Instruction at the Hopkins Marine Station

Epel, David and Mazia, Daniel

This program provides an intense training environment with hands-on experience in molecular approaches to marine biology. Twenty-one students were enrolled in the program in 1988 and sixteen students received ONR support. Areas covered in 1988 included (1) physiology/molecular biology of algae and (2) cell biology of early embryonic development. These two courses will also be offered in 1989 and in addition there will be a course in Video Microscopy and Image Processing. The exposure of students in this intense environment will result in the participants developing new approaches to answer classic problems of marine biology.
Progress Report on Contract N00014-88-K-0325

Principal Investigators: Daniel Mazia
                               David Epel

Contractor: Stanford University

Contract Title: Instruction at the Hopkins Marine Station

Start Date: April 1, 1988 (Year 1)
                          April 1, 1989 (Year 2)

PROGRAM OBJECTIVES:

Exposure of students/young investigators to problems/opportunities in
marine biology, emphasizing new cellular and molecular approaches to
classical marine biological questions.

PROGRESS (YEAR 1)

Two courses were offered in the summer of 1988, "The Ecophysiology and
Molecular Biology of Macrophytes" and "The Cell Biology of Early
Development." We were not able to offer the course in "Video Microscopy
and Image Processing" because of problems in assembling a knowledgeable
staff for this relatively new field.

The students enrolled in these courses come from highly diverse
backgrounds. All classes had students at the graduate, post-doctoral and
faculty level as well as a small number of undergraduates. The students
come from universities throughout the US, and also from abroad (e.g.,
United Kingdom, Japan, Portugal).

Training in the courses is intense and this total immersion in subject
matter is an important part of the program's success. Classes involve in-
depth lectures, often by visiting specialists, with ample time (and
encouragement) for questions and discussion. The lectures complement an
active laboratory experience which exposes students to the current body of knowledge in each field and perhaps more importantly the outstanding problems in each discipline. At the end of three or four weeks of lecture/lab experience, the students design a research project which they then complete over the next one-two weeks; they then report on these projects in a day-long symposium. The course schedules for 1988 are attached as well as a listing of papers presented at the symposia (note that some of the papers presented in this symposia are from an ecology course not sponsored by the ONR).

The individual research projects culminate this intense summer experience. As examples of the scope of the projects, the Cell Biology of Early Development class included studies on (1) electropermeabilization, a new tool for introducing impermeant molecules into cells, along with other studies on micro-injection, (2) effects of high hydrostatic pressure on embryos, (3) scanning electron micrograph studies and (4) effects on ultraviolet radiation. The Ecophysiology and Molecular Biology of Macrophytes course examined areas ranging from the ecological-physiological interface - such as the effects of osmotic stress and flow rates on photosynthesis - to physiological studies on nitrogen assimilation and photo-inhibition of this important process.

WORK PLAN (YEAR 2)

We have modified the approach and content of last years' courses and added a course in "Video Microscopy and Image Processing". The "Cell Biology of Early Development" course will bring three guest instructors for one-week periods, beginning with a one-week intensive introduction to patterns of development and larval metamorphosis. This will be followed by a week on fertilization/chemotaxis and one week on mitosis and cytokinesis,
emphasizing immunochemistry. The Image Processing course will introduce students to the technologies and instrumentation of this rapidly developing fields. The algal course will be upgrading its emphasis on molecular techniques as applied to marine algae.

As in the previous year, all courses will utilize numerous guest lecturers who are all leaders in their fields. Also as in past years, the courses will benefit from the loan of state-of-the-art equipment from various vendors (such as microscopes, confocal microscopes, micro-injectors, image processing equipment etc. etc.).

**Training Activities:** A list of students supported by the ONR grant for 1988 is appended. Also attached are a listing of lecture and research projects.

**Research Activities:** At least one of the class projects has been continued as an ongoing research program. Robert Lauzon, a post-doctoral fellow in Dr. Irving Weissman’s lab and a student in the 1988 Cell Biology of Early Development course, has now shifted his work as a result of the course experience. His research has been selected for presentation at a symposium of the International Conference on Invertebrate Reproduction, to be held in Japan. A publication will be forthcoming.
The following students were awarded ONR-Advanced Training in Molecular Marine Biology Tuition Fellowships for the 1988 Summer Quarter:

<table>
<thead>
<tr>
<th>Name</th>
<th>Amount</th>
<th>Course</th>
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<tr>
<td>Josef D. Ackerman</td>
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<td>(California State University Fullerton)</td>
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<td>Marie A. Vodicka</td>
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<td>(Amherst College)</td>
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Harry Witchel
(University of California
Berkeley)

970.00
Cell Biology
# CELL BIOLOGY OF EARLY DEVELOPMENT: THE CELL CYCLE

**June 13-July 15, 1988**  
Hopkins Marine Station  
David Epel, Daniel Mazia and Dominic Poccia, Instructors

Lectures will be in Agassiz 11, typically from 9:00 am to noon. Labs will begin -1:00--1:30 pm (depending on when lecture is over). On days of field trips, the lecture will be later (time to be announced).

