



# Newsletter

Of the

## New York Microscopical Society

1 Prospect Village Plaza  
(66F Mt. Prospect Avenue)  
Clifton, New Jersey 07013-1918  
GPS: Latitude 40.8648N, Longitude 74.1540W



October 2014

N.Y.M.S. (973) 470-8733

Volume 8 (28) Number 8

### Fall 2014 NYMS lecture Series

#### Trade and political interactions in the eastern Mediterranean during the 2nd millennium BCE as seen under the petrographic microscope.

**Speaker: Prof. Yuval Goren, Date: Sunday, October 26, 2014 at 2 PM at NYMS at Clifton, NJ**

Dynamic interaction throughout western Asia and the eastern Mediterranean between ca. 1500–1200 B.C. brought about a period of international exchange characterized by the transmission of commodities, artistic motifs and styles derived from Mesopotamia, Anatolia, Egypt, the Levant, and the Aegean. Although for decades, scholarly interest has focused on the nature of this exchange, much remains open for various lines of interpretation. In this lecture the results of a research project will be presented, which aims at disclosing more evidence about the characteristics of this international exchange system through microscopic and elemental analyses of the ceramic containers and some sailing equipment from the cargo of the most important 2nd millennium BC shipwrecks ever to be found along the eastern Mediterranean coastline. Additional information is obtained by the petrographic study of East Mediterranean clay cuneiform tablets from el Amarna, Hattuşa, Ugarit, Babylon, and the southern Levant. This project aims at pinpointing the origin of the texts and clarifying the geographical history of the Ancient Near East.

Dr. Yuval Goren is Professor of Archaeology at Tel Aviv University. He joined the faculty of Tel Aviv University after graduating at the Hebrew University of Jerusalem, and working for seven years as petrography researcher and archaeologist in the Israel Antiquities Authority. He served as the Head of the Department of Archaeology and Ancient Near Eastern Cultures and as Vice Dean of the Faculty of Humanities at Tel Aviv University. He also initiated and directed the graduate program in Archaeology and Archaeomaterials and the Laboratory for Comparative Microarchaeology. Prof. Goren served as a major scientist and expert witness for the state in the investigation and trial regarding many alleged biblical forgeries, including the ossuary attributed to the brother of Jesus. Goren is an Honorary Professor at the University College London (UCL) and serves as a member of Israel's Archaeological Council (the advisory council in archaeology to the Minister of Culture).

Doors will be open at Noon. Refreshments will be available. For additional information, please contact Mel Pollinger (pollingmel@optonline.net) or call (201)791-9826, between 9am & 9pm before the day of the meeting, or by cell: (201) 314-1354, between 9am & 11am (meeting day only). Following the speaker program, NYMS members and their guests may join the speaker for an early dinner at a selected, local restaurant. Cost to members and their guests to be determined. Some arrangements may be made prior to the meeting day.

**September 2014 meeting at Clifton: Reviewing the Aschoff slide collection. (see page 3)**



## Board of Managers

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Peter Diaczuk	<a href="mailto:Peter.diaczuk@gmail.com">Peter.diaczuk@gmail.com</a> ;	(212) 237-8896	June 2016	Board, Past President

**For additional information contact the Editor: Mel Pollinger at (201) 791-9826, or [pollingmel@optonline.net](mailto:pollingmel@optonline.net)**

### Dues and Addresses

Please remember to mail in your Dues to:

**Mel Pollinger**  
**Treasurer, NYMS**  
**18-04 Hillery St.**  
**Fair Lawn, NJ 07410-5207**

Junior (under age 18) \$10

Annually

Regular \$30

Student (age 18 or above) \$20

Annually

Supporting \$60 Annually

Corporate (includes one advertisement in NYMS News)

\$175 Annually

Life \$300 (payable within the year)

To avoid missing notices:

Notify Mel Pollinger if you have changed your address, phone or email.

### Awards Given by the New York Microscopical Society

**The New York** microscopical Society takes great pleasure in recognizing and rewarding individuals who have contributed to either the activities of the society or to furthering microscopy.

These awards are described in our website and in a pdf file for our email newsletter recipients. All members are eligible to nominate individuals for these various awards, and are encouraged to do so.  
 John A. Reffner, Awards Committee Chairperson

### Awards Committee

Chair: John A. Reffner

### Members

Jan Hinsch  
 Peter Diaczuk  
 Angela Klaus  
 John R. Reffner



Mel Pollinger, Editor  
 18-04 Hillery St.  
 Fair Lawn, NJ 07410-5207

### To Order Your NYMS Lapel Pins

Send a check in the amount of \$12.00 per pin to:  
 New York Microscopical Society  
 c/o Mel Pollinger, 18-04 Hillery Street, Fair Lawn, NJ 07410. To avoid shipping & handling charges, pins may be purchased directly at any NYMS meeting for \$10.00.



### The Mission of the New York Microscopical Society

is the promotion of theoretical and applied microscopy and the promotion of education and interest in all phases of microscopy.

### Alternate Meeting Notifications

Please note that due to time constraints in publishing, some meeting notices may be available by calling Mel Pollinger at 201-791-9826, or by visiting the NYMS website, or emailing: [pollingmel@optonline.net](mailto:pollingmel@optonline.net)

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**Please remember to pay your dues**

*Buy and Read a Good Book on Microscopy.*

...continued from page 1, bottom



The three of us (Seymour Perlowitz, Bob Varner and myself) had a great time going through the antique microscope slides from the collection donated by Walter Aschoff. The variety of specimens (mineral thin-sections, algae and protozoa, blood, plant sections, human anatomy and disease, etc.) and their excellent quality kept us in awe for the entire day. There was a lot to learn and a lot to enjoy.

\*\*\*\*\*

**Register today for McCrone Research Institute's upcoming course:**

## **Comparative Microscopy of Soils**

**Held on December 8-12, 2014**

**Taught by Skip Palenik**

Developed and taught by leading forensic microscopist Skip Palenik, this advanced forensic microscopy course covers the basic principles of soil comparison. Students will study the composition and origin of soils and approaches to scientific soil comparison through lectures, demonstrations and laboratory exercises.

Visit [www.mcri.org](http://www.mcri.org) for full descriptions of all courses, secure online registration, hotel information and more.

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## **Upcoming Events in 2014**

**Dates, Times and Locations to be announced when confirmed:**

NYMS October Meeting lecture Sunday 10/26

•Eastern Analytical Symposium & courses

•McCrone's Course Dec 8-12, 2014

•Winter Forensic Course at Cifton

•NYMS Annual Banquet (December meeting)

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## **Short courses offered this year at the Eastern Analytical Symposium:**

There will be 23 short courses, 8 of them new. They will be held at the Holiday Inn Somerset from Nov. 16 to Nov. 19. You will find all the details at

[http://easinc.org/wordpress/?page\\_id=481](http://easinc.org/wordpress/?page_id=481)

## **Amphiuma...continued from page 4**

The two-toed amphiuma (Amphiuma means) is a snake-like [salamander](#) found chiefly in the southeastern [United States](#). It is commonly, but incorrectly, called "congo snake", "[conger eel](#)" or the "blind eel". One of the largest extant species of amphibians in the world, they can grow from 39 to 1,042 g (1.4 to 36.8 oz) in mass and from 34.8 to 116 cm (13.7 to 45.7 in) in length. They have four vestigial legs that end in two or three toes which are virtually useless, and eyes with lids. they are blue-black in color.

They feed on small [fish](#), [crawfish](#), [insect larvae](#), and even small snakes; they are harmless to humans when left alone, but when disturbed, they can deliver a tough bite, which may lead to a severe infection. Unlike other salamanders, which are [mute](#), A. means gives a clear whistle when disturbed. ( From Wikipedia)



## **Hong Kong Elementary School First Grade Student Admissions Test Question**



香港小学入学考试题: 21题 Hong Kong Elementary School Admissions Test Question #21

What parking spot # is the car parked in?

请问汽车停的是几号车位?

请在20秒内完成回答

Please answer within 20 seconds

## **Be A Volunteer – There's Always Something to do and see at NYMS.**

If you wish to contribute some of your time to NYMS, please contact me at (201) 791-9826 or by email at [pollingmel@optonline.net](mailto:pollingmel@optonline.net)



## Visitors Always Welcome to NYMS

Although most of our lecture meetings, workshops and classes are held in the NYMS Clifton facility on the last Sunday of the month, the building may be opened for special purposes at other times, by appointment only. For such an appointment, please contact Mel Pollinger by phone at (201) 791-9826, M-F noon to 9:30pm, or by email at [pollingmel@optonline.net](mailto:pollingmel@optonline.net).

### ***From The Editor...***

**if you have an email address:** Getting the newsletter by email means you can receive an **extended pdf version** that cannot be sent by "snail mail." Even if you only continue your USPS delivery of the newsletter, NYMS needs your email address for reporting priority events and special news. Being able to contact you quickly by email means better communication between you & NYMS■ Mel

### **Need to use a Microscope?**

The various microscopes that are presently set up on the main floor of the New York Microscopical Society building in Clifton, N.J. are there for the use of its members.

From Gary Mayer: In need of parts for older Olympus Microscopes? Contact J.C. Ricky in Ohio at (740) 862-9252

### **Microscope Cleaning Kit**

A complete set of tools and accessories to keep your microscope in optimum operating condition. The kit is put together by our previous Curator/Educational Chairman, Don O'Leary, and available directly from NYMS, while they last, for only \$35.00 plus shipping & handling, or may be purchased at a meeting. Call or email Mel Pollinger for details (see page two for contact numbers).

