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PHOTOMICROGRAPHIC
INSPIRATIONS
FOR
GRAPHIC
DESIGN

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FOR THE
MASTER OF FINE ARTS

COLLEGE OF
FINE AND APPLIED
ARTS

ROCHESTER INSTITUTE
OF TECHNOLOGY

SUBMITTED
9 AUGUST
1963

ADVISOR: MR. HANS J. BARSCHHEL

ACKNOWLEDGEMENT

I am especially indebted to my advisor, Mr. Hans J. Barschel, for his personal interest and helpful suggestions. Through unselfish guidance, through encouragement and confidence when it was needed most, he has inspired me to work hard and receive much in return.

FOREWORD

This report makes no pretense at the scholarly depth of a treatise, but rather it seeks to recount and illumine, in a graphic manner, the investigation of a creative source.

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*Through the courtesy of Professor Barschel

PURPOSE OF THE THESIS:

The purpose of this thesis is to investigate and report on the field of photomicrography as a design source which normally escapes human vision, to execute a graphic presentation which effectively demonstrates the applications of this research in the field of visual communication, and to comment analytically and critically on the qualities of order and coherence observed in the field of photomicrography.

SCOPE OF THE THESIS:

The reading pertinent to research in photomicrography will be largely from books and periodicals in the fields of photography, art, science, and medicine. Examples of photomicrography will be solicited through correspondence with sources such as Bausch and Lomb, Eastman Kodak, Graphlex, various educational institutions, photography magazines, pharmaceutical houses, and government agencies. Additional prints and transparencies will be gathered through personal use of the camera and from individuals active in photomicrography. Sketches, the thesis report, and at least six visual presentations rendered in a variety of media appropriate to the field of graphic design will be developed from this research.

PROCEDURES:

Research will involve extensive reading and the interviewing of authorities in photography to discover technical data and background information, as well as existing relationships between photomicrography and art. A variety of photomicrographs will be gathered through correspondence, direct contact with photographers, and personal use of the camera and microscope. Photographed material will be studied for design quality and for applications of the photomicrograph in the field of graphic design. Typical avenues of investigation would be, (1) the use of the photomicrograph as an adjunct to other visual material, (2) its use as a point of departure toward a purely personal expression, (3) its value in communicating a concept, and (4) its aesthetic value and decorative application.

The thesis report will contain examples of correspondence, a variety of photomicrographs, preliminary art work significant to the development of a concept, and a critical commentary on the order and coherence (design) observed. In addition, there will be a statement of conclusions, a list of sources, and suggested applications for further research.

ALTERNATIVE PROPOSALS:

American Indian Inspirations for Contemporary Graphic Design
Graphic Design Creates a More Effective Image of the Public School

INTRODUCTION

"The world of Nature is the visible extremity of the human mind and the human mind is the invisible extremity of Nature. The human mind may be brought to register with any point in Nature when attention moves towards a freedom beyond fixed habits: much like a camera bellows allows the lens to extend from infinity out to a focal length of identical transmission. In this great compass of vision the mind tends to retreat from intuition into the obvious, limiting cognition to a fractional portion of the whole intelligence. Such an undeveloped receptivity leaves the mind closed to a fundamental function of art: a creative agent in Nature acting on the human mind through sense-perception, developing and deepening its sensitivity to finer impressions, localized in an image, in this way enlarging the capacities of absorption..."¹

Writers exhort us to open ourselves to a larger cosmos in order that we might gain a larger and cleaner vision. Scientists equip us with ".....visual tools that assist us in perceiving those phases of the visible world which were previously too small, too fast, too large, too distant, or too slow for us to comprehend."² Photographic media permit us, symbolically at least, to juxtapose the most diverse orders of the cosmos, to look from above and below, to be outside and inside simultaneously. A search for some part of this larger vision with its greater receptivity and extended visual frontiers is represented in this thesis report.