### Week 1  
June 13  
Cell activation  
D. Epel  
FIELD TRIP  
14  
Cell activation  
D. Epel  
15  
Cell activation  
D. Epel  
Cell permeabilization  
Robert Scewey (HMS)  
FIELD TRIP  
16  
Cell cycle  
D. Mazia  
17  
Cell cycle  
D. Mazia

### Week 2  
June 20  
Mitotic apparatus  
D. Mazia  
21  
Cytoskeleton/Cytokinesis  
James Spudich (Stanford)  
22  
Chromosome movement  
Zacheus Cande (UCB)  
23  
Mitotic chromosome condensation  
D. Poccia/D. Mazia

### Week 3  
June 27  
Spermatogenesis/Pronuclear activation  
D. Poccia  
28  
Histones in the Cell Cycle  
D. Poccia  
29  
Ciliogenesis  
Ellen Dirksen (UCLA)  
30  
Cell Organization  
Gerald Schatten (Wisc)  
FIELD TRIP-July 1  
Protein Phosphorylation in the Cell Cycle  
Frank Supranyowicz (Scripps Clinic).

### Week 4  
July 4  
RESEARCH PROJECTS

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### Week 5  
July 11  
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13  
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14  
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CLASS SYMPOSIUM
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<tr>
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<tr>
<td><strong>WEEK I</strong></td>
<td></td>
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<tr>
<td>Mon. June 13</td>
<td>The Inter- and Subtidal Zones</td>
<td>C. Smith</td>
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<td>The Chlorophyta</td>
<td>C. Smith</td>
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<td>Tues. June 14</td>
<td>The Rhodophyta</td>
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<td>Wed. June 15</td>
<td>The Phaeophyta</td>
<td>C. Smith</td>
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<td>The Kelps</td>
<td>C. Smith</td>
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<tr>
<td>Thurs. June 16</td>
<td>Intertidal Transect</td>
<td>R. Alberte</td>
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<tr>
<td>2:30 p.m.</td>
<td>Monterey Bay Aquarium Tour</td>
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<tr>
<td>Fri. June 17</td>
<td>More Intertidal Field Work</td>
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<tr>
<td>11:00 a.m.</td>
<td>Optical Properties of the Water Column</td>
<td>R. Zimmerman</td>
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<td></td>
<td>Light Phenomena: Pigments and Photoreception</td>
<td>R. Alberte</td>
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<tr>
<td>4:00 p.m.</td>
<td>Women in Science</td>
<td>P. Penhale</td>
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<td>Sat. June 18</td>
<td>Big Sur Field Trip (8:00 to ca. 2:00)</td>
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WEEK II

Mon. June 20  Molecular Tools for Studying Adaptation  R. Alberto
Marine Symbioses  L. Muscatine

Tues. June 21  Targeting and Cell Wall Synthesis  E. Gonzalez
Pigment-Proteins & the Photosynthetic Unit  R. Alberto

Wed. June 22  Cell & Molecular Biology of Chloroplasts  R. Alberto
Light Reactions in Photosynthesis  R. Alberto

Thurs. June 23  Applications of DNA Technologies to Algae  S. Fain
Light Adaptation in Algae  R. Alberto

Fri. June 24  DNA Polymorphisms: Markers for Speciation  S. Fain
Photosynthetic Carbon Metabolism  R. Alberto

evening  Research Project Discussions

Sat. June 25  Ano Nuevo Field Trip (10:00 to ca. 3:00)

WEEK III

Mon. June 27  Carbon Metabolism & Partitioning  R. Alberto
Nutrient Dynamics in Algae  R. Zimmerman

Tues. June 28  Nitrogen Assimilation and Metabolism  R. Zimmerman
Integration of Metabolism and Cell Processes  R. Alberto

Wed. June 29  Immunological Methods for Macrophytes  R. Alberto

HOPKINS LECTURE
4:00 p.m.  Molecular Approaches to Algal Phylogenies  R. Cattolico

Thurs. June 30  Stress in the Intertidal  C. Smith
Salinity and Temperature Stress  C. Smith

Fri. July 1  Fluid Dynamics of the Inter- & Subtidal  M. Denny
Parasitism in Red Algae  L. Goff

Sat. July 2  Elkhorn Slough Field Trip (10:00 to ca. 3:00)
WEEK IV
RESEARCH PROJECTS

Mon. July 4  Picnic

 Tues. July 5  VAN NIEL MEMORIAL LECTURE
  4:00 p.m.
  Fisher Hall  Silicon and Life: What the Diatom
           Can Tell Us  B. Volcani

Weds. July 6  Environmental Control of The Cell Cycle  J. Smith
(9:00 a.m.)