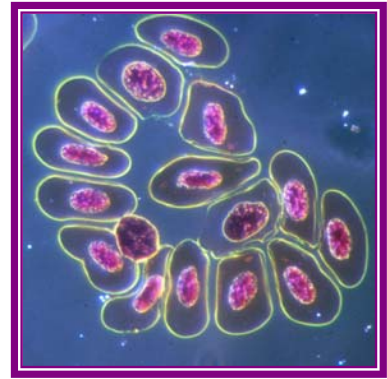
## **NYMS Meeting Dates**

***Most meetings of NYMS are usually held in Clifton on the last Sunday of the months of Jan., Feb., Mar., May, Sep., Oct. Exceptions will be noted in the Newsletter.***

NYMS microscope slide collections are available for study at meetings and by appointment.

***Please note that our website is presently under repair.***

## **Answer to Mystery Photo for September 2014**



Amphiuma blood. Amphiuma is an aquatic salamander. Did you guess correctly? (See page 3)

## **Mystery Photo for October 2014**



Want to take a guess? Send it to me by email or call me: [pollingmel@optonline.net](mailto:pollingmel@optonline.net), (201) 791-9826

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Additional Historical NYMS Supplements  
Email Newsletter recipients will also be getting copies of NYMS Newsletter pdf back-Issues from 2007. Copies of older newsletters will be sent as I convert them.

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## ***Attention NYMS Members***

***Got something to sell? Article to publish? Pictures for the newsletter? Looking to buy something? Want to use the library? Want to use a NYMS microscope? For any of the above, contact the Editor, Mel Pollinger.***



**Supporting Member**

# **NYMS Extended Newsletter Section**

## **Directions to NYMS Headquarters**

**One Prospect Village Plaza  
(66F Mount Prospect Avenue)  
Clifton, NJ 07013**

**GPS: Intersection of Colfax & Mt. Prospect:  
Latitude 40.8656 N, Longitude 74.1531W,  
GPS: Our building: Latitude 40.8648 N,  
Longitude 74.1540 W**

### **In This Section:**

- NYMS Banquet Flyer
- McCrone Soil course
- Cycloptic microscopes
- Field microscope sales
- NYMS Items for Sale
- Membership Application
- Last page images

### **From George Washington Bridge:**

Take Interstate Route 80 west to Exit 57A, Route 19 South. Take Route 19 to Broad Street and continue two lights to Van Houten Avenue. Turn Left. Go to second light, Mount Prospect Avenue and turn left. Building 66F is on the left side , one and a half blocks from Van Houton.

### **From Lincoln Tunnel:**

Follow exit road to NJ route three west. Continue to Bloomfield Avenue exit. Turn right to Circle and go three quarters to Allwood Road West. Mount Prospect Avenue is a few blocks on the right (a small street) Turn right and go to first light (Van Houton) continue. Building 66F is on the left side , one and a half blocks from Van Houton.

### **From North:**

Take Garden state Parkway South to Route 46 Clifton Exit. On 46 Make second exit to Van Houton Ave. Continue to third light Mount Prospect Avenue and turn left. Building 66F is on the left side , one and a half blocks from Van Houten.

### **From Route 46 coming from west:**

Take Broad Street Exit in Clifton and follow Directions above from GW Bridge.

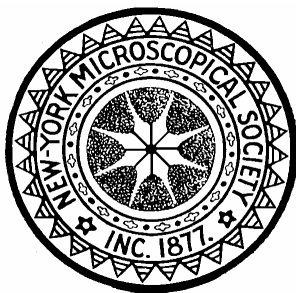
**From route 46 coming from East:** Take Paulson Avenue Exit in Clifton and follow to Second light, Clifton Ave turn right. Go to next light, Colfax, turn left, go three blocks and turn right on Mount Prospect Ave.. Building 66F is half block on right.

### **Public transportation from NY:**

Take NJ Transit train from Penn Station to Secaucus Transfer Station. Change trains to Bergen Line to Clifton (call NJ Transit for schedules). From Clifton Station cross under tracks to first street and go left one block to Mount Prospect Street, turn right and Building 66F is one half block on Right.

### **If you plan to come by bus or train, please copy the links below into your browser:**

[http://www.njtransit.com/sf/sf\\_servlet.srv?hdnPageAction=TripPlannerItineraryTo](http://www.njtransit.com/sf/sf_servlet.srv?hdnPageAction=TripPlannerItineraryTo)  
[http://www.njtransit.com/sf/sf\\_servlet.srv?hdnPageAction=BusSchedulesP2PTo](http://www.njtransit.com/sf/sf_servlet.srv?hdnPageAction=BusSchedulesP2PTo)  
[http://www.njtransit.com/sf/sf\\_servlet.srv?hdnPageAction=TrainTo](http://www.njtransit.com/sf/sf_servlet.srv?hdnPageAction=TrainTo)



# New York Microscopical Society

One Prospect Village Plaza  
(66 Mount Prospect Avenue)  
Clifton, NJ 07013

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## NYMS 2014 Annual Banquet

**What:** Enjoy a wonderful Buffet Luncheon, including soft beverages (cash bar available) and desserts, with your fellow-members, an exciting speaker presentation (to be announced) and an overall jolly time at one of the oldest restaurants in mid-town Manhattan; The Landmark Tavern.

**When:** Sunday December 14, 2014, from noon until 3:30pm.

**Where:** Landmark Tavern, 626 11th Ave., at W. 46th St New York City, NY  
Tel: 212-247-2562.

**Cost:** \$35.00 per person.

**How:** Reserve your place now\* by filling in the Reservation Request form below and mailing it along with your check to the Treasurer (see address below).

**\*Reservation requests must be received on or before November 20, 2014**

-----  
Number attending \_\_\_\_\_ @ \$35/each = (write check amount) \_\_\_\_\_

Member name \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_ eMail \_\_\_\_\_

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Send this form and payment to:

NYMS Banquet 2014  
c/o Mel Pollinger, Treasurer  
18-04 Hillery Street  
Fair Lawn, NJ 07410-5207

For additional information contact Mel Pollinger  
(201) 791-9826 or email: [pollingmel@optonline.net](mailto:pollingmel@optonline.net)

**Space is limited, so rush your application in asap.**

***The Cycloptic®***

***AO (American Optical) CMO Stereomicroscope***

*R. Jordan Kreindler (USA)*

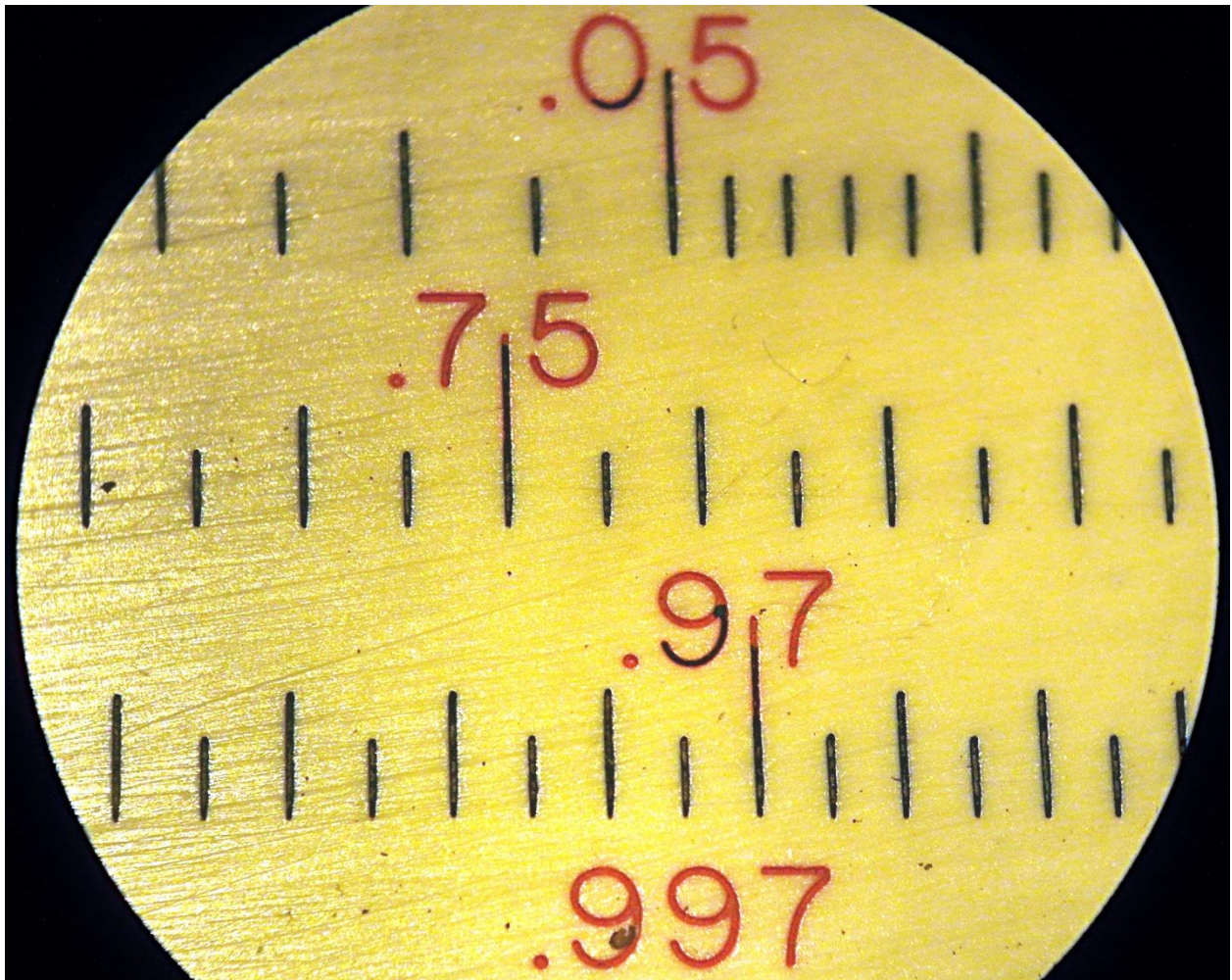


Figure 1. Portion of K&E DECI-LON 6" slide rule, seen through AO Cycloptic microscope in Fig. 8



## ***Background: The Modern CMO***

The first common objective stereo microscope was developed by Prof. John Leonard Riddell of New Orleans, USA c. 1853. Although built by the Grunow Brothers, perhaps the leading microscope maker at the time, it quickly found obscurity. The design of this microscope was later re-discovered independently, i.e., without prior knowledge of Riddell's design, by John Ware Stephenson of England. The Stephenson model was made by a number of manufacturers, including Ross, Browning, Baker, and James Swift and Son.

