

**SCIENCE  
SERVICES**

# ***DiATOME***

## Introduction

Dear customer,

**DiATOME** Diamond Knives – Development, manufacturing  
and customer service since 1970

### Our developments in this period:

<b>ultra 45°</b>	the diamond knife with a hydrophilic cutting edge, allowing high quality ultrathin sections of epoxy resin embedded samples
<b>ultra 35°</b>	the low angle diamond knife for reduced compression and better structure preservation
<b>histo</b>	the first diamond knife for cutting semithin sections for the observation in the optical microscope
<b>cryo</b>	the diamond knife for cutting in the cryo-ultramicrotome
<b>Static Line Ionizer</b>	for eliminating electrostatic charging
<b>cryo immuno</b>	the knife with a large diamond platform facilitating pick-up of cryo sections from sucrose infiltrated samples (Tokuyasu)
<b>cryo 25°</b>	the low angle diamond knife for sectioning frozen hydrated samples (CEMOVIS)
<b>ultra AFM and cryo AFM</b>	the knives for generating absolutely smooth and flat surfaces of biological and technical samples for the observation in the AFM
<b>ultra sonic</b>	the oscillating diamond knife for eliminating compression and allowing best structure preservation
<b>accessories</b>	such as pick-up loops, special forceps, special knife boats, etc.

These developments were possible by the co-operation with you, our valued customers.

We are convinced that also in the future new developments are possible and that our knives may be adapted to the changing requirements.

Make use of our many years experience in perfecting our knives.

With a telephone call or an email we can inform you on any details you require.

We are looking forward to hear from you soon!

Your *DiATOME* team

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## Characteristics of **DiATOME** Diamond Knives

### ***DiATOME knives are compatible with all ultramicrotomes***

The boat is designed in such a manner that the water is horizontal when the clearance angle is set. This results in a stationary water surface and good reflection.

The shape of the boat offers you the advantage of an easy pick-up of the floating sections.

The surfaces of the *DiATOME* diamond knives are hydrophilic. This property allows an easy wetting of the cutting edge, even with a very low water level (important for sectioning Lowicryls and other hydrophilic embedding media, as well as for water sensitive samples).

The diamond is high vacuum brazed onto a metal shank which is securely screwed into the boat.

The cementing material seals boat and knife. It is hydrophilic and aids the easy wetting of the cutting edge.

## Resharpener and Exchange Service

Resharpener *DiATOME* knives undergo the same stringent optical checking and sectioning test as new knives.

**A diamond knife resharpener by *DiATOME* is the same high quality as a new one!**

We let you choose: You may have your knife resharpener, or exchanged against a new knife at a slightly elevated price.

In the exchange price a type change is possible (ultra to cryo, 45° to 35°, small knives to large ones, etc).

**We guarantee a fast resharpener service for all our knives including the oldest knives ever purchased!**

## **DiATOME** Quality Guarantee

Before delivery, each knife, new or resharpened, is subject to extensive testing. We can therefore guarantee perfect sectioning (in the respective thickness range) over the entire cutting edge.

Should a knife not fulfil your high expectations, please kindly send it back with a short note of the problem.

## **DiATOME** Customer Service

The great experience obtained during long years of development, manufacturing and use of diamond knives allows us to offer a unique sample testing service:

**You** send us biological or material research specimens of any nature.

**We** perform a sectioning test and send you the resulting ultrathin sections on grids, the surfaced sample, along with a report of how the results were obtained.

You may be assured that we treat your proprietary specimens with absolute discretion.

**Please allow us to help you choose the appropriate knife type from our large range for your specific application.**

## DiATOME ultra knives and their applications

- Highest quality diamonds and optimal crystal orientation guarantee perfect ultrathin sections and a durable cutting edge
- Section pick-up is facilitated as the boat is horizontal allowing the water to completely fill the boat all the way round
- A hydrophilic surface makes it easy to wet the cutting edge, even with low water level

Knife type	Knife angle	Size [mm]	Thickness range [nm]	Boat type	Code	Application
<b>ultra 35°</b>	35°	1.5 2.0 2.5 3.0 3.5 4.0	30–200	Standard boat	DU3515 DU3520 DU3525 DU3530 DU3535 DU3540	<ul style="list-style-type: none"> <li>• Biological and materials science specimens</li> </ul>
<b>ultra semi</b>	35°	3.0	50–500	Standard boat	DU3530-semi	<ul style="list-style-type: none"> <li>• Alternating sectioning ultrathin semithin</li> </ul>
<b>ultra AFM</b>	35°	2.0 3.0	15–100	Small boat	DU3520-AFM DU3530-AFM	<ul style="list-style-type: none"> <li>• Sample surfacing for AFM</li> </ul>
<b>ultra 35° Jumbo</b>	35°	3.0	50–200	Jumbo boat	DUJ3520 DUJ3530	<ul style="list-style-type: none"> <li>• Section series for 3D reconstruction, STEM</li> </ul>
<b>ultra sonic</b>	35°	3.0	15–100	Special boat	DUS3530	<ul style="list-style-type: none"> <li>• Compression free sections</li> <li>• Best structure preservation</li> <li>• Biological and materials science specimens</li> </ul>
<b>ultra 45°</b>	45°	1.5 2.0 2.5 3.0 3.5 4.0	30–200	Standard boat	DU4515 DU4520 DU4525 DU4530 DU4535 DU4540	<ul style="list-style-type: none"> <li>• Routine sectioning of biological and materials science specimens</li> </ul>
<b>ultra 45° Jumbo</b>	45°	3.0	50–200	Jumbo boat	DUJ4530	<ul style="list-style-type: none"> <li>• Section series for 3D reconstruction, STEM</li> </ul>
<b>trim 45</b> <b>trim 20</b> <b>trim 90</b>	45°			Triangular holder	DTB45 DTB20 DTB90	<ul style="list-style-type: none"> <li>• Trimming biological and materials science specimens</li> </ul>

## ultra 35°

In 1989 considerably reduced compression, smoother section surfaces and improved structural preservation thanks to the use of our ultra 35° knives was demonstrated (J. C. Jérior, *Scanning Microscopy Supplement 3*, pp. 17 – 153, 1998).

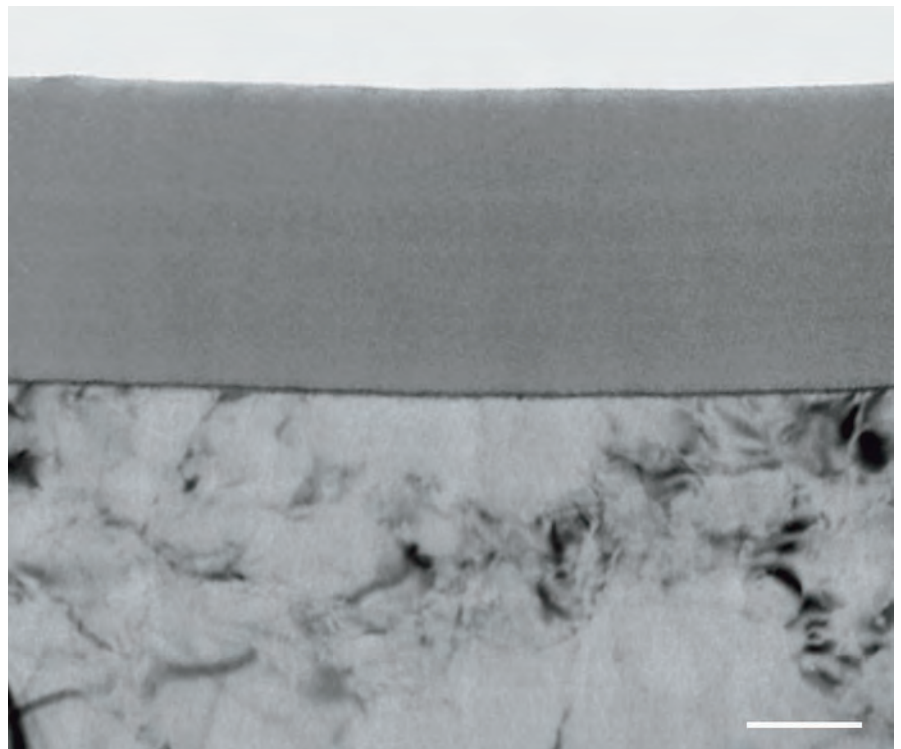
In the meantime, a large number of researchers have recognized the advantages of 35° knives, in particular for sectioning biological specimens of all kind, non-homogenous specimens, non decalcified bone, dental material, etc.