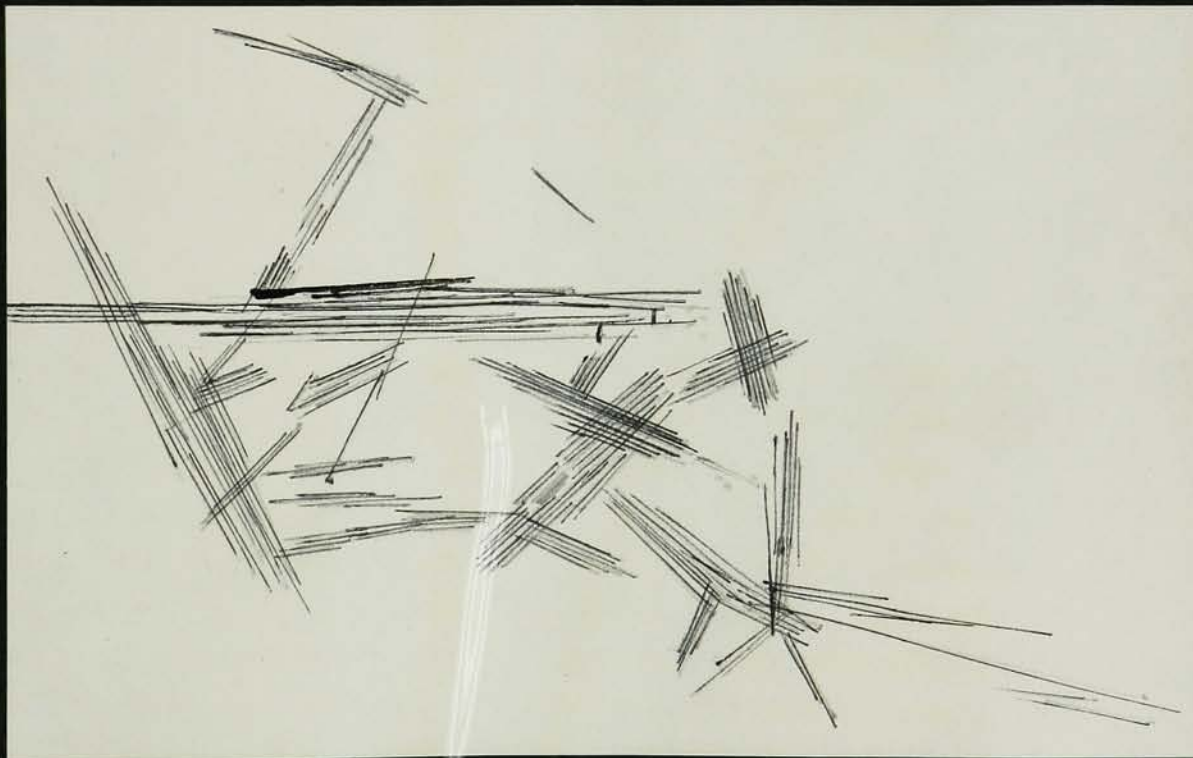
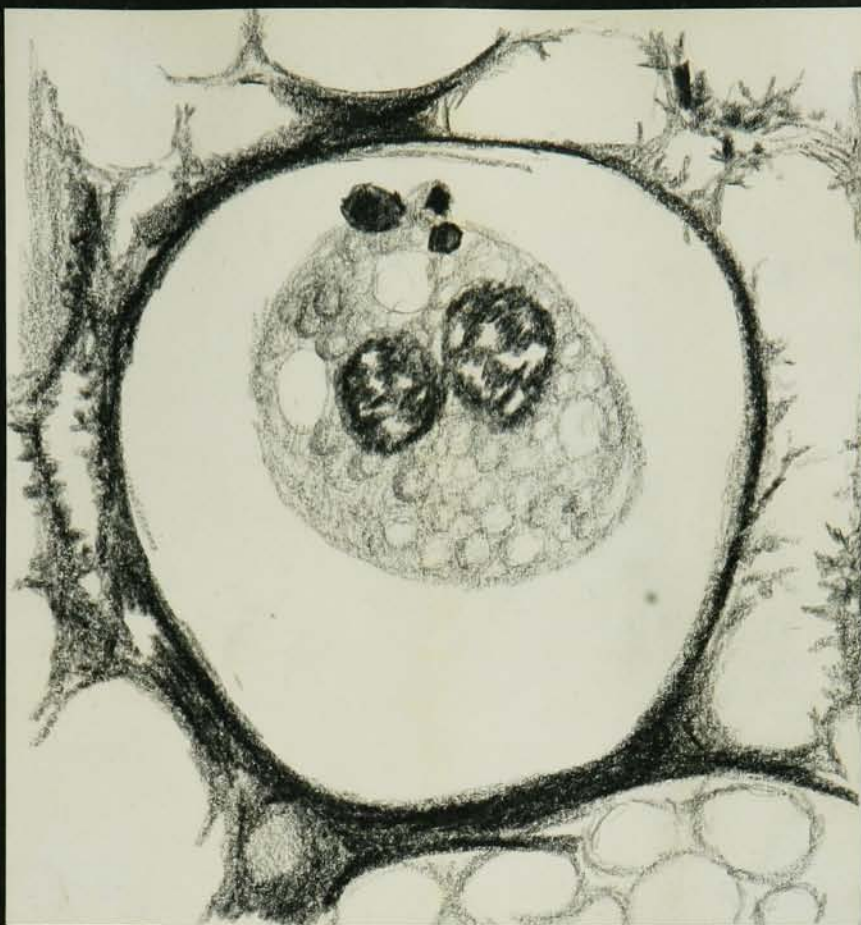
Photographic media have long been the source of a particular fascination for me, but my interest has been confined to an area of the visible world recorded by the normal lens. This has required no greater extension of vision than to perceive the abstractions of nature which are visible to any naked eye of sensitivity.

MY INTRODUCTION TO PHOTOMICROGRAPHY

My acquaintance with the photomicrograph had been no more than a superficial awareness until a few months ago. A greater familiarity with it evolved from working in an entirely different medium.....etching. The plate and acid seemed to draw less feeling from me than any medium experienced before. Admittedly, there was an excitement in its interplays of darks and lights, and the rich variety of textures possible. And, technical mastery of various procedures in this medium posed no real problem. My work, however, was still no source of real satisfaction. It seemed that 'technical mastery' and intellect were negating all feeling. My concepts were oriented toward forms from the everyday world of vision. It soon became apparent that a richer experience with the materials before me would be possible if my "object-mindedness"³ were played down. There was a need to extend my vision, to find a better balance between intellect and emotion. A search for this new vision began with extensive sketching and a closer look at the work of contemporary painters as well as printmakers. It was during this period of searching that the photomicrograph, with its possibilities as a creative source, appeared.

Sketching from this microcosmic material and the subsequent applications of these sketches in printmaking was a source of satisfaction. It was found, however, that my concepts, although starting on the somewhat abstract plane of the photomicrograph, still seemed to gravitate toward forms from the everyday world of vision. Because of my 'object-mindedness', recognizable forms were still being unconsciously sought. Illustrative material contained in this report typifies this early association

Sketches included both
organic and anorganic
materials





.....Sketch with litho
crayon was based
upon photomicro-
graph study.