Fig. 2 shows a Riddell-Stephenson model made by J. Swift and Son.

Although, Riddell-Stephenson style microscopes used a single common objective to obtain stereo images, the objective was small with limited light gathering ability.

The modern CMO (Common Main Objective) microscope, one with a large single objective was developed by Carl Zeiss, Jena in the late 1940s. It was known as the "Citoplast" in East Germany. A similar model was developed by the West German Zeiss Company. See Fig. 3 for an example of the Citoplast and Figs. 4 and 5 for a Zeiss CMO made under the Opton label. (Kreindler, September 2012).

In his book Armin Herman (Hermann, 1991) mentions that the first West German Zeiss-Opton Stereomicroscope was given in a small ceremony on January 23, 1949 to Professor Bauersfeld on the occasion of his 70th birthday.

The Opton CMO version was manufactured by the Opton-Optische Werstatte Oberkochen GmbH Zeiss factory at Oberkochen, West Germany. For a period, versions of this CMO microscope were made by both East and West German Zeiss companies.



The Zeiss Opton-branded CMO was considerably larger than most, then current, stereo microscopes, being taller, wider, and heavier. At 12 pounds, it weighed almost 50% more than, e.g., the c. 1929 B&L Greenough, dual objective, microscope.

Production of the West German Opton version, ceased in 1954, when the name of the West German Zeiss company was changed to Carl Zeiss, about three years before the introduction of AO's Cycloptic (Orlowski, 2012), (Zeiss, undated). An Opton-style CMO microscope continued in production by the West German Zeiss Company until 1959, under the Carl Zeiss label. (Schulze, 2011, 2012). At least until the 1980s, Zeiss West Germany appears to have used CMO designs in their stereo microscopes, except for models 01, 02, I, Ib, III, and the D-series (Kreindler, September 2012).





Figure 2. Riddell-Stephenson style stereomicroscope  
made by J. Swift and Son

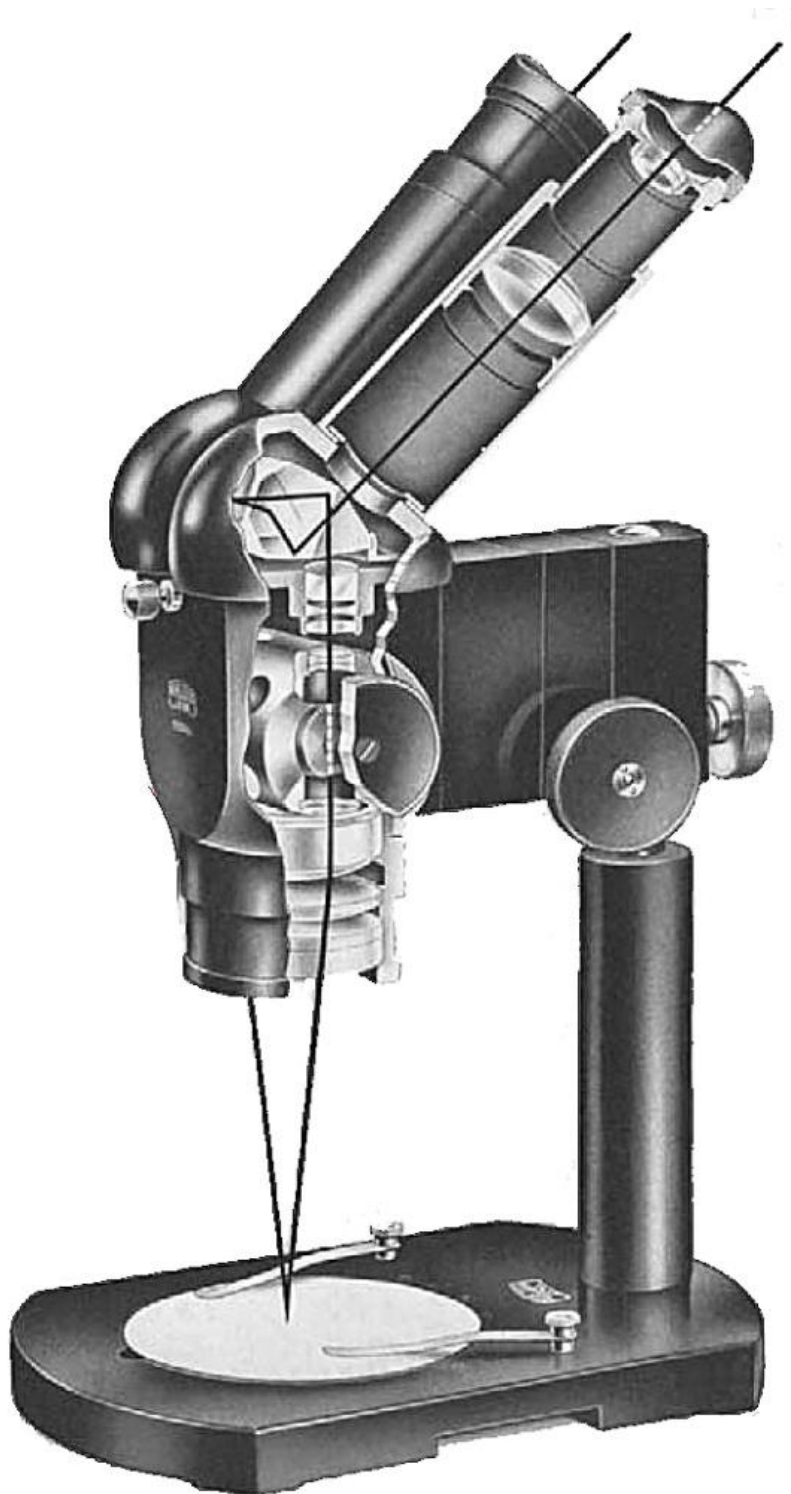


Figure 3. From the East German Citoplast brochure, date unknown. Courtesy, and with permission, of Carl Zeiss Microscopy, LLC (Kreindler, September 2012)

## Stereo Microscopy

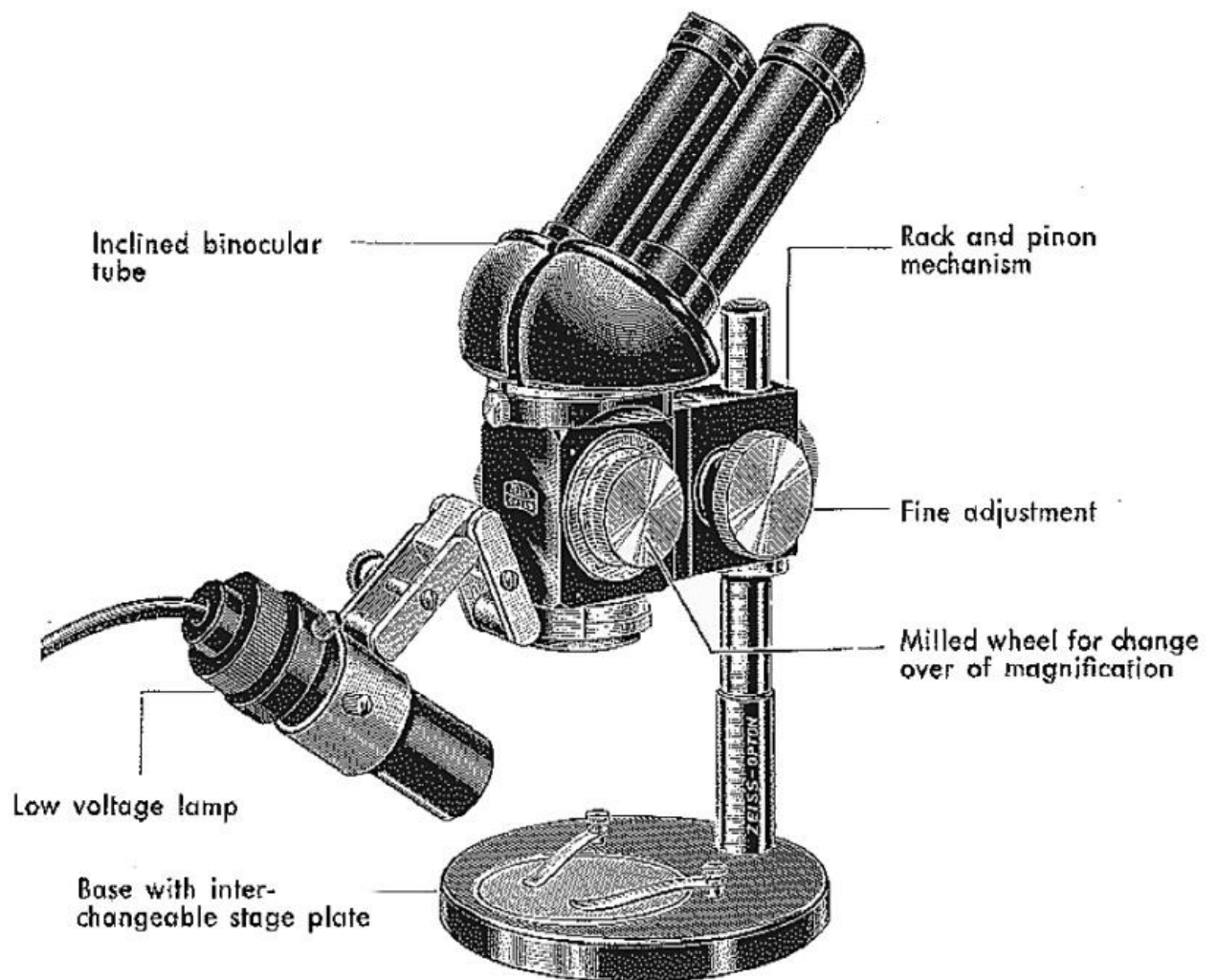


Figure 4. From West German Opton brochure (translated to English), date unknown. Courtesy, and with permission, of Carl Zeiss Microscopy, LLC (Kreindler, September 2012)

