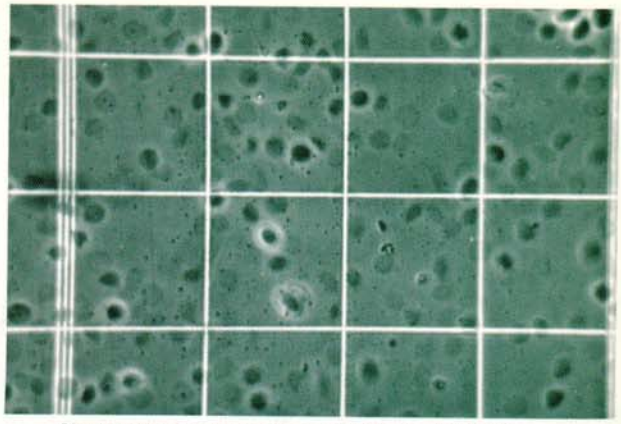
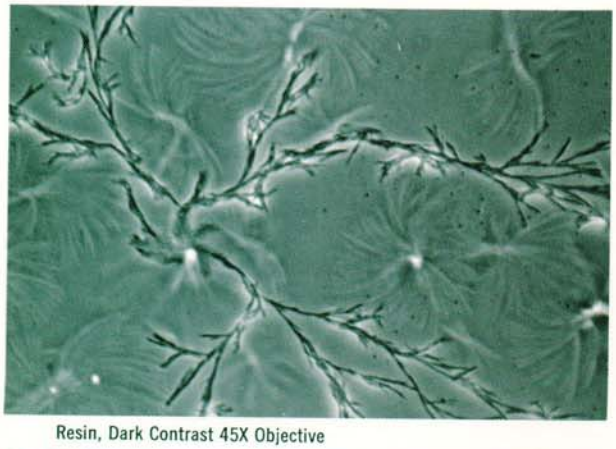
A NEW PERSPECTIVE ON PHASE MICROSCOPY

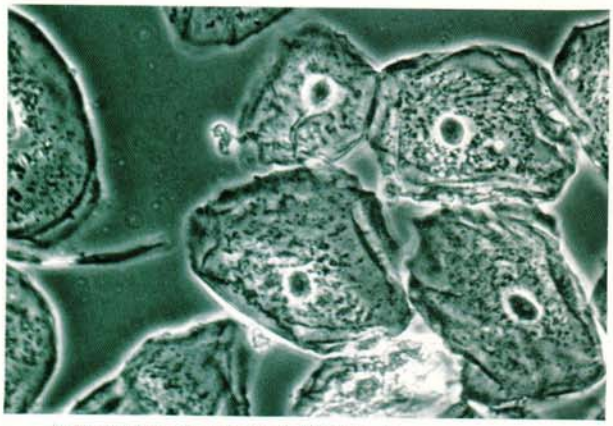
Chick Blastoderm, Dark Contrast 45X Objective



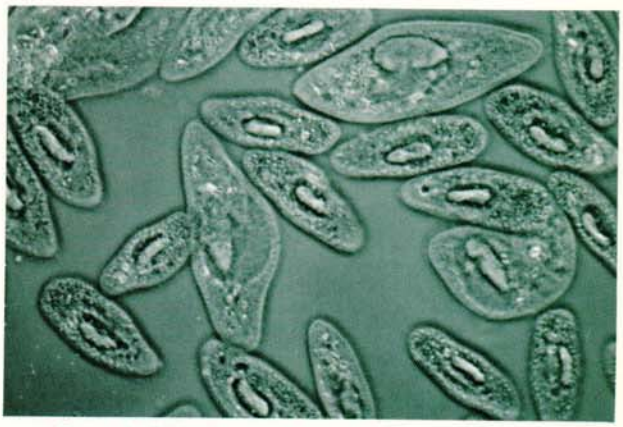
Blood Platelets on Hemacytometer, Dark Contrast 45X Obj.



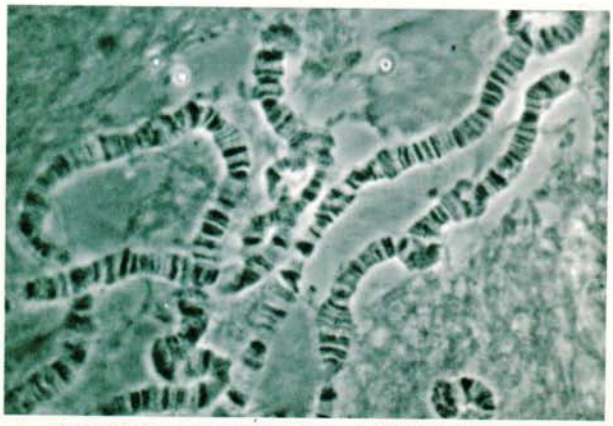
Resin, Dark Contrast 45X Objective



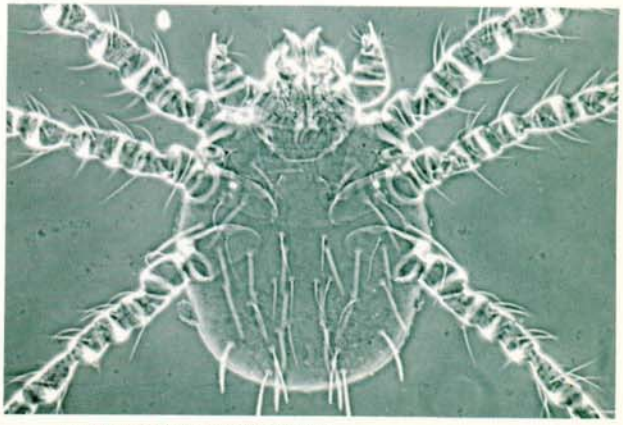
Epithelial Cells, Dark Contrast, 100X Objective



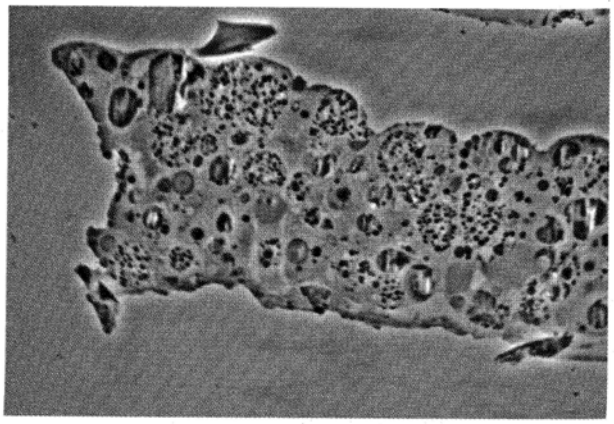
Paramecia, Bright Contrast 10X Objective



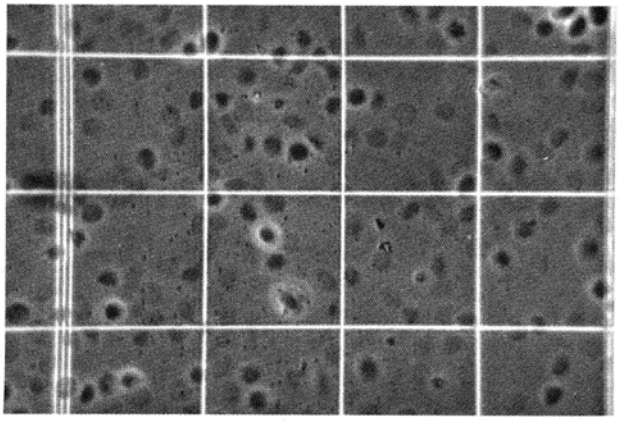
Drosophila Chromosomes, Dark Contrast, 100X Objective