Etching evolved
from sketch.....



with the photomicrograph.

After this early exposure to the microcosm, the problem of choosing a thesis topic arose. My desire was to work in an area containing an element of uniqueness, something which would lead to personal growth, a subject which would extend my visual frontier. This thinking did not represent an "everyday something new"⁴ attitude. My intent was to discover a medium of expression which would add depth to, and build upon, prior abilities. True, it would be safer to investigate an area more fully rooted in my previous experience. But, this Master's project was viewed as something more than a polished exhibition of one's skills. If it carries an attendant value of growth through experiencing, then the choice of the photomicrograph and the experiences developing from this choice have been rewarding.

PHOTOMICROGRAPHY

To gaze through the lens of a microscope is to witness the existence of a "...world that seems stranger than the remotest corners of the earth."⁵ It is an exciting world of seemingly endless variety, ranging from the fugitive structures of organic forms to the crystalline geometry of anorganic materials. It is a world vital to the pursuits of the scientist and technician and all who ponder the nature of forms and laws which govern them. It is similarly important to those who seek to understand relationships between the structure of materials and their functions. It is an intriguing and stimulating source for the contemporary artist and all whose imagination is fired by unusual configurations. There is an excitement attached to the microcosm which is as vital today as it was at the time of the first microscope; each new discovery is unique and rewarding.⁶

The unaided eye has a resolving power of one tenth of a millimeter at a distance of half a meter, or stated another way, at half a meter the eye has the ability to distinguish two points one tenth of a millimeter apart as separate points. The microscope on the other hand, can distinguish separate points which are only one thousandth of a millimeter apart. This distance corresponds closely with the wavelength of visible light. Light rays are too coarse to resolve objects smaller than a thousandth of a millimeter. For the study of more minute objects the scientist has turned to a medium of finer transmission, the electron waves.⁷ Recent literature indicates the ability of the electron microscope to produce magnifications of 750,000:1.⁸

Such magnifications represent a staggering advance from fleaglasses of the early fifteenth century, or Galileo's inverted telescope of 1609, or even Antonie van Leeuwenhoek's concept of 1673, which was to multiply the magnification of one lens with that of another.⁹ What seems an elementary concept today was at that time a revolutionary extension of man's perceptual world. Minute animal and plant forms, common to presentday science students, were striking phenomena to the first microscopists. It was the early studies in organic form by these men which revealed some of the basic knowledge of modern medicine.¹⁰

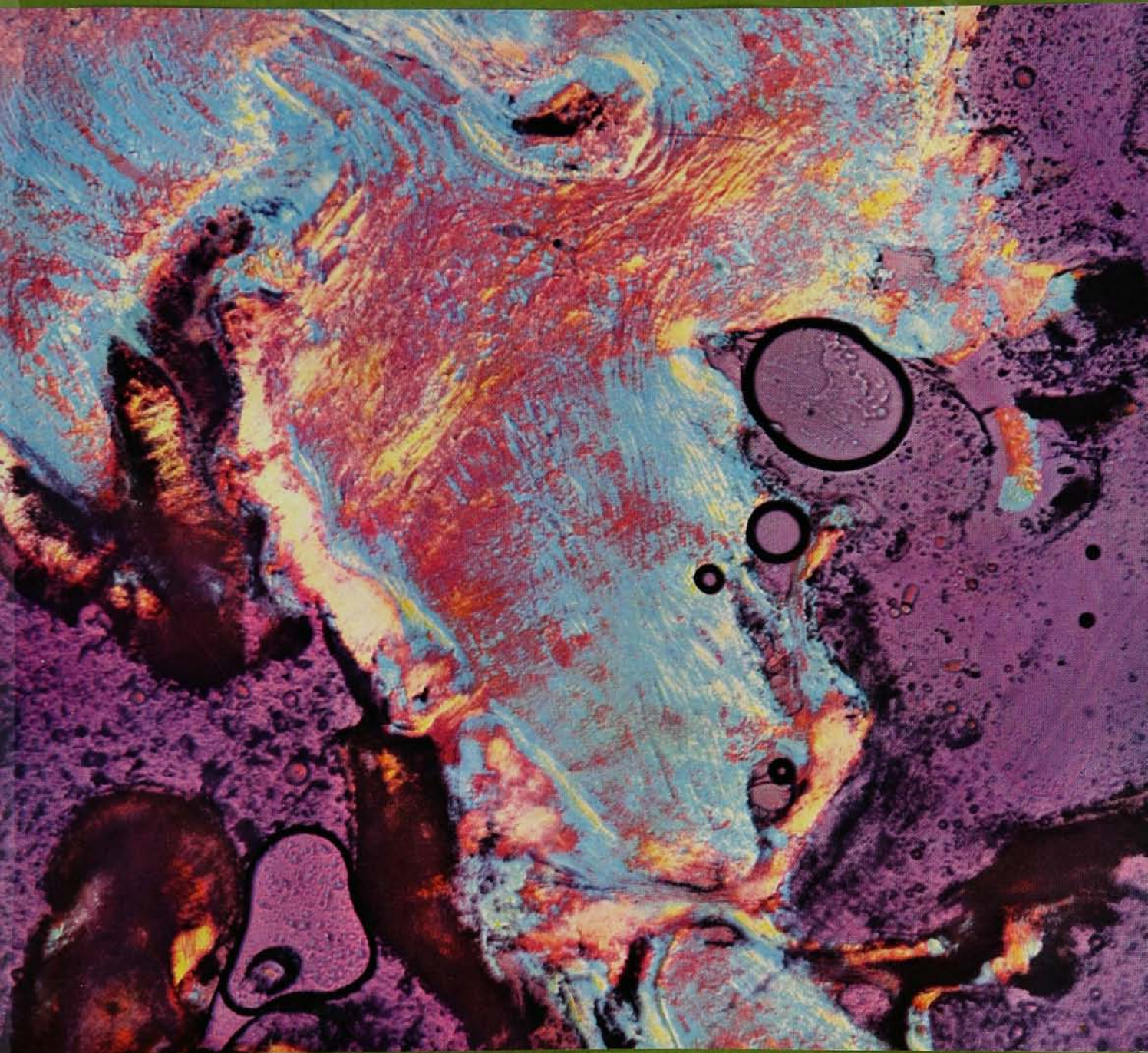
Equally valuable to man's knowledge has been the microstructure study of chemical substances, such as metals, salts, and manmade compounds. These studies have disclosed the important significance of the crystal, ninety percent of all material being composed of very small crystals. Structural properties, and their relationships to size and arrangement of crystal components are vital subjects for scientific scrutiny.

