
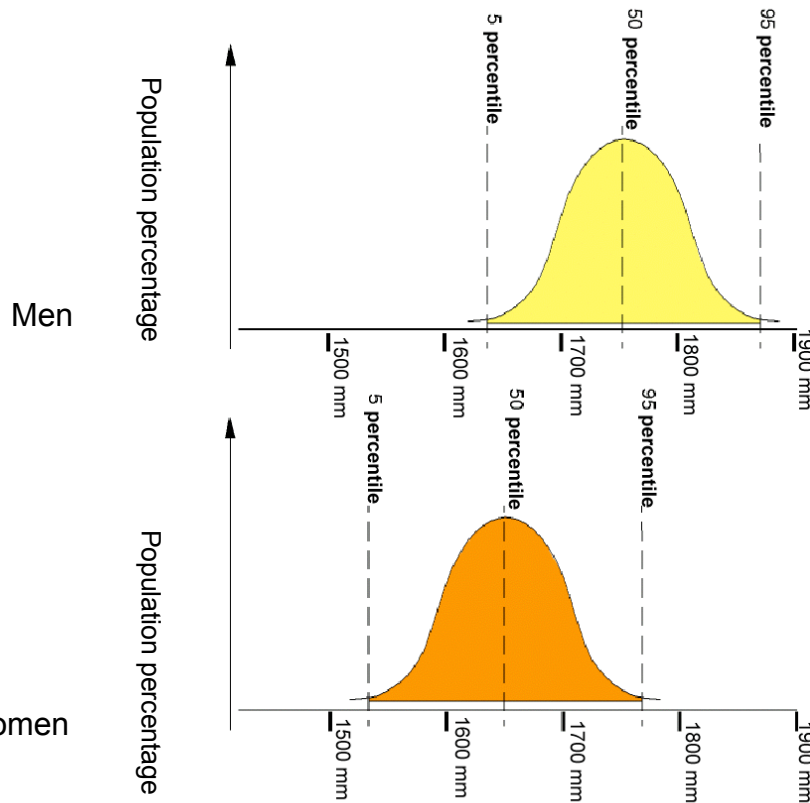


### 3. Ergonomically correct sitting position at the workstation

#### 3.2 Anthropometrical distribution within a sample population group from Central and Eastern Europe

Basic height distribution within a population group

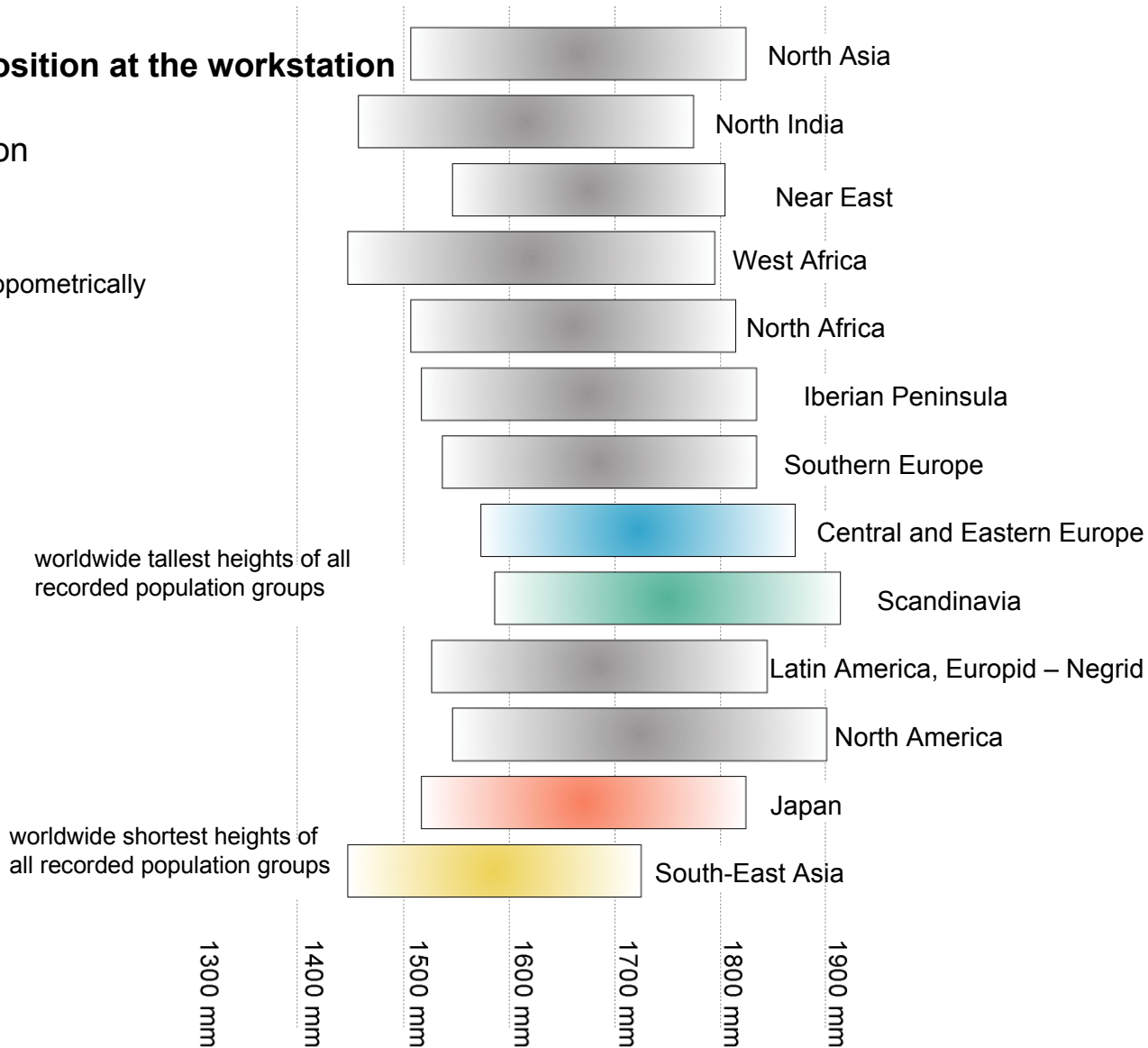
Presentation principle of the following examinations



