First Half of 20 but No Half M

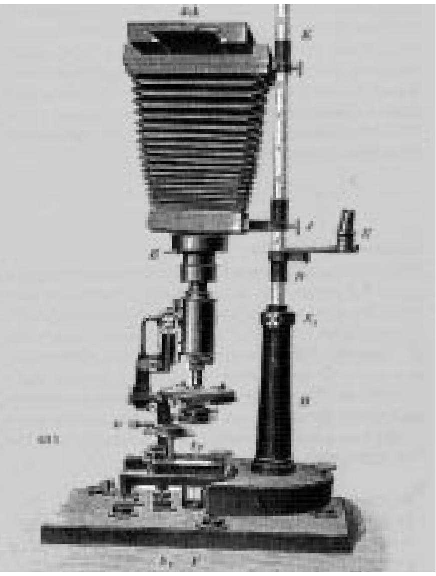
The first year starting with 19 sees the Carl Zeiss company employing no less than 1070 people, and there is no end of growth. While activities over the first fifty years were exclusively devoted to microscopes, the enterprise now gets busy in more and more other lines of optical instruments.

Still, the history of Zeiss is primarily a history of microscopes. So let us stick to the subject in this tribute to Carl Zeiss, the more so as there is no lack of sensational development, inventions and innovations during the first decades of the century. Their mere enumeration would go beyond the scope of this brochure. At least the most essential ones deserve mentioning, though.

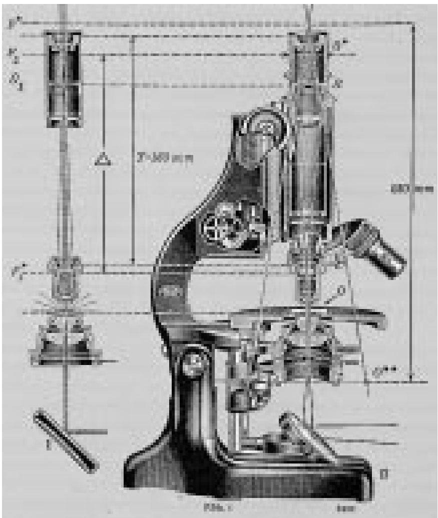
In 1903 Ernst Abbe retires from the management, handicapped by severe health problems. He lives to see in this year the limits of classical microscopy finally exceeded by the ultramicroscope, an invention by Henry Siedentopf and Richard Zsigmondy, which makes submicroscopical colloids visible. He lives to welcome August Köhler's study reports about the ultraviolet microscope in 1904 (which is followed by the luminescence microscope in 1913). On January 14, 1905, the man who jointly with Carl Zeiss wrote a decisive chapter of the history of microscope making dies, deeply mourned by all Zeiss employees.

The ultramicroscope, the UV microscope and the luminescence microscope exemplify the inventive genius of those years and reflect three goals of microscopy, which have remained topical to date: Making ever smaller dimensions accessible to observation; observing living objects without damaging them; and finding methods to contrast the substances in such objects.

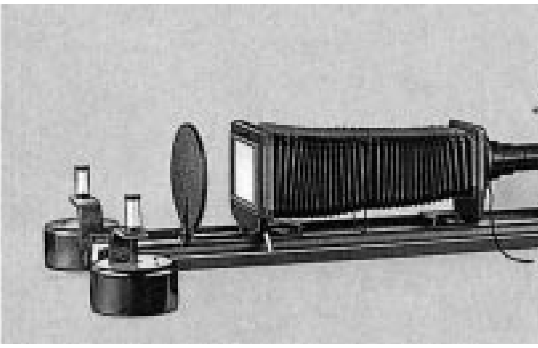
In 1911, Zeiss implements Köhler's idea of parfocalizing all objectives used on a microscope, which means that the image remains in focus when the observer exchanges one objective for another. In 1920,



1904: Ultraviolet microscope



1924: Path of rays in a microscope



1934: NEOPHOT, a large epi-microscope with camera

th Century,
easures

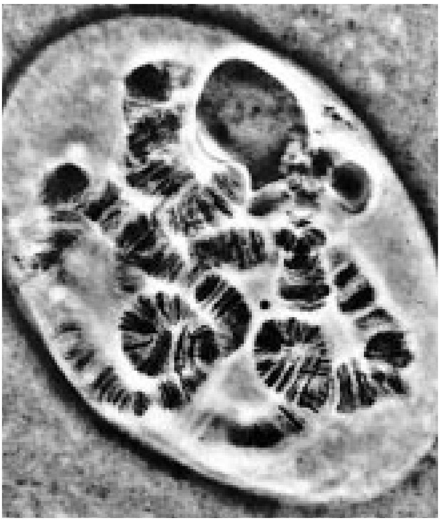
the comparison eyepiece is introduced, which allows simultaneous observation of two specimens under two microscopes.

