MICRO-NOTES

Devoted to Microscopy

VOL. IV JULY -- SEPTEMBER, 1949 NO. 3

Thalamophora. Sammelstinge.

- * -

Published by

MICRO NOTES, INC.
2001 North Clark Street
Chicago 14, Illinois

- * -

J. E. Nielsen, Editor

I. J. Coldevin, Managing Editor

- * -

MICRO NOTES... is open to articles of interest to
***** ***** microscopists.

... Is not responsible for statements and opinions expressed by authors in their respective articles.

... Will, upon request, return manuscripts, photographs, and sketches to authors.

- * -

SUBSCRIPTIONS: $1.00 per year.
********** Special Group Subscription Rates given to Educational Institutions and Societies.

- * -

Volume IV, Number 3

Contents for July - September, 1949
****

ARTICLES Page

Myxomycetes, Mycetozoa, or Slime Molds
By Cloyd Burnley Stifler 52

Widgets and Gadgets No. 7
Kohler Illumination
By Dan M. Stump 66

Further Notes on the Habits of
Trichocerca Capucina
By C. Rudlin, F.R.M.S., M.A.M.S. 68

Symposium on Fine Particles and Resolution
June 9th, 10th and 11th, 1949 71

DEPARTMENTS

News from the Field 74
Super-thin Tissue Sections 74
Plastic Photographic Film 74
Camera Replaces Eyes 75
Things You've Never Wondered About 75
Electronics Reveal Make-up of Stars 76
Genes Nearer Identification 76
Fungi Present Own Evidence 77
New Lens Improves Eyesight 78
International Science Clubs 78
Food Possibilities of Water Plant 80
New Micro-Analysis Apparatus 81
Reflector Applied to Microscope 81
Growth Control Substance in Seaweed 82
Fluorescence Help Solve Soil Problems 82
National Quest for Knowledge 83
A Micro-Organism as Food Producer 83
Super Microscope Sees With Mirrors 84
Light for Photo Enlarger 86
Fingerprinting Powder Poisons Policemen 86

New Products 88
De Fonbrune Equipment for Probing
the Unknown 88

Our Front Page 88

Laboratory Technique 90
A Good Algae Stain 90

Advertising 91-96

MYXOMYCETES, MYCETOZOA
****

or

Slime Molds
****

By Cloyd Burnley Stifler

Myxomycetes or slime molds should be of interest to microscopists because the compound microscope is essential for their identification.

They have been known for over two hundred years and are claimed by the zoologists as belonging to the animal kingdom and by the botanists as belonging to the plant kingdom because at different stages in their development they show characteristics of both plants and animals.

Zoologists call them mycetozoa, "fungous animals". Botanists call them myxomycetes, "slime fungus". A student trying to identify a specimen in this group must of necessity consult references under both names.

When myxomycetes fruit, they produce spores which function as seeds, but do not contain embryos. The protoplasmic contents of the spores possess those factors necessary for carrying on the heriditary characteristics of each genus and species.

These spores, if placed in a most chamber or in water, open, the protoplasmic material emerges and is to all appearances an amoeba, or there may be several amoebulae or several flagellate swarm cells which later become amoebulae.

This amoeba possesses a nucleus and vacuoles. It can change its shape, develop "pseudopodia" with which it can surround and engulf food. It can move or flow in any direction as its outer covering is an amorphous invisible layer which allows the enclosed protoplasm to flow in any direction but keeps the contents intact unless it fuses with other amoebulae to form a plasmodium.

Undigested waste material is ejected by means of the vacuoles.

These bodies resemble an amoeba so closely that zoology teachers who could not obtain amoeba to illustrate their lectures have been known to substitute these slime mold amoebulae for them.

If the spore contents appear first as amoebulae, they change to a somewhat pear shaped form with a whip-

lash cilia at the anterior end. The posterior end retains the ability to form pseudopodia and engulf food. The flagellum makes possible rapid movement from place to place. This form is known as a swarm spore. It changes back to the amoeboid form and sooner or later these amoebulae unite to form larger masses of protoplasm containing nuclei and having the properties and characteristics of an enlarged amoeba. This is called a plasmodium. It can move or flow in any direction, often branching into threads which resemble the delta of a river, but they are united at the anterior border and are reabsorbed into the larger mass if the plasmodium flows in another direction. Change in direction may be due to the food supply having been exhausted. A regular pulsation has been noted in these plasmodia as they move about.

Myxomycetes are supposed to feed on bacteria and possibly protozoans, undeveloped spores of fungi, etc. Some species are found on the gills or honeycomb-like spore bearing portion of mushrooms which they digest.

The spores of slime molds retain their viability for years, and when placed in containers with water or nutrient solutions or with agar they germinate, and with proper feeding will again reach a spore forming stage.

Spores of Reticularia lycoperdon, after three years in a herbarium will develop within two hours into amoebulae and swarm spores if placed in water, and can easily be studied.

A plasmodia, finally, due to lack of food or for some unknown reason, comes to a fruiting or spore forming stage. Up to this time it has been living in a dark and moist place hidden in old wood, soil, dung, piles of leaves, etc., thru which it can move. At this later stage, it is known as urgent plasmodium and moves fairly rapidly to a dry and light place, on weeds, on ferns, stacks of old leaves, until it finds a suitable place. Here it rounds up into large or small cushions, called aethalia, or remains as coils or a network, known as plasmodiocarps or develops into small almost microscopic globose, ovoid, or cylinderical bodies with or without stems (sessile) which are called sporangia.

Urgent plasmodia vary in color - being colorless, yellow, greenish or red, etc.

The plasmodium separates into spores, and other materials which develop into the sporangial wall, the stem of the sporangium and a thin membrane on which the fruiting body rests - the hypothallus. Inside the sporangium among the spores there is formed an abundant or

scanty mass of threadlike material called capillitium. In some species this is lacking but when present its form is characteristic for each genus and species.

The plasmodia of some kinds of myxomycetes contain lime. This is exuded on the surface of the aethalia or sporangia or appears in the capillitium, either as rounded granules or as crystals. As crystals it is usually in or on the sporangial wall. This wall may be smooth or wrinkled or may have plate-like divisions or blunt plugs. Some species and genera have double walls.

The capillitial threads may be simple or branched, colored or colorless, free or attached to the wall of the sporangium or an extension of the stem. They sometimes form a net, but always permeate the mass of spores. They may be smooth or decorated with spines, warts, cogs or rings, or may be irregularly enlarged.

Some capillitium seems to be composed of hollow tubes or just hardened strands of gelatinous or cartilaginous material. The variations are numerous and are characteristic of the genera and species but they are microscopic.

The sporangical walls may be fragile and evanescent or permanent. Parts of it may fall away in flakes, or it may have certain strands in it which are tougher and remain in a definite pattern when the connecting tissue disappears.

The stem or stipe of the sporangium may end when it expands into the wall of the sporangium or it may continue through the sporangium forming a columella, from which the capillitium may radiate. It may be like translucent cartilage or filled with debris or with spores.

Myxomycete spores, when borne externally, exosporae, develop singly on basal projections of the wall, a minute elevation of the fruit called the sporophor. These spores are elliptical. Spores of the endosporae are usually globose or ovoid or the shape may be changed by mutual pressure. Their color, size or external sculpturing vary with the genus and species, and may be warted or spiny or reticulated with raised lines. See Plate I.

All of these characteristics and even the character of the sporangial wall are made use of in identifying the genus and species to which a specimen of myxomycete belongs.

With these facts in mind, we are ready to go on a collecting trip. Little equipment is necessary. If possible, a cigar box with a cork lining glued to the

bottom, a supply of long sharp pins with which a specimen may be fastened to the cork, some waxed paper cut in several sized squares, a strong sharp knife and a hand lens with a magnification of ten to fourteen diameters with which to examine the specimens in the field.

Add to this pencil and notebook and a basket to carry equipment in and for specimens which may be loosely wrapped in waxed paper.

A record should be kept of the location in which a specimen is found - its host, the county and state, and the date of collection. When the identification is made and the specimen is mounted in a box, the label should state the scientific name with the abbreviation of the names of the men who first named the genus and species, the location where it was found, the date of collecting and also the names of the collector and the person who identified it.

As stated above, when a plasmodium is ready to fruit, it moves quickly to the air and light where it can develop into spores. At this stage it is called urgent" plasmodium.

Woods containing stumps, fallen logs, or trees or old branches, piles of fallen leaves in a moist place, and an old pile of firewood are excellent collecting places.

Fruiting bodies may appear on a tree trunk four or five feet from the ground. They have even been found on outside window sills and door sills.

The top and sides of stumps, the underside of fallen logs and branches are profitable hunting grounds.

Look for aethalia and plasmodiocarps but especially for small sporangia which often suggest insect eggs. Their colors may be white, tan, reddish, yellow, brown or grey and may have a metallic luster. The small sporangia are usually globose, pear-shaped, elliptical or cylindrical, and may be sessile or have stems.

If a specimen is older the outer skin may have disappeared in part or entirely. The aethalia encrusted with lime granules are fragile and the crust may fall away. See Plate II.

If the urgent plasmodium has just rounded up and the sporangia are separating, they may look like semi-translucent grains of rice standing on end.

If a plasmodium or immature sporangium is touched at this stage, it will probably change color and become

horny, forming a sclerotium. This may be a resting stage in its development.

An urgent plasmodium may look like yellow pancake batter or white of egg spilled on a log or leaves, or may have orange or greenish tints.

In order not to injure a specimen, cut out the piece of bark or old wood under it or separate carefully the leaves on which it is found. Pin the specimen through the substratum to the cork in your box or wrap it carefully in waxed paper without crushing.

Urgent plasmodia can be collected but disturbing them may delay the formation of the sporangia. Portions of large specimens at this stage may be obtained by slicing off thin sections of the wood under it. If carried home in waxed paper and placed in loosely covered glass jars containing a little water, they may fruit if kept in the light.

One specimen of Stemonitis collected when it was a rounded mass of rice-like grains on the trunk of an old maple tree, by cutting out a two inch square of bark, was taken in the house about six p.m. and placed on a piece of typewriter paper on a desk. When examined at eight p.m. after being in the dark, it had divided in four or five portions and two of these had left the bark and were on the paper. Kept in the light until twelve p.m. they began to show brown color above and little black shiny stems below. With no light after midnight, in the morning the fruiting bodies were completely formed.

In two other cases where urgent plasmodia were collected on slices of wood and placed in mason jars - one covered with a small plate - remained unchanged from Saturday until the following Wednesday afternoon when it moved quickly up the wood and pushing the dish up slightly crept out on the shoulder of the jar and formed a perfect aethalium. Another similar specimen collected on a Friday and placed in a mason jar with waxed paper fastened over the top crept through a minute pore in the paper and formed an aethalium by Sunday morning.

If a plasmodium becomes waxy or horny (sclerotium), it may revive if kept in moist atmosphere.

Collections pinned in cigar boxes or taken home in waxed paper should be opened to the air and allowed to dry out. If crystals of para-dichlor-benzene are kept with specimens to destroy insect pests they may be kept in good condition for years.