Whether investigating the microcosm of organic structure or that of the anorganic world, the photomicrograph provides a long-life record which can be studied with more precision than a cursory visual examination of the specimen in the microscope. Inherent in photographing through the microscope are a variety of technical barriers. Noteable among these are color and lighting. A detailed explanation of these is neither within the objective of this paper nor within the present comprehension of its author. For the person of a scientific inclination, excellent volumes are available which describe such specialized topics as infra-red, ultra-violet, X-ray, fluorescence, interference, and phase microscopy.¹¹ It is comforting

for the inexperienced to note that the current trend is toward automatic operation. Much of the new apparatus has been so designed that the microscopist no longer need be trained in optical theory. Such difficult factors as critical illumination are handled automatically.¹²

There does not appear to be any marked progress, however, in color photomicrography.¹³ A problem still demanding concern of the photomicrographer is that of organic subjects losing the ability to transmit color rays when divided into very thin layers. In order to distinguish various parts the microscopist must employ artificial staining or pigmenting. These stains are quickly absorbed by some tissues and rejected by others. Anorganic or crystalline structures which in normal viewing are colorless and without differentiation may appear in the brightest hues under the microscope, without having been stained. This is made possible through polarization, the manipulating of light rays so that they are ordered in one direction. In polarization a mutual cancellation of certain wavelengths takes place and colors are perceived. If man were equipped with differently constructed image perceptors, he would see a larger portion of his world and in a different array of color.¹⁴

Color photomicrograph
of chemical reaction
study supplied by the
Allied Chemical Corp.....