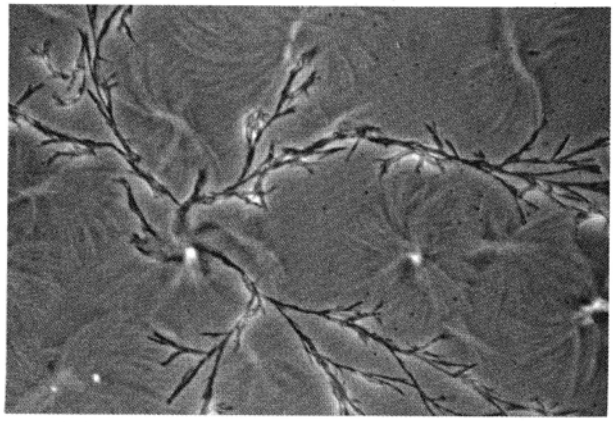
Mite, Bright Contrast 20X Objective



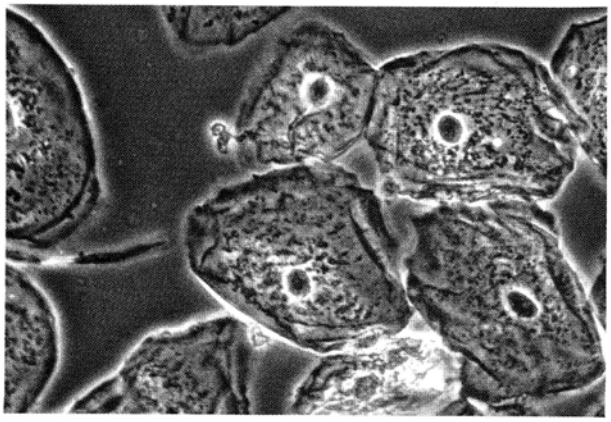
Chick Blastoderm, Dark Contrast 45X Objective



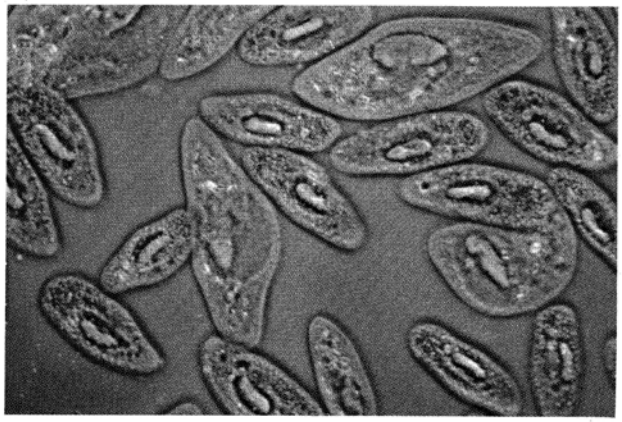
Blood Platelets on Hemacytometer, Dark Contrast 45X Obj.



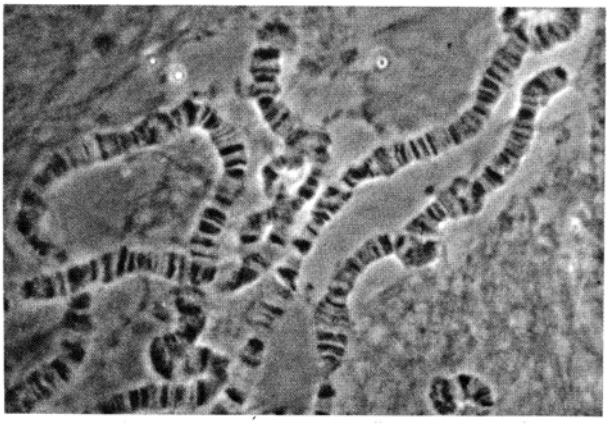
Resin, Dark Contrast 45X Objective



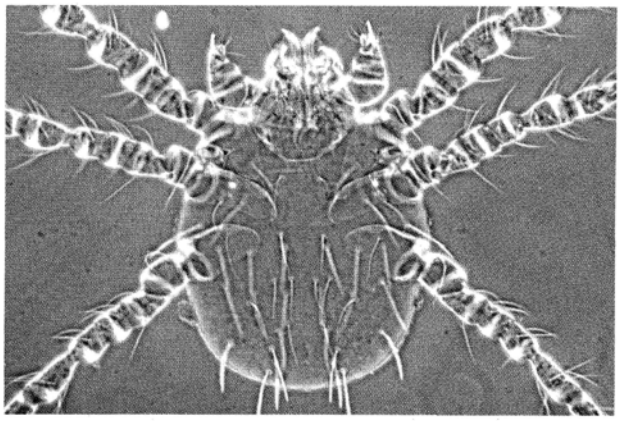
Epithelial Cells, Dark Contrast, 100X Objective



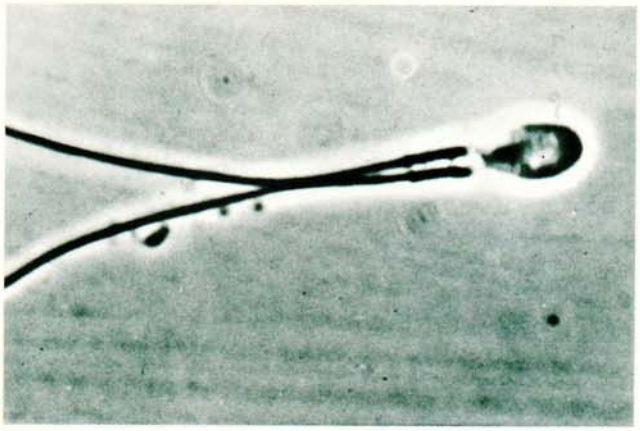
Paramecia, Bright Contrast 10X Objective



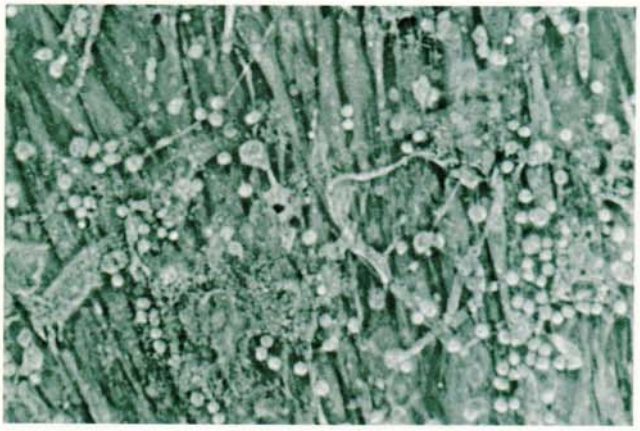
Drosophila Chromosomes, Dark Contrast, 100X Objective