The ultra 35° knives are perfect for sectioning relatively soft materials research specimens including metals and polymers, as well as mixed specimens such as polymers filled with nanoparticles, brittle materials such as catalysts, crystals, semiconductors, etc (G. Mahon et al., *Microscopy Research and Technique*, Vol. 31, pp. 267 – 274, 1995, S. R. Glanvill, *Microscopy Research and Technique*, Vol. 31, pp. 275 – 284, 1995, P. Swab et al., *Mat. Res. Soc. Symp. Proc.* Vol. 115, pp. 229 – 234, 1989, P. Schubert-Bischoff et al., *Microscopy and Microanalysis*, proceedings, page 359, 1997).

The ultra 35° knife has demonstrated it's usefulness as a standard knife for the majority of applications in both biological and materials research.

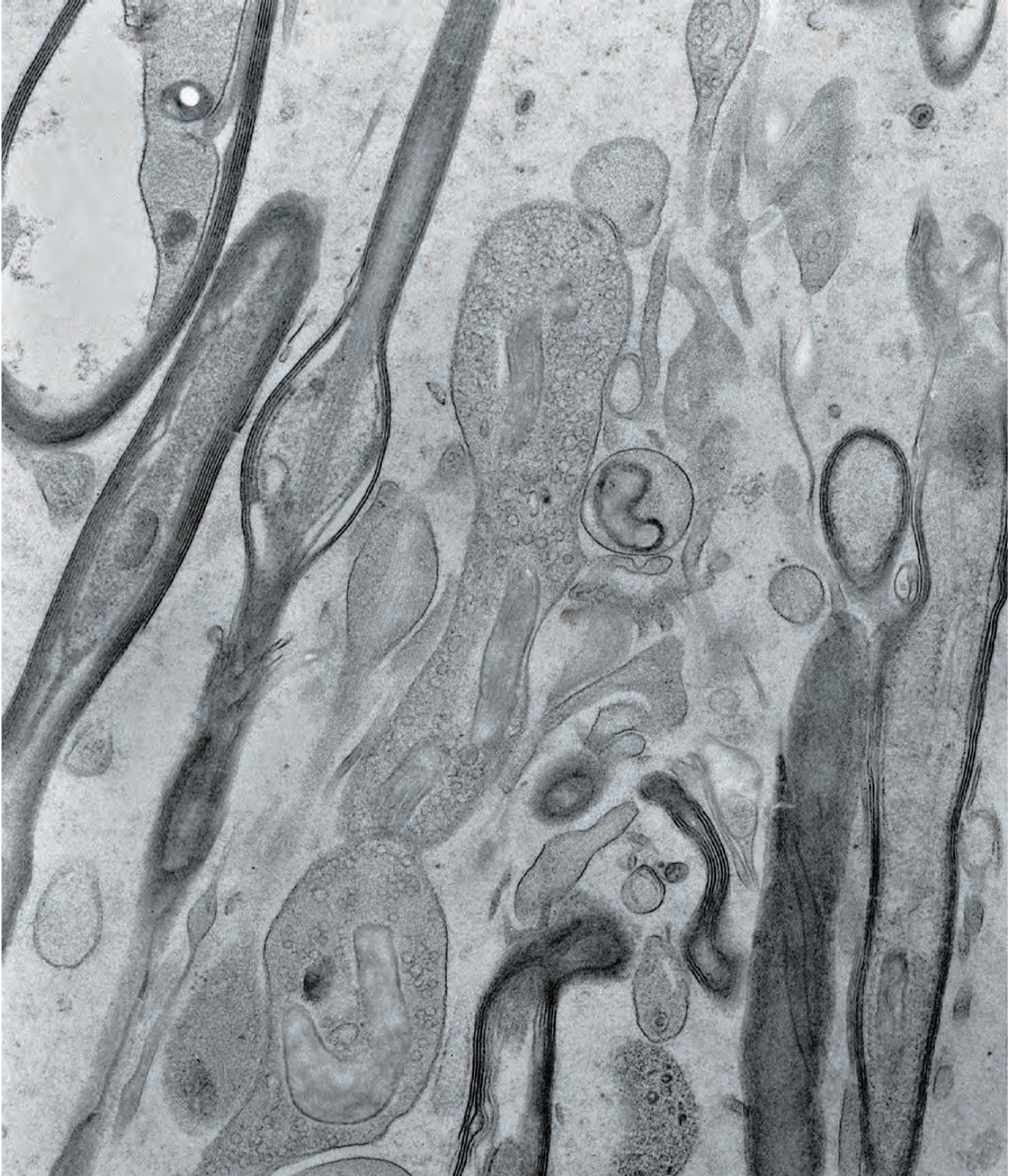


▼  
EM micrograph of an ultramicrotomed section of the anodic alumina film formed on Al-2 wt%Cu alloy. Scale bar = 100 nm. Xiarong Zhou, School of Materials, University of Manchester.



ultra

▼  
Rat brain x 18'000  
Werner Graber, Anatomisches Institut, Bern.

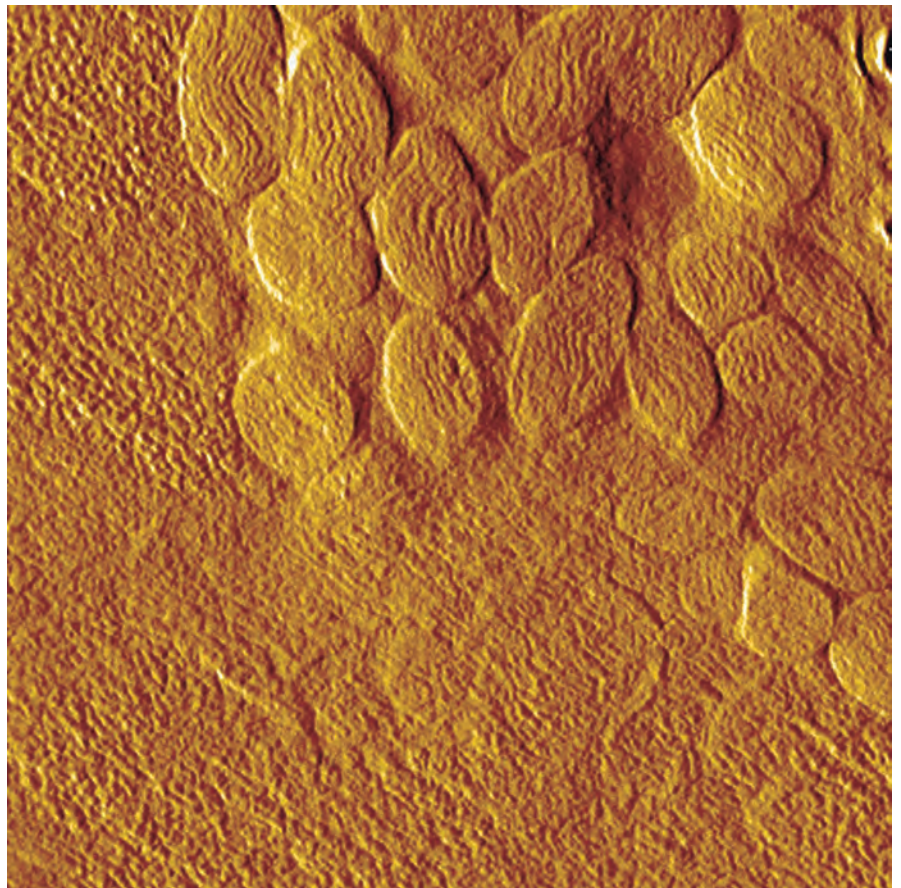




## ultra AFM

In order to achieve the best results for AFM investigation, only the highest quality diamond knives should be used (P. H. Vallotton et al., *J. Biomater. Sci. Polymer Edn.*, Vol. 6, No. 7, pp. 609 – 620, 1994. N. Matzko et al., *Journal of Structural Biology* 146, pp. 334 – 343, 2004).

Our ultra AFM knives are made of highest quality to ensure the increased quality requirements of AFM investigation. They produce extremely smooth sample surfaces and guarantee the best possible structure preservation.