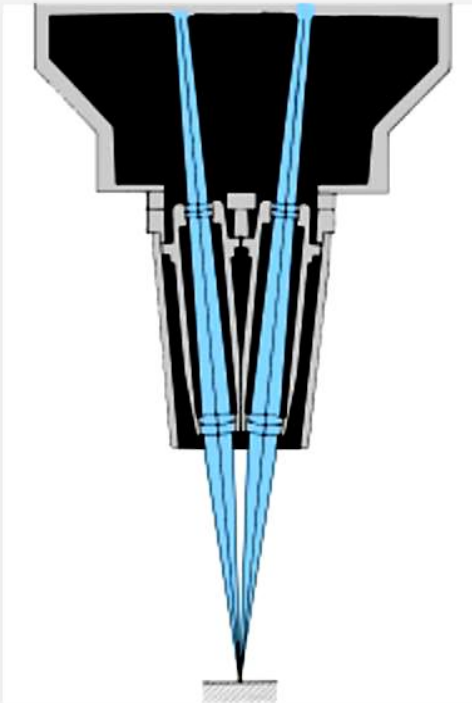


Figure 5. Zeiss Opton-branded CMO Microscope  
(Kreindler, September 2012)



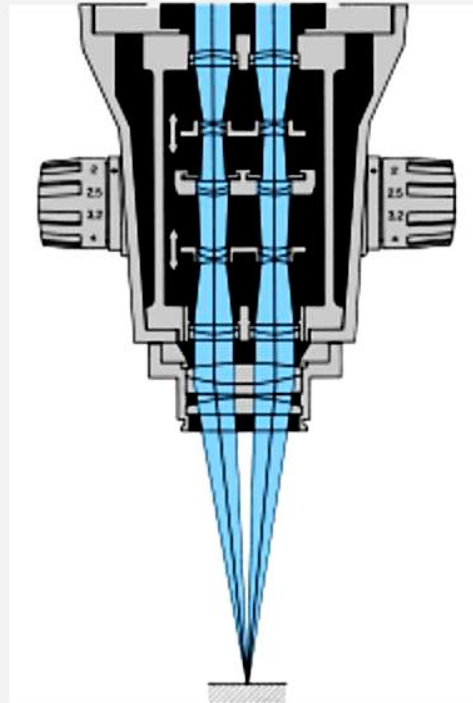
In CMOs, Fig. 6, a single large objective lens is used, and the image from this single lens is divided into two image paths to provide stereoscopic views.

*Modern stereomicroscopes are built according to either of two design concepts:*



### **The Greenough design**

*Two identical objectives, arranged with their optical axes including the stereo angle, generate two separate images. Observed through separate eyepieces, they combine to form a 3D image.*



### **The Telescope design**

*Two microscope systems arranged in parallel share a common objective. The stereo angle is formed by the extra-axial pairs of rays.*

Figure 6. From the Zeiss brochure: *Microscopy from Carl Zeiss. Stemi DR, Stemi DV4, Stemi 2000 Stereomicroscopes*, Courtesy, and with permission of Carl Zeiss Microscopy, LLC. A comparison of Greenough and CMO (Telescope) design microscopes (Kreindler, September 2012)

## *The American Optical (AO) Cycloptic Microscope*

In the aftermath of WW II, any product made in Germany had a hard time getting "traction" in the US and other Western countries' markets. Under these conditions, the first American-made common main objective (CMO) stereomicroscope, AO's Cycloptic quickly became the CMO leader. Although often presented, e.g., on eBay, as if it was a single product, the Cycloptic is actually a variety of different products, with various magnifications, bases, illumination, etc.

AO introduced the Cycloptic in 1957. It came in four basic magnification configurations. These magnification options are shown below for 10x eyepieces.

- "F"      Fixed 15x magnification
- "J":      7x, 15x, and 25x
- "K":      10x, 15x, and 20x
- "M":      7x, 10x, 15x, 20x, 25x

Series "J" and "K" offered three optional magnification options, while Series M offered five. These "built-in" magnifications could be modified in two ways, by the use of different eyepieces, e.g., 15x and/or by the use of auxiliary lens attachments, e.g., the 2x magnifier. The cost differences between e.g., "K" and "M" models, calculated from the AO price list of August 1975, was about 7% to upgrade to an "M" from a "J" model, and about 36%, to upgrade from the fixed model "F" .

AO released the Cycloptic in a color they referred to as "Dove-gray". Others might call this color steel gray. All models came with inclined viewing tubes, and as with most stereomicroscopes long working distances and erect (non-reversed) images. All models provided for interpupillary distance adjustments.

R. B. Tackaberry, Manager Instrument Development. AO Spencer (American Optical, Unknown) in AO's Cycloptic Reference Manual provides a partial list that sums up some of the microscope's most salient features. The features listed include:

*Apochromatic Objectives*

*Long Working Distance*

*Full Color Correction*

*Uniformly Sharp Field*

*Wide Range of Magnifications*

*Rapid "Dial-In" Magni-Changer*

*Reversible Inclined Body*

*Comfortable 30° inclined body*

*Dustproof, Watertight, Construction*

*Permanent Optical Alignment*

*Erect Non-Reversed Image*

*Magnification Extending Attachments*  
*Planned Illumination*  
*Versatile Transilluminator*  
*"Cyclospot" Illuminator*  
*Modern Cabinets*

*Interpupillary Adjustment*  
*Nylon Knobs*  
*Dove-Gray Epoxy Finish*  
*Lifetime Lubricants*  
*Adjustable Focusing Tension*  
*Attached Stage Clips*

*Coated Optics*  
*Finest Optical System*  
*Rugged Construction Throughout*  
*Modern Functional Styling*  
*200 Precision Parts*

*3-Element Eyepieces*  
*Highly Corrected Wide Fields*  
*High Eyepoints*  
*Eyeshields*  
*Mechanical Stage Accessory*

In their 1977 manual AO (American Optical, 1977) further notes,

*The CYCLOPTIC principle utilizes a highly corrected monobjective whose image is examined with a unique binocular telescope system to yield sharp, clear, enhanced stereoscopic image of the full field of view.*



Figure 7, Cycloptic common main objective (CMO), apochromatic triplet

*The objective of the CYCLOPTIC microscope is a true apochromatic triplet (Author: Fig. 7) providing a full four inches of working distance.*

*The binocular telescope system consists of paired achromatic telephoto lens combinations, unique one piece prisms and new four element wide field, high eyepoint eyepieces which permit comfortable visualization with or without eyeglasses.*

It is likely the Cycloptic name, in consideration of the CMO, derives from the one-eyed giant, "Cyclops", of Greek and Roman mythology.



Figure 8. AO Cycloptic model for reflected light, with Magni-Changer "M" (Kreindler, September 2012)



The Cycloptic's CMO lens was an apochromatic triplet.

Fig. 8 shows a portion of the basic binocular Cycloptic stereomicroscope model with Magni-Changer "M". Fig. 9 presents the fixed model "F", 1.33X, without Magni-Changer (see below).

Figure 9. Cycloptic with fixed magnification option



### *The Magni-Changer*

Magnification changes using the built-in capabilities of options "J", "K", and "M" were accomplished using the Magni-Changer. The three magnifications options of Magni-Changers "J" and "K" were obtained using 8 achromatic lens elements. Option "M"'s five choices were obtained using 16 achromatic elements.

*The "M" Cycloptic Magni-Changer shown in Fig 10, contains four clear openings, in opposite pairs, and two telescopes. The clear openings allow for "straight through" images. The dual paired telescopes have four lens groups each. The telescopes can be rotated into the optical path in opposite orientations. This allows, as with stand-alone telescopes, for the magnification or diminution of images. The drum provides five magnification options. One for the "see-thru" openings, the same in either forward or backward orientations, four additional magnifications using the two telescopes on the drum, in either front or back orientations.*

-- (Kreindler, September , 2012)



Figure 10. AO Cycloptic Magni-Changer

*This type of magnification changer where the same components are used but reversed to obtain different magnifications is often referred to as a "Galilean drum", as here, as the drum actually contains small Galilean telescopes. These telescopes are frequently composed of plano-convex and bi-concave lenses. Galilean telescopes provide erect images.*

*The Cycloptic, with its Galilean drum and distinctive external markings to show magnification choices has a unique appearance, and has been used in various US TV shows including, possibly the most popular TV drama series of its time, CSI where it was used by Supervisor Dr. Gil Grissom, one of the show's lead characters.*

--- (Kreindler, September 2012)

Magni-Changer's various magnifications can be selected just by rotating the changer. AO refers to this as "dialed-in" magnifications. Owing to the relatively small price differences between the "J" and "K" Magni-Changers and the "M" Magni-Changer, the "M" was the most popular Cycloptic model, as can be confirmed by the large number of previously owned Cycloptic model "M"s that are available for sale today.