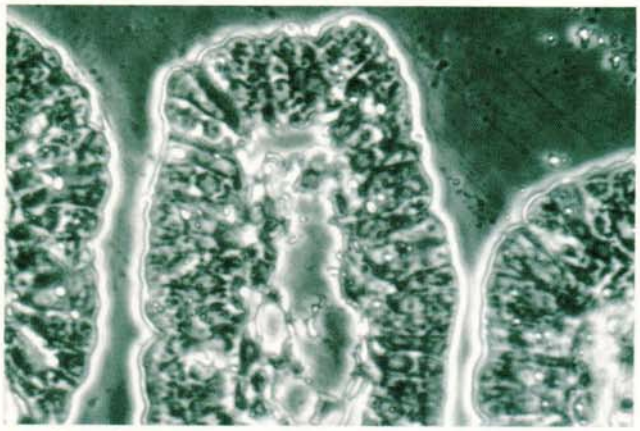
Mite, Bright Contrast 20X Objective



Human Spermatozoon, Dark Contrast 45X Objective

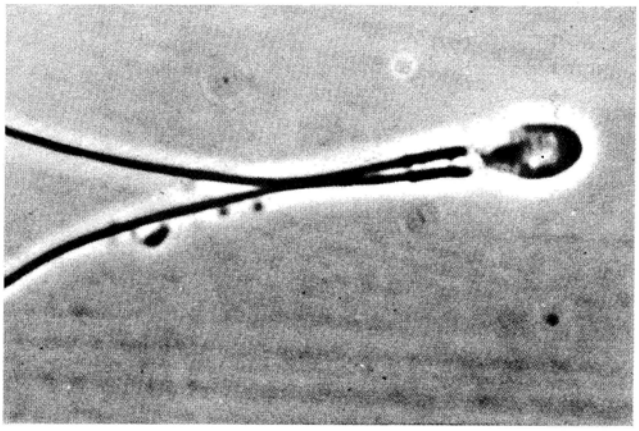


Young tumorous tissue culture, Bright Contrast 10X Objective

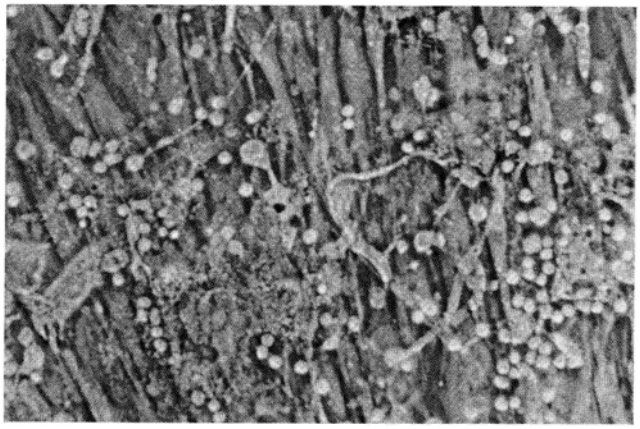


Tissue Section, 2 microns thick, Dark Contrast 45X Objective

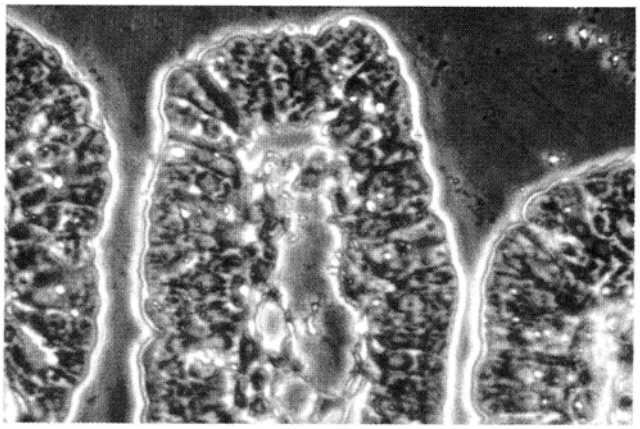
Fork-tailed Arcaria, Dark Contrast 20X Objective



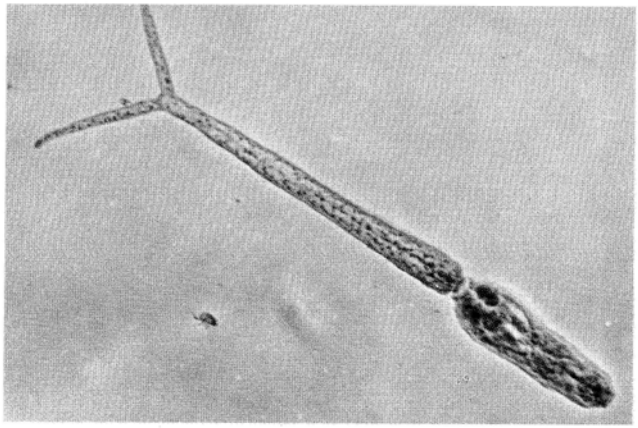
Human Spermatozoon, Dark Contrast 45X Objective



Young tumorous tissue culture, Bright Contrast 10X Objective

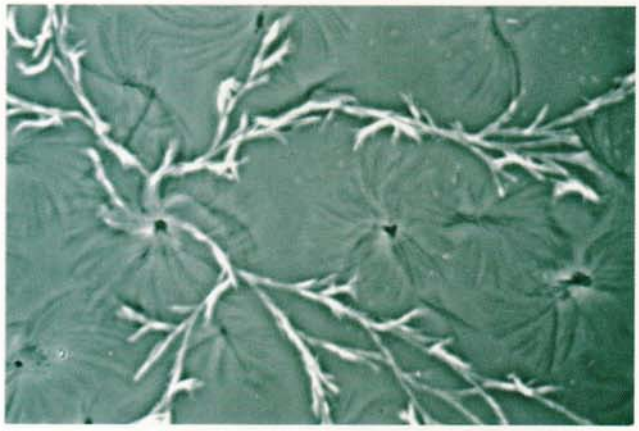


Tissue Section, 2 microns thick, Dark Contrast 45X Objective

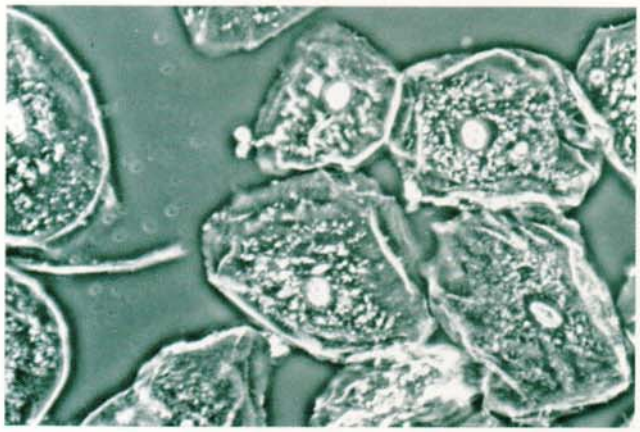


Fork-tailed Arcaria, Dark Contrast 20X Objective

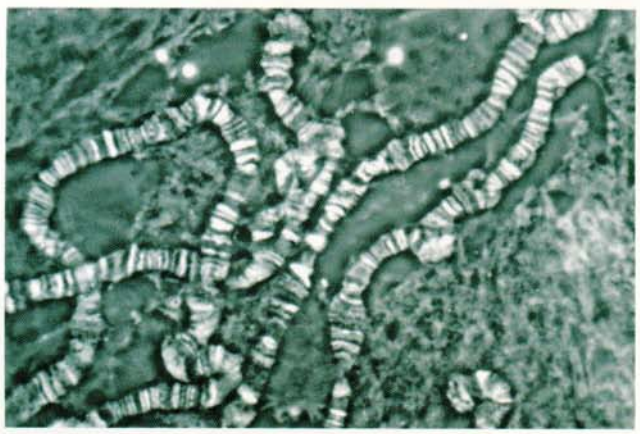
Chick Blastoderm, Bright Contrast 45X Objective