1924 sees the world's first lot production of infinity-corrected objectives for the Large Metallograph of the LeChatelier type.

Let us jump to 1931 to see the development of the first electron microscope, devised by Max Knoll and Ernst Ruska. Two years later, Zeiss once more revolutionizes microscope design with its legendary L stand. Curved tube arm, inclined viewing head, invariably horizontal stage and low-positioned controls – features that are enthusiastically welcomed by users for the operating convenience they provide.

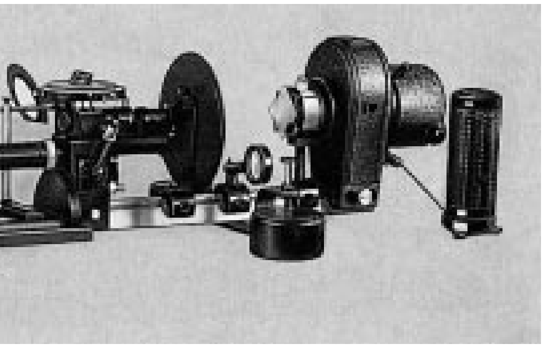
1936: The L stand, prototype of a phase microscope

Photomicroscopes follow – the Neophot in 1934, and the Ultraphot in 1937. In 1938, Zeiss presents another "first": After long and tedious experimentation, Hans Boegehold succeeds in flattening the image field of objectives, so that the company can market the first planachromats. Upon a suggestion by Frits Zernike, Zeiss in 1936 creates the prototype of the phase microscope.



1941: First photograph of a living cell nucleus

During World War II, microscope development has to be soft-pedaled, on government order. Nevertheless, the microscope development laboratory designs and builds a cine-micrographic apparatus and in 1943 shoots the first cine record of a cell division through a phase microscope – an examination method that opens up a new era of cell research.



This may suffice as a fast glimpse of the near-half century of Zeiss since 1900. The grief over Abbe's death, enormous technical progress, successful business, setbacks: all considered, a great time.

Now imagine, in striking contrast, the drastic consequences of the war and its aftermath.

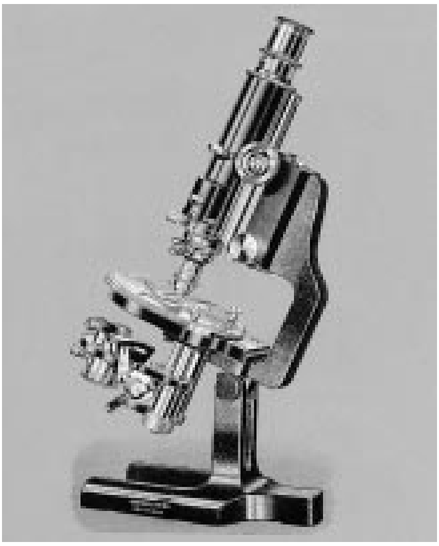
Jena – Göttingen – Oberkochen – Jena

1945: The disastrous war has ended with Germany's (and Europe's) political and ideological division. As a bitter consequence, Zeiss is forcibly cut in two.

Zeiss managers and many scientists are evacuated to the American zone, many more scientists, designers, engineers and foremen taken to Russia. By 1947, all production facilities in Jena, save for a rest of 6%, have been dismantled and shipped abroad.

In the first years after the war, Carl Zeiss once again demonstrates the significance of a future-oriented attitude. Reconstruction in Jena starts with a workforce of about 4500.

A new start is also made by 250 people at Oberkochen, Württemberg. Despite adverse conditions, the old Carl Zeiss spirit refuses to give up. Splitting, in this case, means doubling.