▲ AFM amplitude image of the muscle of cat's mite *Otodectes cynotis*. The contrast covers amplitude variation in the 1–3 nm range. Size of the whole image equals 4.6 microns. Nadejda Borisovna Matsko, Institut für angewandte Physik, ETH Zürich.

## ultra sonic

- Thinner sections
- No compression
- Best structure preservation

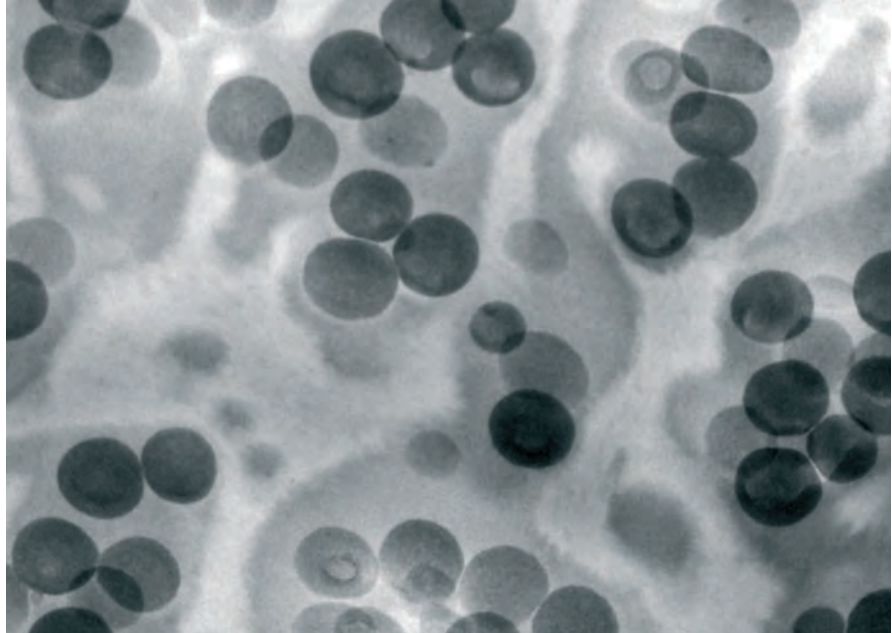
The patented ultra sonic knife allows the cutting of ultrathin sections free of compression (D. Studer et al., *Journal of Microscopy*, Vol. 197, pp. 94 – 100, 2000).

With correct setting of frequency and amplitude the sections become as long as the height of the sample.

Best results are not only achieved with biological samples, but also with polymers (J. S. Vastenhout et al., *Microscopy and Microanalysis* 8, 2001. J. S. Vastenhout et al., *Microscopy Today*, pp. 20–21, 2006).

We have tested the ultra sonic knife with the following samples:

- Biological samples in Epon, Araldite, EM Bed, etc.
- Biological samples in acrylic resins (Lowicryl, LR White).
- Rigid polymers such as PS, PMMA, ABS, HIPS, modified PP, blends of various kind.

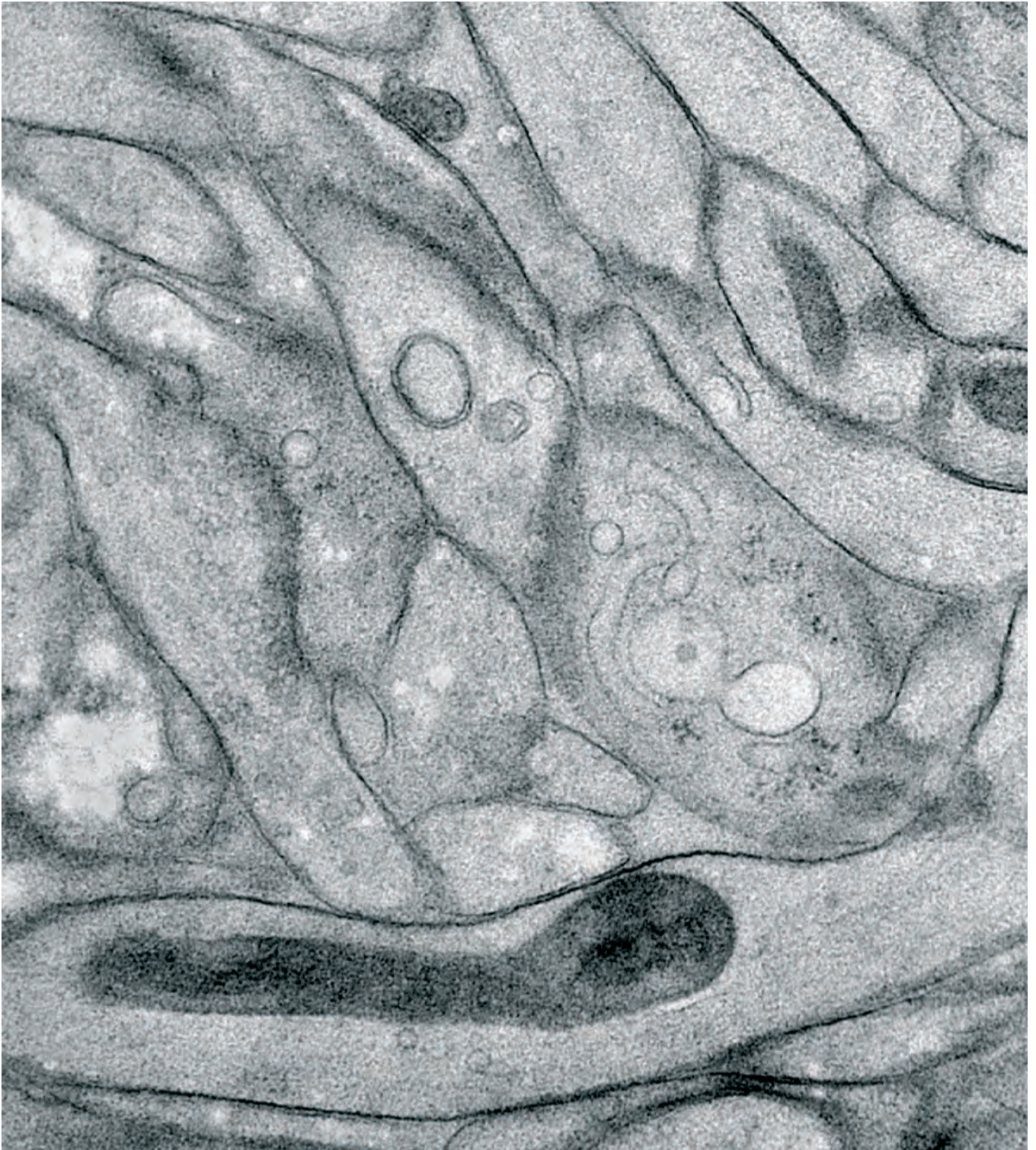


▲ Polycarbonate modified with rubber  
Jens Sicking, Bayer Technology Services, Leverkusen.  
└──────────┘ 200 nm



▼  
Neuropil of a HP frozen / freeze substituted  
hippocampus slice culture,  
Daniel Studer and Werner Graber, Inst. of  
Anatomy, University of Bern.  
Sectioned with the ultra sonic knife.