The markings at the ends of the Magni-Changer allow for magnification determination for four different optical accessories. For example, in Fig. 8, those optional accessories, identified on the Magni-Changer, can be seen to be the 10x and 15x eyepiece pairs separately and then these eyepiece pairs combined with a 2x auxiliary lens. A quite useful feature of the Magni-Changer is parfocality. That is, the magnification can be changed, i.e., dialed-in, without the need to change focus.

The best way to use a Cycloptic with Magni-Changer is to focus on the object at the highest magnification, with the instrument raised above the position of best focus. The focusing knob is then turned to bring the object into focus. This approach will minimize focus accommodation, and produce a less fatiguing viewing session. Initially focusing at the highest magnification will insure that when the magnification is changed, the object will still be in focus. The Cycloptic body has a small indented red dot to allow the magnification in use to be identified, Fig. 11.

Figure 11. Indented red magnification mark



As Dr. Cooke recommends it is always best to,

*... commence the examination with the lowest power of [the] microscope ... the greatest satisfaction will always be derived from a great practical use of low powers.*

-- (Cooke, 1869)

Thus, although the Cycloptic should first be focused with the greatest magnification available, to ensure parfocality, it should then be used at the lowest magnification needed.

The Magni-Changer has detent pins to insure the magnification selected can be locked into place. The detent pins, Fig. 12. snap into a hole in a detent spring. This spring is occasionally missing, allowing the Magni-Changer to rotate freely and continuously when turned.

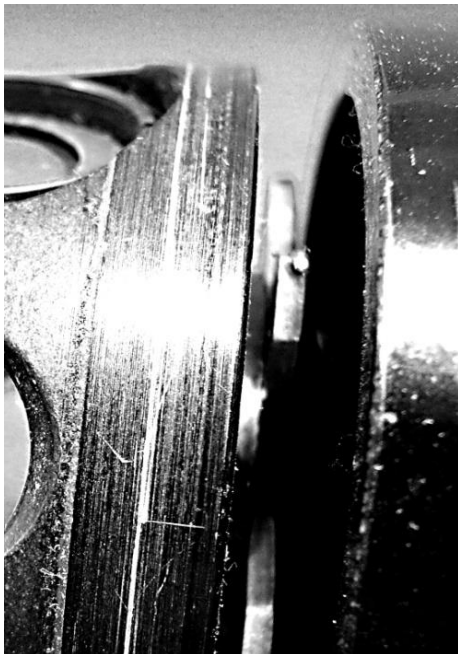


Figure 12. Side view of right-side of Magni-Changer (seen from front of microscope) showing detent pin

If the detent spring is missing or broken, the spring can be replaced. However, if an available AO alternate cannot be found, replacing the broken spring will require machining work (MacGregor, 2007). Even if the detents are no longer functioning, the scope is still fully useable, if care is taken to line up the magnification choices when turning the Magni-Changer.

## *Reversible Binocular Body*

The Cycloptic viewing tubes can be connected to the microscope's frame either facing toward the supporting column or in the opposite direction. Figs. 13 and 14 show the viewing tubes in both positions.



Figure 13. Viewing tubes facing away from column support



Figure 14. Viewing tubes facing toward column support



## Stereo Microscopy

The presence of a hinge pin at the joint where the two viewing sections come together makes it easy to change the viewing tubes orientation. Reversing the direction of the tubes is done as follows:



- (1) The top of the hinge pin (see Fig. 15) has provisions for the insertion of a spanner wrench. Insert a spanner wrench, or thin needle nose pliers - as the AO spanner wrench is often missing - into the openings on the hinge pin's top and rotate counterclockwise.
- (2) Continue rotating the hinge pin until it is free from its threads and can be removed (Fig. 16).
- (3) Remove the viewing tubes, rotate them 180 degrees. Place the hinge pin into the rotated assembly in the alternate mounting hole (Fig. 17), and rotate the pin clockwise until it is fully tightened.
- (4) The rotated assembly is now ready to use (Fig. 14).



Figure 15. Cycloptic hinge pin



Figure 16. Cycloptic hinge pin unthreaded

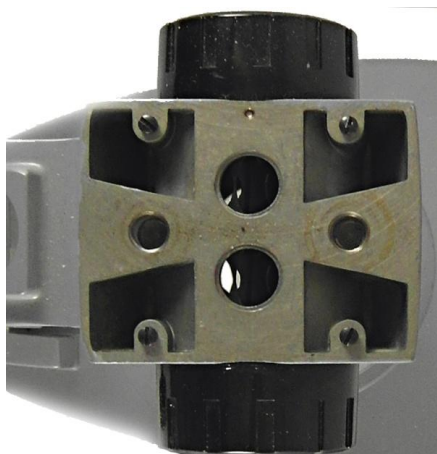


Figure 17. Cycloptic plate showing hinge pin receptacles

### *Cycloptic Bases*

AO offered a variety of bases, including two with phenolic-resin boards, models 30A and 30B. The 30B board was relatively large at 12 x 17 inches. They also offered two table boom stands, models 52S (Table Stand Model) and 53S (Universal Table Microscope Stand). The 52S was a pole stand with a pole boom, while the 53S has an almost pillar-like cross bar section.

However, the most popular Series were the 56 and 59, with single component and dual component bases respectively, and the Series 58, which used the transilluminating base (discussed below).

Figs. 18 and 19 provide photographs of the popular stands, Series 59 and 56.





Figure 19, Series 56 single section base

## Accessories

The most commonly found, and/or helpful, accessories are discussed below.

### *Transilluminating Substage Base with Mirror*

Although stereo microscopes are most often used with opaque subjects, they are at times used with transparent ones. For these applications, the "Transilluminating Substage Base with Mirror" is appropriate. This substage base is shown disconnected and with the mirror detached in Fig. 20 and connected to the microscope in Fig. 21.

Unlike most standard, non-stereomicroscopes, here the mirror is rectangular, not round, and fairly large at approximately 2-1/2 x 2-1/4 inches.

The Transilluminating substage base has a rear opening providing for the insertion of an illuminator. Cycloptic illuminators are discussed below.



Figure 20. Transilluminating substage base unconnected to Cycloptic, and with mirror detached



Figure 21. Cycloptic with Transilluminating Substage Base installed



The mirror is two-sided, allowing for the selection of either a matte or mirrored surface.

The optional substage base is easily added to an existing stand. To attach this base to a Cycloptic stereomicroscope Series 56, do the following:

(1) The base of the Series 56 comes with cork pads (Fig. 22) at the distal ends. These must be removed to allow the bosses (i.e., the two protuberances at the top front ends of the transilluminating base) to mate with the bottom of the Series 56 stand.

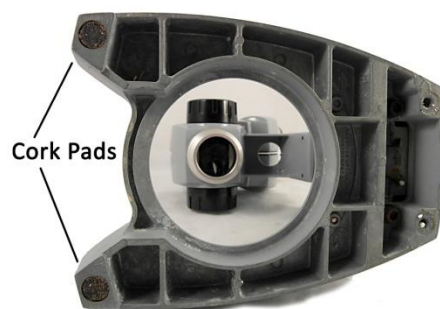


Figure 22. Series 56 cork pads

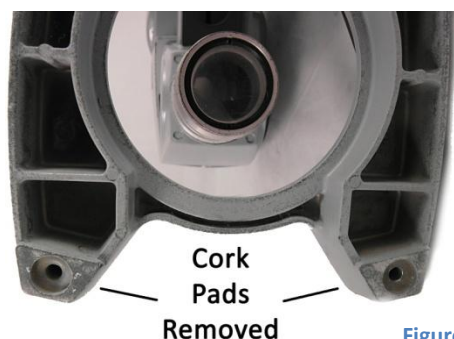


Figure 23. Cork pads removed from Series 56 stand

(2) Once these pads are removed (Fig. 23), place the transilluminator base, face up, against the bottom of the Series 56 stand so that the locating bosses on the substage base line up with the indentions on the bottom of the stand.

(3) The locking screws on the substage base, Figs. 24 and 25, can then be engaged into bottom of the stand and tightened. The microscope with substage base is ready to use.

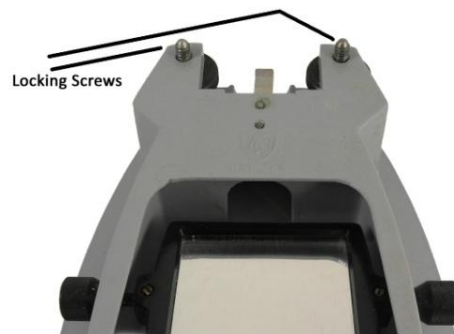


Figure 24. Locking screws on Transilluminating Substage Base



Figure 25. Thumb adjustments for locking screws on Transilluminating Substage Base, and illumination holder spring

### *Auxiliary Lens Attachments*



Figure 26. Cycloptic Auxiliary lenses (a) 2X Swing-out, (b) 2X fixed examples, (c) 2/3X mounted (d) 0.5X,

Optional auxiliary lens attachments could be obtained for the Cycloptic Series of stereomicroscopes. The most popular of these were the 2X and 2/3X. The 2X attachment was available in two options as either a fixed adapter or a swing out lens. The first two illustrations in Fig. 26 show these options, designated respectively by AO as Nos. 254 and 265. These adapters doubled the magnification, but reduced the working distance to 1.5 inches. The 2/3X attachment identified by AO as No. 267 reduced total magnification and offered a slight increase in working distance to 4.4 inches. The 2/3X option, affixed to a CMO lens is shown as the third illustration in Fig. 26. The 0.5X auxiliary lenses, AO 266 - Fig. 26d, doubles the working

distance to 8 inches, and halves the magnifying power of the system. It takes the place of the standard CMO.

### ***Eyepieces, Eyeshields and Reticules***

High eyepoint 4 element eyepieces were available in 10x and 15X magnifications. These chromatic eyepieces were parfocal. AO designated the 10X as No. 146 and the 15X as No. 147. No. 146's eye relief is 19mm and 147's 17mm. Their respective fields of view are 20mm and 16.8mm. For non-eyeglass viewers optional hard plastic eyeshields (AO No. 149) are available, Fig. 27.