1926: Ore microscope III M for teaching and routine

Göttingen A Flashback

Back to the year 1857. Rudolf Winkel sets up a mechanic's workshop in Göttingen. Guess what he makes? Right – microscopes. Simple ones at first, compound ones later. Good ones throughout. He is successful, exports a lot, expands the business, and has his sons enter it. Ernst Abbe first visits Winkel in 1894. In 1911, Carl Zeiss becomes the principal shareholder of the company, which continues to grow.

After 1945, Jena's traditional microscope manufacture is continued in Göttingen. In 1957, the firm of R. Winkel GmbH is taken over by the Carl Zeiss Foundation.

Stages of a Chronicle

1955: Automatic photomicroscope

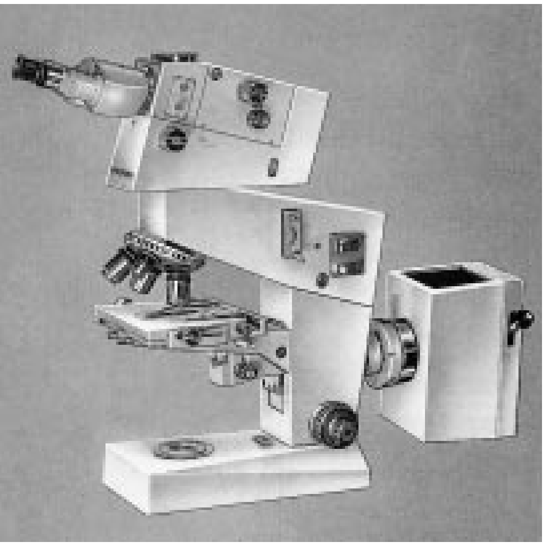
Today, the company which has contributed many improvements to microscope design, still makes about 80% of all Zeiss microscopes and employs about 750 people. They simply have deserved this brief flashback

For four decades, the Zeiss plants in eastern and western Germany operate separately and independently of one another. Achievements are made on both sides. There is no point in separately counting the points made by either side. Let us rather count the points made by Carl Zeiss at large. There are many of them in the chronicle of Zeiss microscope making in the years after 1945.

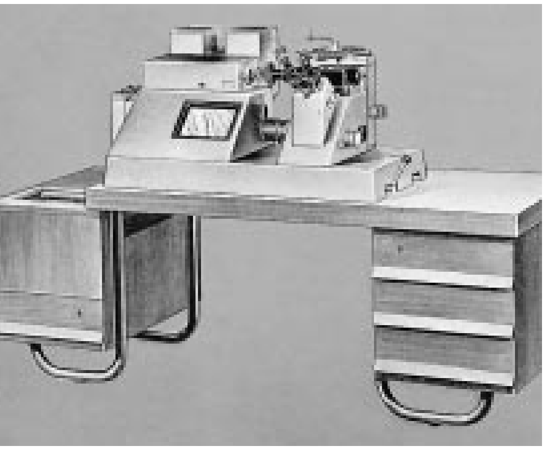
Take 1949, for example: The intensive development efforts in transmission electron microscopy bears fruit. Or 1950: The first member of the Standard family of microscopes sees the light of day. It ushers in a modular, highly flexible system, which becomes one of the most successful developments in the history of microscopes. In the same year, Zeiss applies for a patent on the invention of a magnification changer known by the name of Optovar. 1955: Launching of an all-new photomicroscope with integrated camera and automatic exposure control. 1959: The year of Ultrafluar. Zeiss succeeds in making dioptric objectives suitable for both ultraviolet and visible light. A big step ahead in microspectrophotometry.

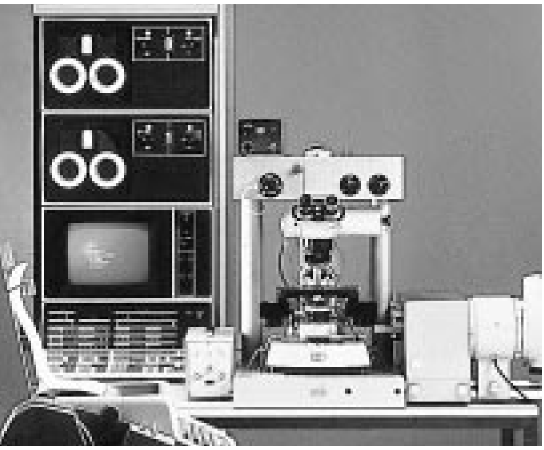
In 1965, materials researchers, doctors and biologists are happy with the new interference phase contrast (Interphako) technique for measuring object thicknesses in the nanometer range and refractive indices of tiniest substance volumes. In 1966 the Mikroval series of microscopes is ▷