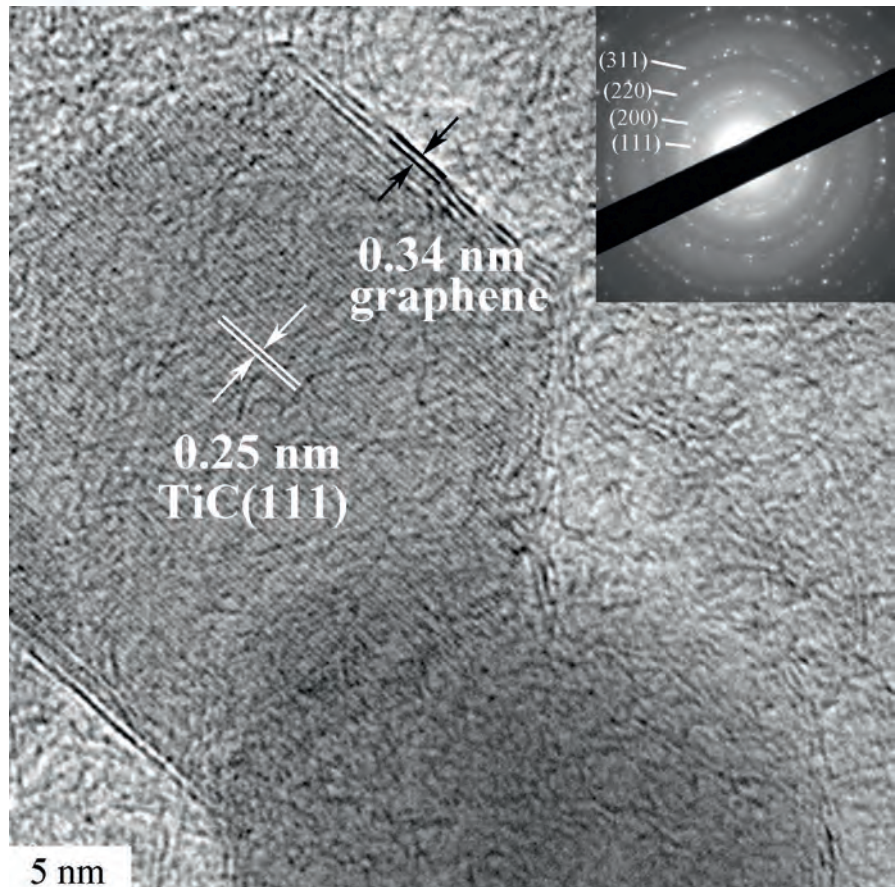
— 200 nm



## ultra 45°

Acknowledged as the appropriate knife angle for routine sectioning of both biological and materials research specimens, it represents a balanced compromise between section quality and durability.

For the sectioning of a number of hard materials such as ceramics, semiconductors, oxides etc, with the use of the ultra 45° knife a longer service time may be expected. Kindly contact us and make use of our long years experience in all ultramicrotomy applications.



▲ HRTEM image of a TiC microsphere showing nanocrystalline carbon coating on the TiC grain (confirmed by the electron diffraction pattern).  
J. Zhong et al, Journal of the European Ceramic Society 32, pp. 3407 – 3414, 2012.

## trim 45, trim 20 and trim 90

- Rapid and precise trimming
- Shiny block faces and pyramidal sides
- Sample surface aligned with the cutting direction
- Durable cutting edge

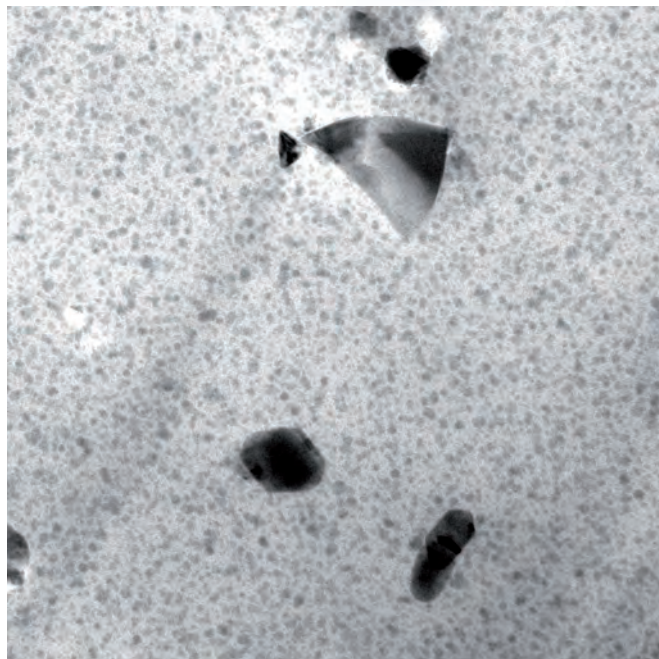
For successful ultramicrotomy in biology and materials science, precise trimming is mandatory.

The *DiATOME* knives trim 45, trim 20 and trim 90 will fulfil your trimming requirements, allowing quick, easy and accurate trimming.

A well trimmed sample is a precondition for perfect section ribbons.

Trimming with the trim 45, trim 20 and trim 90 improves the service time of your diamond knives.

When a sample is trimmed with glass knives or razor blades hard particles may be introduced in the surface or the pyramidal sides. These particles immediately cause knife marks in the diamond knives.



▲  
SiC, SiO<sub>2</sub>, TiO<sub>2</sub> and AlO<sub>3</sub> nanoparticles  
in polymer matrix.  
Claudia Mayrhofer, TU Graz.

## DiATOME cryo knives and their applications

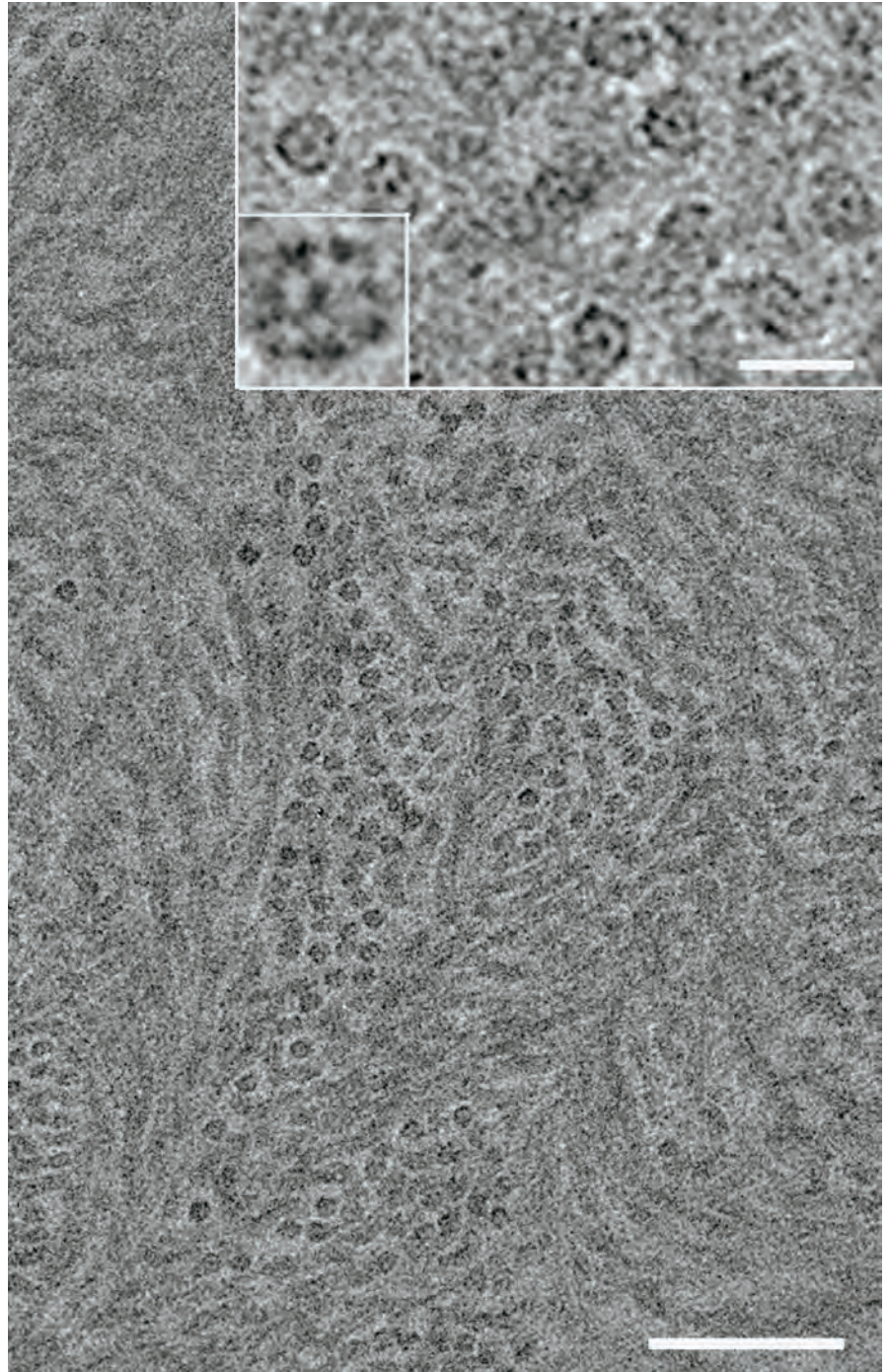
- Thinner cryo sections
- Perfect cryosections from ultrathin to semi with the same knife
- Minimal compression and best structure preservation
- Highest quality diamonds and optimal crystal orientation guarantee perfect ultrathin sections and a durable cutting edge