The eyepieces could also be fitted with optional micrometer calibrated reticule disks. A "Lens Protecting Window" (AO 585), could also be purchased for the CMO.



Figure 27. 10X and 20X eyepiece pairs, and eyeshields

### ***Mechanical Stage***

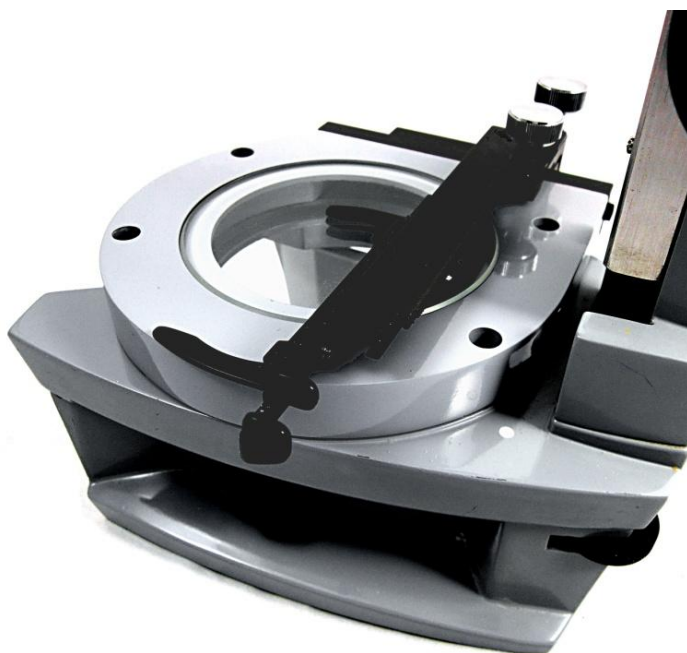


Figure 28. Mechanical stage, No. 1556

For those using the Transilluminating Substage Base to examine slides, the mechanical stage (AO No. 1556) was available. This stage could be used in the conventional position or reversed to allow left-hand use. It came with a circular glass stage. A picture of this unit mounted on a Cycloptic with Transilluminating Substage Base appears in Fig. 28.

### *Storage Cases*

Storage cases to hold the Cycloptic and some accessories were available for microscopes in Series 56, 58, and 59. Fig. 29 shows a storage case for Series 56, AO No. 1656.

Figure 29. Storage case for AO Cycloptic





### *Illuminators and Illuminator Mounts*

The Cycloptic has provisions for a reflected light illuminator to be placed in the circular cutout at the top rear of the microscope's arm, or to shine light through that cutout into an optional vertical illuminator (discussed below). The Transilluminating Substage Base has a similar circular opening in its rear. This allows the insertion of an illuminator into the Substage Base to project light onto the mirror, to be reflected upward through a transparent or semi-transparent object.

A "new", at the time, "Cyclospot Vertical Illuminator" was specifically advertised by American Optical for use with the Cycloptic (note the similarity in names).

All of the illuminators, but one - the Fluorescent Illuminator [AO 640 Series - *with aperture and thumb lockscrew for attachment to Cycloptic, complete with two daylight fluorescent tubes, two-button manual starting switch, cord and plug* (American Optical, 1962)] - used incandescent bulbs. The two most popular illuminators were the Cyclospot, and the Starlite Illuminator (AO 363V). For some of the illuminators, special sleeves that look somewhat like the housing of eyepieces, were provided.



Figure 30. Starlight Illuminators

Fig. 30 shows two Starlite illuminators, using GE1460 bulbs. They come with flexible multi-section supports, but the lamp could be removed and placed into the circular openings in the top arm of a Cycloptic, or the opening at the back of the Transilluminating Substage Base.

Starlite Illuminators came with fixed or variable transformers. The illuminator on the left, of Fig. 30, (an earlier model) was designed for European mains and that on the right for the US. They provided uniform lighting using fixed pre-focused condensers.

The Starlite Illuminators changed little over time, with slight changes to the variable transformer faceplates.





Figure 31. Starlite Illuminator in use

Here the Starlite Illuminator, Fig. 31, is used with an AO Cycloptic rebranded with the Reichert name. In recent decades, AO was purchased and eventually merged with various companies. AO is now part of the Leica group.

The illuminator mounting sleeves, as mentioned above, are shown in Fig. 32. They were designed so a sleeve could be placed in a circular opening before the Starlite illuminator was inserted. This sleeve is often missing on Cycloptics for sale. *[Author's note: Possibly purchasers of pre-owned Cycloptic stereomicroscopes had no idea what the sleeve was for and discarded it.]*



Figure 32. Sleeves to hold an Illuminator

Fortunately, the sleeve is not required.



Figure 33. Cyclospot Illuminator

AO made other illuminators. One mentioned earlier was the Cyclospot. It is shown in Fig. 33. This was designed, as its name implies, to mate well with the Cycloptic stereomicroscope. It uses a single on/off switch.

Another popular illuminator was the AO model 653 Universal Microscope Illuminator. In one AO brochure, this is described as having a ... *three-link jackknife standard and with 6.5 volt, 2.75 ampere bulb, clear blue glass, ground glass filters and No. 651 Variable Transformer, UL and CSA Approved.* (American Optical, Unknown-2). This was designed to connect to the hinge pin and shine light into a Vertical Illuminator that mounts over a Cycloptic CMO or auxiliary lens attachment.

## Stereo Microscopy

The illuminator contains a multiple lens system that allows the viewer to focus the light beam. A picture of a Universal Microscope Illuminator, with an optional blue filter mounted, is shown in use in Fig. 34 (note the adapter arm with screw connected to the hinge pin).



Figure 34. Vertical illuminator using a lamp connected to an arm attached to the hinge pin. On the stage is hemimorphite (a common sorosilicate) on limonite (hydrated iron oxide - thus the color).



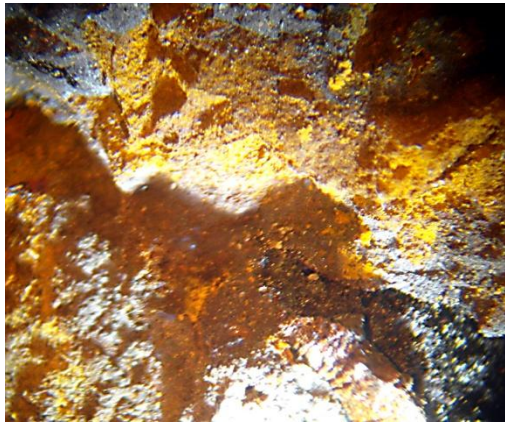


Figure 35. Limonite as seen using Vertical Illuminator

The Cycloptic shown has an opaque white stage plate, and lacks slide clips, as is appropriate for examining thick non-transparent objects. The vertical illuminator contains two reflecting surfaces. The first reflecting surface catches the light from the lamp and reflects it across to the second, which sends it down to the object. This overhead, rather than oblique, illumination allows for the inspection of, e.g., objects with deep cracks or crevices, such as borings in machined parts or for medical procedures where lighting might otherwise be difficult. AO also provided an Internal Vertical Illuminator (K1730) as well, which had its own lamp.

The use of any microscope mounted reflected light illuminator, except for the fluorescent illuminator of Fig. 36, requires the viewing tubes be turned away from the support column, as shown previously, so the cylindrical opening for inserting the illuminator for direct lighting, or shining light through the arm's opening, is accessible. However, the fluorescent illuminator is mounted directly to the CMO, so the orientation of the viewing tubes is then not a consideration. It can also be mounted to a base stand. Because of the fluorescent bulbs voltage requirements, a transformer is a permanent part of the wall plug.

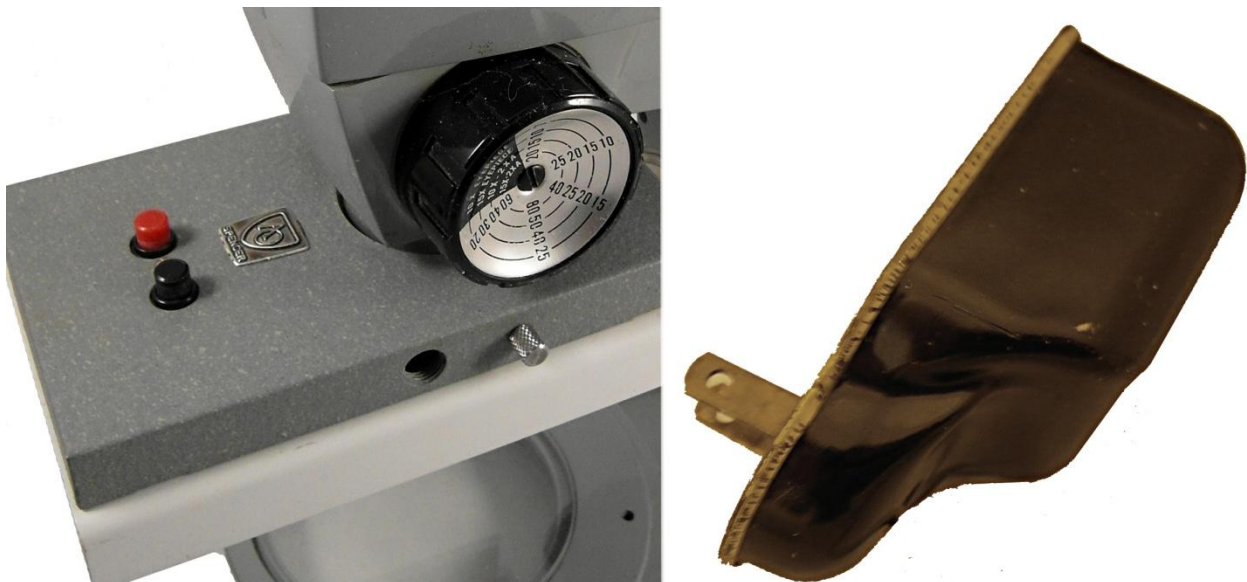


Figure 36. Fluorescent illuminator and wall transformer

### *Trinocular Cycloptic (The Photographic Tube Adapter[PTA] - AO No. 638)*

The PTA is used to convert a binocular Cycloptic into a trinocular. It is easily attached, and focusing is then as normal, but it allows for a flip-up/down mirror to send the light from a binocular tube to the PTA for photography. That is, the trinocular Cycloptic is not a separate microscope, but a binocular with the optional photographic adapter attached.