### 3. Ergonomically correct sitting position at the workstation

#### 3.3 Body height of the global population

Comparison of body heights and proportions of 13 groups determined anthropometrically to represent the global population.



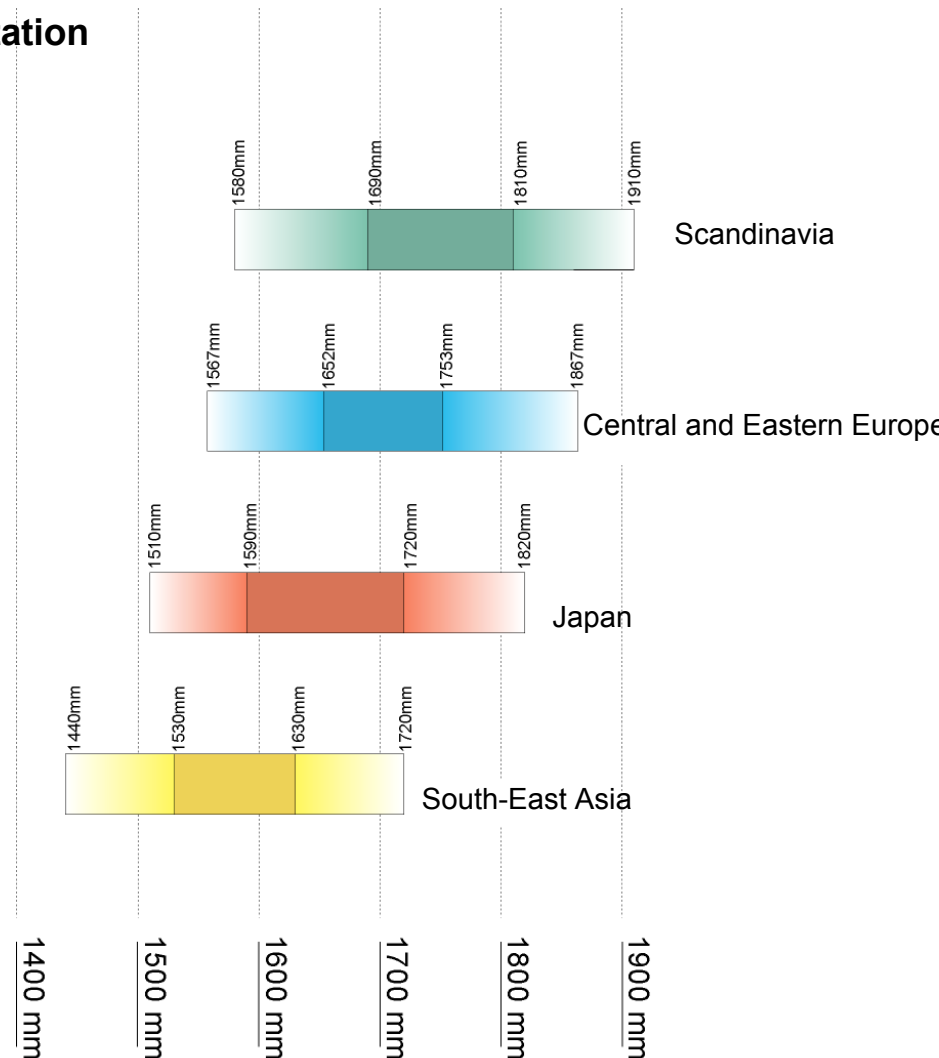
### 3. Ergonomically correct sitting position at the workstation