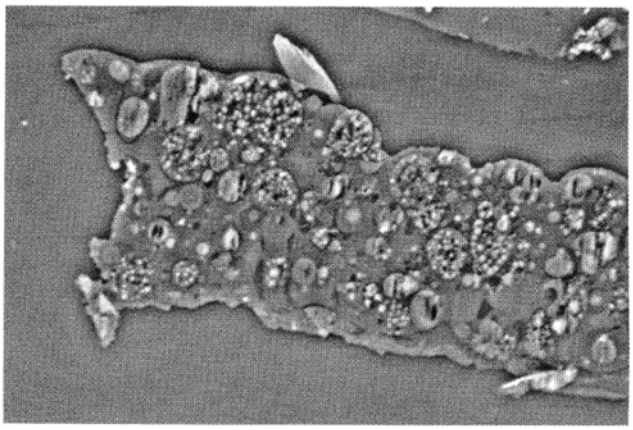
Resin, Bright Contrast 45X Objective



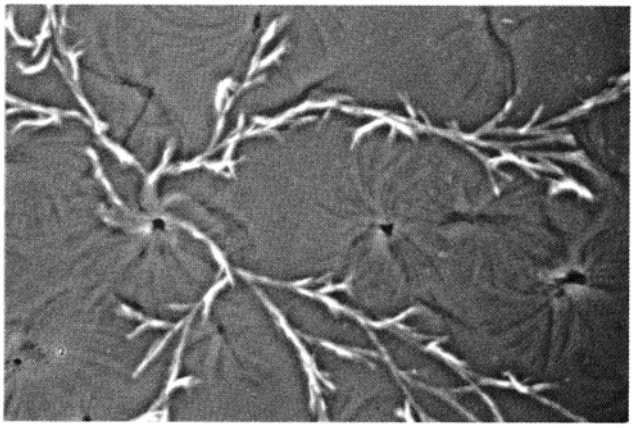
Epithelial Cells, Bright Contrast, 100X Objective



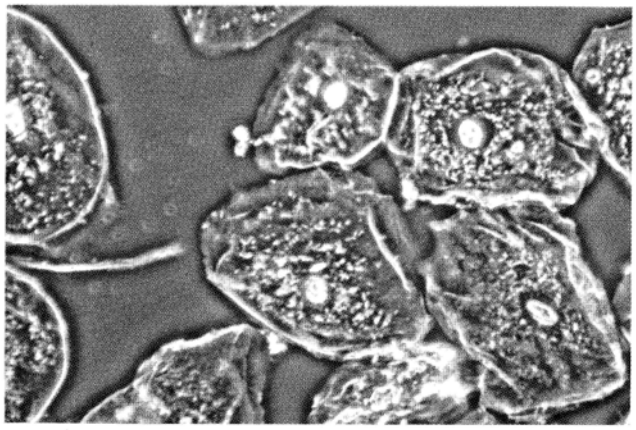
Drosophila Chromosomes, Bright Contrast, 100X Objective



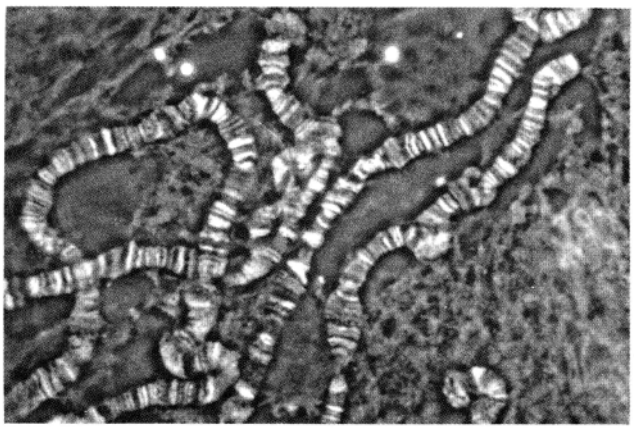
Chick Blastoderm, Bright Contrast 45X Objective



Resin, Bright Contrast 45X Objective



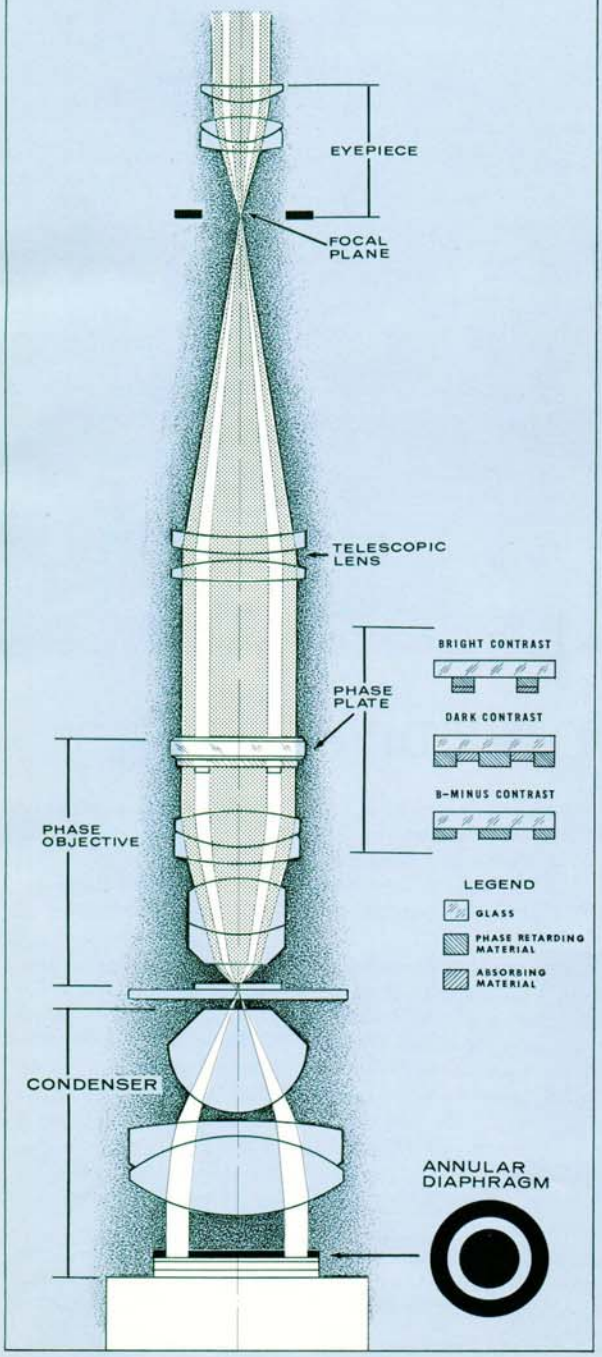
Epithelial Cells, Bright Contrast, 100X Objective



Drosophila Chromosomes, Bright Contrast, 100X Objective

Brief Description of Phase

Essentially, phase contrast is produced by the combination of: a) an annular diaphragm located below the condenser which directs a hollow cone of light through the specimen; and b), a phase plate at the back focal plane of the objective. Some of the light passing through the transparent specimen is diffracted by slight differences in optical path (refractive index X thickness) and moves so as to be distributed over the whole aperture of the objective. The balance of the light passes directly through the specimen as a cone of concentrated light toward coincidence with the "ring" of the phase plate. The phase plate alters the intensity and phase relationships of the diffracted and direct light so that when they recombine to form an image, invisible specimen optical path differences are converted into visible light intensity differences.

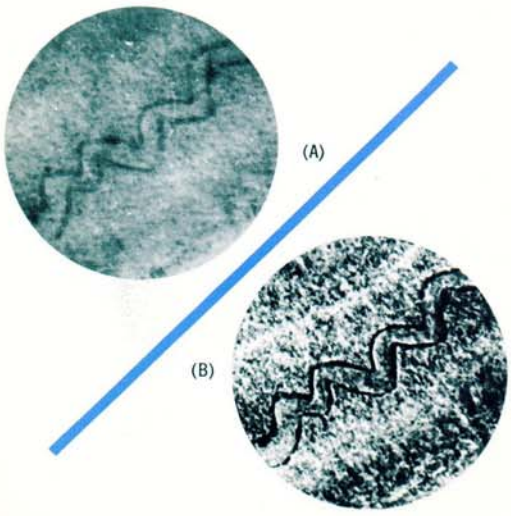


If you stand alone...

because you stand guardian over an independent and inquisitive mind . . . if your hallmark as a microscopist is an insistant pursuit of perfection and you've long since walked away from that cloister called compromise . . . the American Optical Company, in a kindred spirit, invites your analytical inspection of the AO Phasestar. Here is instrumentation genuinely unique, singular in concept, different in design. The Phasestar adds a new perspective to phase microscopy . . . stands ready to serve you as a truly practical vocational partner.