An example of a trinocular Cycloptic with 2X auxiliary adapter, mechanical stage, and dual Starlite Illuminators is shown in Fig. 37. This is a heavy instrument. With its two illuminators, it weighs about 15 pounds.

Unfortunately, owing to the displaced vertical location produced by the PTA, which raises the height of the arm, the Vertical Illuminator cannot be used appropriately with the Photographic Tube Adapter in place.





Figure 37. Cycloptic trinocular with mechanical stage, 2x auxiliary adapter and dual illumination

The focusing tension on all Cycloptics can be adjusted by holding one coarse focusing knob and turning the other. This is particularly helpful if heavy accessories are used.

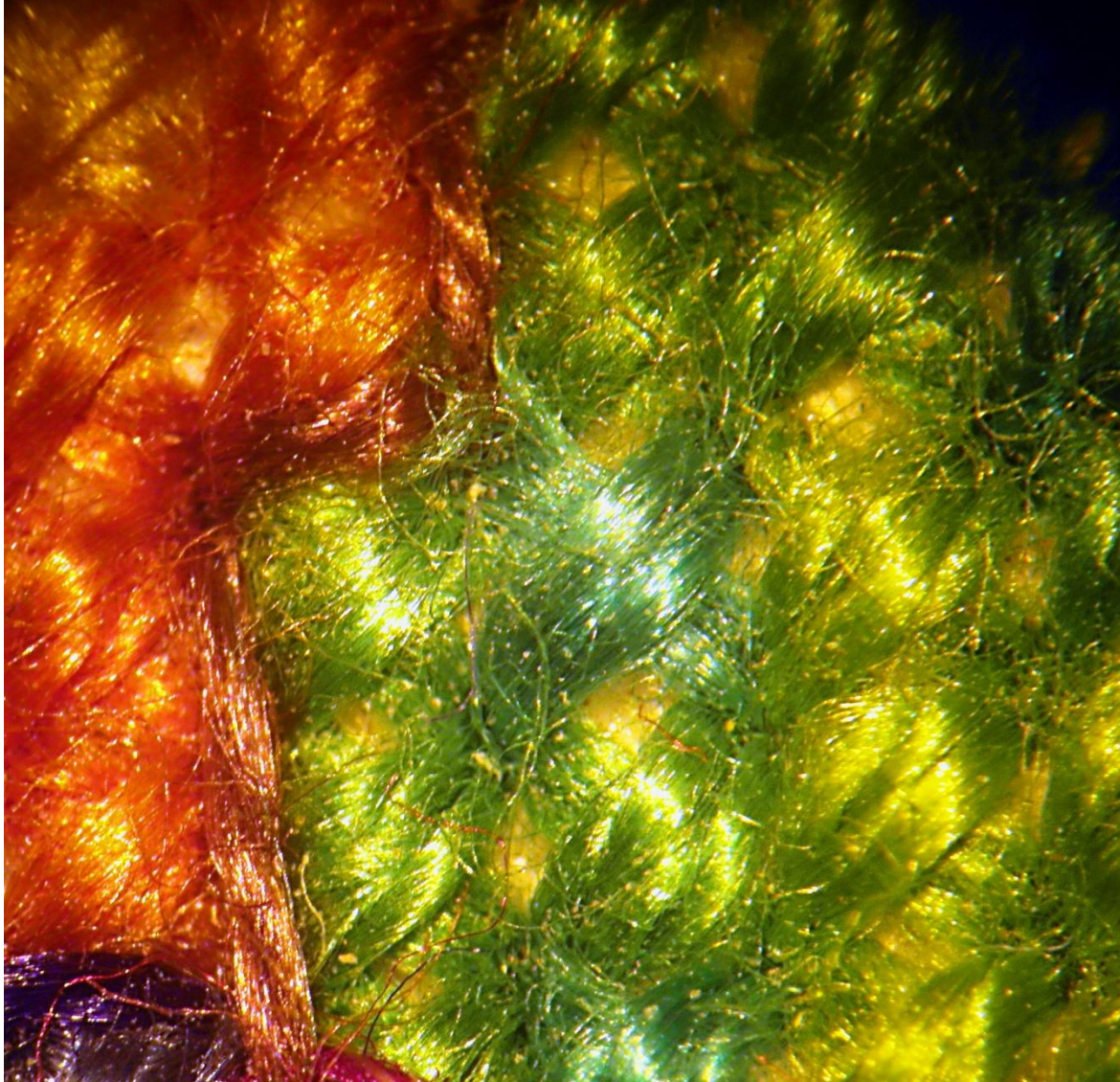


Figure 38. Closeup of fabric seen through Cycloptic microscope, 25X



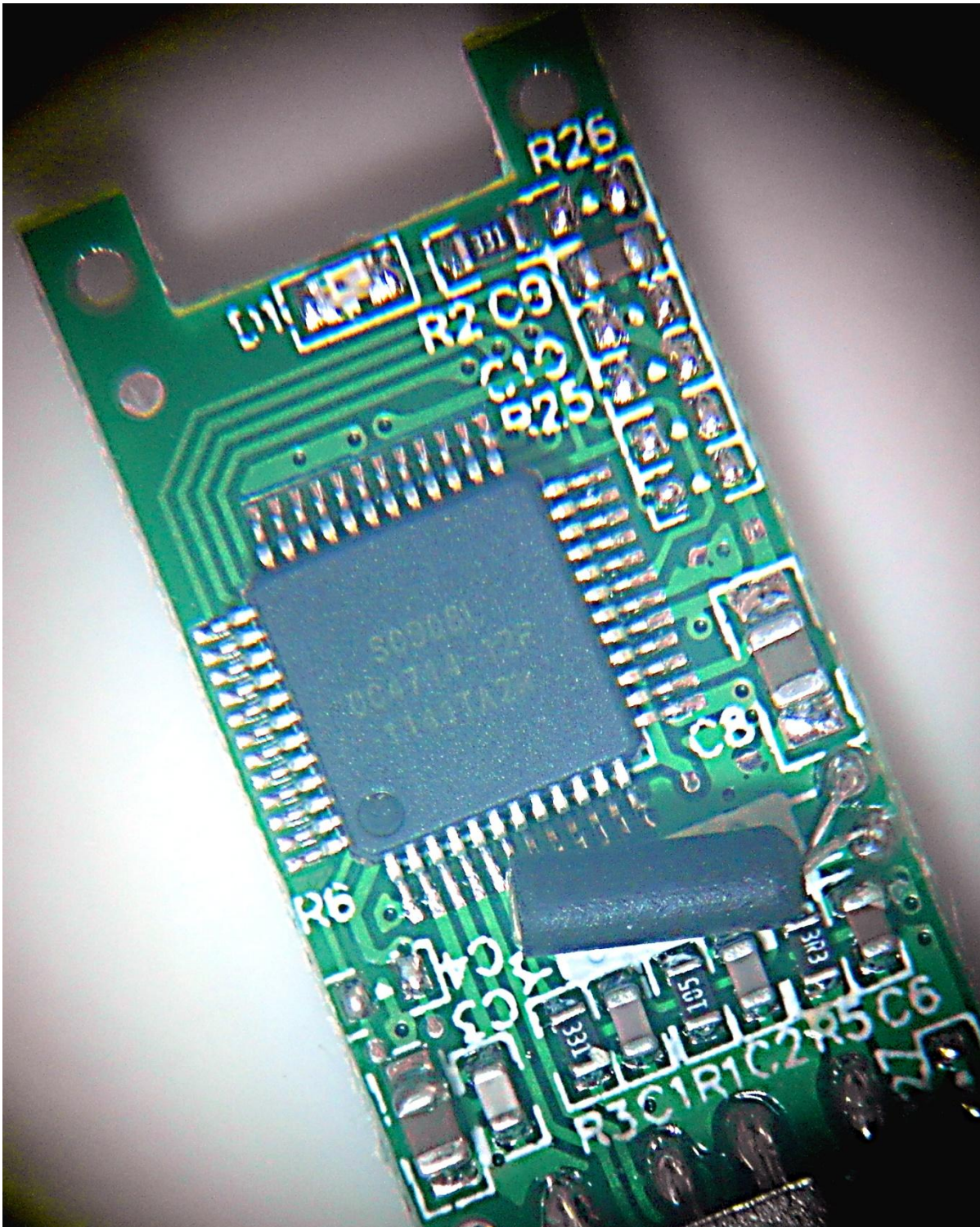


Figure 39. USB flash drive seen through Cycloptic trinocular with 0.5X CMO

### *Afterward: Non-Cycloptic AO Microscopes*

A caution: AO Series 40 microscopes look somewhat similar to Cycloptics, particularly as they also have similar locations for Magni-Changers. Fig. 40, shows an AO Model 40RT. AO used RT to indicate microscopes that include illumination for both reflected (R) and transmitted (T) light. The model 40 might be mistaken for a Cycloptic "F", with a fixed magnification of 15x. However, this, and other Model 40 style instruments are Greenough, not CMO microscope, (i.e. they use two objectives not one). The models 40s are attractive instruments, but were relatively inexpensive and designed primarily for student use.