◁ STANDARD, a microscope family with many members


1971: EPIVAL interphako


1973: Axiomat NDC


1965: NEOPHOT 2


1969: Scanning microscope photometer

started. The Ultraphot and Neophot, photomicroscopes of good repute, are upgraded into #2 versions and continue on their triumphant progress around the world. A scanning microscope photometer for the automatic photometry of microscopic specimens follows in 1969. Zeiss is always likely to turn out some innovation or other.

1986: JENAMED 2

1987: Axioskop

1973 sees another instant: Zeiss presents the Axiomat microscope system, a modular system with zoom optics providing unparalleled stability and imaging performance. In the same year, Epiquant makes its debut, a fully automatic digital petrofabric analyzer. In 1975 follow the Plan-Neofluar multi-immersion objectives, in 1976 the inverted IM 35 and ICM 405 microscopes in a design that sets new standards.

1982: Zeiss creates the prototype of a laser scanning microscope. Another sensation in the same year: the JENA MICROSCOPES 250-CF with new, fully color-corrected and infinity-corrected objectives, available at last for daily routine in medicine and biology. 1986: ICS optics, an optical highlight that still causes experts to go into raptures; the SI (System Integration) design, the Axioplan and Axiophot universal microscopes, the Axiotron inspection microscope for the semiconductor industry. 1987: Axioskop, a high-grade routine microscope. 1988: Axiovert inverted microscopes ... where to begin, where to end?

1990: A great year. And, just this once, not because of microscopes. The Berlin wall comes down, and so does the wall between the two concerns bearing a common name. The agreement made between them to go together from now on seems to release extra thrust and to open up a new dimension – without borders or other limits.

There always seems to have existed some affinity between Carl Zeiss and top-flight scientists. People with bold ideas have sought to get in touch with Zeiss, where many of the tools and methods for their research have come from, while Zeiss has always entertained close relations with universities and other research institutes. No wonder that quite a number of Nobel laureates have either, in their research, used Zeiss microscopes, or made discoveries or inventions that went into them. Our applause is due to all of these celebrities, even though we can only mention a few here.

Nobel Prizes for Noble Minds

Robert Koch, Nobel Prize for Medicine, 1905.
Koch is considered the founder of modern bacteriology. In the eighteen-eighties, the country doctor discovered the bacilli that caused tuberculosis and cholera. In a letter to Carl Zeiss he wrote, *"A large part of my success I owe to your excellent microscopes".* In 1904, he received the 10,000th Zeiss objective, a homogeneous immersion system, as a present.

Richard Zsigmondy, Nobel Prize for Chemistry, 1925.
As a professor at Göttingen, Zsigmondy conducted pioneering research in colloid chemistry. He invented the ultramicroscope in 1903, and two types of membrane filters in 1918 and 1922. Ultramicroscopy after Siedentopf and Zsigmondy makes visible submicroscopic particles whose linear extension is below the microscope's resolution limit.

Frits Zernike, Nobel Prize for Physics, 1953.
The Dutch physicist, when experimenting with reflection gratings in 1930, discovered that he could observe the phase position of each ray, and sought to utilize the effect for microscopy. Together with Zeiss he developed the first phase-contrast microscope, the prototype of which was made in 1936. It allowed the examination of living cells without harmful chemical staining.