AMERICAN OPTICAL COMPANY

DISCOVER THE DEFINITIVE DIFFERENCE



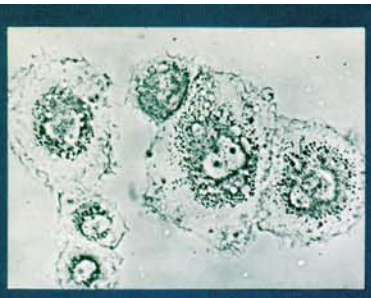
Perhaps your work concerns cytological detail with a living or unstained specimen. Possibly you probe for innovations in industrial products or, in your calling as an educator, you seek ways to quicken the cadence of learning. Whatever your endeavor, the AO Phasestar can play a significant part in new chapters in your story of accomplishment.

The Phasestar permits transparent, unstained specimens such as tissues, cells, yeast, bacteria, protozoa, emulsions, plastics, fibers and crystals to be seen with remarkable clarity of image and crisp definition of detail. With the proper choice of AO phase contrast, detail is revealed with an optical equivalent of differential staining . . . sharp boundaries are provided for measurement and adequate contrast for counting.

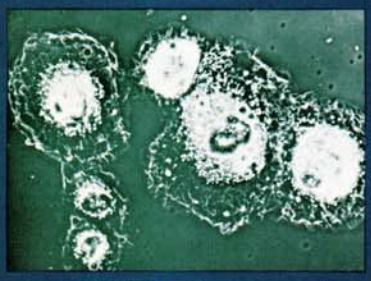
With your new Phasestar, you gain the advantage of AO's exclusive, infinity-corrected optical system which achieves superior flatness of field, color correction and definition not offered in conventional achromatic systems.

As you look to a future of continued achievement, review the Phasestar story presented on these pages and discover why the definitive difference is Phasestar.

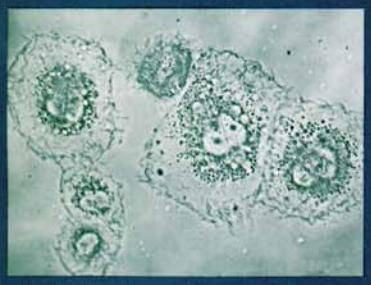
Blood Vessel in Mesentery. Illustration (A): brightfield; (B): AO Phase Contrast



Rat Carcinoma with
Dark Contrast Phase Objective



Rat Carcinoma with
Bright Contrast Phase Objective



Rat Carcinoma with
B-minus Contrast Phase Objective

The PHASESTAR Story

Phasestar Alone Offers You This Wide Selection of Phase Contrasts

Your choice of Phasestar gives you the opportunity to choose from an unequalled selection of phase contrast objectives . . . 10X, 20X, 45X, 100X, *Bright Contrast* . . . 10X, 20X, 45X, 100X *Dark Contrast* and 100X B-minus.

AO *Bright Contrast* shows the specimen detail light against a darker background (this assumes that the specimen has greater "optical path"* characteristics than its surround). *Dark Contrast* reveals the specimen detail dark against a lighter background. *B-minus* is a modification of Dark Contrast and is used primarily with lightly stained or pigmented or dense specimens.

You can install one type of phase contrast objectives; a combination of several phase contrast objectives; or a combination of phase and AO brightfield objectives onto the nosepiece to suit your preference. Regardless of your selection, or the placement sequence in the nosepiece, parcentration and parfocality is assured through precise tolerances held in the manufacture of American Optical objectives.

In deciding upon the Phasestar model which best fits your requirements, keep in mind that you can choose from *triple, quadruple* and *quintuple* nosepieces and select either a turret or single unit condenser.

*Optical path being described as the product of refractive index times thickness.

Cross section of 45X phase objective is shown above.

1 *Only the AO Phasestar provides a selection of Bright, Dark and B-minus phase contrast objectives.*

2 *The diffraction or "phase" plate appears at the rear focal plane of the objective as a grayish ring.*

3 *Parfocality is not affected by any random selection or arrangement of objectives on the nosepiece.*

4 *Quintuple nosepiece is supplied with Phasestar Model P2 but can be specified as an alternate with other models.*

1

Bright Contrast
10X, 20X, 45X, 100X

Dark Contrast
10X, 20X, 45X, 100X

B-minus Contrast
100X

2

3

4

MODEL
P4

P8

Offers unmatched versatility . . . equally suited to the needs of phase microscopists in clinical and medical research, education and industry.

L10TG-P4

L10TU-P4
with 1052A Camera

The definitive difference is **PHASE Star**

AO PHASESTAR Series 10

MODEL **P4**

Features:

1240	Phase Turret Condenser Mount and Accessory Case
1242	Standard Working Distance Condenser
1074	Quadruple Nosepiece
1224	10X Phase Objective, Dark Contrast
1225	20X Phase Objective, Dark Contrast
1238	45X Phase Objective, Dark Contrast
1227	100X Phase Objective, Dark Contrast
1247	10X Standard Phase Annulus
1248	20X Standard Phase Annulus
1249	45X Standard Phase Annulus
1250	100X Standard Phase Annulus
1245	Phase Aperture Viewing Unit
176 or 1176	10X Wide Field Eyepiece(s)

AO PHASESTAR Series 10

MODEL **P8**

Includes all the same features as listed under Model P4 PLUS:

1234	10X Phase Objective, Bright Contrast
1235	20X Phase Objective, Bright Contrast
1239	45X Phase Objective, Bright Contrast
1237	100X Phase Objective, Bright Contrast

See CODE FOR SERIES 10 PHASESTAR in illustrated price list.

The PHASESTAR Story (cont.)

Unique Phasestar Aperture Viewing Unit Conserves Your Valuable Time

The AO Phase Aperture Viewing Unit allows you to binocularly view and quickly focus on the diffraction, or "phase", plate of the objective and the image of the annular diaphragm for fast and easy centration. You will also find this unique Unit—which in conjunction with the eyepiece acts as a built-in telescope—a most convenient and rapid method of checking alignment from time to time.

It will take you only a few moments to attach the Unit to your AO Phasestar. It is positioned beneath the body and held in place with a positive thumb screw. The operating lever can face either side of the microscope to accommodate your technique and equipment arrangement. Regardless of orientation, the Aperture Viewing Unit will be precisely located on the optical axis of the microscope.

AO PHASE TELESCOPE

Where budget considerations preclude the use of the Phasestar Aperture Viewing Unit, the AO Phase Telescope serves as an efficient and economical alternate. By sliding the upper part in or out, in the conventional manner, you simultaneously bring the phase plate and annulus image into sharp focus.

AO EYEPIECES

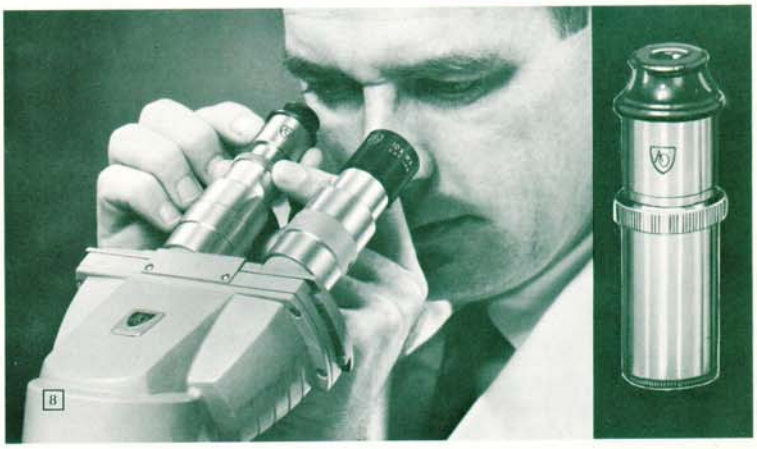
All Phasestar Microscopes are supplied with Wide Field Americote 10X Eyepieces which offer superior imagery, full chromatic and distortion corrections and comfortable eye relief for those who wear glasses. Americote 15X, 20X Wide Field and 10X Huygenian Eyepieces are also available.