#### 3.4 Height comparison between four relevant population groups

- Scandinavia
- Central and Eastern Europe
- Japan
- South-East Asia

Each of the bars displayed is limited by the heights of women on the left and those of men on the right.

The center field marks the most frequent heights.



### 3. Ergonomically correct sitting position at the workstation

#### 3.5 Adaptation to body height by vertical adjustment of chair and eyepieces

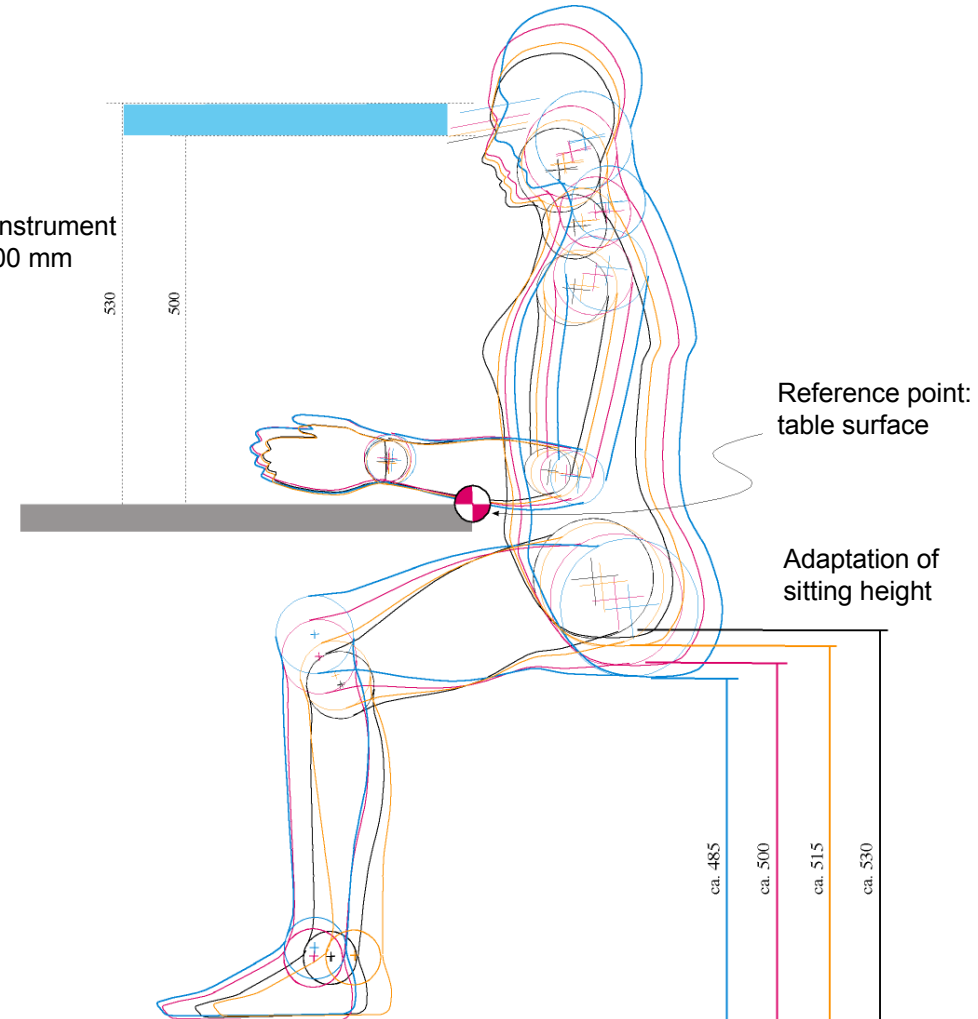
As regards the viewing height of the eyepieces, different body heights are mainly compensated for by adapting the sitting height. (Short persons might require a footrest if the table height cannot be adjusted)