Shown in Fig. 41 is an AO Model 42RT allowing two magnifications, 10x and 20x. The AO marketing team apparently liked the term Magni-Changer, as the magnification changer on the Model 42RT, is also referred to in the AO literature as a Magni-Changer. However, Model 40 Magni-Changers do not have the distinctive knob-end markings found on Cycloptic Magni-Changers (See Cycloptic Magni-Changer above).

The model 43RT looks almost the same as the Model 42RT, but offered 15X and 30X magnifications. Models 45 and 46, which offer zooming, are also part of the Model 40 Series. However, these models have black bodies, and so are unlikely to be mistaken for Cycloptics.



Figure 40. AO Greenough microscope Model 40





Figure 41. AO Greenough microscope Model 42

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Nikon Microscopy U (undated) *Introduction to Stereomicroscopy* states, "The first modern stereomicroscope was introduced in the United States by the American Optical Company in 1957. Named the Cycloptic, this breakthrough design..."

Although the Cycloptic is a landmark in American stereomicroscopy, the common objective concept was first used by Riddell in 1850s, and a common large objective was later implemented by Zeiss in their Citoplast, considerably before the Cycloptic was introduced.

Orlowski, Kristen and Dr. Michael Zölffel (private correspondence, 2012)

- The author's thanks to both Kristen Orlowski, Product Marketing Manager, Light Microscopes, Carl Zeiss Microscopy, LLC and Dr. Michael Zölffel, Carl Zeiss MicroImaging GmbH, Jena, Germany for information and materials they provided regarding Zeiss history.

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Zeiss, (Microscopy, LLC, MicroImaging GmbH, Jena)

- Zeiss (Undated) Citoplast brochure, East Germany
- Zeiss (Undated) Opton catalog,, West Germany

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Optional objectives	X20, X60, X100 Oil		X60
Condenser	Original patented condenser		
Polarizer+Analyzer	Standard configuration		Optional
Optional Compensators	1/4λ, λ		
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NYMS Patch	\$5.00
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Model 131: Tungsten  
Model 131-FLU: Fluorescent

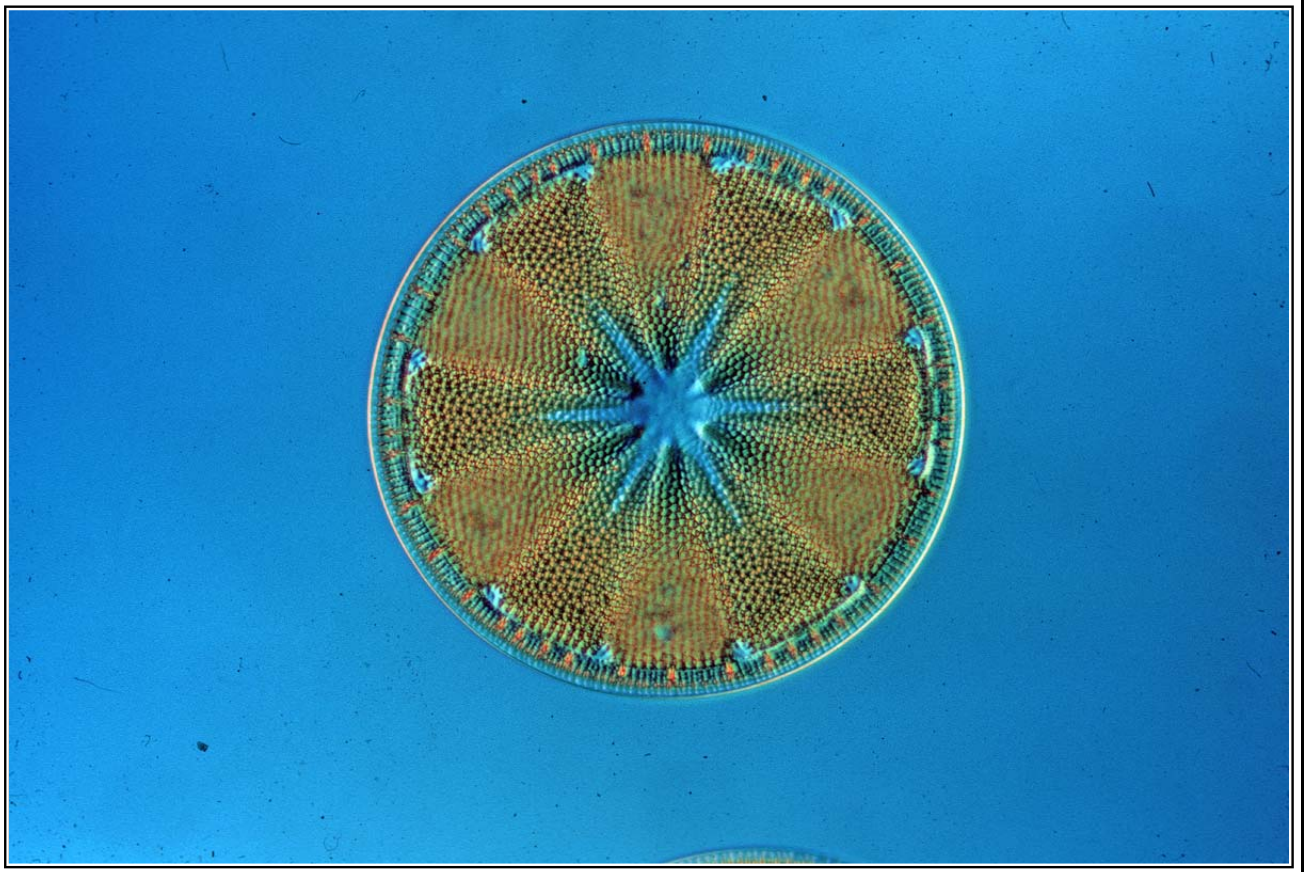


Model 185: 20x

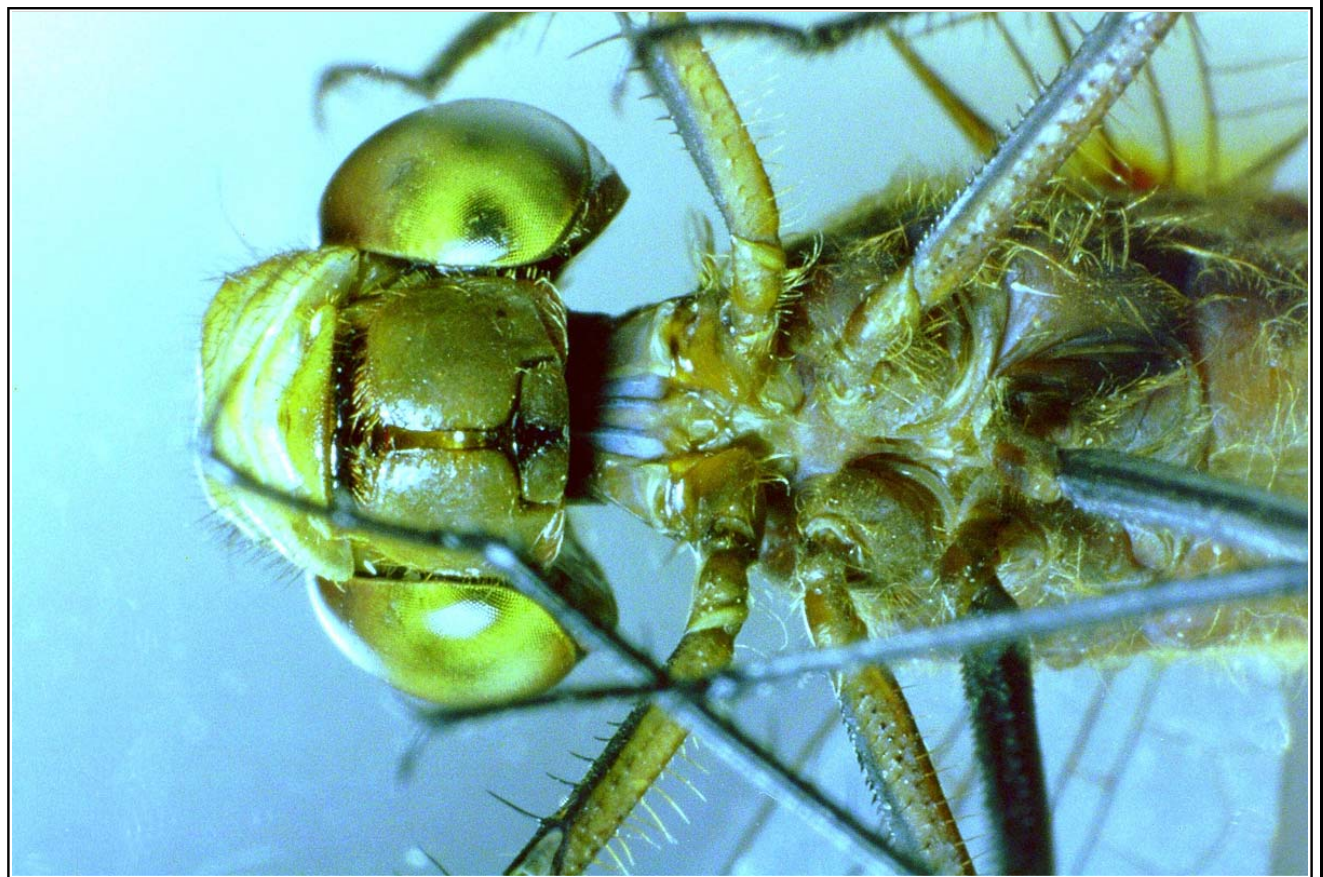


Model 125-LED Cordless





Diatom: *Actinopterychus heliopelta*, 160x by Eric Gravé



Dragonfly, by Len Tilstra