For permanent collections, specimens when dry may be glued to bristol board slips, cut to fit the bottom of a pasteboard pill box and turn up at the ends. This keeps the specimen from being knocked about and the bristol board and specimen can be removed for study.

A completely fruited specimen is always ready for microscopic study. For this only a few things are needed. Microscopic slides, cover glasses, dissecting needle, fine pointed forceps, a millimeter measure. Several small bottles with droppers, one for alcohol, one for dilute potassium hydroxide solution, one for distilled or boiled water, one for oil if the oil immersion objective is to be used. (A small vial, with cork and a needle pushed into the bottom of the cork so that the eye dips in the oil, will do.)

The compound microscope should have a calibrated micrometer in the ocular for measuring the size of spores and capillitium or very small sporangia.

The height and diameter of the sporangia should be measured - length of stem if one is present and a record kept of these data with notes as to external appearance, the absence of presence of lines, etc., the type of capillitium and the color of various parts recorded.

With forceps place a small sporangia or a portion of one on a slide, moisten it with alcohol to remove air. Wet with a drop of dilute (2-3%) potassium hydroxide. This will restore the specimen to its normal size if it has shrunk. Tease it apart with the needle, place a cover glass over it and examine and measure it under the microscope. Often adding a drop of dilute solution of eosin gives a more distinct picture.

If the sporangia are small, measure them under low power of the microscope and note the size and character of stem if any, and of sporangial sac. Note the presence or absence of lime and its character. Increase the magnification, measure the spores, noting their shape, color, and the character of the sculpturing of the outer part (exospore), spines, warts, reticulations, etc.

Record measurements in microns. Note the type of capillitium and measure its diameter if constant. Note lime knots if present and their color. If the threads are twisted, note the number of lines in the spiral turns. Note whether the threads branch and the type of branching, whether they are irregularly thickened, smooth, warty, spiny, ridged, etc. and then consult a key. See Plate III.

The following general characteristics of the orders and families of myxomycetes should give the student an idea of the points to consider in determining the type he has collected.

MYXOMYCETES

Sub Class I Exosporeae
Spores borne on the exterior of short filaments called sporophores. The spores are elliptical. There is only one genus and one species. This species has three varieties.
1. Short white filaments-rosetted
2. Similar but in form of tree
3. A poroid form — Ceratiomyxa

Sub Class II Endosporaceae
Spores developed inside sporangia. Two large divisions (orders) determined by color of spores.

Order I Amaurosporales
Spores violet brown or purple gray (occasionally rusty)

Order II Lamprosporales
Spores variously colored not violet or purple grey

Order I Amaurosporales

Sub Order I Calcarineae
(1) granules of lime
(2) crystals of lime

Sub Order II Amaurachaetineae
No lime on sporangia or capillitium

Sub Order I Calcarineae

Family I — Physaraceae
Lime in minute granules in sporangial wall or capillitium or in columella or stalk.

Family II — Didymiaceae
Lime in crystals, in discs, not in capillitium.

Sub Order II Amaurochaetineae

Family I — Colloderma
Sporangia - aethalium distinct sessile, with an outer gelatinous coat.

Family II — Stemonitaceae
Sporangia stalked, wall an evanescent membrane, stalk solid and extends through the sporangium, becoming a columella from which the capillitium branches.

Family III — Amaurochaetoceae
Sporangia combine to form an aethalium. Capillitium dark purple brown of irregular strands and threads or complex vesicles.

Order II Lamprosporales

Sub Order I — Anemineae
Capillitium wanting or if present not forming a system of uniform threads.

Sub Order II — Calonemineae
Capillitium present a system of uniform or sculptured threads. Sporangia simple, spore yellow, red or grey.

Sub Order I Anemineae

Family I — Heterodermaceae
Sporangial wall membranous studded with microscopic granules either continuous or forming a net in the upper part.
Capillitium wanting.

Family II — Liceaceae
Sporangia solitary, walls cartilaginous or membranous. Sporangia scattered, sessile or stalked. Capillitium and columella wanting.

Family III — Tubulinaceae
Sporangial wall membranous without plasmodic granules. Sporangia clustered, cylindrical or ellipsoid, stalked or sessile. Wall pale rufous. Spores minutely reticulated.

Family IV — Reticulariaceae
Sporangia closely compacted usually forming an aethalium. Sporangia with fragile walls. Spurious capillitium.

Family V — Lycogoloceae
Sporangia forming an aethalium. Pseudo capillitium of colorless tubes

Sub Order II Calonemineae

Family I — Trichiaceae
Capillitium of tubular threads unbranched or forming a network branching at wide angles, with thickenings as spirals or rings.

Family II — Arcyriaceae
Capillitium, a netted tubular thread branched at wide angles, smooth or thickened with cogs or half rings. Cup often scaly.

Family III — Margaritaceae
Capillitium of solid threads. Either coiled or hair-like or nearly straight and attached to sporangial walls. Simple or branched at acute angles. Sporangia usually sessile. Usually wall single, rarely double (2 layered). Smooth translucent.

****

The families have one or more genera:

Physaraceae has twelve genera
Didymium has four genera
Collodermaceae has one genera
Stemonitaceae has seven genera
Amaurochaetaceae has two genera
Heterodermaceae has three genera
Liceaceae has three genera
Tubulinaceae has two genera
Reticulariaceae has four genera
Lycogolaceae has one genera
Trichiaceae has five genera
Arcyiraceae has four genera
Margaritaceae has four genera

Some genera have as many as 60 species and some two or three.

Good keys for genera and species are found in the following books:

The Myxomycetes by Thomas H. McBride and G. W. Martin published by the MacMillan Company, New York. It has descriptions of all known species, especially those occuring in North America and illustrations or photographs in black and white, and a bibliography.

A Monograph of the Mycetozoa by Arthur Lister and Gulielma Lister published by the British Museum (Natural History) Cromwell Rd., London S. W. 7. It is a descriptive catalogue of the species in the British Museum and contains many colored plates and wood cuts and a bibliography.

The Mycetozoa of North America by Robert Hagelstein is based on the specimens in the Herbarium of the New York Botanical Gardens. The illustrations are photographs. It also contains a bibliography.

North American Flora Vol. I, Part I is devoted to the Myxomycetes, and consists entirely of keys and written descriptions, with no illustrations. It is the work of G. W. Martin. The keys are worked out in a new order. The bibliography is by H. W. Ricketts. It is published by the New York Botanical Gardens, New York 58, N. Y. and may be purchased from the New York Botanical Gardens.

****

P L A T E S
* * * * * *

FIGURES ON THE FOLLOWING PLATES ARE NOT DRAWN TO SCALE BUT ARE INTENDED TO SUGGEST DIFFERENT TYPES OF SPORES, SPORANGIA, AD CAPILLITIUM

PLATE I: Spore types and sketch of slime mold with exogenous spores (ceratiomyxa).

1. Elliptical spore of ceratiomyxa
2. Aerolate sporophores of ceratiomyxa
3. -7. Types of spores of endogenous slime molds
3. Smooth spore
4. Reticulated spore
5. Warted spore
6. Spiny spore
7. 1/2 of spore only reticulated.

PLATE II: Some typical fruiting bodies of slime molds (Sporangia).

1. Aethalium
2. Plasmodiocarp
3. Globose - and stipitate
4. Shaped like a wine glass and stipitate
5. Flattened and stipitate
6. Pear-shaped and stipitate
7. Short cylindric and stipitate (columella white)
8. Globose - stipitate - upper part of sporangial wall falling away and leaving a network
9. Globose - sporangial wall falling away and leaving parallel ribs with fine cross threads
10. Elongated plasmodiocarp
11. Elliptic sporangia with membranous stems
12. Cylindrical sporangia
13. Sporangia with capillitium escaping
14. Sporangia with common stem for several cups
15. Sporangia - 1 shows base; 1 shows base and extended capillitium
16. Globose aethalium
17. Small globose, elliptical or cylindrical sessile sporangia
18. Elongated sessile sporangia

PLATE III: Some types of capillitum.

1. Lime knots with rounded lime granules connected by clear threads
2. All of the capillitium filled with rounded lime granules
3. No lime knots in capillitium. Crystalline lime
4. sporangial wall
5. Net work of tubes as capillitium
6. Capillitium starting from columella which is extension of stem
7. Capillitium attached to head of columella only
8. Capillitium with irregular enlargements
9. Capillitium with rings and warts (conical)
10. Tip of capillitial thread with rings
11. Tip of capillitial thread with spines
12. Free capillitial thread with spiral thickenings
13. Spiny capillitial threads that branch at wide angles.