Due to the ergonomically recommended body positioning, i.e. with the lower arms positioned as horizontal as possible, the eye position lies between 500 mm and 530 mm, even in cases of extreme differences in the body height.

Body heights, based on the anthropometric pattern in Central and Eastern Europe.

- 1867 95 percentile men
- 1753 50 percentile men
- 1652 50 percentile women
- 1567 5 percentile women

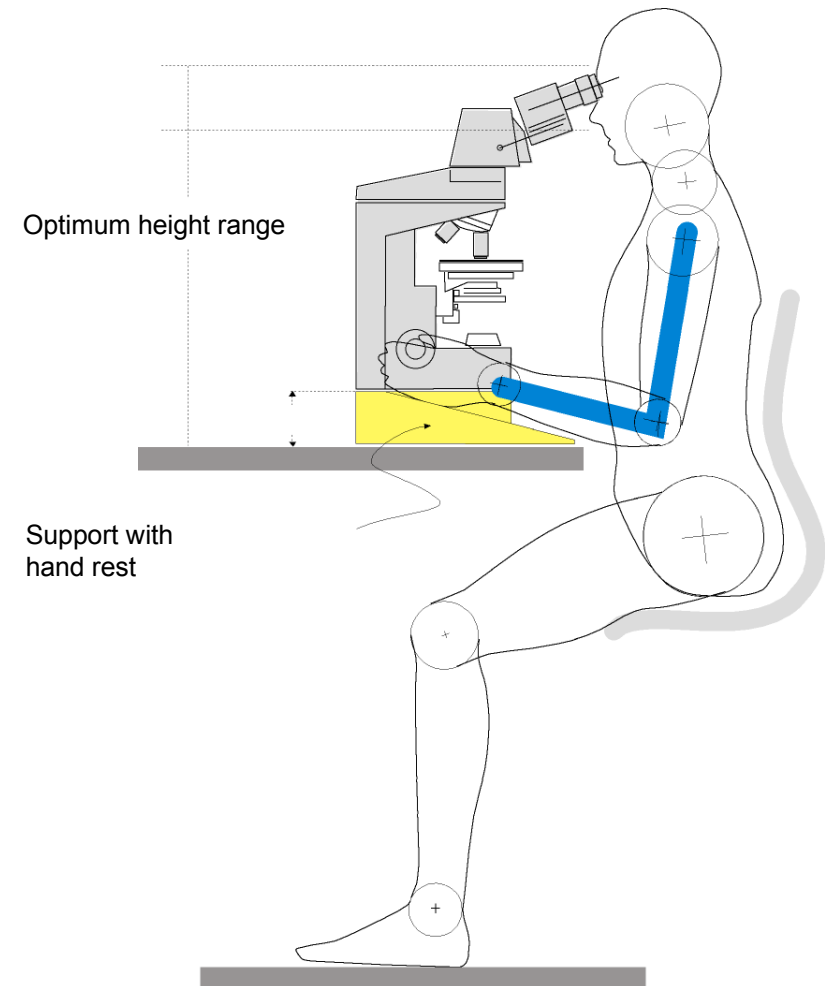
Area of optimum instrument height between 500 mm and 530 mm



