

Innovation Award for IOLMaster®

The IOLMaster®, a precision instrument for eye measurement and computation of intraocular lenses prior to cataract surgery, has received the Innovation Award 2000 of the German federal state of Thuringia. The award is presented for technology-oriented, knowledge-based product and process innovations which have been or are likely to be highly successful on the market.

With this development, it has been possible for the first time to utilize innovative technologies to achieve a fundamental improvement in the standard measuring techniques used in the past. The new, pionee-

ring technology incorporated in the system now allows highly precise, non-contact measurement of the length of the eye, the corneal radius and the depth of the anterior chamber, providing the basic data required for determining the parameters of intraocular lenses. The new instrument helps to enhance the patient's visual quality and standard of life after cataract surgery. There is currently no comparable instrument on the world market.

Cataracts, a clouding of the lens of the eye, are the most frequent cause of blindness in developing countries, accounting for more than

50% of all cases. In industrialized countries, cataracts are treated by surgery, in which the opaque lens of the eye is replaced by a plastic intraocular lens. Millions of these operations are carried out all over the world every year, making this technique the most frequent surgical procedure to be performed. About 400,000 cataract operations are carried out in Germany alone every year, and as many as 1.5 million in the USA.

More than 1000 IOLMaster® systems have now been sold after the start of serial production in September 1999. The grand total of 1306 had been reached on March 8, 2001.

Figs 1 and 2: Precise eye measurement and computation of intraocular lenses prior to cataract surgery – the convenient, non-contact way with the IOLMaster®.



Philip Morris Research Award

The force of light is capable of picking up living cells without contact and moving them to and fro under the microscope or, for example, cutting sperm tails with unparalleled precision in order to immobilize the sperm for invitro fertilization. The concentrated light of a laser is a universal tool used in more and more applications in biology, biotechnology and medicine. Karin and Raimund Schütze have been honored with the Philip Morris Research Award 2001 for the development of marketable micromanipulation systems using this technology as a basis.

The so-called optical tweezers are a continuously operating laser beam which is projected into the beam path of a microscope and focused through its optics on a minute spot located exactly in the plane of the object observed. The wavelength is chosen in such a way that the biological objects are transparent for the laser light – this way they are not heated or even burnt. However, the really interesting processes take place at the focal point of the laser which is only one thousandth of a millimeter wide: As a result of the concentrated energy of the photons, individual cells can be held in much the same way as with a pair of tweezers and moved in the grip of the light beam.

In contrast, in a laser scalpel (microdissection system) a UV laser emits high-energy pulses and the beams cut precise paths into the biological material. Photolysis, the "cold" decomposition of biochemical structures, ensures point-to-point precision.

Karin Schütze discovered another application of the laser: the pinpoint "catapulting" of single cells. Under the pressure of a laser beam, it is possible to transport a cell cleanly, without contact and with high precision. The user of the procedure automated by P.A.L.M. just marks the selected cells of the specimen on a



Fig. 1: Dr. Karin Schütze at the PALM® MicroBeam System (manufacturer: P.A.L.M. Microlaser Technologies AG) including the Axiovert® 200 microscope from Carl Zeiss.

monitor and is then able to catapult them with a simple mouse click. Thus, the marked cells are obtained with a degree of purity which cannot be achieved using conventional methods, but which is a must in many applications.

New fields of application for laser systems are constantly emerging. The laser scalpel, for example, can be used to drill a minute hole in a living cell and thus induce the cell to absorb substances from its surroundings before it closes the hole again. At the P.A.L.M. laboratory, the first successful forensic trials have been started including, for example, the isolation of individual sperm cells from the clothes of sexually abused children, or the catapulting of cells sticking to hair in order to help find the perpetrator.

Scientists who are advancing deeper and deeper into the microcosm and nanocosm are in urgent need of instruments allowing them to work at this microscopic level. One of the most important of these tools is now provided by P.A.L.M: the PALM® MicroBeam System for the non-contact recovery of specimens of biological material which is based on the Axiovert® 200 inverted microscope from Carl Zeiss.

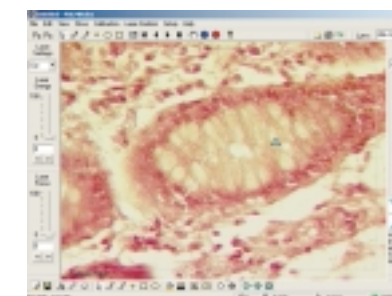
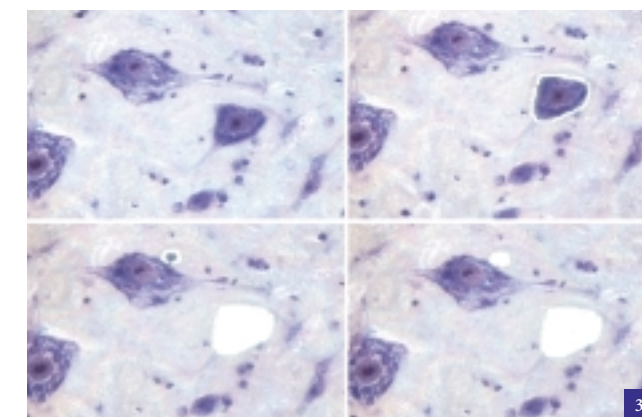


Fig. 2: Screenshot of the user-specific PALM® RoboSoftware with marked cell areas.



Figs 3 and 4: Examples showing possible applications of the PALM® MicroBeam System. 3: Dissection of nerve cells. (Photo: B. Meurers/ R. W. Johnson, Pharmaceutical Research Institute, San Diego, USA). 4: Recovery of chromosomes.