****

Plate I

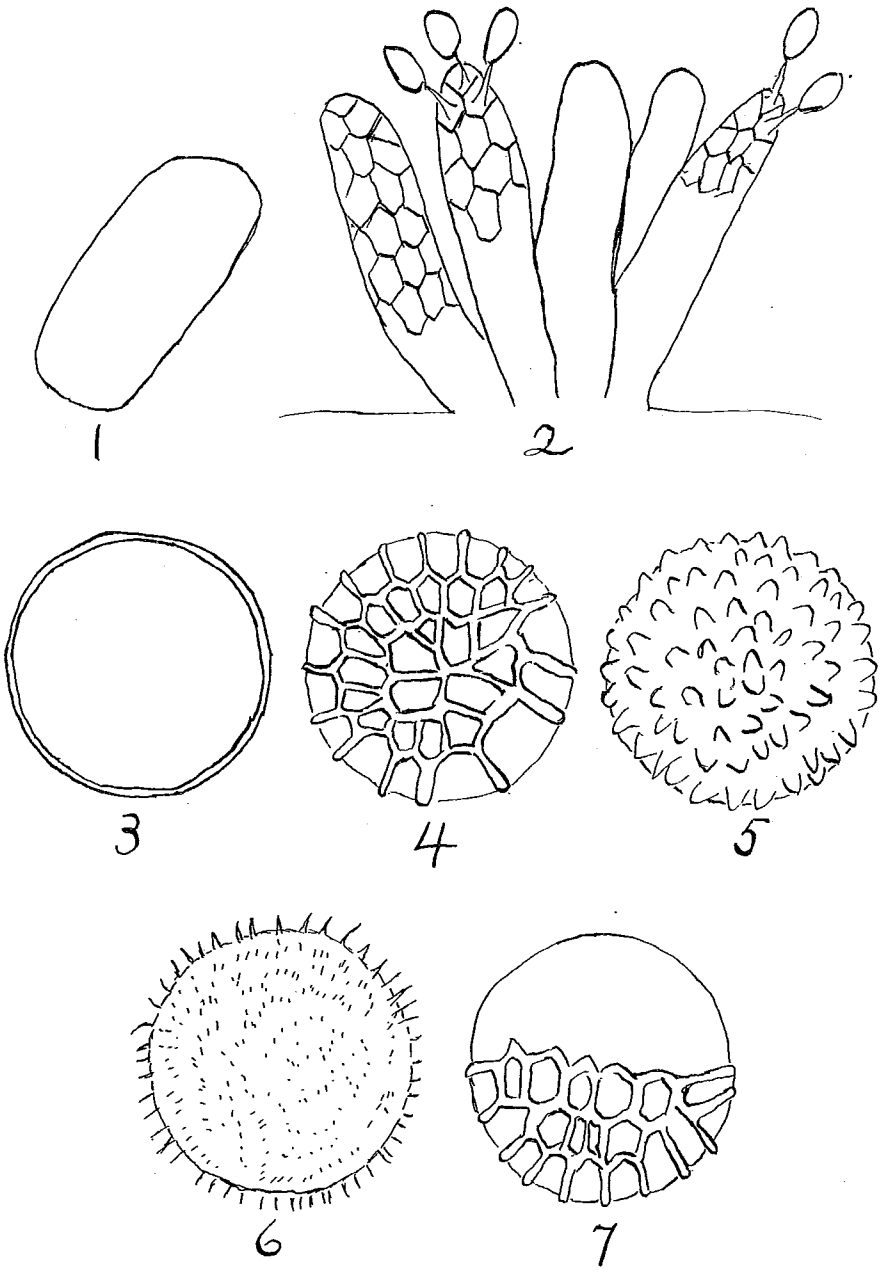


Plate II

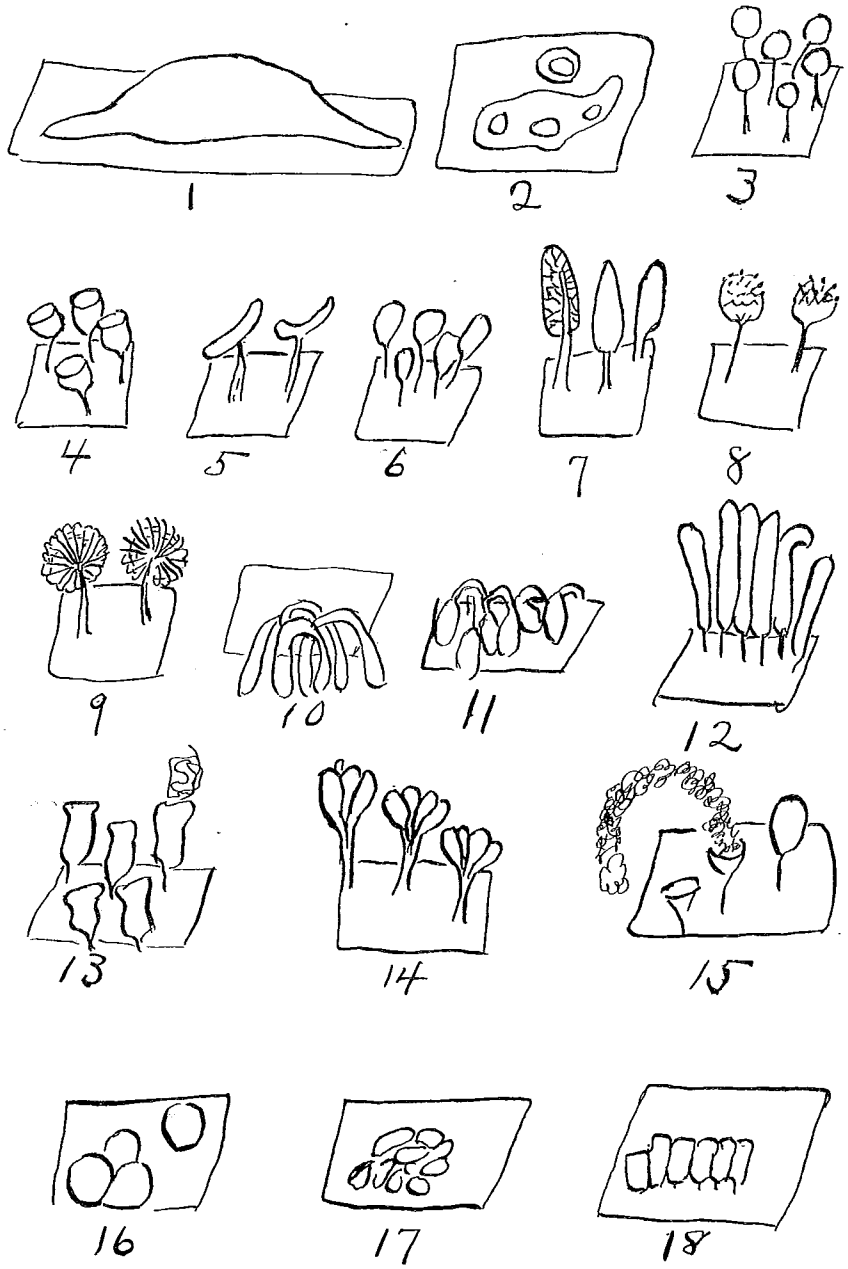
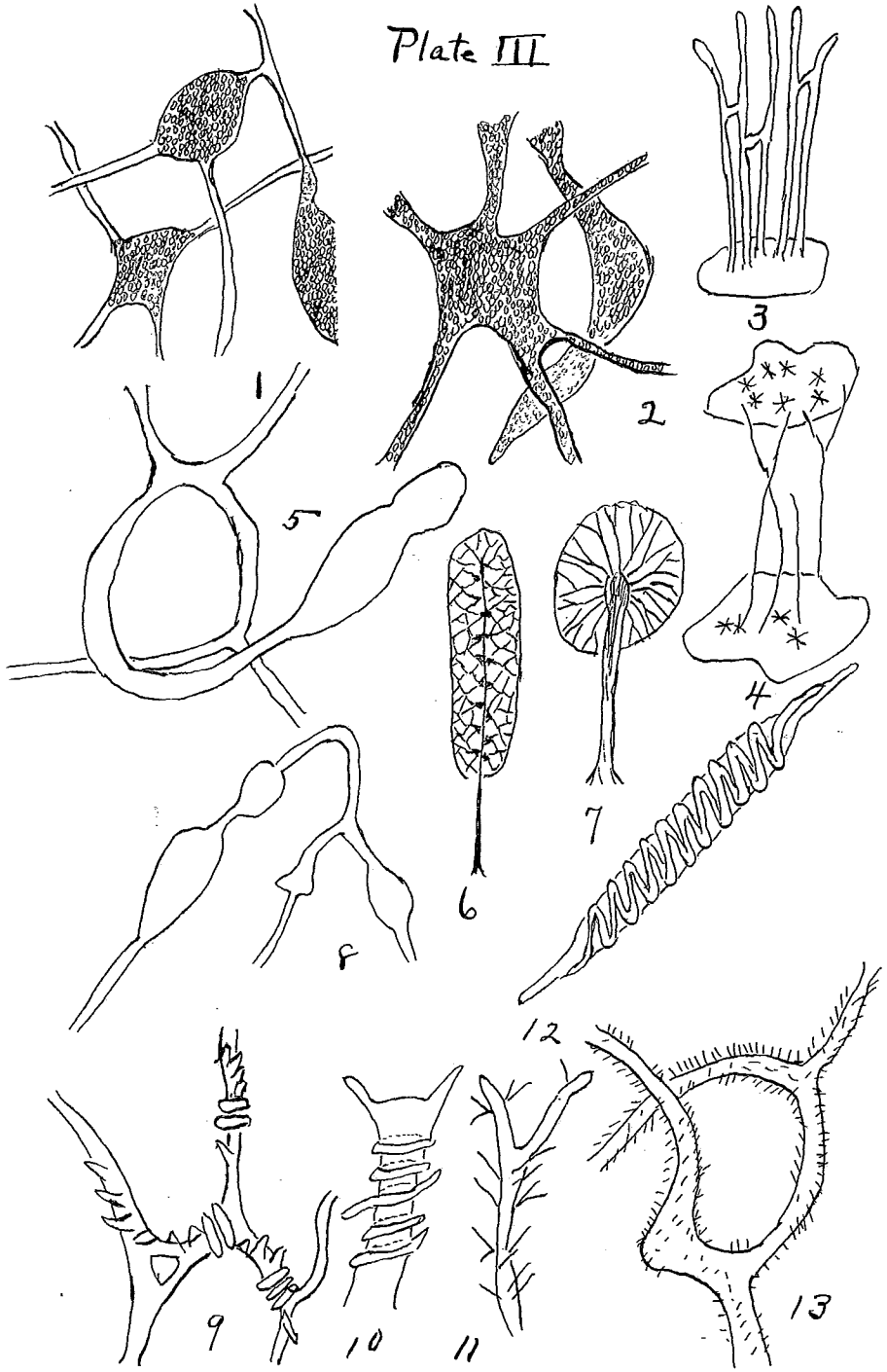


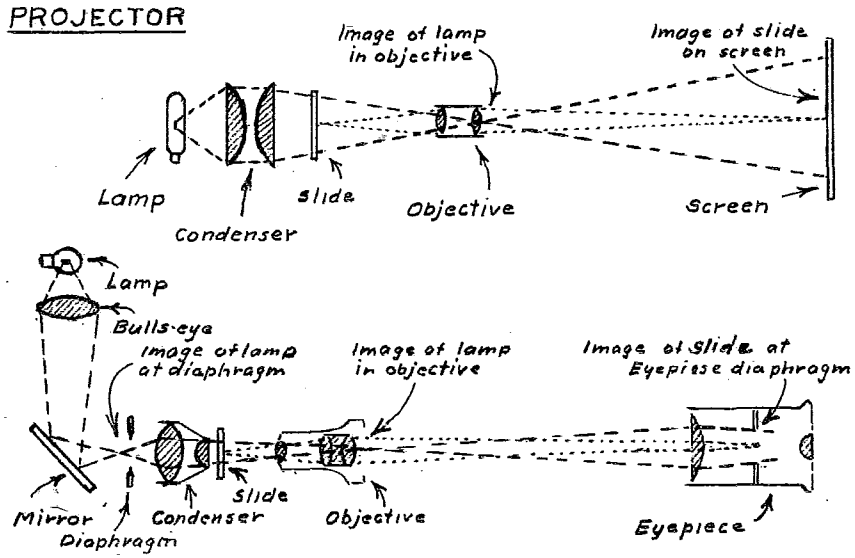
Plate III



WIDGETS and GADGETS

No.7- Köhler Illumination. Dan M. Stump

Have you ever noted the similarity of your microscope to a projection lantern or condenser type photo-enlarger? Identical optical principles are involved, and an understanding of this similarity may help you while adjusting the illumination of objects viewed under your microscope.



Note in the above sketch of the projector that the condenser is located so as to pick up a relatively large cone of light from the lamp, and then to converge a large portion of this light through the objective and from there onto the screen. Also note particularly that the light from the lamp is not focused on the semi-transparent slide itself, but in or near the objective lens. How, then, if the light merely passes through the slide, is the image formed on the screen?

When the light strikes the slide, a small portion of this light is spread out or "diffracted" by the structural details on the slide. Every detail on the slide is then sending out a tiny separate bundle of light, all of which are gathered by the objective which from them forms the image of the slide on the screen.