## 4. Proposals for technical implementation

### 4.1 Vertically adjustable base plate with hand rest

A vertically adjustable base plate with hand rest provides settings within the range of optimum viewing heights



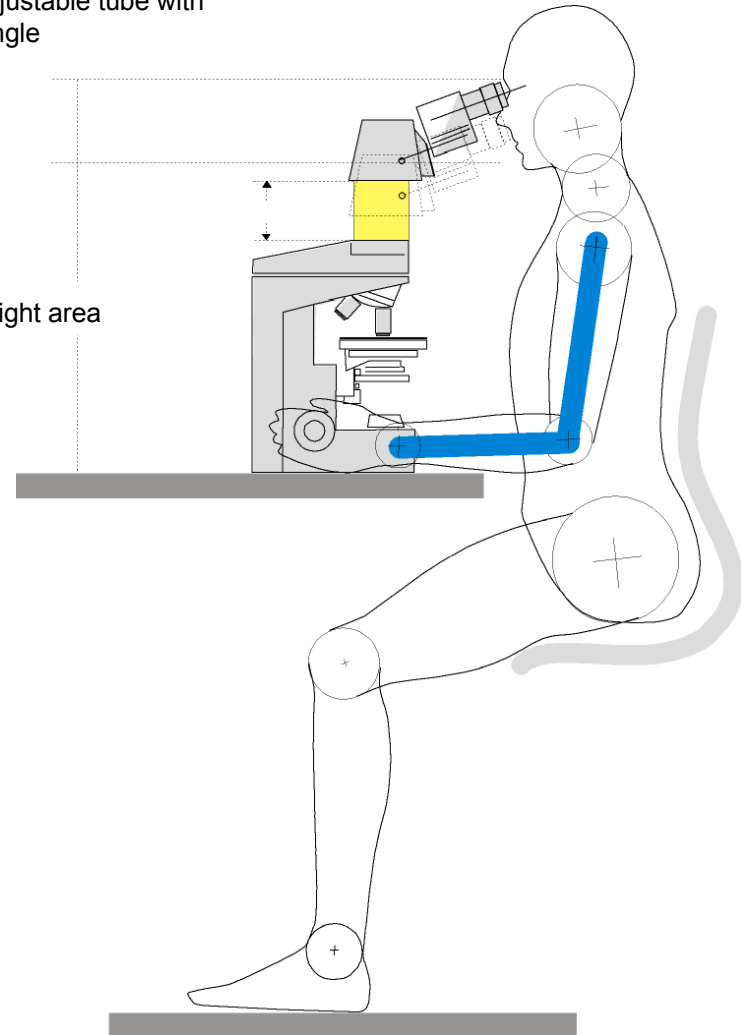
## 4. Proposals for technical implementation

### 4.2 Vertically adjustable tube with invariable viewing angle

The optimum instrument height is achieved with a vertically adjustable tube permitting an optimum sitting position.

Vertically adjustable tube with invariable angle

Optimum height area



## 5. Basis of the study and literature references

The study is based on current ergonomic key data and empiric examination results obtained on the object.

The results were reviewed on a group of 15 persons.

„The measure of man and woman“	1993 Alvin R Tilley, Henry Dreyfuss Assosiation, New York
„Räumlich-ergonomische Gestaltung“	1990 Bundesanstalt für Arbeitsschutz (Fb 632)
„Ergonomische Arbeitsmittelgestaltung 3“	1979 Bundesanstalt für Arbeitsschutz (Forschungsbericht Nr. 198)
„Reibung zwischen Hand und Griff“	1979 Bundesanstalt für Arbeitsschutz (Forschungsbericht Nr. 213)
„Internationaler anthropometrischer Datenatlas“	1989 Bundesanstalt für Arbeitsschutz (Fb 587)
„Ergonomic Design for People at Work Volume 1“	1983 Eastman Kodak Com
„Grundlagen der Büroeinrichtung“	2000 Roger Schlimm
„Ergonomie“	1996 BIA-Report HVBG