5 *The Aperture Viewing Unit is an integral part of the microscope.*

6 *Lever is used to swing lens into optical path to view phase plate and annulus image; you swing lens out to view specimen.*

7 *You move knob "in" or "out" to bring image of the annular diaphragm and phase plate into sharp focus.*

8 *AO Phase Telescope (#1265) can be used as an economical alternate for the Aperture Viewing Unit.*



9 *Unless otherwise specified, 10X Wide Field Eyepieces are supplied; however, 15X and 20X Wide Field and 10X Huygenian Eyepieces are also available.*

MODEL
P2

P3

M10MU-P3

Designed and recommended for educational work at the university level, particularly for advanced courses and graduate study.

L10BU-P2

AO PHASESTAR Series 10

MODEL **P2**

Features:

1240	Phase Turret Condenser Mount and Accessory Case
1242	Standard Working Distance Condenser
1105	Quintuple Nosepiece
1238	45X Phase Objective, Dark Contrast
1227	100X Phase Objective, Dark Contrast
1249	45X Standard Phase Annulus
1250	100X Standard Phase Annulus
1245	Phase Aperture Viewing Unit
1076	10X Achromatic Infinity Corrected Objective
1116	45X Achromatic Infinity Corrected Objective
1079	100X Achromatic Infinity Corrected Objective
176 or 1176	10X Wide Field Eyepiece(s)

AO PHASESTAR Series 10

MODEL **P3**

Features:

1240	Phase Turret Condenser Mount and Accessory Case
1242	Standard Working Distance Condenser
1073	Triple Nosepiece
1224	10X Phase Objective, Dark Contrast
1238	45X Phase Objective, Dark Contrast
1227	100X Phase Objective, Dark Contrast
1247	10X Standard Phase Annulus
1249	45X Standard Phase Annulus
1250	100X Standard Phase Annulus
1265	Phase Telescope
176 or 1176	10X Wide Field Eyepiece(s)

See CODE FOR SERIES 10 PHASESTAR in illustrated price list.

Upon request, these models are available with special **removable condenser centering wrenches.** Also available, when requested, are special **cap screws** to replace annuli centering wrenches when these are removed to insure proper alignment during entire period of use by student.

The definitive difference is **PHASE Star**

The PHASESTAR Story (cont.)

You Center Annuli Only Once with the AO Phase Turret Condenser

The Turret Condenser of the Phasestar contains provision for four *individually centerable* annular diaphragms and one open aperture. Two captive centering wrenches are used to align each annulus to its corresponding objective. Once all annuli are properly aligned, you can change the turret setting from one magnification, or type of phase contrast, to another without further adjustment for centration being required. You'll find this feature a real benefit in terms of time saved and indispensable when working with living material or observing rapid reactions where quick change of objectives is imperative.

You have the choice of three condensers for standard, intermediate and long working distances. The Standard Annuli are used with both the Standard and Intermediate Condensers; Long Working Distance Annuli, with the L.W.D. Condenser. You'll find removing and changing annuli fast and easy. The Phasestar Turret Condenser also features an aperture iris diaphragm and thumb screws for independent condenser centration.

SINGLE ANNULUS PHASE CONDENSER MOUNT

Mount incorporates a slideway to move a single phase annulus into or out of the optical path. Open aperture in slideway permits immediate changeover from phase microscopy to brightfield. Single Mount accepts all Phasestar annuli and condensers; has aperture iris diaphragm; provision for independent centering of annulus and condenser.

10 *Condenser and Turret cover removed to show positions of annular diaphragms and open aperture.*

11 *Each annulus is aligned independently to its respective objective.*

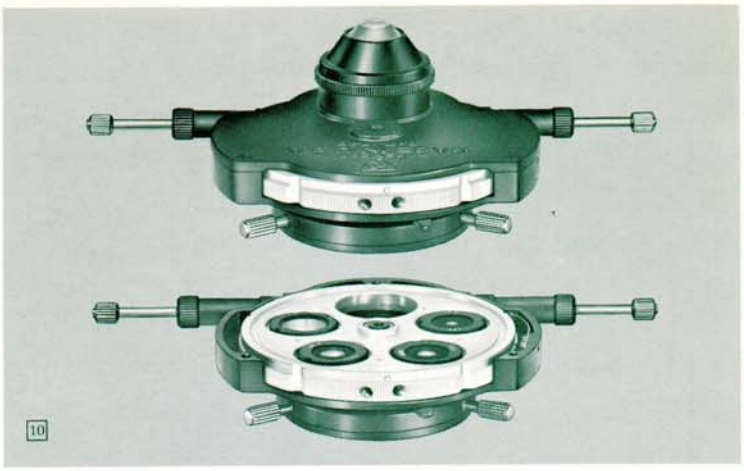
12 *Both Turret and Single Annulus Condenser Mounts accept all three condensers.*

13 *Appearance of annulus image and phase plate when: (A) annulus is out of center; (B) concentric with (properly superimposed on) phase plate.*

14 *Annuli are easily removed with spanner wrench.*

15 *AO No. 1246 Single Annulus Phase Condenser Mount with #1242 Condenser.*

16 *Slideway is used to move annular diaphragm into or out of optical path.*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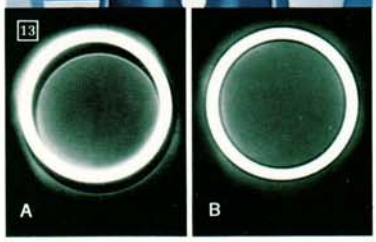
11