The second sketch illustrates the path of light through a microscope adjusted for what is commonly known as the Köhler system of illumination. Note that the bulls-eye is adjusted to form an image of the lamp near the substage diaphragm. The condenser then picks up this light and directs it through the slide, and a second image of the lamp is formed within the objective.

Each and every detail on the slide is then forming its individual diffraction bundle of light, the combined effect of which when gathered and focused by the objective is an image resembling the object, located in the plane of the eyepiece diaphragm.

This image in turn is then enlarged by the top lens of the eyepiece, resulting in the virtual image we see when looking into the microscope.

It may be well to note that the resolving power of the objective, as expressed by its Numerical Aperture (N.A.), merely indicates its ability to gather in a definite portion of each of the diffracted bundles sent out by the details of the object. The larger the aperture, the greater the proportion of the entire diffraction bundles are utilized, and the more closely the final image will resemble the actual object.

In passing, it may be noted that if the condenser were adjusted to focus an image of the lamp directly upon the slide, we would then be set up for the so called Critical illumination. However, it is beyond the scope of this elementary paper to discuss the advantages of the various systems of illumination.

I shall merely conclude that an understanding of the principles underlying the Köhler system as outlined above should help the microscopist in the intelligent use of his instrument, and that this method is of great value, particulary in photomicrography when it becomes necessary to drive the maximum amount of light through the objective onto the photographic plate.

FURTHER NOTES ON THE HABITS OF TRICHOCERCA CAPUCINA

By C. Rudlin, F.R.M.S., M.A.M.S.

After the appearance of my article entitled Tricho cerca Capucina; An European Cuckoo or An American Cow Bird Among the Rotifera", a friend, in a letter referring to this article, wrote the following:

"The particular habit you have described opens up a promising line of speculation. Is it essential, one wonders, that certain rotifer eggs should be kept in motion during development, and that others should not? There is such remarkable specialization in at least some of the species that carry the extruded eggs that the process is evidently of much importance. One has only to think of the tethering strap or hyssus that draws back the egg after it has been shot forth.

You cite a case in which the animal has no provision for carrying the egg itself, and so attaches it to another species. I am sure there is something involved here."

After reading this, I decided that if the Editor would be kind enough to allow me the space, I would like to try to explain this extraordinary behavior on the part of Trichocerca capucina.

To make it easier for those who are not students of the Rotifera, and those who are just starting in this line, I will first of all give a short description of the two Rotifers involved.

Trichocerca capucina (Wierzejski & Zacharias) = Mastigocerca carinata Ehr. belongs to the genus Trichocerca Lamarck., which are usually of small size, and in which the cuticle of the body has become stiffened to form a lorica. The usual form of the body is cylindrical, and it also tends to asymmetry in shape.

In Trichocerca capucina the head sheath is set off by a marked constriction from the remainder of the lorica. The dorsal part of the head runs out to a strong triangular projection over the ventral edge of the lorica; this gives the retracted head the appearance of a Capucin cap, hence the specific name capucina.

The eggs of this genus are not normally carried attached to the lorica (or body) after extrusion.

Jennings* says of the Rattulidae (now Trichocercide) " "They are found, as a rule, amid aquatic plants in the quiet parts of lakes, ponds, and streams. Only one of the Trichocercidae, T. capucina, can be said to be limnetic - that is, commonly found free swimming at a distance from the vegetation of the shores and bottom.

Asplanchna priodonta Gosse is a common rotifer, large in size, approximately 650 micra in length, carnivorous and cannibalistic. Body is large, transparent, sac-like, soft, and flexible. The ciliary wreath consists of a single row of cilia. Around the coronal margin, the coronal surface is produced into two humps, each bearing a bunch of setae. Asplanchna species have no intestine, faecal matter being regurgitated by way of the oesophagus. This rotifer is viviparous, apart from the resting egg, which is carried internally. Asplanchna priodonta is usually found in the open waters of lakes and other large bodies of water.

Now for the reasons for Trichocerca capucina attaching its eggs to Asplanchna. Normally all or most of the limnetic or plankton rotifers carry their eggs attached to the posterior end of their bodies, or are viviparous, bringing forth their young alive and capable of fending for themselves, the reason for this being that if they were not attached to their parents they would, if heavier than water, sink to the bottom and find themselves in an environment not suitable for their development, where even if they did hatch out suitable food would most probably not be at hand.

If lighter than water, they would float to the surface and probably get blown by the wind, or driven by water currents, to an environment on or near the shore, which would be equally unsuitable, both to the embryo and the grown animal.

It might also be, as my friend suggests, that planktonic Rotifera, living as they normally do in the clear and highly oxygenated parts of the water, their eggs have to be kept in motion, so that they have a constant current of fresh water flowing around them.

Now Trichocerca capucina belongs to a family and genus that do not, as a rule, carry their eggs attached to their bodies but deposits them on or amongst plants growing near the water's edge (on or the bottom) but it has adopted a different form of life amongst the limnetic and/or planktonic species, and had to find a way

*Jennings, Bull. U. S. Fish Comm., Vol. 22, 1903, p.275.

of getting over the difficulty of reproduction in an environment unsuitable to the usual methods of its genus. Like the cuckoo, it found an easy but very efficient way of doing this by handing over the job of looking after her offspring to another kind of Rotifer, i.e. Asplanchna priodonta, who, like the hedge sparrow and other birds in the case of the cuckoo, satisfactorily completes the job.

As to its method of getting food by extracting the contents of eggs carried by Keratella and perhaps of other species also, I have only seen them attack Keratella species, but it is quite possible that they might also attack others. The question is: Did they adopt the planktonic way of life because of this easy way of getting their food, or did they take to this method after (for some unknown reason) they had taken to open waters?

This question I find very difficult to try to answer, but I think it is quite probable that they took to the planktonic way of life because of the plentiful supply of food to be found there in the form of the eggs carried by the open-water species of Rotifera.

****

We can again thank Mr. Rudlin for another most interesting article on Rotifers.

Mr. Rudlin is the Secretary of THE ROTIFER SOCIETY (of England) and writes us as follows: --

"We, "The Rotifer Society", are shortly starting on a "World List of Rotifera Species" and wonder if you would help me by informing me as to where or to whom I would apply to get a list of American Soecia of Rotifers for this list, and also I should like to get a list or bibliography of all publications on the Rotifera, published in the United States of America. If you would help me, or send me the name (or names) of someone who could do so, we should be very grateful. There are several publications and articles on Rotifera published in your country which I should very much like to get hold of, but owing to the dollar trouble and also some of them being out of print, I have up to the present been unable to do so."

What can we do in regard to this matter?

Why not get in touch with the Rotifer Society! The address is as follows: THE ROTIFER SOCIETY, c/o Mr. C. Rudlin, F.R.M.S., M.A.M.S., "Owl Hoot", West Mersea, nr. Colchester, Essex, England.

SYMPOSIUM
****
on
FINE PARTICLES
****
and
RESOLUTION
****

- * -

The Armour Research Foundation of Illinois Institute of Technology again sponsored a very successful symposium. It was held at the Stevens Hotel, Chicago, Illinois on June 9th, 10th and 11th, 1949 and covered Fine Particles and Resolution.

The symposium was the outgrowth of the highly successful SYMPOSIUM ON ELECTRON AND LIGHT MICROSCOPY held last year in Chicago (MICRO NOTES, VOL. III, p. 31, p. 45, and p. 63).

At this year's symposium each session was under the direction of a session chairman who had surrounded himself with a selected and highly qualified group of experts to assist him by presenting formal and semi-formal remarks. Time was also given for appropriate discussion from the floor. The program was extremely flexible and its vitality was enhanced by lack of excessive formality. More than three hundred microscopists attended the symposium. A summary of the program is given below.

In addition to the regular sessions there were interesting displays of instruments of interest to workers in fields related to the many symposium topics. Another feature was an exhibit of light and electron micrographs dealing with subjects that were being discussed at the symposium.

- * -

PROGRAM
****

(See the following two pages)

- * -

FORMATION AND CHARACTERIZATION OF FINE PARTICLES

Chairman: Herman F. Mark, Director, Institute of Polymer Research, Polytechnic Institute of Brooklyn, New York, N. Y.

Principal Topics for Discussion:
- The Formation of Macromolecules
- Size Distribution Functions of Macromolecules
- Formation and Growth Rate of Nuclei
- Sedimentation and Diffusion in Colloidal Systems

LIGHT SCATTERING

Chairman: Peter J. W. Debye, Chairman, Department of Chemistry, Cornell University, Ithaca, N.Y.

Principal Topics for Discussion:
- Differential Refractometer
  - Wave-length
  - Concentration Dependence
- Turbidity by Scattered Intensity
  - Instrumental Arrangements
  - Absolute Calibration
  - Cleaning of Solutions
  - Angular Distribution
  - Effects of Depolatization, Association, Preferential Adsorption in Mixed Solvents
  - Effect of Changes in Scattering Complex
  - Colored Solutions
- Scattering by Large Particles (Angular Dissymmetry, Turbidity by Transmission, Wave-length Dependence)
- Small Differences of Refractive Index (Theory, Results), Effect of Molecular Weight Distribution
  - Appreciable Differences of Refractive Index Combined with Larger Size
- Scattering of High Concentrations
  - Theory of the "Second Virial Coefficient in Light Scattering" and Its Relation to the Corresponding Coefficients in Osmotic Pressure
- Fundamental Interpretation of Scattering as a Result of Inhomogeneities. The Correlation Function and Solutions of Particles From This Point of View.
- Scattering in Solids
- Low Angle X-Ray Scattering

MICROSCOPY OF FINE PARTICLES

Chairmen: C. W. Mason, Department of Chemical Engineering, Cornell University, Ithaca, N. Y., and Robley C. Williams, Department of Physics, University of Michigan, Ann Arbor, Michigan

Principal Topics for Discussion:
- Instrumental Theory and Practical Limitations
  - Optical Imagery
    - Calculation of Resolution
    - Definition of Resolution
    - Effect Upon Resolution of Apertures, Depth of Field, Conditions of Illumination (Wave-length Dependence, Dark-Field, Phase Contrast), Aberrations
    - Criteria of Resolution
  - Practical Problems Associated with Resolution
    - Instrumental
    - Technical (Focussing, Vibrations, Disturbing Fields, Stability of Specimen, Photographic Techniques)
    - Resolution and Apparent Shape of Particles
- The Problem of Contrast
  - Optical (Effect of Conditions of Illumination)
  - Specimen Characteristics
    - Size and Thickness of Specimen Material
    - Staining
    - Shadow-casting
    - Association of Particles With Other Specimen Materials Such as Films and Sections
    - Effects Due to Indices of Refraction
- Distortions and Disturbances of Specimen
  - Staining, Drying, Heating, Shadow-casting, Smoothness of Substrata
  - Effect of Mechanical and Chemical Treatment of Particles Prior to Microscopy
- Measurement of Particle Size
  - Calibration of Magnification of Microscopes
  - Photographic vs. Visual Measurement
  - Determination of Particle Boundaries, Effect of Shape, Definition of a "Particle
  - Criteria of Accuracy of Measurement
  - Particles to Use as Standards for Size Determinations
  - Correlations Among Methods of Size Determination
- Representative Fields and Particle Counting
  - Sampling and Preparation Methods
    - Dispersions, Droplets, Emulsions
    - Criteria of Dispersion Methods
  - Counting of Particles, Presentation and Evaluation of the Statistical Data
- Identification of Particles
  - Criteria of Preparation Purity and Quantity
  - The Use of Control Preparations
  - Identification Correlations Among Light Microscopy, Electron Microscopy, X-Ray and Electron Diffraction, and Polarization Microscopy
- New Instruments
- Methods and Techniques

NEWS FROM THE FIELD
****

SUPER-THIN TISSUE SECTIONS

Dr. Edward U. Condon, Director of the Federal Bureau of Standards, has just revealed that tissue now can be cut so thin that it cannot be seen edgewise under the most powerful light microscope. The new technique is practical and inexpensive and will be of utmost importance in the study of cancer and virus diseases.