Knife type	Knife angle	Size [mm]	Thickness range [nm]	Boat type	Code	Application
<b>cryo 25°</b>	25°	3.0	30 – 150	Triangular holder	DCO2530	• Frozen hydrated samples (CEMOVIS)
<b>cryo immuno</b>	35°	2.0 2.0 3.0 3.0	30 – 300	Support triangulaire	DCIMM3520 DCIMM3520-CEM DCIMM3530 DCIMM3530-CEM	• Sucrose infiltrated samples (Tokuyasu) • Frozen hydrated samples (CEMOVIS)
<b>cryo 35° (dry)</b>	35°	1.5 2.0 2.5 3.0 3.5 4.0	30 – 300	Triangular holder	DCO3515 DCO3520 DCO3525 DCO3530 DCO3535 DCO3540	• Polymers, rubber, paints, etc.
<b>cryo AFM</b>	35°	2.0 3.0	20 – 100	Triangular holder	DCO3520-AFM DCO3530-AFM	• Sample planing for AFM imaging
<b>cryo 35° (wet)</b>	35°	1.5 2.0 2.5 3.0 3.5 4.0	30 – 300	Small cryo boat	DCM3515 DCM3520 DCM3525 DCM3530 DCM3535 DCM3540	• Wet sectioning of polymers with DMSO/water mixture
<b>cryo 45° (dry)</b>	45°	1.5 2.0 2.5 3.0 3.5 4.0	30 – 300	Triangular holder	DCO4515 DCO4520 DCO4525 DCO4530 DCO4535 DCO4540	• Routine dry cryo sectioning of polymers
<b>cryo 45° (wet)</b>	45°	1.5 2.0 2.5 3.0 3.5 4.0	30 – 300	Small cryo boat	DCM4515 DCM4520 DCM4525 DCM4530 DCM4535 DCM4540	• Routine wet cryo sectioning of polymers with DMSO/water
<b>trim 45 trim 20 trim 90</b>	45°			Triangular holder	DTB45 DTB20 DTB90	• Trimming biological and materials science samples

## cryo 25°

The cryo 25° knife is designed for sectioning frozen hydrated specimens. The 25° angle results in the least possible compression and the best structure preservation (H.M. Han et al., *Journal of Microscopy*, Vol. 230, Pt. 2, pp. 167–171, 2007).

Please note: best results are achieved at low humidity, when the cryo-ultramicrotome is placed in a glovebox and the sections attached by electrostatic force (J. Pierson et al., *Journal of Structural Biology* 169, pp. 219 – 225, 2010).



▲ High resolution electron micrograph of vitreous section of keratin intermediate filaments in the midportion of stratum corneum of human epidermis.

The fine structure of the keratin filaments is well resolved and their molecular organisation is seen in favourable cases (inset).

Scale bar = 100 nm.

Scale bar inset = 20 nm.

Ashraf Al-Amoudi, Laboratoire d'Analyse Ultrastructurale, Lausanne.

## cryo immuno

The first cryo knife with a diamond platform, guarantees the best possible sectioning for sucrose infiltrated samples (Tokuyasu).

The diamond platform guarantees an easy and gentle section pick-up.

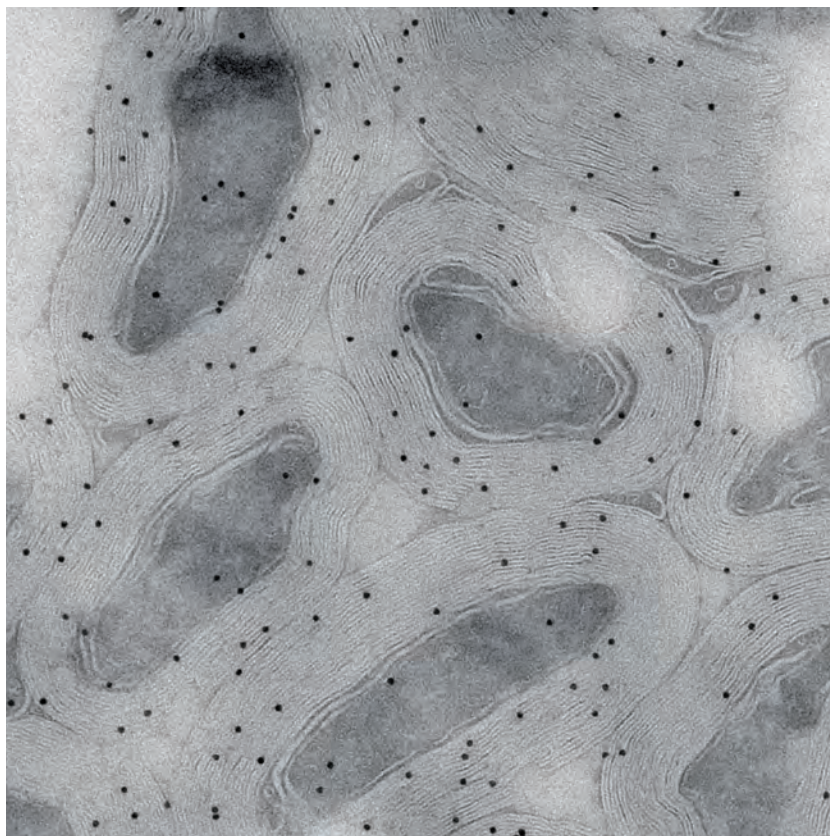
The sections are collected directly from the diamond surface using a loop and a sucrose/methyl-cellulose droplet (W. Liou et al., *Histochemistry and Cell Biology*, Vol. 106, pp. 41 – 55, 1996. P. J. Peters et al., *Current Protocols in Cell Biology*, pp. 4.7.1 – 4.7.18, 2006).

The 35° angle leads to a considerable reduction in mechanical stresses and therefore to improved structure preservation in sucrose infiltrated samples (E. Bos et al., *Journal of Structural Biology* 175, pp. 62 – 72, 2011).

We recommend the cryo immuno knife also for sectioning frozen hydrated samples (CEMOVIS). The 35° angle is a good compromise between durability and cutting performance (A. Al-Amoudi et al., *Journal of Structural Biology* 150, pp. 109 – 121, 2005).