Thurs. July 7  Life in reducing Sediments  R. Smith

WEEK V
RESEARCH PROJECTS

Mon. July 11  Flow, Flapping and Photosynthesis:
               The Role of Undulate Blades  M. Koehl

July 14-15  Research Project Reports - HMS Annual Meeting
LABORATORY SCHEDULE

WEEK I

Mon. Jun. 13  Laboratory - Green Algae
Tues. Jun 14  Laboratory - Red Algae
Weds. Jun 15 Laboratory - Brown Algae
Thurs. Jun 16 Field - Intertidal Transect, Data Analysis (Lotus)
Fri. Jun 17  Field - Intertidal Work, Data Discussions
Pigment Analyses and Spectrophotometry
Sat. Jun 18  Field Trip to Big Sur

WEEK II

Mon. Jun 20  Oxygen Exchange Technologies/Spectrophotometry
Tues. Jun 21 Measurement of Reaction Centers, PSU sizes
Weds. Jun 22 Protoplast Isolation
Thurs. Jun 23 Isolation and Purification of DNA and RNA
Fri. Jun 24  DNA Restriction Mapping
Sat. Jun 25  Field Trip - Ana Nuevo

WEEK III

Mon. Jun 27  Nitrate Assimilation - Nitrate Reductase
Tues. Jun 28 Ammonium Assimilation - Glutamine Synthetase
Weds. Jun 29 Protein Isolation and Separations/Western Blotting
Thurs. Jun 30 In situ Immuno-localizations
Fri. Jul  1  Fluorescence Microscopy
Sat. Jul  2  Field Trip - Elkhorn Slough

WEEKS IV & V

Jul 5-13  RESEARCH PROJECTS
Jul 14-15 Research Project Presentations
Opening Remarks: David Epel

SESSION 1
Chairperson: Daniel Kazia

9:00-9:15  Bill Pavan  Electropermeabilization and introduction of inhibitors into sea urchin embryos.


9:30-9:45  John Ryan  The microhabitats of the predatory gastropod *Ocenebra*.

9:45-10:00  John Fowler  Pattern of distribution of the predatory gastropod *Ocenebra circumtexta* in the region of the population explosion.

10:00-10:15  David Nagajski  Hydrostatic pressure effects on sea urchin development

10:15-10:30  Emily Carrington  Thermal and osmotic stress in the intertidal red alga *Mastocarpus papillatus*.

10:30-10:45  COFFEE/TEA BREAK

SESSION 2
Chairperson: Celia Smith

10:45-11:00  Ellen Popodi & Marie Vodicka  Twinning of sand dollar embryos: thiols or heavy metal?

11:00-11:15  Heidi Dierssen  Inter- & intra- specific interactions among four carnivorous snail species.

11:15-11:30  Minas Kocamoglu  A new technique for microinjection of starfish oocytes.

11:30-11:45  Josef Ackerman  Photosynthetic responses of marine macrophytes to current flow.

11:45-12:00  Robert Lauzon & Debby Kajiyama  The role of microtubules in ooplasmic segregation in *Ascidia ceratodes*.

12:00-1:00  LUNCH BREAK
SESSION 3

Chairperson: Lani West

1:00-1:15  John Reguzzoni  Partitioning of nitrogen assimilation in two populations of the eelgrass, Zostera marina.

1:15-1:30  Stuart Slavin  Nitrogen assimilation in two ecotypes of the giant kelp Macrocystis pyrifera.

1:30-1:45  John Kellogg  Light adaptation in Macrocystis pyrifera.

1:45-2:00  Mwenda Kudumu  Observations from the simulated natural habitats of predatory snails (Nucella emarginata, Ocenebra curcumtexta, Acanthina punctulata, and A. spirata).

2:00-2:15  Sandy K. S. Luk  Microinjection of sperm into sea urchin eggs.


2:30-2:45  Megan Smith  Feeding habits of hatchling Nucella emarginata and Acanthina spp.

2:45-3:00  COFFEE/TEA BREAK

SESSION 4

Chairperson: Chuck Baxter

3:00-3:15  Linda Franklin  Effects of photoinhibition on red algal photosynthesis.

3:15-3:30  Mark Haffer  SEM observation on refertilization of sea urchin eggs.

3:30-3:45  Navdeep Jaikaria  Effect of aphidicolin on chromosomal replication and condensation.

3:45-4:00  Kris Thomas  The role of microtubules in polar body formation in Urechis.

4:00-4:15  Curtis Givan  Glycollate metabolism in Chlorophytes.

4:15-4:30  Gustavo Rosania  An interpretation of ultraviolet radiation-induced delay of mitosis.

4:30-4:45  Scott Morrison  Problems in studying behavioral ecology: Haul-out pattern and site fidelity of the harbor seal, Phoca vitulina.

4:45-5:00  Concluding Remarks: Randall Alberte