Such studies up to now have been hampered because tissue sections were not thin enough to permit the transmission of the electron beam. Therefore, the new technique is expected to be of great help in utilizing the highest magnifying power of the electron microscope.

PLASTIC INSTEAD OF GELATIN FORESEEN IN PHOTOGRAPHIC FILM

WASHINGTON, June 17 (Science Service) -- Old fashioned gelatin, made from skin of calves, may in the future give way to a synthetic plastic as the emulsion material that coats photographic film and carries the chemicals that are affected by light and make the picture.

The replacement of conventional gelatin by a synthetic polymer resin in a Du Pont color printing film suggests that synthetic material may eventually be used in more photographic films.

Color film emulsions using gelatin have a chemical put into them which makes the dyes stick to the silver image, called a color former. The new film uses the synthetic polymer to replace both the color former and the gelatin binder, thus making the one substance do the work of two.

Because the new color former plastic is only swollen by water, the dyes in the resulting picture are deposited in place and keep the picture sharper than by the older method.

The new color film announced by Du Pont is for professional 35 mm motion picture projection. The film consists of three emulsion layers superimposed on one side of standard cine film base. Each layer contains the sensitive silver salts suspended in the new color former plastic.

In each emulsion the amount of dye in the final print is proportional to the amount of silver deposited by the first exposure and development.

The gelatin now in use for photographic films is made from the skin of calves. The quality and impurities of gelatin have a great effect on the sensitivity of the photographic emulsion. The plants that the animals eat affect the gelatin made from their skin. Two drops of mustard oil per ton of emulsion is enough to increase the sensitivity of a gelatin emulsion.

The synthetic resin can be made under controlled conditions and should be more uniform. The physical characteristics of some of the synthetic plastics may be better than that of gelatin. It may have better dimensional stability.

CAMERA REPLACES EYES FOR READING ASTRONOMY SCALES

OTTAWA, Canada, June 20 (Science Service) -- Astronomers no longer rely on their eyes to read off the scale markings on their most precise instruments.

E. G. Woolsey of the Dominion Observatory here told the American Astronomical Society meeting that cameras are being used to photograph the division marks on the declination scale of the Observatory's meridian circle telescope.

Declination measure of star positions, made with this telescope, can be used to determine latitude exactly. Latitude changes because the axis on which the earth rotates keeps moving around a bit inside the earth. Greatest change from a mean position is about 40 feet.

A similar use of camera apparatus is for similar studies at the U. S. Naval Observatory in Washington.

NEW CHART TELLS YOU THINGS YOU'VE NEVER WONDERED ABOUT

ROCHESTER, N. Y., June 20 (Science Service) -- If you know the weight of an elephant's brain, you can get at a glance such data as his water intake and body weight. Or you can spot the weight of a mouse's liver, if you know his heart beat.

These are some of the possibilities with a chart developed by Dr. E. F. Adolph of the University of Rochester here. Dr. Adolph's chart, published in the journal, Science, listed 34 properties of mammals including man. The relationships between these 34 biological characteristics have been established so that with the chart, a ruler and any one of the measurements, you can immediately read off any of the other 33 for a particular mammal.

Relationships on which the chart is based apply to physiological processes, sizes of organs, numbers of reduplicated structures and biochemical compositions.

ELECTRONICS HELPS REVEAL WHAT MAKES UP THE STARS

OTTAWA, Canada, June 21 (Science Service) -- Newest job for electronics is to help astronomers discover what makes up stars.

Harold L. Johnson of the University of Wisconsin's Washburn Observatory described a new electronic plate-measuring machine to the American Astronomical Society here. Plates measured by the machine are photographs of star light, spread out into its component wave-lengths to give bands of colored light crossed by numerous dark and bright "spectral" lines. These lines can reveal the chemical elements present in the stars.

The Wisconsin astronomer said that the new machine will not only give more accurate spectrogram measurements, but it will also be easier on the astronomer. It all but does away with eyestrain and fatigue and eliminates personal judgement, and personal error, plus offering increased speed.

With the electronic machine, most of the job is done automatically: the astronomer pushes a button to indicate the spectral lines to be measured, and the reading is recorded for him on photographic film. Previously astronomers have generally examined the faint lines from a star under a MICROSCOPE. This, particularly in the case of a very hot star, required much practice and many measurements.

One major limitation remains the same as for direct eye measurements. This is the grain of the photographic plate on which the spectrum of a star is taken. Scientists can take some steps to get easy-to-measure lines, but sometimes stars make their own spectra with fuzzy lines.

NEW ELECTRON MICROSCOPE METHOD BRINGS GENES NEARER IDENTIFICATION

PHILADELPHIA, July 1 (Science Service). Genes, the ultra-minute biochemical units that determine the course of heredity in man and other organisms, are moved one step closer to positive identification and detailed mapping by a new method of preparing chromosome containing cell nuclei for electron microscope photography developed by a three man research team here.

Involving several steps of chemical preparation, the careful squeezing of the nuclei to spread the chromosomes, and preliminary examination under high-powered ordinary microscopic lenses, the new technique has been employed on immature human male sex cells, as well as on material from fruit-flies. An illustrated report of results is presented in the journal, Science.

A feature brought out by the electron microscope, never detected with even the highest powers of the ordinary microscope, is an ultra-fine web of connecting threads between the chromomeres or segments of individual chromosomes. Their significance has not yet been interpreted.

Participating in the research were Dr. Jack Schultz of the Institute for Cancer Research here, Dr. Robert C. MacDuffee of the Army Medical Center, Washington, D.C., and Dr. Thomas F. Anderson of the University of Pennsylvania.

FUNGI PRESENT OWN EVIDENCE OF AID GIVEN TO PLANT ROOTS

DURHAM, N.C., July 5 (Science Service). Proof that fungi on plant roots help the plants in absorbing mineral nutrients from the soil has been written by the fungi themselves on photosensitive plates, in experiments carried out by Drs. Paul J. Kramer and Karl M. Wilbur at Duke University here.

Many species of trees and shrubs, and some herbaceous plants as well, have the smaller branches of their roots densely covered with a fine weft of fungous hairs, known to botanists as mycorrhiza. It has long been assumed that mycorrhiza aid roots in absorbing water and minerals from the soil, but conclusive proof has been lacking.

Drs. Kramer and Wilbur prepared a solution of radioactive phosphate, and immersed in it the roots of pine seedlings both with and without micorrhiza. Then they laid the roots on photographic plates, separated from the plates only by a thin layer of aluminum foil. The radioactivity of the phosphorus recorded itself as bright outlines on the sensitive emulsion. Roots with micorrhiza registered themselves much more strongly than roots without the fungous webs.

An illustrated report of the results of these experiments is presented in the journal, Science.

NEW LENS MAKES VISION BLUR BUT IMPROVES EYESIGHT

SOUTHBRIDGE, Mass., July 29 (Science Service). A lens that will rest the good eye while putting the laggard eye to the work of seeing was announced here today by the American Optical Company.

Working on the principle that some patients afflicted with cross-eyes use only one eye to see with while letting the other lose from disuse its ability to see, scientists devised a slightly pebbled clear glass. This lens will blur the vision in the working eye and so force the poorer eye to perform the task of seeing.

An advantage credited this lens is that it looks much like an ordinary spectacle lens with the eye visible. Previously, treatment in such cases called for eye patches or opaque lenses which attracted attention to the condition and make people reluctant to wear them.

FASTER BETWEEN-THE LENS SHUTTER NEW INDOOR COLOR FILM ANNOUNCED

ROCHESTER, N. Y., Aug. 3 (Science Service). The fastest shutter of its type in the world and a new type of indoor, color roll film were announced here today by the Eastman Kodak Company.

Eastman said the new between-the-lens shutter, which will be incorporated in a new model camera, has an accurate top speed of one eight-hundreth of a second, making it the fastest shutter of this type.

Blades in the shutter pivot and rotate through a partial circle inside the shutter housing, opening and closing the aperture in a single stroke, it was explained.

The new film is similar to other Kodacolor film, but it requires no special filters for taking pictures indoors or outdoors at night with flash or flood bulbs. If used in daylight, however, the new Kodacolor film, type A, should be used with a filter, it was explained.

MANY COUNTRIES WORKING ON SCIENCE CLUB PROGRAM

PARIS, Aug. 2 (Science Service). Groups of young people will be studying and working in science in many countries during the coming school year as a result of the impetus given to international science clubs by a conference held at UNESCO, the United Nations Educational, Scientific and Cultural Organization, here in Paris.

Representatives from nine nations and reports from many other areas were received during a two-day meeting. Leaders of science youth organizations working in many lands and languages became acquainted and exchanged experiences.

The American experience developed through years of experience with Science Clubs of America and the Science Talent Search formed the basis of the projected extension of science club work to all nations. The 600 foreign clubs already affiliated with Science Clubs of America form a nucleus for the international expansion of the movement.

In France, representatives of the national departments of education and colonial affairs, the French national radio, a leading science journal, a youth center and other interested organizations are discussing a joint sponsorship of the organization of science clubs for youth.

Czechoslovakia is planning science clubs in every secondary school during the coming year.

Denmark is expanding its youth science organizations and so is Holland.

For Latin America, UNESCO is planning a traveling exhibit to demonstrate the methods and advantages of science organization by young people.

Interest in science clubs was also reported from Poland, Finland, Switzerland, England and other nations.

Delegates and observers at the science clubs conference were presented the Science Clubs of America emblem by Watson Davis, director of Science Service, who was elected chairman of the conference.

Director General Jaime Torres Bodet of UNESCO opened the conference, telling the delegates:

"Yours is the rare privilege of disseminating, humanizing and advancing the cause of science. It enables you to help train men who will be, not mere scientists, but citizens with deeper insight into the possibilities and dangers of the world today. Whether they make a name for themselves through far-famed discoveries or merely perform a more humble yet necessary task, the members of your clubs will have this in common: They will together have fought against ignorance and prejudice, worked methodically with ever open minds, faithfully carried out their task, great or small, and with their deeper knowledge of the world about them, will better understand the bonds which unite mankind in a common destiny."