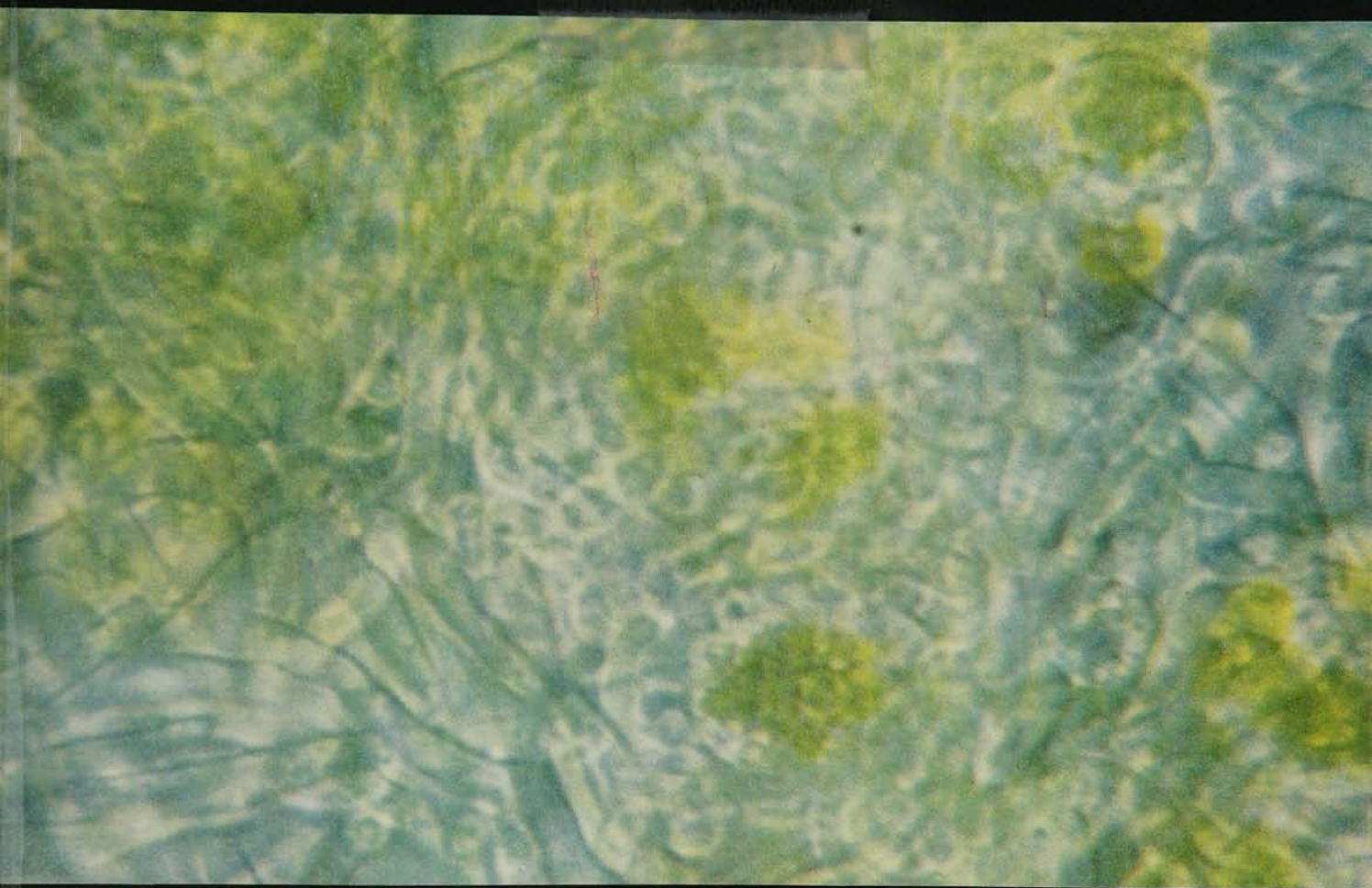




.....Metal Surface

.....Fibre Optics

.....Crystalline Formation





EARLY PREPARATION FOR PROJECT

In view of such problems as critical illumination and color factors mentioned above, it became evident in the early stages of this project that the filming of high-quality photomicrographs in a wide variety of subject-matter would be a time consuming task. It would require a considerable knowledge of optics and photography plus a great deal of expensive equipment.

In preparation for this project a microscope adapter for my 35mm reflex camera had been acquired. My plan was to use this apparatus with a microscope borrowed from the science laboratory. Excellent volumes giving detailed coverage of photomicrography were also acquired. Through the kindness of Mr. Donald C. Ryon of Eastman Kodak Company's Publications Department a generous number of booklets on photomicrography were added to my library. After reading voraciously, but with much faltering, it became apparent that this material was directed to the comprehension of the scientist rather than the artist. The encountering of such terms as substage condenser, chromatic aberration, and interference microscopy presented difficulty. Even with an offer of assistance from Mr. Fred German and Mr. Lynn Wahl, two of Kodak's experts in these matters, it was evident that an inordinate amount of time would be consumed in developing proficiency with even the modest equipment at my disposal. The experts suggested that my cause could best be served by the photomicrographs gathered through correspondence. They agreed that pursuing my interest in photomicrography at a more leisurely pace, after completing my thesis, would be wise.

July 2, 1963

Agfa Incorporated
Rockleigh, N.J.

Gentlemen:

As a candidate for an M.F.A. at the Rochester Institute of Technology, I am engaged in a thesis project entitled, "Photomicrographic Inspirations for Graphic Design." The purpose of this thesis is to investigate the field of photomicrography and show it to be a rich source of design, a source which extends the vision of the artist.

To develop this idea effectively it is necessary for me to compile a great variety of photomicrographs, in black and white, or in color, large or small, of any subject, and at any magnification. I have made some attempts with camera and microscope, but my major advance thus far is the respect I have gained for experts in the field. I must solicit help. Do you have examples of photomicrography, in any form, which you could make available to me?

Your consideration will be greatly appreciated.

Sincerely,

David B. Smith

**UNITRON**INSTRUMENT COMPANY
66 NEEDHAM STREET • NEWTON HIGHLANDS 61, MASS.

July 12, 1963

Mr. David B. Smith
BRIGHTON SCHOOLS DISTRICT NUMBER ONE
Monroe and Elmwood Avenues
Rochester 10, New York

Dear Mr. Smith:

Thank you for telling us about your project "Photomicrographic Inspirations for Graphic Design". Although we have searched our files in an attempt to provide you with some sample photos, I am afraid that our efforts have been unsuccessful. The few photos that we do have, used in conjunction with some of our literature, has been retouched, or masked, so that it becomes in the nature of original artwork, which must remain in our files, or with our printers.

Have you tried contacting the Eastman Kodak Company, Medical Sales Department? If not, you might try contacting Mr. Lynn Wall who may be able to be of some assistance to you. I know that he has helped us several times in technical problems involving the use of certain types of film, to show best contrast and detail. The other possibility is Mr. John Butterfield of Bausch & Lomb, Inc. Both of these gentlemen are members of the Biological Photographers Association, and may be able to give you further local contacts that would assist you in your project.

Cordially yours,

H. KeysUNITRON INSTRUMENT COMPANY
H. Keys/ddm

NIKON



July 26, 1963

INCORPORATED

Brighton Schools
District Number One
Monroe and Elmwood Avenues
Rochester 10, New York

ATT: Mr. David B. Smith

Dear Mr. Smith:

First let me apologize for the delay in answering your letter of July 1st in reference to photomicrographic applications.

I have been away at conventions and I am just catching up with my correspondence.

In spite of the excellence of your letter, I do not, unfortunately, have spare photomicrographs to aid you in your project. However, I am referring your letter to both my agent in Rochester, Mr. David Graham, Box 252, University of Rochester Medical Center, Rochester and to an outstanding Photomicrographer in New York City who may be able to be of assistance to you, Mr. Phillip Harrington.

I am sorry that I can not help you any further in this matter.

Sincerely yours,

NIKON, INC.

Saul Bernstein

Saul Bernstein
Sales Manager
Scientific Instrument
Division

SB:agl

cc: David R. Graham
Phillip A. Harrington



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15 July 1963

Mr. David B. Smith
Brighton Schools District No. One
Monroe and Elmwood Avenues
Rochester 10, New York

Dear Mr. Smith:

Thank you for your letter of July 2. Enclosed you will find microphotographic pictures which were taken with the Electron Microscope. Light microscopic pictures are not available at the moment, but I will ask some of our clients if they could supply us with some. You will hear from us as soon as possible. I hope that, in the meantime, the enclosed pictures will serve your purpose.