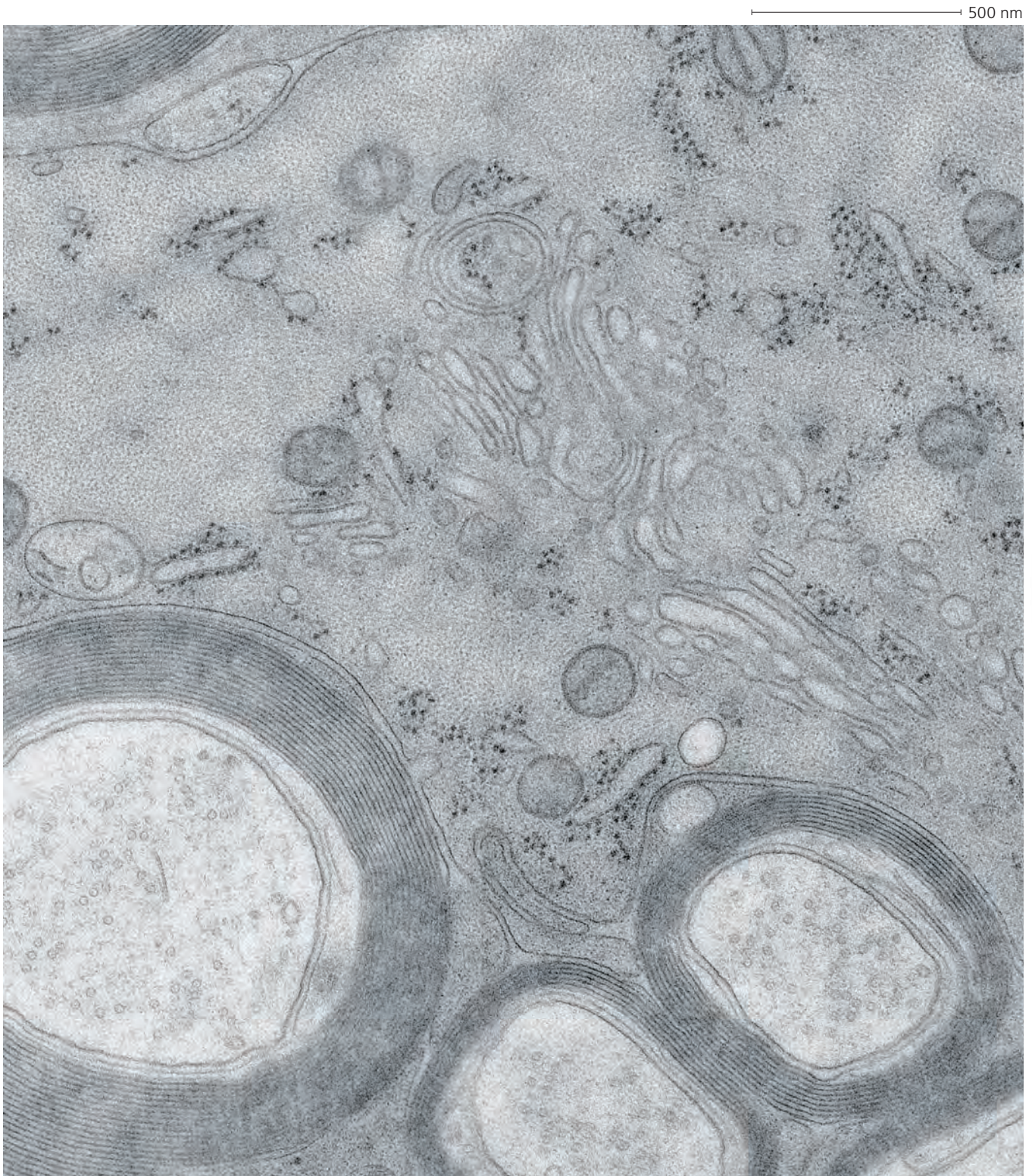


500 nm



▲  
Mouse optic nerve, immunolabeling of the major myelin protein proteolipid protein (PLP), 10 nm gold. Wiebke Möbius, Dept. of Neurogenetics, EM Core Facility, MPI of Experimental Medicine, Göttingen.





▲ Ultrastructure of an astrocyte in the mouse optic nerve, high-pressure frozen. In the astrocyte the glial fibrillary acidic protein is visible.  
Wiebke Moebius, Dept. of Neurogenetics, EM Core Facility, MPI of Experimental Medicine, Göttingen.

## **cryo 35° cryo 45°**

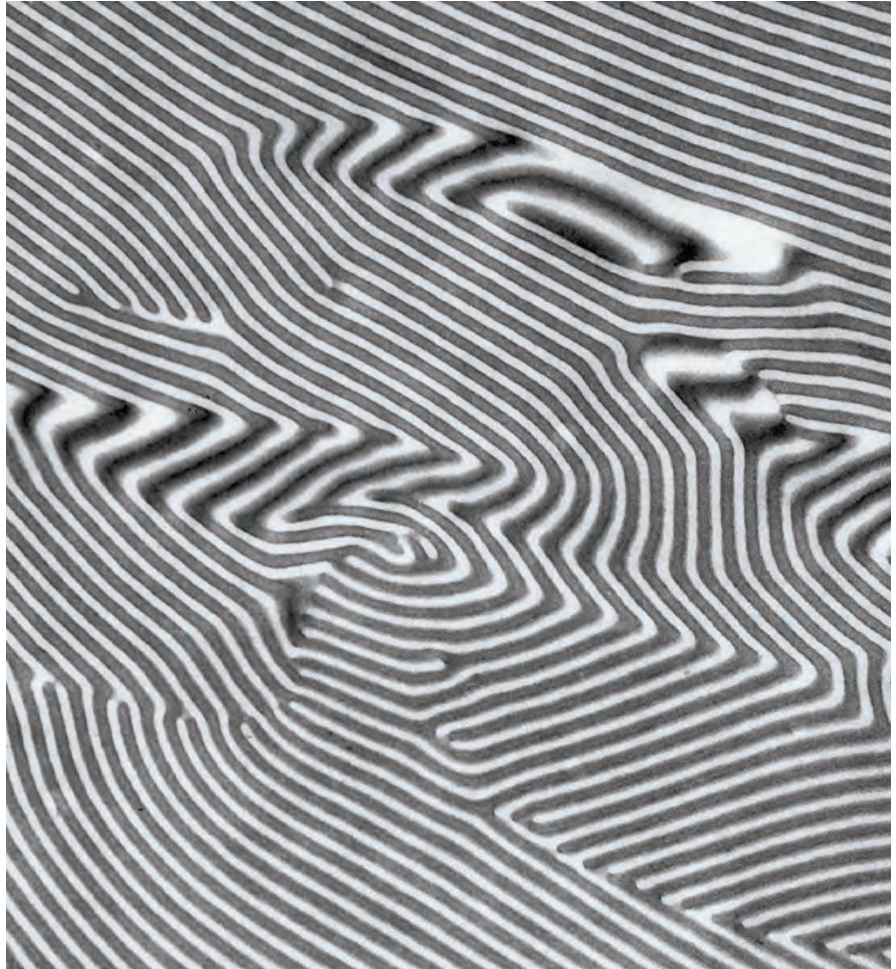
The cryo 35° knife has demonstrated its usefulness as a standard knife for the low temperature sectioning of polymers, rubber, paints, etc.

The 35° angle represents a balanced compromise between section quality and durability.

The cryo 35° and cryo 45° knife mounted in the triangular holder is suitable for dry cryosectioning.

The cryo 35° and cryo 45° knife mounted in the trough are used for sectioning with fluids such as a DMSO/water mixture.

The cryo 45° knife is well suited for routine cryo sectioning.

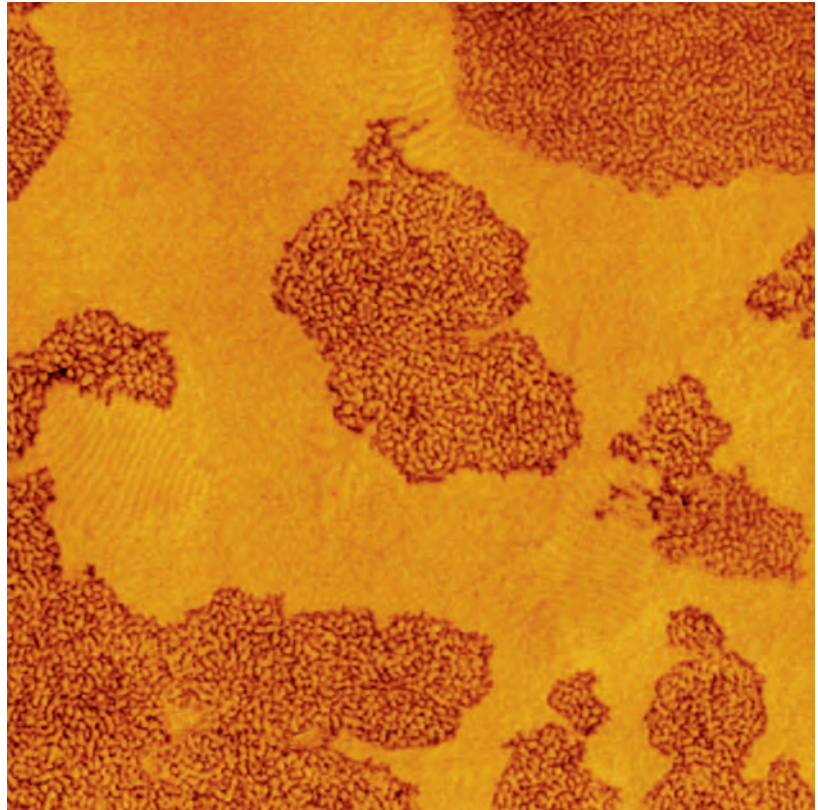


▲ Styrene-butadiene block copolymer x 25'000  
Ronald Walter, BASF Aktiengesellschaft, Polymer Physics, D-67056 Ludwigshafen.



## cryo AFM

Our cryo AFM knives are made of highest quality to ensure the increased quality requirements of AFM investigation. They produce extremely smooth sample surfaces and guarantee the best possible structure preservation.



