

PROPOSAL TO THE NEW YORK STATE HEALTH RESEARCH COUNCIL

TITLE: The Environmental Health Implications of Aerobic and Anaerobic Decomposition of Polychlorinated Biphenyls (PCBs) in the Hudson Estuary

PRINCIPAL INVESTIGATOR: Dr. Chun C. Lee (SSN 521-52-6704)

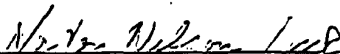
INSTITUTION: New York University Medical Center
Institute of Environmental Medicine
Laboratory for Environmental Studies
550 First Avenue
New York, New York 10016

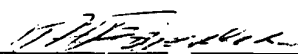
DURATION OF PROPOSED WORK: January 1, 1979 through December 31, 1979

TOTAL AMOUNT REQUESTED: \$31,080


Chun Chi Lee
Research Scientist
Institute of Environmental
Medicine
New York University Medical
Center
Tuxedo, New York 10987


Merril Eisenbud
Associate Director
Institute of Environmental
Medicine
New York University Medical
Center
Tuxedo, New York 10987


Norton Nelson, Director
Institute of Environmental
Medicine
New York University Medical
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550 First Avenue
New York, New York 10016


Thomas A. Fitzgerald, Director
Office of Grants Administration
and Institutional Studies
550 First Avenue
New York, New York 10016

NEW YORK STATE
HEALTH RESEARCH COUNCIL
GRANT APPLICATION

PRIORITY AREA # 7

LAST NAME Lee

SECTION I

SOCIAL SECURITY #
521-52-6704

TO BE COMPLETED BY PRINCIPAL INVESTIGATOR

1. TITLE OF PROPOSAL The Environmental Health Implications of Aerobic and Anaerobic Decomposition of Polychlorinated biphenyls (PCBs) in the Hudson Estuary
2. G. DEPARTMENT, SERVICE, LABORATORY OR EQUIVALENT Lab. for Environmental Studies, Inst. of Environmental Medicine, NYU Medical Center

2. A. NAME (Last, First, Initial)
Lee, Chun C.

3. DATES OF PROPOSED PROJECT PERIOD (THIS APPLICATION)
From Jan. 1, '79 through Dec. 31, 1979

2. B. TITLE OF POSITION
Research Scientist and Adjunct Assistant Professor

4. TOTAL DIRECT COSTS FOR PERIOD IN ITEM 3
\$31,080

5. DIRECT COSTS REQUESTED FOR FIRST 12-MONTH PERIOD
\$31,080

2. C. MAILING ADDRESS (Street, City, P.O. Box 817 State, Zip Code)
Tuxedo NY 10987

6. PERFORMANCE SITE (S)

A. Primary Site A.J. Lanza Labs

2. D. DEGREE
Ph.D.

2. E. SOCIAL SECURITY No.
521-52-6704

B. NEW YORK STATE SENATORIAL DISTRICT NUMBER 26

C. NEW YORK STATE ASSEMBLY DISTRICT NUMBER 65

2. F. TELEPHONE NUMBER
AC (914)351-4229 EXT.

7. RESEARCH INVOLVING HUMAN SUBJECTS
A. ☒ No B. ☐ Yes-Approved: _____

Date

C. ☐ Yes-Pending Review

TO BE COMPLETED BY RESPONSIBLE ADMINISTRATIVE AUTHORITY

8. APPLICANT ORGANIZATIONS (S)
Institute of Environmental Medicine
NYU Medical Center
550 1st Ave., New York NY 10016
IRS # 135562309N

10. NAME, TITLE, ADDRESS, AND TELEPHONE NO. OF OFFICIAL IN BUSINESS OFFICE WHO SHOULD ALSO BE NOTIFIED IF AN AWARD IS MADE.
John N. Ballow, Vice President for Finance
TELEPHONE NUMBER 212 679-3200 ext. 3611

9. NAME, TITLE, AND TELEPHONE NO. OF OFFICIAL (S) SIGNING FOR APPLICANT ORGANIZATION
T.A. Fitzgerald, Director
Office of Grants Administration & Institutional Studies
TELEPHONE NUMBER (S) 212 679-3200 2235

11. IDENTIFY ORGANIZATIONAL COMPONENT TO RECEIVE CREDIT FOR INSTITUTIONAL GRANT (SEE INSTRUCTIONS)

01 New York University Medical Center

12. CERTIFICATION AND ACCEPTANCE. WE, THE UNDERSIGNED, CERTIFY THAT THE STATEMENTS HEREIN ARE TRUE AND COMPLETE TO THE BEST OF OUR KNOWLEDGE AND ACCEPT, AS TO ANY GRANT AWARDED, THE OBLIGATION TO COMPLY WITH NYS HEALTH RESEARCH COUNCIL TERMS AND CONDITIONS IN EFFECT AT THE TIME OF THE AWARD.