12



13


14

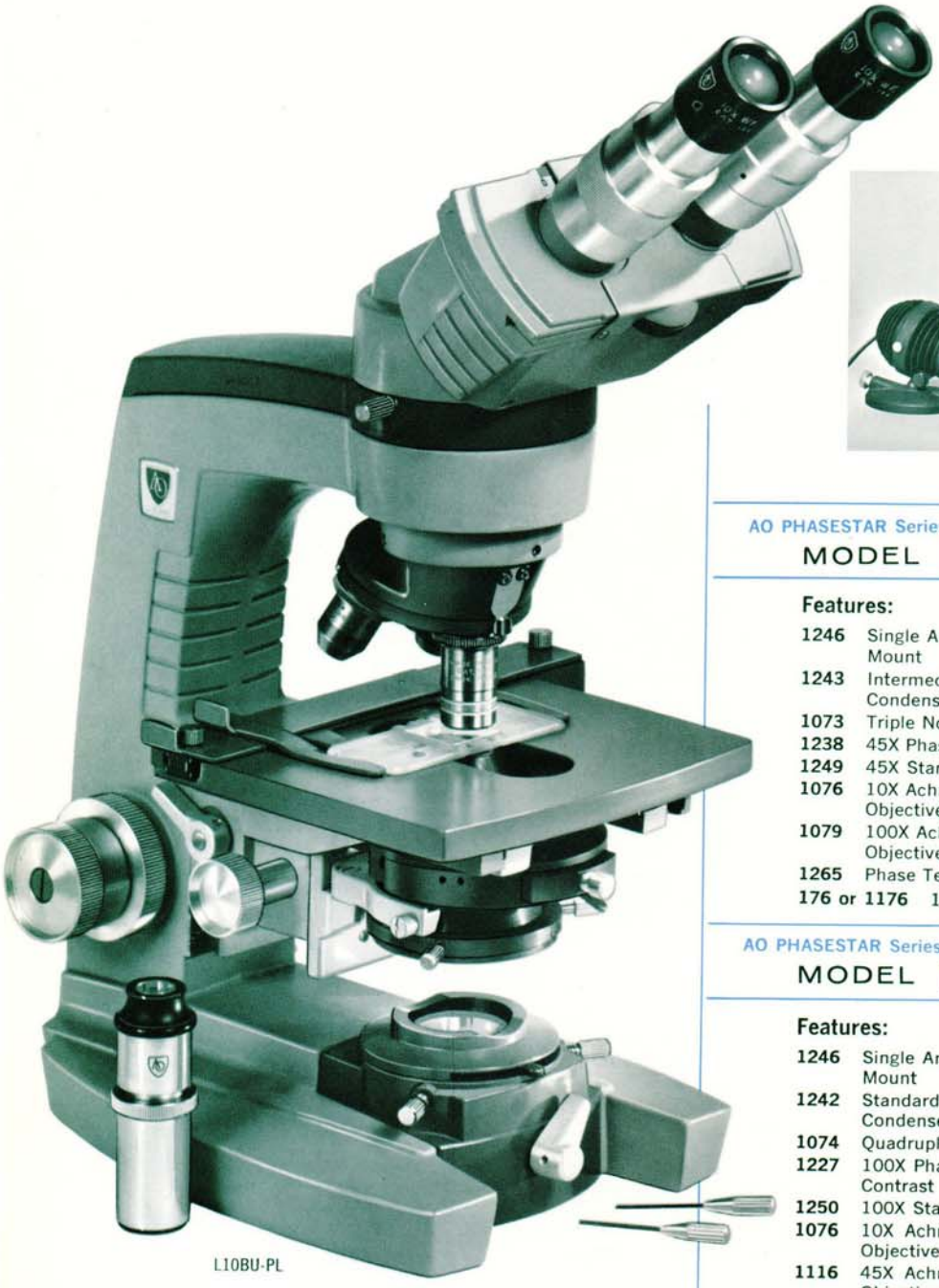
15


16

MODEL
PL

PM

Specifically tailored to meet the requirements of Hematology, particularly for platelet count, and Microbiology



L10BU-PL

M10BG-PM

The definitive difference is **PHASE Star**

AO PHASESTAR Series 10

MODEL **PL**

Features:

- **1246** Single Annulus Phase Condenser Mount
- **1243** Intermediate Working Distance Condenser
- **1073** Triple Nosepiece
- **1238** 45X Phase Objective, Dark Contrast
- **1249** 45X Standard Phase Annulus
- **1076** 10X Achromatic Infinity Corrected Objective
- **1079** 100X Achromatic Infinity Corrected Objective
- **1265** Phase Telescope
- **176 or 1176** 10X Wide Field Eyepiece(s)

AO PHASESTAR Series 10

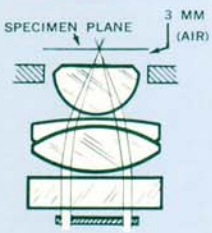
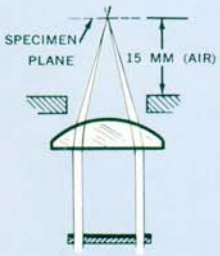
MODEL **PM**

Features:

- **1246** Single Annulus Phase Condenser Mount
- **1242** Standard Working Distance Condenser
- **1074** Quadruple Nosepiece
- **1227** 100X Phase Objective, Dark Contrast
- **1250** 100X Standard Phase Annulus
- **1076** 10X Achromatic Infinity Corrected Objective
- **1116** 45X Achromatic Infinity Corrected Objective
- **1079** 100X Achromatic Infinity Corrected Objective
- **1265** Phase Telescope
- **176 or 1176** 10X Wide Field Eyepiece(s)

See CODE FOR SERIES 10 PHASESTAR in illustrated price list.

CONDENSER, OBJECTIVE, ANNULAR DIAPHRAGM COMBINATIONS

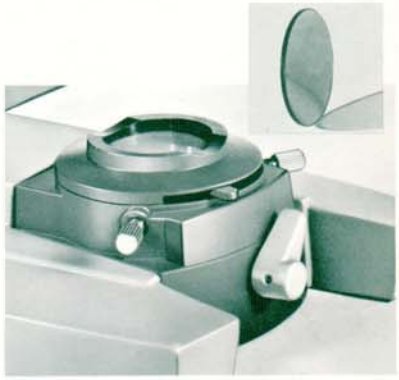
Condenser:	Use with Objectives:	Use with Annular Diaphragms:	Working Distance Above Stage:
STANDARD WORKING DISTANCE CONDENSER 	10X	#1247 10X Standard Phase Annulus	For standard thickness microscope slides.
	20X	#1248 20X Standard Phase Annulus	
	45X	#1249 45X Standard Phase Annulus	
	100X	#1250 100X Standard Phase Annulus	
INTERMEDIATE WORKING DISTANCE CONDENSER 	10X	#1247 10X Standard Phase Annulus	For standard thickness microscope slides and chambers (for example, #1475 AO Hemacytometer) not exceeding the equivalent of 3mm of air.*
	20X	#1248 20X Standard Phase Annulus	
	45X	#1249 45X Standard Phase Annulus	
	100X	#1250 100X Standard Phase Annulus	
LONG WORKING DISTANCE CONDENSER 	10X	#1251 Long Working Distance Phase Annulus	For specimen preparations and chambers (for example, culture flasks, tubes and bottles) requiring working distances equivalent to 15mm of air.*
	20X	#1252 Long Working Distance Phase Annulus	

*One mm of air equals 1.33mm of water or 1.52mm of crown glass. These ratios of refractive indices can be used to obtain equivalent working distance when the specimen includes more than one medium.

The Phasestar Equipped with 1036A In-Base Illuminator Gives You Complete, Convenient Control

The AO 1036A provides Koehler-type illumination with excellent uniformity and optimum numerical aperture at all magnifications. Two centering screws permit exact centration of the field diaphragm. Neutral density filter, conveniently controlled by lever in front, has a transmission of approximately 10%. Five-step transformer combined with neutral density filter assures you of correct intensity level for all requirements. While a color filter is not required with AO Phase equipment, a green filter, No. 408, is supplied with the 1036A In-Base Illuminator and may be used if desired.

See illustrated price list for information on separate illuminators.



You Can Quickly Adapt Your Phasestar for Longer Working Distances

When your studies require a longer working distance than the thickness of a standard microscope slide between specimen and condenser, adaptation of your Phasestar will take only a few moments. For a working distance to the equivalent of 3mm of air, you simply change condensers, using the #1243 Intermediate Working Distance Condenser in place of the #1242 Standard Condenser. The same annuli and all objective magnifications are utilized in intermediate working distance phase microscopy.

For long working distance (to the equivalent of 15mm of air), you change the 10X and 20X annular diaphragms as well as the condenser, using the #1244 L.W.D. Condenser. The annuli are readily accessible and can be quickly changed using a spanner wrench.

Designed for the microscopist who wishes to select his AO phase objectives and annular diaphragms separately

AO PHASESTAR Series 10

MODEL P

Features:

1240 Phase Turret Condenser Mount and Accessory Case
1242 Standard Working Distance Condenser
1074 Quadruple Nosepiece
1265 Phase Telescope
176 or 1176 10X Wide Field Eyepiece(s)

See CODE FOR SERIES 10 PHASESTAR in illustrated price list.