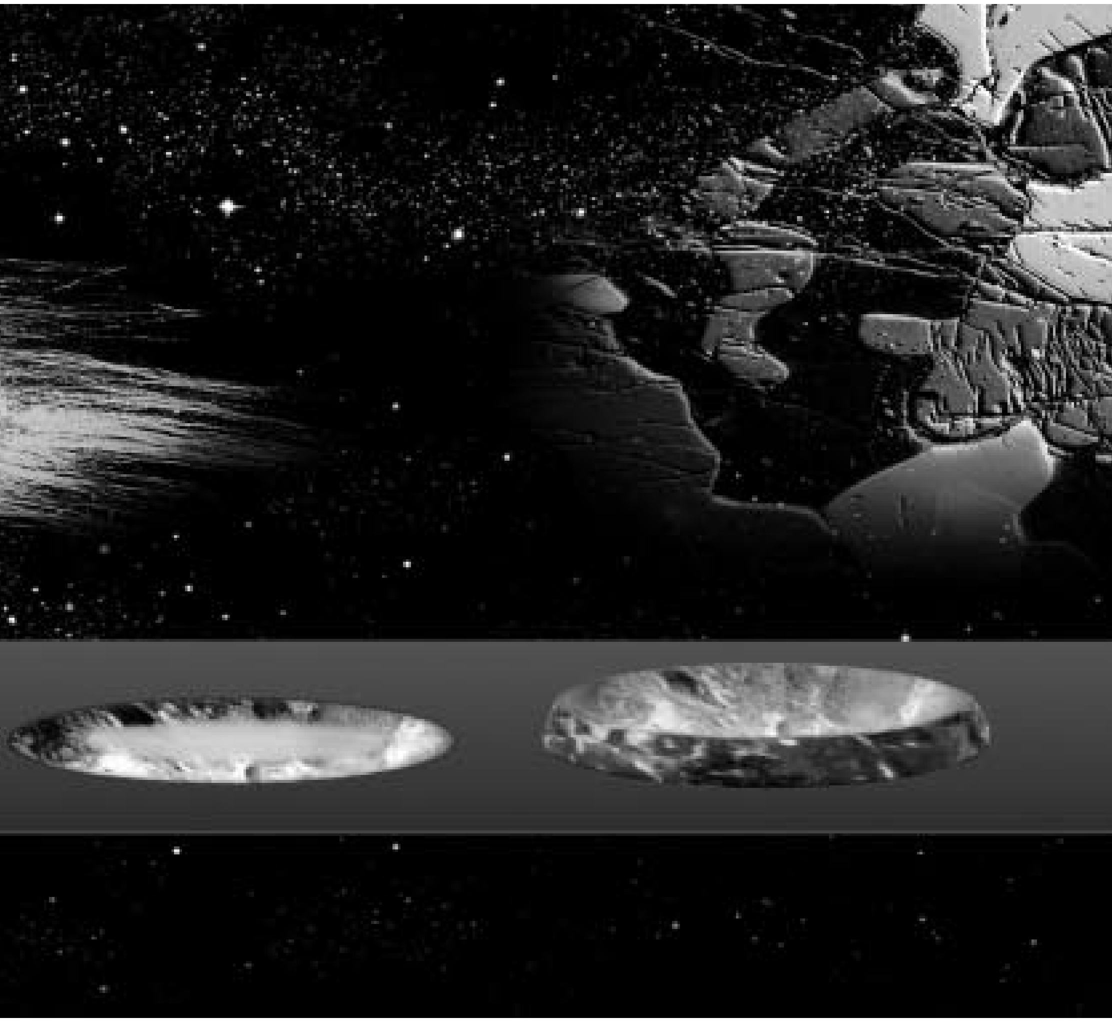
The Nobel Tradition Continues

Manfred Eigen, Nobel Prize for Chemistry, 1967.
The molecular biologist and director of the Max Planck Institute in Göttingen developed a method of keeping track of extremely fast chemical and biochemical processes. In a joint effort, Eigen, his Swedish colleague Rudolf Riegler and Carl Zeiss succeeded in 1993 to create ConfoCor, the first commercial fluorescence correlation spectrometer.

Bert Sakman (photo) and **Erwin Neher,** Nobel Prize for Medicine, 1991.
The two scientists of the Max Planck Institute conducted epoch-making investigations of living cells. All microscopes they used were custom-designed Zeiss products specially made for this application.

Edward B. Lewis, Christiane Nüsslein-Volhard (photo) and **Eric Wieschaus,** Nobel Price for Medicine, 1995.
Two Americans and one German studied the hereditary factors of the fruit fly (Drosophila) to explore the development of complex organisms from an egg cell and the mechanisms of morphogenesis. The epoch-making discoveries might, in the long run, throw light on the causes of deformities, the Nobel committee declared. For their experiments, the three scientists extensively used Zeiss microscopes, among them the Stemi 2000 stereomicroscope.