Dr. Pierre Auger, French physicist and cosmic ray authority, participated in the conference as the head of the natural sciences department of UNESCO.

Just as Science Service through Science Clubs of America supplies material and inspiration to between 12,000 and 15,000 science clubs in the USA each year, without charge, so an identical service without charge is being offered by Science Service to all science clubs, already organized or in the process of organization, in all countries.

An exhibition of science club work in various countries and a display of educational and industrial materials supplied to science clubs largely by American organizations was opened at UNESCO at the time of the conference.

The science club movement is being fostered in UNESCO by a division of science popularization and social implications of science, staffed by Borge Michelsen, of Denmark, and Maurice Goldsmith, of Great Britain, both science writers.

SCIENTISTS EXPLORE FOOD POSSIBILITIES OF CHLORELLA, ONE-CELLED WATER PLANT

NEW YORK, Aug. 6 (Science Service). Food-producing possibilities of a lower plant that can treble its bulk in 24 hours if supplied with constant illumination are being technically explored at the Stanford Research Institute, Palo Alto, Calif., Dr. J. E. Hobson, director of the Institute stated here today. Dr. Hobson spoke as guest of Watson Davis, director of Science Service, on the Adventures in Science program, sent out over stations of the Columbia Broadcasting System.

The plant is the one-celled alga known to botanists as Chlorella. It is familiar as the cause of much of the green scum that forms on cattle ponds and other bodies of still water in warm weather.

First hint of the possibilities of this humble plant was obtained by plant scientists of the Carnegie Institution of Washington. They discovered that by controlling its chemical environment they could at will cause it to produce a very high yield of either protein or fat.

The Stanford Research Institute was asked to probe into the economic potentialities of Chlorella. One of the first things they discovered was that it could be made to grow very much more rapidly by giving it 100 times as much carbon dioxide as occurs naturally in the air. This extra supply is readily obtainable from the waste gases from brewery vats or from the combustion gases escaping up factory chimneys.

The Institute has also undertaken a study of the fat or oil piled up in Chlorella's tiny body when its nitrogen supply is kept short. This may prove useful in soap-making or similar industries, thereby releasing animal or vegetable fats and oils now used there for other purposes. It is even possible that Chlorella oil may prove a good drying oil, which is always in demand by paint and varnish makers.

Chlorella protein, which accumulates when the plant is given an abundant supply of fixed nitrogen, is most likely to get into the human food cycle by way of livestock or poultry feed, being converted into milk, meat and eggs. There is the possibility, however, Dr. Hobson stated, that this protein may be processed into a form palatable enough for direct human consumption.

NEW ANALYTIC APPARATUS MEASURES MINUTE CONSTITUENTS OF CELLS

NEW YORK, Aug. 5 (Science Service). Genes, the elusive heredity-determining chemical units whose existence has been mathematically proven but not visually demonstrated may be among the minute cell-nucleus structures that will be tracked down by a new micro-analysis apparatus developed in the cytology laboratories of Columbia University, under the direction of Prof. Arthur W. Pollister.

The apparatus, though complex in principle, has been so simplified that any fairly well trained laboratory worker can use it under the high powers of an ordinary microscope, Prof. Pollister declared.

The device operates by measuring, with ultra-sensitive photo-electric tubes, the amounts of light absorbed by various chemical components of the cell nucleus. One important compound, nucleic acid, has been shown to exist in a single cell in an amount less than one-trillionth of an ounce. Similarly "fantastically small" quantities of other chemical compounds can likewise be measured.

Research centers for the use of the new apparatus are being set up at Brookhaven National Laboratory, the Doctors' Hospital in Cleveland and a number of universities in this country, as well as at Mysore and Bombay universities in India.

REFLECTOR

WASHINGTON, August 8 (Science Service). The reflector principle, long used in the world's great telescopes, is

beginning to be applied at the other end of the optical scale, to microscopes. A reflecting instrument of this class is covered by patent 2,478,762, granted to Lyle T. Johnson of La Plata, Md. It can be used with ultraviolet radiation as well as with visible light.

SEAWEED CONTAINS GROWTH CONTROL SUBSTANCE, EXPERIMENTS SHOW

GREENVILLE, S.C., Aug. 12 (Science Service). Seaweeds produce growth-control substance, and respond to it in very much the same manner as the higher land plants. This has been demonstrated in two ways by Dr. Louis G. Williams of Furman University here, who carried on his experiments at the Woods Hole, Mass., Marine Biological Laboratory.

In one series of experiments, Dr. Williams cut disks out of broad-bladed seaweed known as Laminaria, and kept them in beakers of sea water containing various dilutions of the synthetic growth-control substance, indole acetic acid. They responded to the lower concentrations by growing healthily, but became unhealthy and disintegrated when there was too much of the compound. This agrees very well with what is known about growth-hormone effects on higher plants, which are stimulated by low dosages and injured or killed by overdoses, as in 2, 4-D treatment of weeds.

In a second experimental series, Dr. Williams squeezed the juice out of Laminaria tissue, made it into a paste with lanolin, and applied the paste to the sides of oat seedlings. These responded by bending over, indicating increased growth rates where the Laminaria juice was at work on their cells.

Details of the experiments are reported in the journal, Science.

FLUORESCENCE MAY HELP SOLVE SOIL PROBLEMS

DUBLIN, Aug. 13 (Science Service). Fluorescence, the visible light given out by some substances when irradiated with invisible ultra-violet light, may become a useful tool in the scientific study of soils. This suggestion is offered by Prof. P. H. Gallagher of University College here, in a letter to the editor of the London science journal, Nature.

Prof. Gallagher has done some preliminary work along this line. He reports that humus in its most advanced stage has a yellow fluorescence, and that a waxy substance sometimes found in mucky soils fluoresces bluish-

white. Living things found in the soil, such as earthworms and young roots, have their own specific modes of fluorescence.

NATIONAL QUEST FOR KNOWLEDGE URGED IN NATION'S HIGH SCHOOLS

BAR HARBOR, Maine, Aug. 18 (Science Service). "A great national quest for knowledge" to help the million or more high school boys and girls "eager to do things in science" was proposed here tonight by Watson Davis, director of Science Service.

These science-minded high school students and their teachers "need guidance, inspiration and materials with which to work," Mr. Davis explained at the twentieth anniversary meeting at the Roscoe B. Jackson Memorial Laboratory here.

"America needs a great national quest for knowledge - operating in the schools and kindling the sparks of interest and genius latent in our high school youth," he declared.

Foundations for a national quest, Mr. Davis added, have been built in Science Service's Science Clubs of America, which have 15,000 clubs and a third of a million members.

"For the future of America - for peaceful living, for industrial progress, for successful democracy, for a strong and prepared nation - the quest by youth, for science understanding, must be accomplished," the Director of Science Service urged.

MORE FOOD FOR HUNGRY SEEN IN YEASTS, SEAWEED, ALGAE, WOOD

LAKE SUCCESS, N. Y., Aug. 25 (Science Service). For the future populations of the world, that otherwise may be hungry, let them eat yeasts, seaweed, and algae and wood.

The dining rooms of the United Nations do not feature such unusual foods today nor will they in the near future. But the UN conference on conservation and utilization of resources meeting here is discussing just how soon and by what methods such "creatable resources" can be turned to practical use.

A most promising discovery is that A SPECIAL MICRO-ORGANISM, called Rhodotorula gracilis or more simply fat yeast, produces in its cells a substance that is 50% to 60% fat. Because fat is one of the foods in shortest supply, this is exciting practical-minded technologists.

The kinds of fatty acids in the yeast fat are rather close to palm oil fat. The yeast fat also contains some of the vitamin B complex and the stuff from which vitamins A and D are made. A hundred pounds of sugar fed to this yeast produces 16.5 pounds of fat, as well as a quarter that amount of protein. The sugar used can be in molasses of lowest grade.

A report by Dr. Harry Lundin of Sweden's Royal Institute of Technology, Stockholm, shows that the dry matter in fat yeast costs about 13 cents a pound and that a desirable mixture of fat and protein should be manufactured by a practical continuous process. First the yeast is allowed to grow for 10 hours with a moderate amount of fat in its cells. Then it is put through a fattening phase for two days when it converts the sugar to fat at a great rate.

Britain turned to yeast for possible cattle feeding when a Nazi blockade threatened in 1940 just as the hard-pressed Kaiser's government in 1915 studied yeast manufacture from inorganic nitrogen. This was revealed by Dr. A. C. Thaysen, who reported from Britain's Colonial Microbiological Research Institute at Trinidad. Since 1944 there has been in Jamaica a successful food yeast factory, producing material suitable for human consumption.

The yeast itself can be fed on sugar made from wood, Dr. J. A. Hall of the U. S. Forest Service at Portland, Ore., reported. Or molasses made from wood can be fed directly to livestock, as shown in many U. S. agricultural college tests.

As for seaweed used for centuries as laver bread fried for breakfast in the case of the reddish or sea lettuce sort in Scotland, Dr. F. N. Woodward, director of the Scottish Seaweed Research Association, predicted that the greatest use of marine algae will be in providing raw chemical materials, including alginic acid now used in food, drugs, cosmetics and textiles, and newer chemicals called mannitol, laminarin and fuccidin, that correspond roughly to the sugar and starch of land plants.

SUPER MICROSCOPE "SEES" LIVING CHEMISTRY WITH MIRRORS, INVISIBLE LIGHT

NEW CASTLE, Sept. 5 (Science Service). A super microscope that "sees" the chemistry of living things, hailed as a "revolutionary" advance with applications so vast they may not be "fully explored in our lifetime," was reported to the British Association for the Advancement of Science here this morning.

This super microscope, called the reflecting microscope because it "sees" with mirrors instead of lenses, was constructed by Dr. C. R. Burch of Bristol, England. Research with it in fields ranging from cancer-fighting to manufacture of synthetic fabrics like nylon was reported here this morning by Dr. Robert Barer of Oxford University.

Exciting feature of the new microscope to scientists is that with it they can use the invisible light of infra-red rays for spectral analysis and identification of chemicals. The infra-red absorption spectrum of a chemical compound is so characteristic that chemists often call it the "fingerprint of the molecule."

With the new reflecting microscope they can now detect the presence of a chemical, such as penicillin or a vitamin or a cancer-causer, inside a living cell by its spectral "fingerprint". In addition they can find what part of the cell it is in, and how it may be changed structurally by other chemicals in the cell.

Fibers of muscles and nerves and also of fabrics, such as terylene, the English nylon-like material, are being studied with this new microscope. Changes are being detected in the fiber chemicals, according to whether the fiber is stretched or unstretched.

The structures of a minute crystal of a mold chemical related to penicillin and of a crystal of the anti-pernicious anemia vitamin B_{12} are showing themselves through spectral analysis of their mirror-magnified images.

Instead of lenses, such as ordinary refracting microscopes have, the reflecting microscope made by Dr. Burch is equipped with a small spherical convex mirror and a large aspherical concave mirror to do the magnifying job. The mirrors are made of speculum metal coated with a very thin reflecting layer of aluminum. Reflecting microscopes have been made in several countries but some of them are equipped with lenses as well as mirrors and some do not have aspherical mirrors.