Very truly yours,

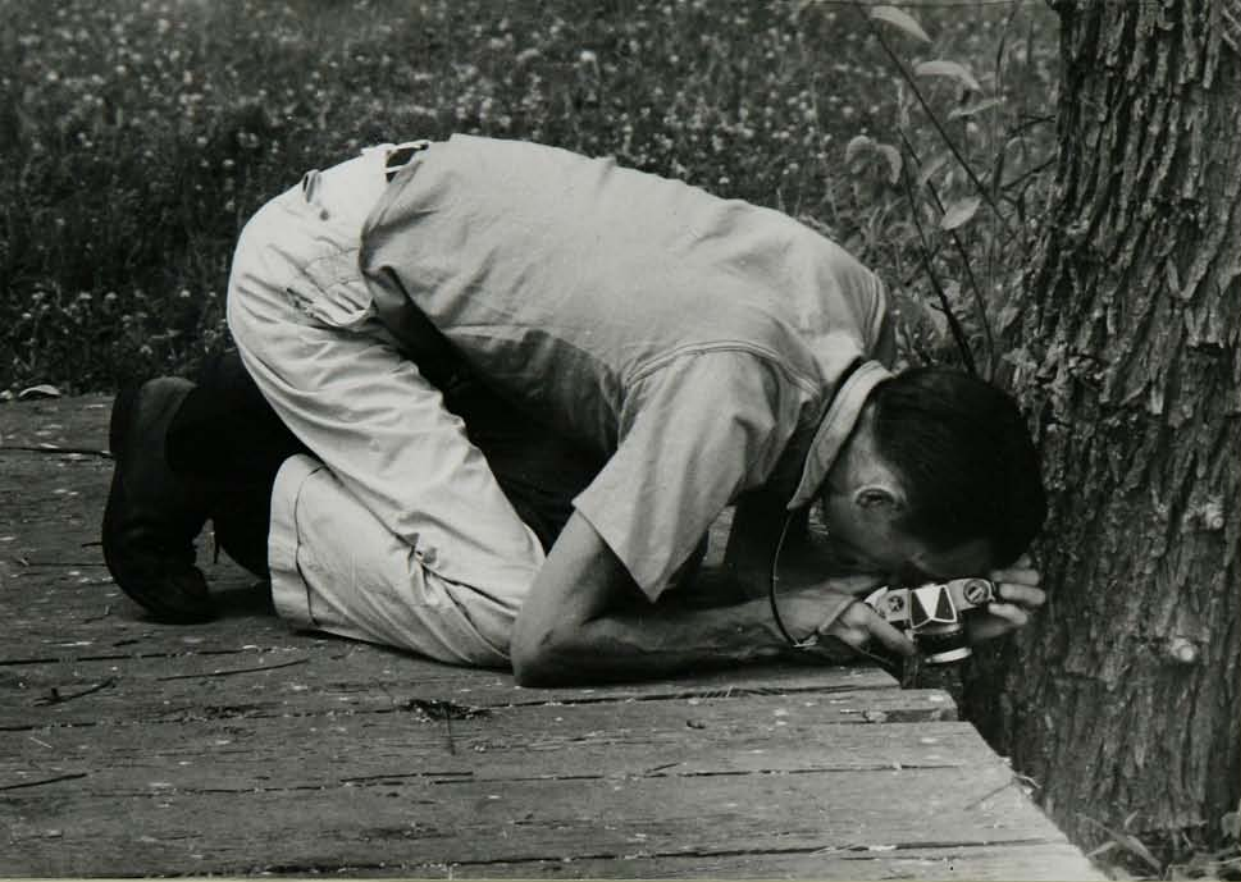
Degenhard

Dr. W. E. Degenhard,
Scientific Director

Dg/mx
Enc.

To accumulate a file of photomicrographs adequate for the purposes of this project, numerous sources were tapped. Friends in the science field contributed catalogs and other printed material from biological supply houses. These yielded a variety of organic photomicrographs in a relatively low magnification. A wider range of subject-matter at higher magnification was found in Scientific American, which proved to be a consistently good source. This magazine also served as a guide in drawing up a list of firms with which to correspond. Many manufacturers of optical equipment are regular advertisers in the Scientific American. Examples of the correspondence with these firms are contained in this report and serve to demonstrate the helpful and interested attitude encountered. The larger firms, of course, were better equipped to offer assistance; some sent material by return mail. Others voluntarily contacted additional sources. These very positive results of correspondence, despite the fact that many companies operate with a reduced compliment during the vacation month of July, were heartening indeed.