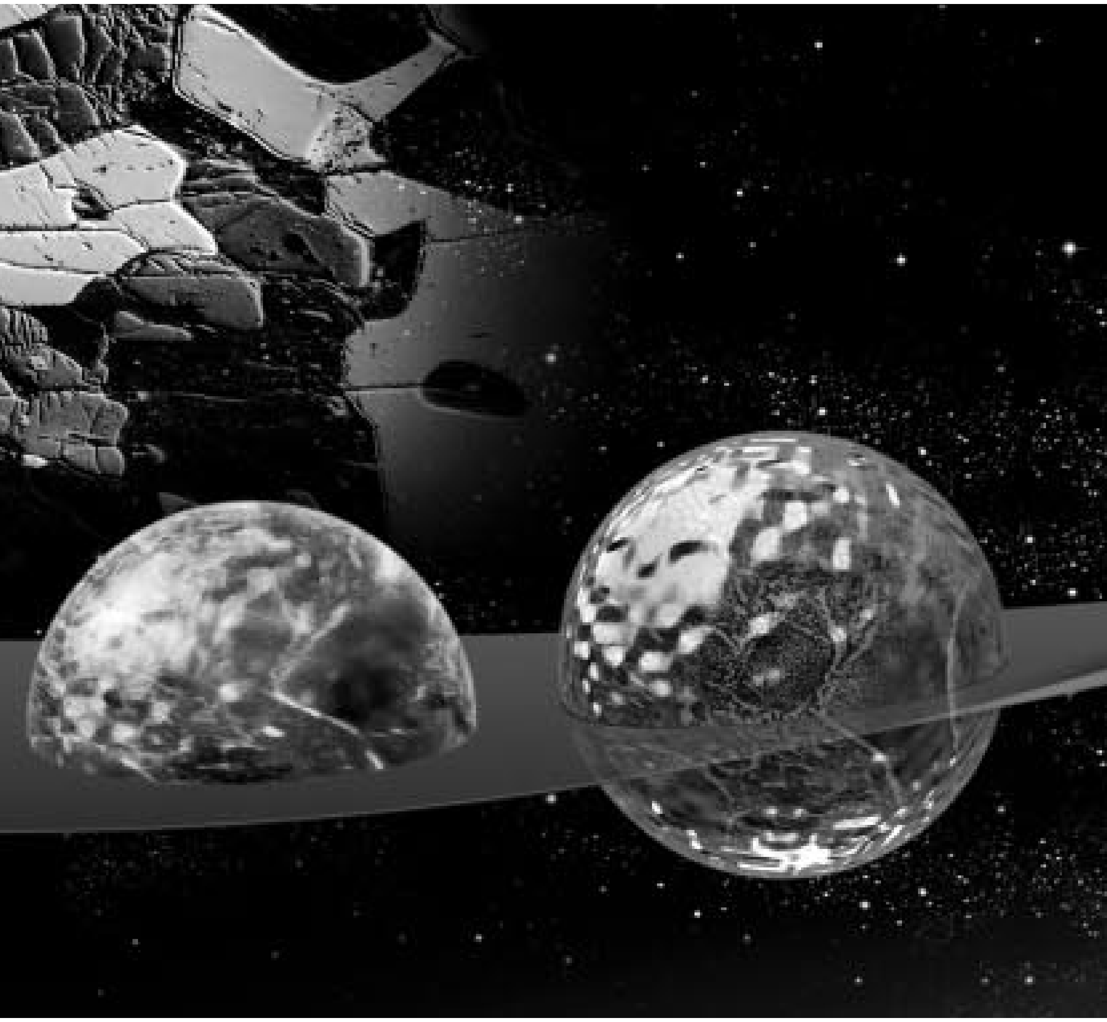
If That Is What the Future Looks Like …



Borders are disappearing, limits are being exceeded and frontiers shifted. New dimensions open up which would have been considered science fiction years ago. The potential of what is technically possible in microscopy is far from exhausted yet.

Telemicroscopy around the globe. Digial communication at light velocity. Series of high-resolution, high-contrast, real-time 3D microimages...

All this, and more, is in the offing. Carl Zeiss, as ever, anticipates the future.



... Super!

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