▲ Morphology of a blend of two SBS block copolymers with different chain-architecture. AFM tapping mode, phase image, image size = 3 x 3 μm. Rameshwar Adhikari, Institut für Werkstoffwissenschaft, Martin-Luther-Universität, Halle-Wittenberg.

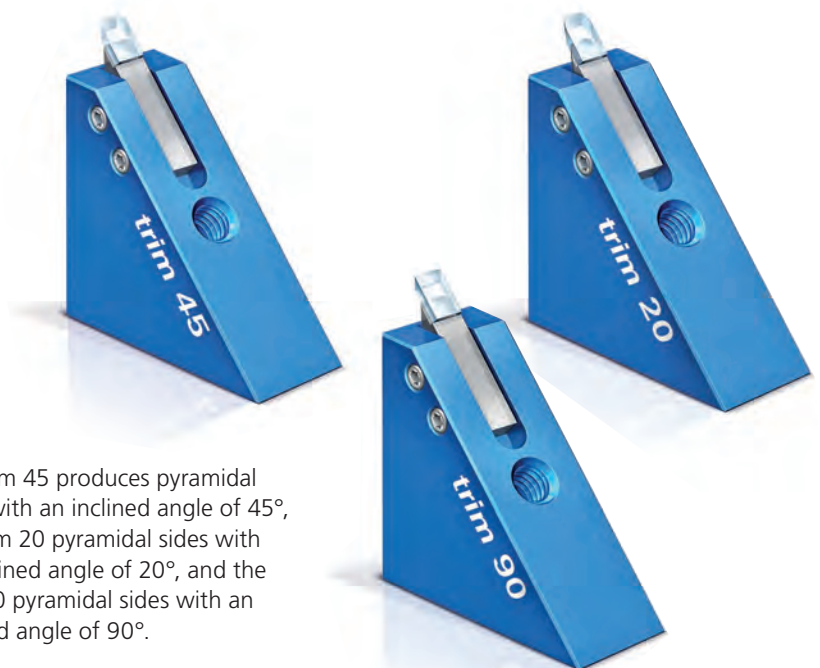


## trim 45, trim 20 and trim 90

For successful ultramicrotomy in biology and materials science, precise trimming is mandatory.

The *DiATOME* knives trim 45, trim 20 and trim 90 diamond blades will fulfil all your trimming requirements, allowing quick, easy and accurate trimming.

Due to the extreme sharpness of our diamond blades, less mechanical damage is applied to the sample during trimming. Very shiny sample faces and precise sides are the result.



The trim 45 produces pyramidal sides with an inclined angle of 45°, the trim 20 pyramidal sides with an inclined angle of 20°, and the trim 90 pyramidal sides with an inclined angle of 90°.

## **DiATOME** histo knives and their applications

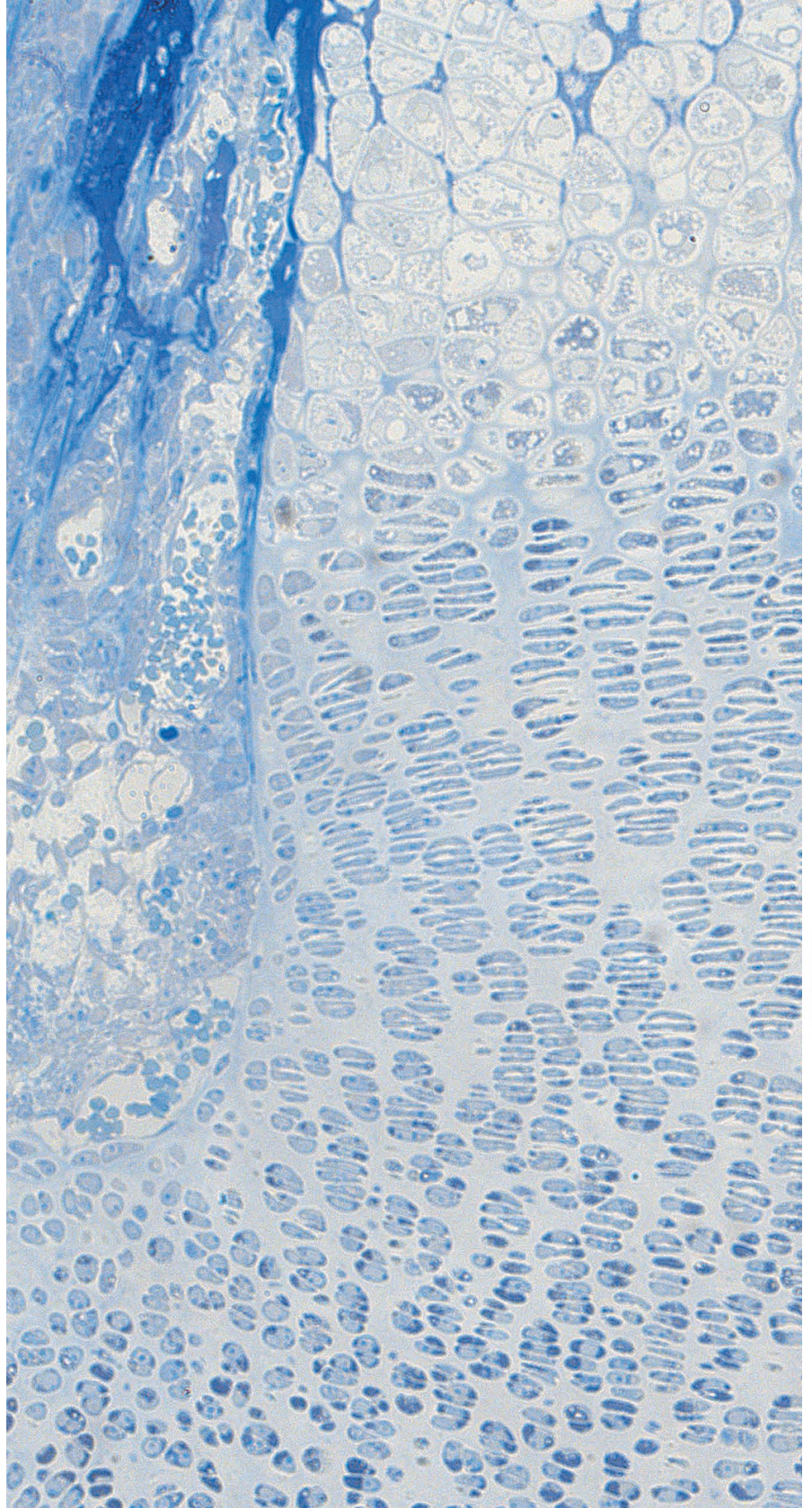
- High quality diamonds guarantee perfect sections and a durable cutting edge
- Easy wetting cutting edge
- Optimised serial sectioning
- Large boat for easy pick-up

Knife type	Knife angle	Size [mm]	Thickness range [ $\mu\text{m}$ ]	Boat type	Code	Application
<b>histo</b>	45°	4.0	0.2 – 2	Standard histo boat	DH4540	• Sectioning biological and industrial materials specimens for optical microscopy
		6.0			DH4560	
		8.0			DH4580	
<b>histo Jumbo</b>	45°	6.0	0.2 – 2	histo Jumbo boat	DHJ4560	• Large boat for serial sectioning
		8.0			DHJ4580	
<b>histo cryo (dry)</b>	45°	4.0	0.2 – 2	Triangular histo holder	DHCO4540	• Sectioning biological and materials specimens for optical microscopy
		6.0			DHCO4560	
		8.0			DHCO4580	
<b>histo cryo (wet)</b>	45°	4.0	0.2 – 2	Small histo boat	DHCM4540	• Wet sectioning of polymers (with DMSO/water mixture)
		6.0			DHCM4560	
		8.0			DHCM4580	

## histo

The histo knife is designed for the sectioning of hard and soft biological and material research specimens, non embedded or embedded in acrylic or epoxy resins (O. L. Reymond, Bas. Appl. Histochem. 30, pp. 487 – 494, 1986).