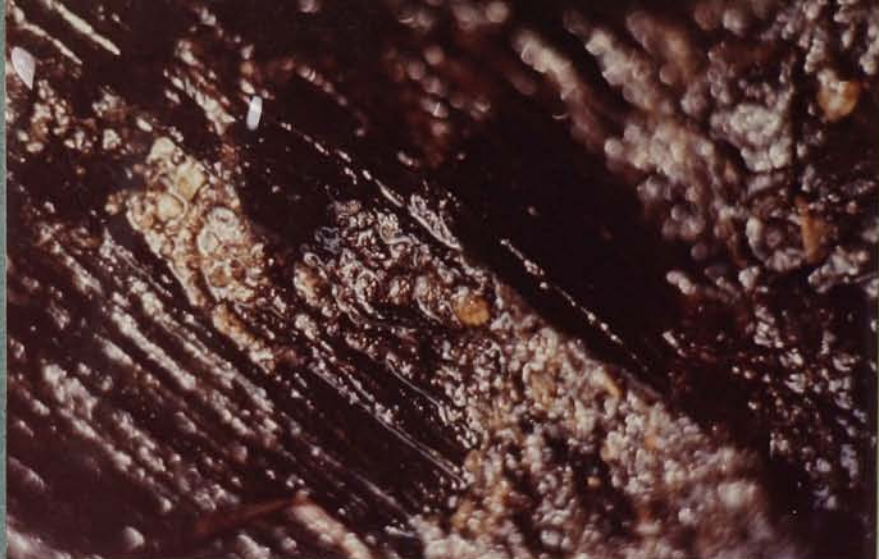
Determined to become steeped in this medium, all other resources which time would permit were investigated. Slides from the science department were viewed and sketches made from some of the material observed. Resources of Eastman House and the Rochester Museum of Arts and Sciences were looked into. Professional photographers, such as Mr. Carl Tandoi of Varden's Studio, were interviewed. There were conversations with dealers in photographic supplies, photofinishers, doctors and science teachers. People seemed genuinely interested in my topic and helpful whenever possible.



Man has always lived
in a natural environ-
ment, and has been
stimulated by nature.
It is logical that
he would use this
stimulus in his art.

Some of the extreme
close-up shots are
from my garden. Others
are from Mendon Ponds.....

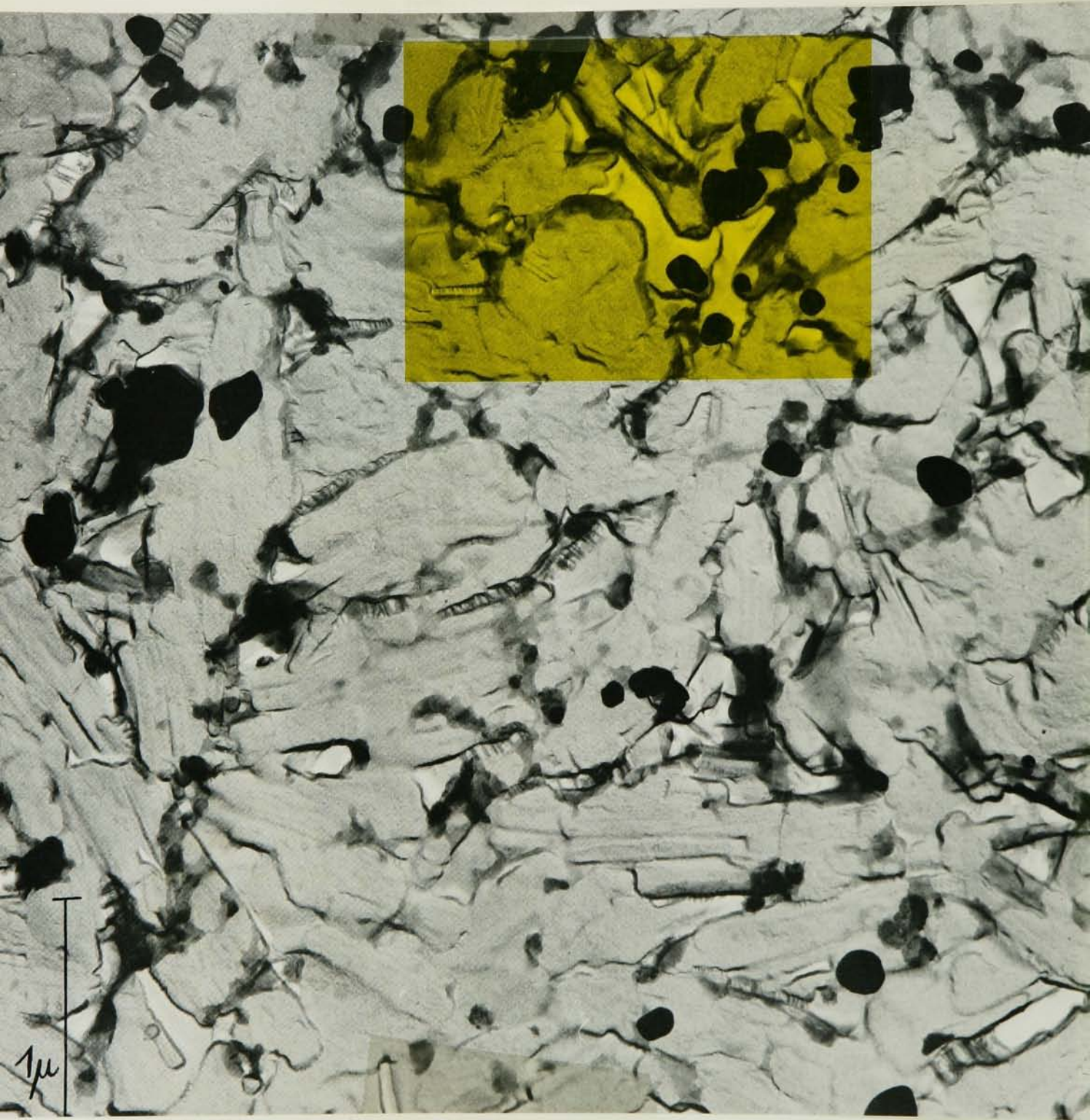




RESPONSES TO AN INSPIRATION

Each new acquisition of resource material became uniquely rewarding, stimulating a variety of creative experimentation. The problem posed by this abundance of material was one of finding media best suited for personal responses to its stimulus. For the artist "...distorts our usual world in an attempt to express poignantly his feelings toward it. He perceives, recoils within, and improvises in expressing his response to it..."¹⁷ These words glorifying intuition do not deny the fact that in visual communication the artist must pursue a rational intent, guaging what he does by what it does to the observer. His audience is the direct object of his work and must be considered in the development of his concept. It is also true that the visual communicator's aesthetic intention is of primary significance. It was on the basis of this rationale that much of the experimenting was carried out. Represented herein is a search for aesthetic growth, an effort to extend perceptual frontiers, with the thought that these logically lead to greater capabilities in total concept development. Maturation in the graphic designer's aesthetic processes augment maturation of his rational processes.