The clearance between the object to be viewed and the small mirror of the Burch microscope is about an inch and a half, or some 13 times the working distance on a lens microscope with a similar numerical aperture. This makes for much easier manipulation and permits examination and dissection under high magnification of organs such as the liver, spleen, kidney and brain of a living anesthetized animal.

Microscopes, however, are no longer regarded as merely super magnifying glasses, Dr. Barer pointed out here today.

"Indeed, with the reflecting microscope we may not al ways want to look at the ordinary appearance of the object at all," he declared.

It is quite possible that in future work with this instrument we may be content to learn about the chemistry of the object by observing the behavior of a spot of light on a cathode-ray tube screen. This is indeed a far cry from the careful visual observation of preserved and stained specimens on which so much knowledge of cell structure is based."

WASHINGTON, Sept. 5 - No reflecting microscopes have yet been built in the United States, so far as is known. Scientists at the National Bureau of Standards, however, as enthusiastic about the possibilities of "seeing" new things with this type microscope and foresee a "rush of energetic research workers" into the field.

LIGHT FOR PHOTO ENLARGERS

An improved illuminating system for photographic enlargers earned Louis L Weisglass, New York City, patent 2,480,101. It has been assigned to Simmon Brothers, Inc., Long Island City. It is claimed to provide almost four times the light of the conventional system using an opalescent light.

It utilizes a diffuse reflector made from white opaque material substantially in the focal point of the condenser. This reflector is, in turn, illuminated by a suitable spotlight, or by several spotlights. The source of light, such as an incandescent lamp, is of the type used in lantern slide or movie projector.

FINGERPRINTING POWDER MAY POISON POLICEMEN

LONDON, Sept. 27, (Science Service). The fingerprint men in police departments are in danger of getting mercury poisoning from the dusting powder they use.

Discovery of this danger, which may be widespread here and in the United States where the same mercury-chalk powder is used, was made when an outbreak of mercury poisoning occurred in the Lancashire Constabulary.

The cases, believed the first of this new occupational poisoning to be recognized, are reported by Dr. John N. Agate and Monamy Buckell of the Medical Research Council, the London Hospital, in the Lancet.

This was actually done in the Lancashire Constabulary by the officer in charge. When the origin of the trouble among his men was found he experimented and discovered a substitute which is credited as being an improvement over mercury powder and forbade the use of the mercury compound.

Policemen who do fingerprinting as a part-time duty are not in much danger of being poisoned, the scientists stated. At the same time they pointed out that certain people may have a special sensitivity to mercury and the hazard for these would be real.

The Lancashire Constabulary consists of a detective chief inspector and some 32 detective sergeants and constables who specialize in taking and developing fingerprints at the scenes of crimes with mercury-with-chalk powder.

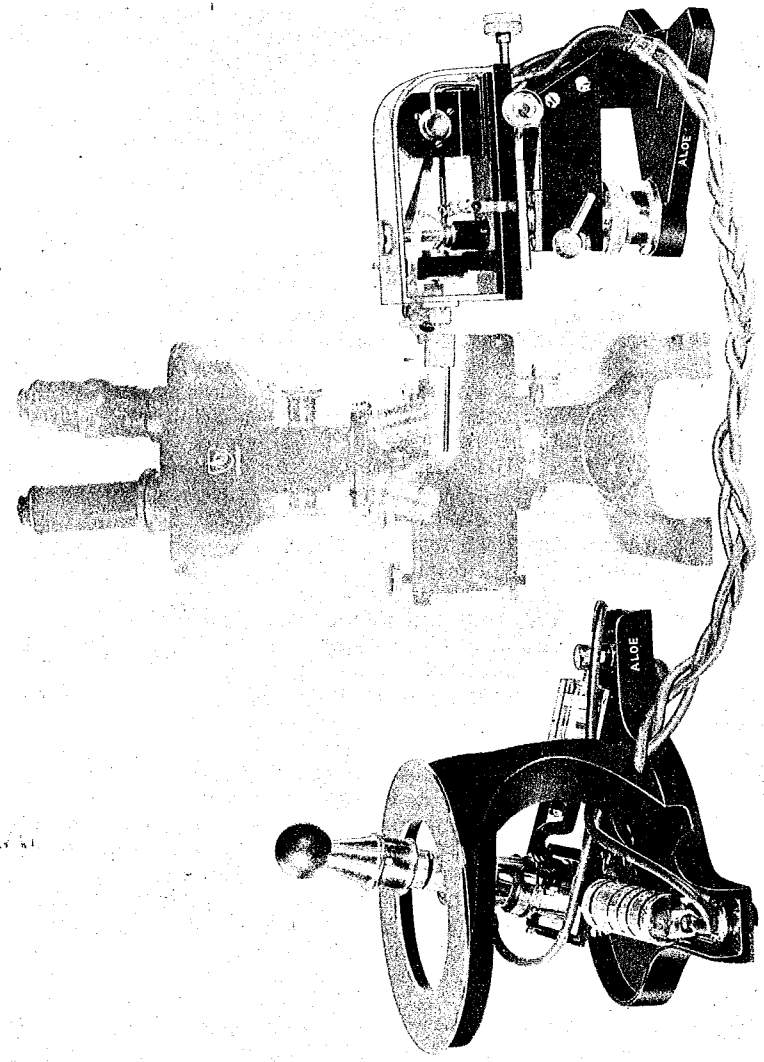
With the exception of one man, all volunteered to be examined. Of the 32, seven had symptoms of tremor which affected the hands in each case. Three of these also had tremors of the lips and tongue and three of the eyelids. Two other symptoms known to be caused by mercury poisoning were also present: loosening of the teeth and irritability and embarrassment which caused the men to blush easily.

Although their urine was examined for traces of mercury, this was not a good test for determining mercury poisoning, the scientists pointed out. However, they said that the amount of mercury excreted by the men was abnormally high.

Estimates were made of how many hours were devoted by the men to developing the latent fingerprints. The technique used is to apply the mercury powder with a soft brush and then to blow off or brush off the excess. One of the affected patients had been exposed for only 160 hours for one year while the others varied between 250 and 460 hours per year. The scientists conclude that 250 hours per year constitute a danger.

The mercury was believed to have been either inhaled by the policemen while they were dusting the finger prints or from the mercury dust lying around the laboratory where they worked or it could have been absorbed through the skin. Some may have acquired the mercury by putting their hands to their mouth with the mercury dust on them.

Measures for protection, such as rubber gloves or masks, do not seem adequate to these scientists. They suggest that a substitute powder be found which will accomplish the same thing.



N E W P R O D U C T S
***** **********

DE FONBRUNE EQUIPMENT FOR PROBING THE UNKNOWN

The de Fonbrune Micro-Manipulator and Micro-Forge, now being manufactured in this country by A. S. Aloe Co., 1831 Olive Street, St. Louis 3, Missouri, and illustrated on the opposite page bring to many research problems tools of inestimable value for micro-investigations. With this easy-to-use equipment, problems in cell research, yeast development, colloidal chemistry, oil analysis, metal deterioration, etc. may be approached in a positive manner.

In ratios up to 1:2,500, the micro-manipulator transmits motion to a tool in the microscopic field. A single control lever provides movement in any plane or at any angle. Acting through a pneumatic system, movement is positive and direct. Lag and drift is eliminated.

The de Fonbrune Micro-manipulator consists of two essential parts -- a manipulator and a receiver.

The manipulator is built with three pneumatic pumps, mounted on a universal joint in an open support. The verticle pump serves as a control lever and is equipped with a sleeve for adjusting the ratio of movement between hand and micro-tool.

The receiver is fitted with three capsules sealed by a sensitive metallic membrane and interconnected by a transmission rod. The tool holder is mounted at the end of this rod. Small increments of motion from the pumps are transmitted through the sensitive membrane to the micro-tool.

To provide the special tools required in micro-studies, the de Fonbrune Micro-Forge offers a useful accessory. Glass, metal, and other fussible materials may be processed to form hooks, needles, probles, etc. The entire operation from initial fussion to the final shaping is carried out in a microscopic field.

OUR FRONT PAGE
****

This is a reproduction of Tafel 81 found in Kunstformen der Natur by Ernest Haeckel (1899-1901).

LABORATORY TECHNIQUE
****

A GOOD ALGAE STAIN

1. Wash the specimen in clean water.
2. Place it in 4% Formalin for one week.
3. Wash it out in distilled water.
4. Place it in 1% Ferric Chloride for one hour. This is the "mordant" which goes into the tissue. It can be used in stronger concentration.
5. Stain with Hematoxylin. A few drops of a saturated solution of Hematoxylen in 100 cc. distilled water will give a cherry-red tint. Place the specimen in this straight from the mordant.
6. When it looks like it is stained sufficiently (the time varies for various algae) take it out and wash for one minute in distilled water.
7. Repeat washing in clear water.
8. If the specimen is not sufficiently stained, transfer back to stain solution. If it is overstained, decolorize with mordant solution.
9. Wash repeatedly with clear water.
10. Dehydrate by placing the specimen in a successive series of alcohol solutions from 30% to absolute, in Dioxan, or in a watery solution of Corn Syrup. If it is left in the watery solution of corn syrup, let the water slowly evaporate; this leaves the specimen preserved in sugar.
11. The specimen may be mounted in Canada Balsam by spreading a little of it on a slide. Place the algae in position and permit the balsam to thicken. If now needed, more balsam can be added, after which cover glass is applied.

If the usual method is used the algae should be cleared in Xylol of Creosote (Beachwood). Creosote is particularly good after Carmine or Hematoxylin stains.

DIATOM SLIDES
****

We are pleased to offer to our many friends the following list of prepared Diatom Slides. All are of exceptional beauty, some of great rarity.

The cleaning, washing, and mounting of the diatomacious material was done with great care. These slides will challenge comparison with any others ever offered for sale at twice our price.

Items listed on this page are regular stock. Any reasonable quantity can be supplied on short notice.

Prices: Single slides @ 25¢' 5 to 24 slides @ 20¢
25 to 49 slides @ 18¢' 50 slides and up @ 15¢

Terms: Prices are net cash. Please include postage. To prevent delay, remit with your order.