SIGNATURES

(SIGNATURES REQUIRED ON EACH COPY. USE DARK INK. "PER" SIGNATURES NOT ACCEPTABLE.)

A. SIGNATURE OF PERSON NAMED IN ITEM 2.A.

DATE

C. C. Lee

10-27-78

B. SIGNATURE OF PERSON NAMED IN ITEM 9.

DATE

T.A. Fitzgerald

(NOTE: Principal investigator must also profess and sign professional assurance at the end of research plan)

MONS 009125

RESEARCH OBJECTIVES

NAME AND ADDRESS OF APPLICANT ORGANIZATION

New York University Medical Center, Inst. of Environmental Medicine
550 First Avenue, New York, New York 10016

NAME, SOCIAL SECURITY NUMBER, OFFICIAL TITLE, AND DEPARTMENT OF ALL PROFESSIONAL PERSONNEL ENGAGED ON PROJECT, BEGINNING WITH PRINCIPAL INVESTIGATOR

Chun C. Lee, Ph.D., 521-52-6704, Research Scientist and Adjunct Assistant Professor, Laboratory for Environmental Studies, Institute of Environmental Medicine, NYU Medical Center (914) 351-5419

Theo. J. Kneip, Ph.D., 031-36-5155, Deputy Director, Laboratory for Environmental Studies, Institute of Environmental Medicine, NYU Medical Center

Joseph O'Connor, Ph.D., 011-34-2794, Assistant Director, Laboratory for Environmental Studies, Institute of Environmental Medicine, NYU Medical Center

TITLE OF PROJECT: THE ENVIRONMENTAL HEALTH IMPLICATIONS OF AEROBIC AND ANAEROBIC DECOMPOSITION OF POLYCHLORINATED BIPHENYLS (PCBs) IN THE HUDSON ESTUARY

It is known that PCBs recovered from environmental samples (e.g., water, sediments and organisms) are different from commercially produced products by having an increased abundance of isomers of high chlorine content; isomers of low chlorine content are readily metabolized by organisms at lower trophic levels, or are otherwise degraded in the environment. It is also known that PCB isomers containing 50% or more chlorine are less active, biologically, than the lower chlorinated isomers, hence those isomers having high chlorine content may be less toxic. Consequently, the health risk from environmental accumulations of PCBs may change with time because of differences in the degradation rate. This study is proposed to investigate the mode and rates of PCB degradation (Aroclor 1221, 1016, 1242 and 1254) by aquatic and estuarine fungi and anaerobic bacteria, and to assay the relative toxicity of the PCB mixture remaining after microbial action against some key Hudson River organisms.

PROJECT CONTROL

Priority Area # <u>7</u>
Last Name <u>Lee</u>
Social Security # <u>521-52-6704</u>
HRC # (Office use only) _____

Type of Application:

X New

Renewal of HRC # _____

Total Direct Costs Requested:

First Year \$ \$31,080

Total \$ N.A.

Date Submitted November 1, 1978

Principal Investigator Chun C. Lee, Ph.D.

Applicant Institution New York University Medical Center

Research Institution Institute of Environmental Medicine, NYU Med. Center

Grant Manager: Ira S. Goodman - Assistant Director, Office of Grants
Administration & Institutional Studies, 212-679-3200 X2233
name phone

Title of Proposal: The Environmental Health Implications of Aerobic and
Anaerobic Decomposition of Polychlorinated Biphenyls
(PCBs) in the Hudson Estuary

DO NOT WRITE BELOW THIS LINE

Completeness Validation

- | | |
|---|---|
| (1) Proper Signatures _____ | (5) Principal Investigator Assurance (Statement and Signatures) _____ |
| (2) Patent/Copyright Agreement (HRC-21) _____ | (6) Progress Report (Renewal) _____ |
| (3) Protection of Human Subjects (HRC-1) _____ | (7) Invention Report (HRC-21) _____ |
| (4) Protection of Laboratory Animals (Letter) _____ | (8) Annual Invention Statement (HRC-22) _____ |