L10BU-P

For the man who owns a Microstar, Series 10

NEW AO OUTFITS OF PHASE ACCESSORIES

PHASE OUTFIT 1240D

Accessories include:

1240 Phase Turret Condenser Mount
1242 Standard Working Distance Phase Condenser
1224 10X Phase Objective, Dark Contrast
1225 20X Phase Objective, Dark Contrast
1238 45X Phase Objective, Dark Contrast
1227 100X Phase Objective, Dark Contrast
1247 10X Standard Phase Annulus
1248 20X Standard Phase Annulus
1249 45X Standard Phase Annulus
1250 100X Standard Phase Annulus
1245 Phase Aperture Viewing Unit

Above complete with accessory case

PHASE OUTFIT 1240DB

Accessories include:

Same as Outfit 1240D, plus the following Bright Contrast Objectives:

1234 10X Phase Objective, Bright Contrast
1235 20X Phase Objective, Bright Contrast
1239 45X Phase Objective, Bright Contrast
1237 100X Phase Objective, Bright Contrast

Above complete with accessory case

PHASE OUTFIT 1240PA*

Accessories include:

1240 Phase Turret Condenser Mount
1242 Standard Working Distance Condenser
1224 10X Phase Objective, Dark Contrast
1238 45X Phase Objective, Dark Contrast
1227 100X Phase Objective, Dark Contrast
1247 10X Standard Phase Annulus
1249 45X Standard Phase Annulus
1250 100X Standard Phase Annulus
1265 Phase Telescope

Above complete with accessory case

PHASE OUTFIT 1246 PM **

Accessories include:

1246 Single Annulus Phase Condenser Mount
1242 Standard Working Distance Condenser
1227 100X Phase Objective, Dark Contrast
1250 100X Standard Phase Annulus
1265 Phase Telescope

PHASE OUTFIT 1246PL***

Accessories include:

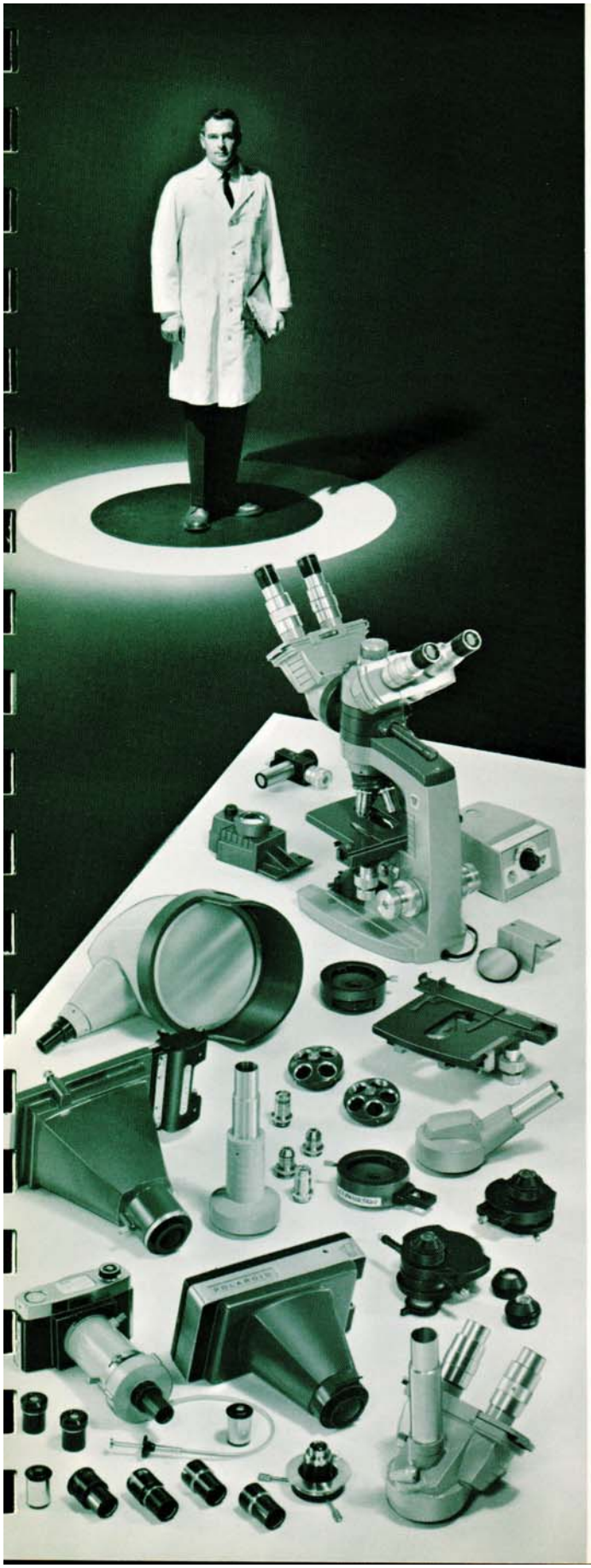
1246 Single Annulus Phase Condenser Mount
1243 Intermediate Working Distance Condenser
1238 45X Phase Objective, Dark Contrast
1249 45X Standard Phase Annulus
1265 Phase Telescope

*Recommended for educational work. To prevent accidental misalignment, Outfit is available, upon request, with special **removable** condenser centering wrenches and special cap screws which can be substituted for the removable turret annuli centering wrenches.

** Recommended for Microbiology.

***Specifically tailored to meet the requirements of Hematology, particularly for platelet count.

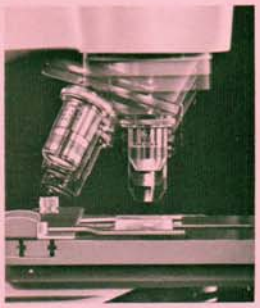
See illustrated price list for individual listings of all phase accessories.



YOUR PHASESTAR WILL KEEP PACE ECONOMICALLY

...should you wish to adapt other techniques of microscopy to the same instrument. The basis for its mechanical versatility is AO's popular, proven "building-block" concept. Your Phasestar, as a partner in design to other Series 10 microscopes, will readily accept a wide variety of interchangeable units and accessories. You can easily and economically adapt your Phasestar to brightfield, darkfield, fluorescence and photomicrography.

PHASESTAR OFFERS THE SAME UNIQUE FEATURES AS THE FAMOUS AO MICROSTAR

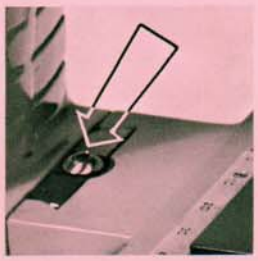


Infinity-Corrected Optical System

A truly remarkable focusing concept...only the nosepiece moves. Simplifies focusing; permits stage to be sturdily attached; parallel light between objective and body tube allows mounting of a wide variety of accessories such as #1110 filter turret for fluorescence or #1039 Dual Viewing Unit.

Gravity-loaded Nosepiece

If you focus down onto slide accidentally, the nosepiece "gives." Force exerted on the slide is insignificant; thus eliminating any chance of damaging objectives or breaking costly slides.

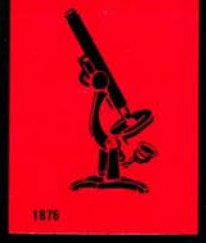


Variable Autofocus Stop

A tremendous time saver, particularly with the oil immersion objective. After changing objectives, you lower coarse adjustment to positive Autofocus Stop. You will be in focus with just a touch of the fine adjustment.

Over

133 years



of leadership in optics

...and 120 years of pioneering, progressive achievement in microscope development. The new AO Phasestar typifies this historical heritage. The American Optical Company was the first American manufacturer to market complete equipment for phase microscopy and is now a recognized world leader in phase microscopes and associated instrumentation.

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