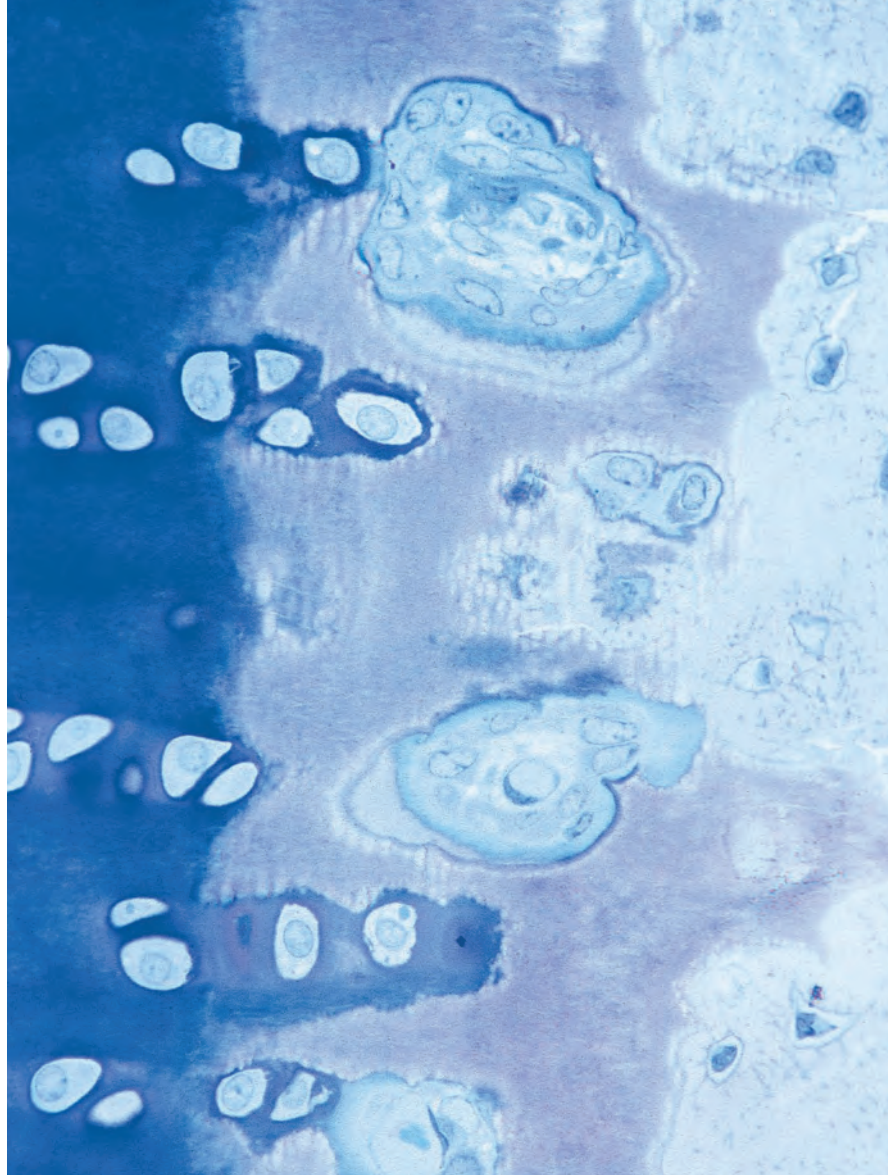
Our histo knives can be used on all ultramicrotomes as well as on microtomes with a retraction of the specimen arm in the return phase.



► Nondecalcified rat bone.  
Scale: 35 mm = 100  $\mu$ m.  
Daniel Studer, Anatomisches Institut, Bern.

## histo cryo

Our histo cryo knives are delivered with a boat for wet sectioning using a DMSO/water mixture or in triangular holders for dry sectioning.



▲ E. B. Hunziker, M. E. Müller, Institute for Biomechanics, University of Bern.  
Rabbit joint, calcified cartilage/bone. X760



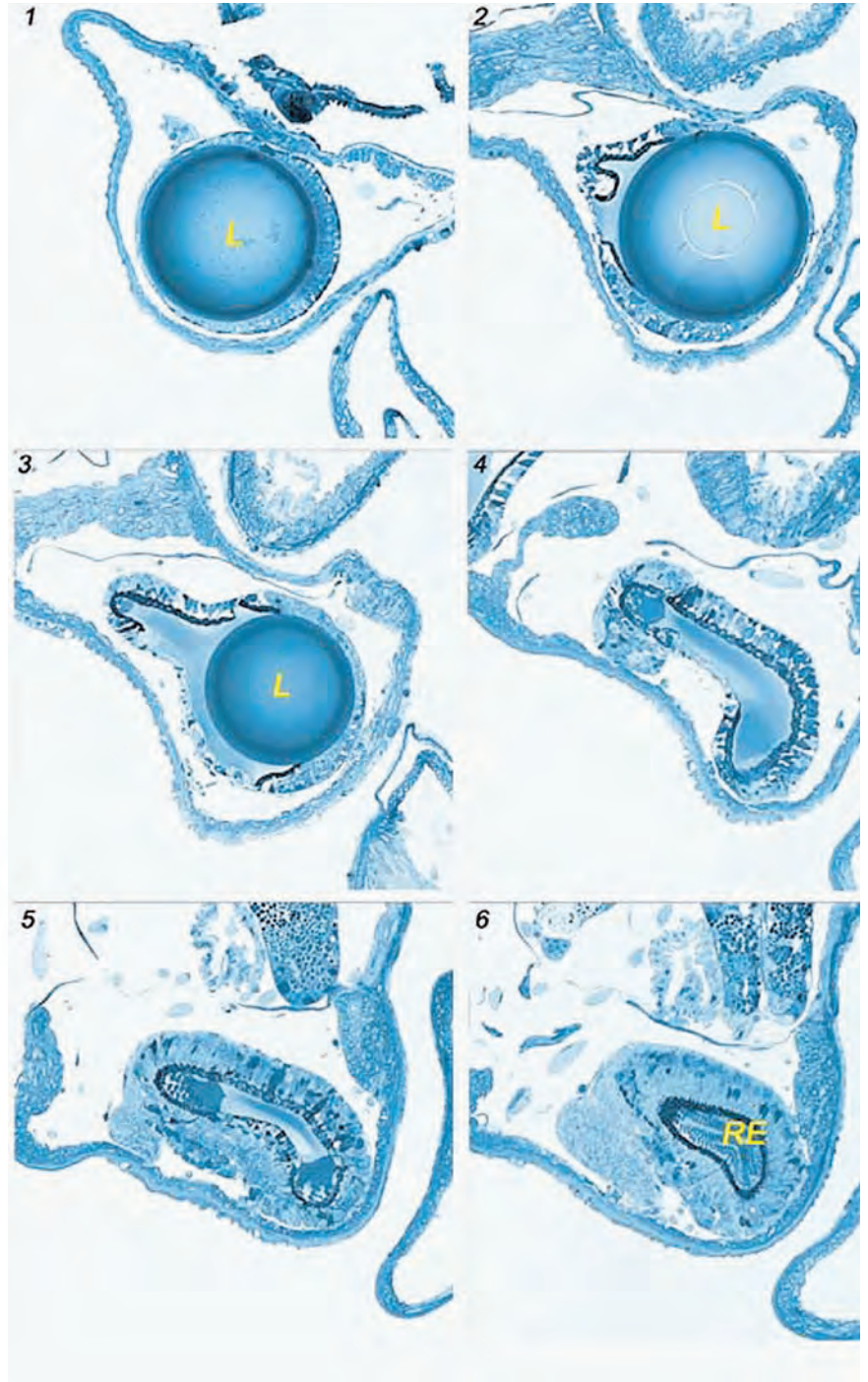
## histo Jumbo

For 3D reconstruction it is imperative not to lose a single section (M. J. F. Blumer et al., *Journal of Neuroscience Methods* 120, pp. 11 – 16, 2002).

The large Jumbo boat as well as the adhesive (Pattex compact by Henkel) applied to the upper side of the sample block increase the distinct advantages of our histo knives.

They allow:

- easy production of section ribbons (0.5 – 2  $\mu\text{m}$ )
- no section loss
- no folding
- the same orientation of all sections
- easy collection of section ribbons
- multiple ribbons on one glass slide
- perfect for immuno-histo-chemistry.



▲ Eye of *A. peroni*: photographic sequence of some semithin sections of a complete serie through the eye. L = lens; RE = retina.

Michael J. F. Blumer, Institut für Zoologie, Universität Wien.

Reprinted from: Ribbons of semithin sections: an advanced method with a new type of diamond knife. *Journal of Neuroscience Methods* 120, pp. 11 – 16, 2002, with permission from Elsevier.

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