Date Received _____

Date Reviewed _____

SECTION II

PRIORITY AREA #

PRIVILEGED COMMUNICATION

Last Name LeeSocial Security # 521-52-6704

DETAILED BUDGET FOR FIRST 12-MONTH PERIOD

(1)	PERSONNEL	TITLE OF POSITION	% OF TIME OR EFFORT	SALARY	AMOUNT REQUESTED	
					FRINGE	TOTAL
					20.5% to 8/31/79	
					\$18 after 9/1/79	
	<u>C. C. Lee</u>	<u>Principal Investigator</u>	<u>20%</u>	<u>4,486</u>	<u>974</u>	<u>5,460</u>
	<u>J.M. O'Connor</u>	<u>Technical Advisor</u>	<u>5%</u>	<u>N.C.</u>		<u>-0-</u>
	<u>T. Kneip</u>	<u>Technical Advisor</u>	<u>5%</u>	<u>N.C.</u>		<u>-0-</u>
	<u>TBA</u>	<u>Secretarial Help</u>	<u>20%</u>	<u>2,407</u>	<u>-523</u>	<u>2,930</u>
	<u>TBA</u>	<u>Laboratory Assist.</u>	<u>100%</u>	<u>12,000</u>	<u>2,606</u>	<u>14,606</u>
			(1)	Subtotal	<u>\$ 8,893</u>	<u>\$ 22,996</u>
(2)	CONSULTANT COSTS			\$		
			(2)	Subtotal	<u>\$ -0-</u>	<u>\$ -0-</u>
(3)	EQUIPMENT <u>Variable shaker</u>			\$ 500		
			(3)	Subtotal	<u>\$ 500</u>	<u>\$ 500</u>
(4)	SUPPLIES <u>Chemicals, reagents, media supplies,</u>			\$		
	<u>labelled and unlabelled PCR's</u>			<u>1,000</u>		
	<u>Routine glassware and solvents</u>			<u>1,000</u>		
	<u>Chromatographic supplies, gasses, columns</u>			<u>750</u>		
	<u>Miscellaneous supplies</u>	(4)		<u>\$ 250</u>		<u>\$ 3,000</u>
			Subtotal	<u>3,000</u>		
(5)	TRAVEL			\$		
	<u>Travel to one domestic meeting and</u>			<u>400</u>		
	<u>for travel to consult with colleagues</u>					
	<u>doing related work</u>		(5)	Subtotal	<u>\$ 400</u>	<u>\$ 400</u>
(6)	PATIENT COSTS			\$		
			(6)	Subtotal	<u>\$ -0-</u>	<u>\$ -0-</u>
(7)	OTHER EXPENSES (DETAIL) <u>Overhead (15% of total)</u>			\$ 4,184		
			(7)	Subtotal	<u>\$ 4,184</u>	<u>\$ 4,184</u>
(8)	ALL DIRECT COSTS.....TOTAL					<u>\$31,080</u>

SECTION II

Priority Area # 7Last Name LeeBUDGET ESTIMATES FOR FUTURE YEARS
DIRECT COSTS ONLY (Omit Cents)*

Social Security #

521-52-6704

<u>Description</u>	First Year (Same As Detailed Budget on Page 3)	Second Year
(1) Personnel Costs, including fringe benefits	\$22,996	N.A.
(2) Consultant Costs (Include fees, travel, etc.)	-0-	
(3) Equipment	500	
(4) Supplies	3,000	
(5) Travel	400	
(6) Patient Costs	-0-	
(7) Other Expenses (overhead 15% of total)	4,184	
TOTAL DIRECT COSTS	\$31,080	\$ N.A.

REMARKS: Justify all costs for the first year for which the need may not be obvious. For future years, justify equipment costs, as well as any significant change in any other category. (Use continuation page if needed.)

Five hundred dollars is requested for the purchase of a small variable shaker assembly for the growth of fungal and bacterial cultures. This piece of equipment is not available at the Institute.

NOTE: Completion of these columns does not obligate the NYS Health Research Council to future funding. An application for renewal must be filed each year.

Priority Area # 7

Last Name Lee

Social Security #
521-52-6704

SECTION II

OTHER RESEARCH SUPPORT

List all research support for each individual including requests now being considered, as well as any proposals being planned, regardless of relevance to this application. Include also current or pending contracts, fellowship awards, research career program awards, training grants, regardless of the source of support. Include title of project, funding source, amount of support, and investigator's time commitment. List grant number(s) for all current support.

Support for Lee

Current: New York State DEC - Monitoring of PCBs in the Hudson River
June 1, 1978 - May 31, 1979 \$44,000. 20 % of time.

New York University Medical Center Institutional - The
Anaerobic Degradation of PCBs by Aquatic and Estuarine
Bacteria. July 1978 - March 1979. \$5,000, no salaries.