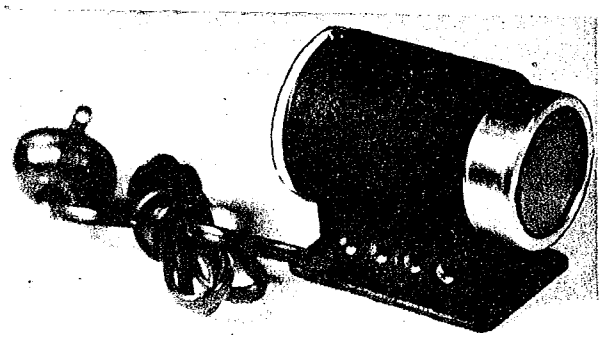
1	PANOCHE HILLS	CAL.	22	SHARKS TOOTH #2	CAL.
2	SHERMAN OAKS	CAL.	23	JEWELL	MD.
3	LOMPOC	CAL.	24	LYONS CREEK	MD.
4	SONOMA	CAL."	25	NOTTINGHAM	MD.
5	INSULATO	CAL.	26	DUNKIRK	MD.
6	BRADLEY	CAL.	27	MARLBORO #1	MD.
7	GRIMES CANYON	CAL.	28	MARLBORO #2	MD.
8	BALCOMBE CANYON	CAL.	29	RICHMOND	VA.
9	SANTA BARBARA	CAL.	30	LEESTOWN	VA.
10	SANTA MONICA	CAL.	31	GRANT	N.Y.
11	MALAGA COVE	CAL.	32	LONG ISLAND SOUND	N.Y.
12	PALOS VERDOS	CAL.	33	BLACKWATER RIVER	FLA.
13	FRESNO COUNTY	CAL.	34	CLERMONT	FLA.
14	POINT DUME	CAL.	35	PRINCE DW.IS.N.B.	CANADA
15	REDONDO BEACH	CAL.	36	SAVONA B.C.	CANADA
16	MOULTON RANCH	CAL.	37	KENT LAKE N.B.	CANADA
17	NEWPORT HIGH BAN	CAL.	38	SILICA LAKE N.B.	CANADA
18	NEWPORT LEFT FLANK	CAL.	39	FITZGERALD N.B.	CANADA
19	NEWPORT TUNNEL	CAL.	40	HARPER	ORE.
20	NEWPORT SLIDE	CAL.	41	KITTIAS	ORE.
21	SHARKS TOOTH #1	CAL.	42	TERRE BONNE #3	ORE.

NOTE: When ordering slides by number please mention this magazine.

HARRY ROSS

MICROSCOPES — TELESCOPES
SCIENTIFIC AND LABORATORY APPARATUS
68-70 WEST BROADWAY
NEW YORK 7, N. Y.

BARCLAY 7-8513

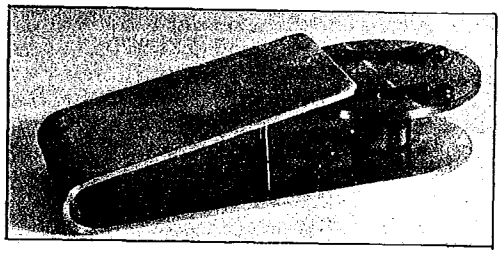


Something New In Microscope Substage Lamps!

Modern design metal body on heat retarding bakelite base. Compact and safe. 15 Watt 120 Volt bulb and special filter give properly diffused"daylight" for blood count,stained material or general microscopical work.

Designed by a Microscopist its construction is simplicity itself--about ½ dozen parts. This economy of components permits us to offer the most reasonably priced sub-stage lamp on the market.

Lamp as described; **$3.00**



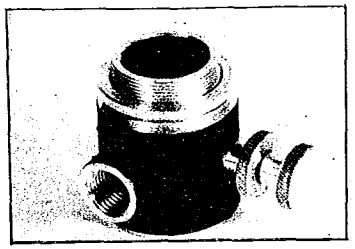
TURNTABLE: 3-1/4" revolving brass table pivoted on a steel shaft; supplied with clips to hold slides. Essential for ringing coverglasses to slide, making deep cells, etc. Arm rest of aluminum. Modern and efficient. Overall length 7".

EACH **$4.50**

HARRY ROSS

MICROSCOPES — TELESCOPES
SCIENTIFIC AND LABORATORY APPARATUS
68-70 WEST BROADWAY
NEW YORK 7, N. Y.

BARCLAY 7-8513

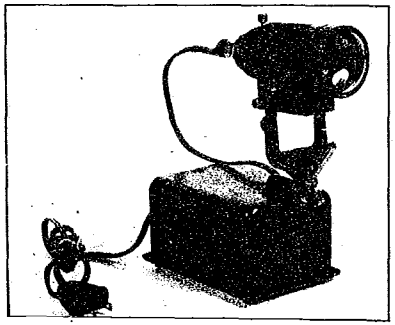


SIMPLIFIED VERTICAL ILLUMINATOR

A simplified vertical illuminator for opaque objects such as metal surfaces. It is screwed into the body tube of the microscope; the society screw thread at the lower end takes the objective. The plain cover glass reflector directs the light from an aperture in the side down through the objective onto the object. With this type of illuminator the full resolving power of the objective is employed as the cone of light from the back lens is not obstructed by mirror or prism. The reflector is mounted so as to be readily adjusted by means of a knob at the side.

Made of Duraluminum, finished in black.

PRICE **$7.50**



MICROSCOPE LAMP

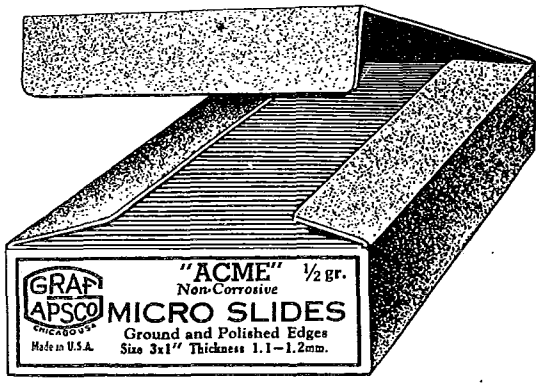
"Universal" brilliant all purpose lamp for projection, dark-field, metallography, photography, etc.-anywhere a finely designed optically correct lamp for precise work is needed. 110 V AC only

Extra bulb, $1.50.

$18.00

BIOLOGY SUPPLIES

MICRO-SLIDES



No. A1450
"ACME" MICRO SLIDES

A high quality slide made of American glass, ground edges, uniform thickness, 1.1-1.2 mm., packed ½ gross to box and cellophane sealed to protect against moisture and corrosion.

No. A1450—Slides gross $1.75 net

CLINICAL GRADE SLIDES

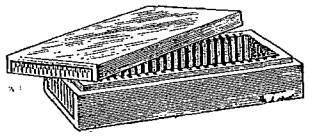
Also available in limited quantities are SECONDS of our No. A1450 slides. These are imperfect but useable and recommended for use on smears, etc.

No. 23—Clinical Slides, gr. $1.10 net

CULTURE SLIDES

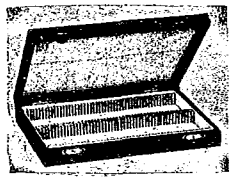
No. A1471 No. A1475 No. A1476

No. A1471—1.5 mm. thick, 1 concavity...doz. $0.90
No. A1472—1.5 mm. thick, 2 concavities..doz. 1.50
No. A1473—3 mm. thick, 1 deep cor cavity . Ea. $0.20
No. A1475—3 mm. thick, 2 deep concavities..Ea. 0.45
No. A1476—DEEP WELL SLIDE, 1 straight wall concavity..... .....Ea. $0.60



No. 43—SLIDE BOX, all wood with overlapping cover. Capacity, 25, 3"x1" slides.
Each $0.25

COVER GLASSES



No. 45—SLIDE BOX, capacity 100, 3"x1" slides. Wood frame and cardboard backing. Overall size 11¼"x7½".
Each .....$ 1.25

No. 1 Thickness

SQUARES		CIRCLES
$2.25 oz.	18 mm	$2.90 oz.
	22 mm	
	25 mm	

22 mm x 30, 35, 40, 45, 50 mm rectangular.$2.25 per oz.
24 mm x 30, 35, 50 mm rectangular..... $2.25 per oz.

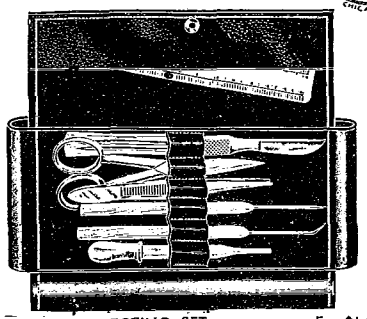
No. 2 Thickness

SQUARES		CIRCLES
$1.60 oz.	18 mm	$2.00 oz.
	22 mm	
	25 mm	

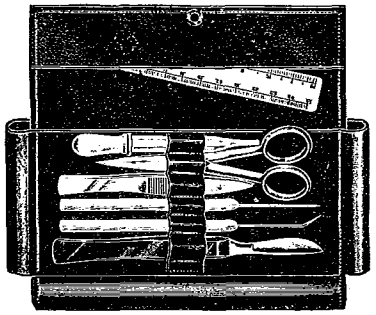
22 mm x 30, 35, 40, 45 or 50 mm rectangular$1.60 per oz.
24 mm x 30, 35, 40, 45 or 50 mm rectangular$1.60 per oz.
10% discount on 50 or more oz.

DISSECTING SETS and MAGNIFIERS

LOWEST PRICES GRAF APSCO PROMPT DELIVERIES

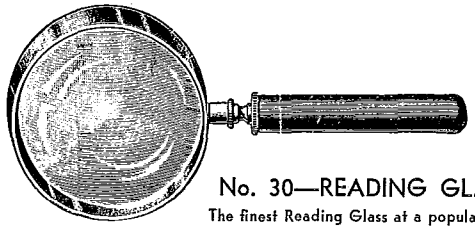


No. 2A—DISSECTING SET .....Ea. $1.90



No. 3B—DISSECTING SET .....Ea. $1.40

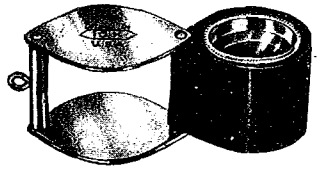
No. 21A—DOUBLET MAGNIFIER, all metal mount, 10X, lenses optically centered. .....Each $2.75



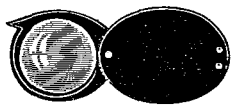
No. 30—READING GLASS

The finest Reading Glass at a popular price.

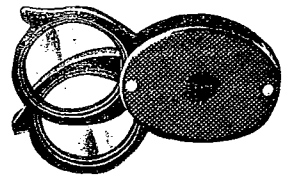
No. 30—2" diameter Reader.....Ea. $1.00
No. 30—2½" " " .....Ea. 1.15
No. 30—3" " " .....Ea. 1.30
No. 30—3½" " " .....Ea. 1.75
No. 30—4" " " .....Ea. 2.75
No. 30—4½" " " .....Ea. 4.00



No. 19F—DOUBLET MAGNIFIER, 10X, folding in metal mount. Very popular in botany, geology, engineering, etc.
Each $3.25



No. 19A MAGNIFIER
Folding 5X magnifier, 25 mm. diameter lens in black vulcanite mounting.
Each. $0.50



No. 19B FOLDING MAGNIFIER. Like No. 19A but two 25 mm. lenses, 5X and 10X magnifications .....Ea. $0.75

No. 1920—COMBINATION MAGNIFIER, RULER, LETTER OPENER
Good quality lens, 1¼" diameter mounted in attractive plastic handle, magnification 4X, individually boxed. .....Ea. $0.55