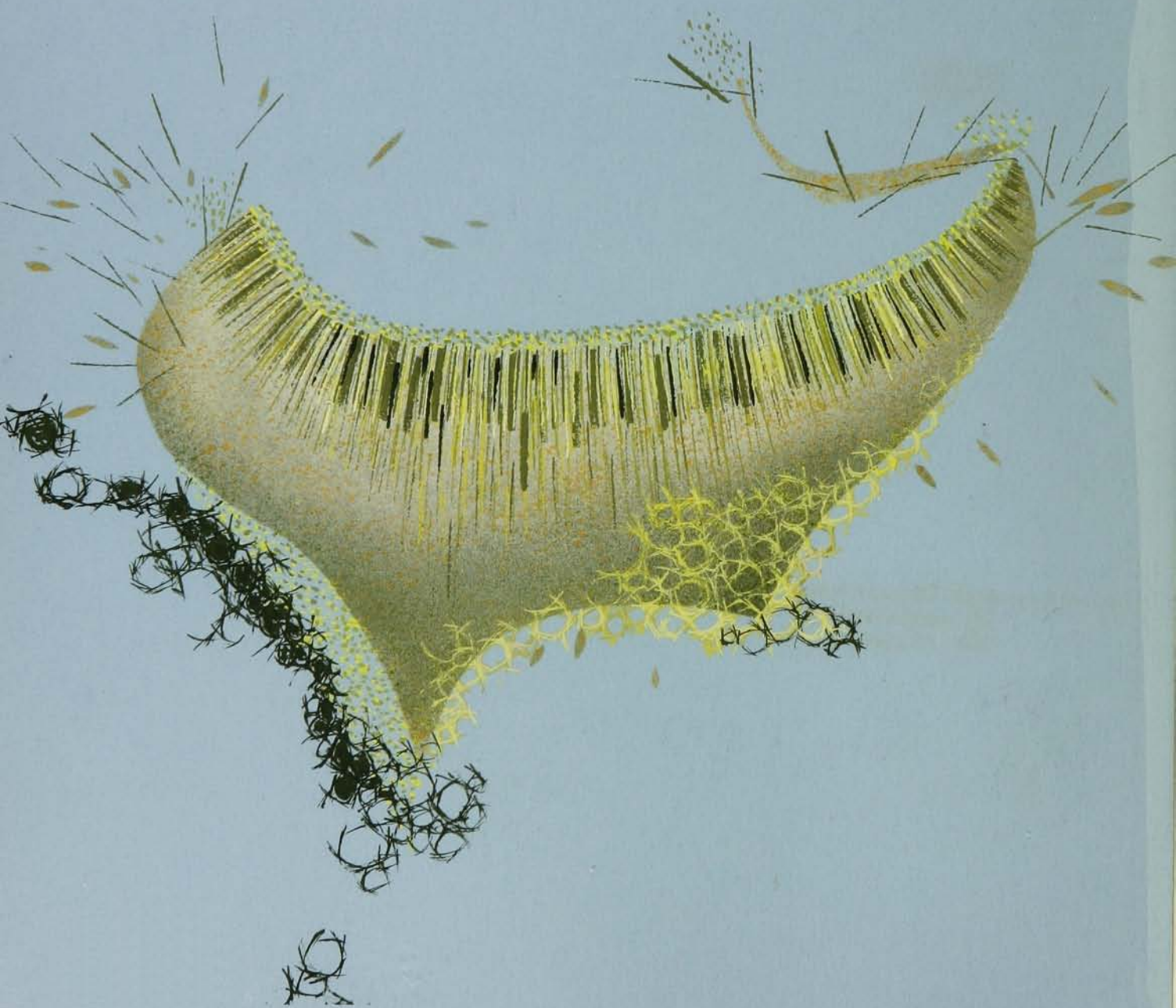
Even in the minutiae of
of the photomicrograph
we practice selective
perception...searching
for areas which satisfy
our feeling for order
and coherence.....





Etched Steel Surface

27,000:1



The artist perceives....

recoils
within

.....and improvises
in expressing
his response.





Colors were screened over chips of paper in a response to a photomicrograph of crystalline forms. Intention: a background for typography in creating a cover design for The Lamp, a publication of Standard Oil. The crystalline forms relate to geological studies made in the search for oil.

An attempt has been made to integrate diverse elements which relate to the steel industry. The unusual configurations are graphite traces from a photomicrograph of a steel surface. The blue zip-a-tone relates to the structural qualities of finished steel. Intention: to combine with typography in creating a cover design for U.S. Steel house organ.





These unusual configurations
were inspired by graphite
traces in a photomicrograph
of steel.



RALPH WALDO EMERSON on nature

Every rational creature has all nature for his dowry and estate. It is his, if he will. In proportion to the energy of his thought and will, he takes up the world into himself That which was unconscious truth, becomes when interpreted and defined in an object, a part of the domain of knowledge,—a new weapon in the magazine of power.

(American Issues, 1941)



Sketch of Chick Heart
Fibroblast and painting
which evolved





Please refer to
Book II for ad-
ditional material.....