Pending: New York State ERDA - Power Plant Simulator Studies
December 1, 1978 - November 30, 1979 \$90,000. 10% of time

Planned: U. S. NOAA-Sea Grant - Comparative Toxicity of of Environmental
PCBs vs. Commercial Preparations of PCBs in Hudson River Food
Fish. Approximately \$75,000.

U.S. EPA - A Proposal to Devise Clean Up procedures for Labor-
atory generated wastes. Approximately \$10,000.

BIOGRAPHICAL SKETCH

Last Name LeeSocial Security #
521-52-6704

(Give the following information for all professional personnel beginning with the Principal Investigator. Use continuation pages and follow the same general format for each person.)

NAME	TITLE	BIRTHDATE (Mo., Day, Yr.)
Chun C. Lee, Ph.D.	Research Scientist and Adjunct Assist. Prof.	08/31/39
PLACE OF BIRTH (City, State, Country)	Present Nationality (If non- U.S. citizen, indicate kind of visa and expiration date)	Sex xx Male Female
Hong Kong		
EDUCATION (Begin with baccalaureate training and include postdoctoral)		
INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED
Colo. State U. Ft. Collins, Colo.	B.S.	1962
U. of Miami	Coral Gables, Fla. PH.D.	1969
		Marine Science

HONORS

Achievement Award in Biological Science, Colo. State U. 1962.

NDEA Fellow 1962-1965, U. of Miami.

MAJOR RESEARCH INTEREST

ROLE IN PROPOSED PROJECT

Environmental Pollution

Project Director

RESEARCH AND/OR PROFESSIONAL EXPERIENCE (Starting with present position, list training and experience relevant to area of project. List all relevant publications.)

See Attached Curriculum Vitae

MONS 009131

BIOGRAPHICAL SKETCH

Last Name Lee

Social Security #

521-52-6704

(Give the following information for all professional personnel beginning with the Principal Investigator. Use continuation pages and follow the same general format for each person.)

NAME	TITLE	BIRTHDATE (Mo., Day, Yr.)
Theo. J. Kneip, Ph.D.	Dep. Dir. Laboratory for Environmental Studies	12/20/26
PLACE OF BIRTH (City, State, Country)	Present Nationality (If non-U.S. citizen, indicate kind of visa and expiration date)	Sex ☒ Male ☐ Female
St. Paul, Minnesota, USA		
EDUCATION (Begin with baccalaureate training and include postdoctoral)		
INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED
University of Minnesota	B.S.	1950
University of Minnesota	M.S.	1952
University of Illinois	Ph.D.	1954
		SCIENTIFIC FIELD
		Chemistry
		Chemistry
		Chemistry

HONORS

Phi Lambda Upsilon, 1950 - Sigma Xi, 1954

MAJOR RESEARCH INTEREST

ROLE IN PROPOSED PROJECT

Environmental Pollution

Technical Advisor

RESEARCH AND/OR PROFESSIONAL EXPERIENCE (Starting with present position, list training and experience relevant to area of project. List all relevant publications.)

See Attached Curriculum Vitae

BIOGRAPHICAL SKETCH

Priority Area # 7Last Name LeeSocial Security #
521-52-6704

(Give the following information for all professional personnel beginning with the Principal Investigator. Use continuation pages and follow the same general format for each person.)

NAME	TITLE	BIRTHDATE (Mo., Day, Yr.)
Joseph M. O'Connor, Ph.D	Assist. Dir., Laboratory for Environmental Studies	11/19/44
PLACE OF BIRTH (City, State, Country) Boston, Mass., USA	Present Nationality (If non- U.S. citizen, indicate kind of visa and expiration date)	Sex ☒ Male ☐ Female
EDUCATION (Begin with baccalaureate training and include postdoctoral)		
INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED
College of Holy Cross Worcester, Mass.	B.S.	1966
State U. of New York at Albany	Ph.D.	1971
		SCIENTIFIC FIELD
		Biology
		Ecology/Physiology

HONORS

Sigma Xi, Beta Beta Beta Biological Society

MAJOR RESEARCH INTEREST

Environmental Pollution

ROLE IN PROPOSED PROJECT

Technical Advisor

RESEARCH AND/OR PROFESSIONAL EXPERIENCE (Starting with present position, list training and experience relevant to area of project. List all relevant publications.)

See Attached Curriculum Vitae

MONS 009133

RESEARCH PLAN

Priority Area # 7
Last Name Lee
Social Security #
521-52-6704

BIBLIOGRAPHY: Provide a detailed bibliography that is relevant to the research project. List any research performed by the principal investigator (s) named in the application. Use continuation sheets if necessary.

- Ahmed, M. and D.D. Focht. (1973). "Degradation of polychlorinated biphenyls by two species of Achromobacter," Can. J. Microbiol. 19: 47.
- Alexander, M. (1965). "Biodegradation: Problems of molecular recalcitrance and microbial fallibility," Adv. Appl. Microbiol. 7: 35.
- Alexander, M. (1975). "Environmental and microbiological problems arising from recalcitrant molecules," Microbiol. Ecol. 2: 17.
- Aulerich, R.J., R.K. Ringer, H.L. Seagran, and W.G. Youatt. (1971). "Effects of feeding coho salmon and other Great Lakes fish on mink reproduction," Can. J. Zool. 49: 611.
- Aulerich, R.J., R.E. Ringer, and S. Iwamoto. (1973). Reproductive failure and mortality in mink fed on Great Lakes Fish," J. Reprod. Fert. Suppl. 19: 365.
- Bruckner, J.V., K.L. Khanna, and H.H. Cornish. (1973). "Biological responses of the rat to polychlorinated biphenyls," Toxicol. Appl. Pharmacol. 24: 434.
- Bryant, M.P. (1972). "Commentary on the Hungate technique for culture of anaerobic bacteria," Amer. J. Clin. Nutrition 25: 1324.
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- Choi, P.S.K., H. Nack, and J.E. Flinn. (1974). "Distribution of polychlorinated biphenyls in an aerated biological oxidation water treatment system," Bull. Environ. Contamin. Toxicol. 11: 12.
- Corcoran, E.F., and C.C. Lee. (1970). "The distribution of chlorinated hydrocarbon pesticides in the Mississippi River delta and the adjacent Gulf of Mexico," Joint Southeast and Southwest ACS Meeting, New Orleans, La., p. 88.
- Duke, T.W., J.I. Lowe, and A.I. Wilson. (1970). "PCB (Aroclor 1254) in the water, sediment, and biota in Escambia Bay, Florida," Bull. Environ. Contamin. Toxicol. 5: 171.

MONS 009134

- Ecobichon, D.J. (1976). "Enzymatic and other biochemical responses to selected PCBs," Nat'l Conf. on Polychlorinated Biphenyls, Chicago, Illinois, p. 57.
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- Gibson, D.T. (1968). "Microbial degradation of aromatic compounds," Science 161: 1093.
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- Haque, R. and D. Schmedding. (1975). "A method of measuring the water solubility of hydrophobic chemicals," Bull. Environ. Contam. and Toxicol. 14: 13.
- Hile, J.P. (1977). "Polychlorinated biphenyls (PCBs): Unavoidable contaminants in food and food packaging materials: reduction of temporary tolerances," Federal Register 42: 17487.
- Hullar, T., R.M. Pleasant, S. Pagano, J. Spagnoli, and W. Stasiuk. (1976). "PCB data in Hudson River fish, sediments, water and wastewater," Report prepared for PCB Task Force, New York State Health Advisory Council.
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- Hutzinger, O., S. Safe and V. Zitko. (1974). The Chemistry of PCBs, CRC Press, Cleveland, Ohio, p. 197.

- Hydroscience Inc. (1978). "Estimation of PCB reduction by remedial action on the Hudson River ecosystem," Report to the New York Department of Environmental Conservation, pp. 107.
- Jensen, S. (1966). "Report of a new chemical hazard," New Scientist 32: 612.
- Kaiser, K. and P. Wong. (1974). "Bacterial degradation of polychlorinated biphenyls. Identification of some metabolic products from Aroclor 1242," Bull. Environ. Contamin. Toxicol. 11: 291.
- Kearney, P.C. and D.D. Kaufman. (1969). The Degradation of Herbicides, Marcel Dekker, Inc., New York, N.Y.
- Kimbrough, R.D. (1976). "Pathological findings associated with chronic experimental exposure to PCBs," Nat'l Conf. on Polychlorinated Biphenyls, Chicago, Illinois, p. 14.
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- Kuratsune, M., T. Yoshimura, J. Matsuzaka, and A. Yamaguchi. (1972). "Epidemiologic study on Yusho, a poisoning caused by ingestion of rice oil contaminated with a commercial brand of polychlorinated biphenyls," Environ. Health Perspectives 1: 119.
- Kuratsune, M., Y. Masuda, and J. Nagayama. (1976). "Some of the recent findings concerning Yusho," Nat'l Conf. on Polychlorinated Biphenyls, Chicago, Ill., p. 14.
- Lee, C.C. and R. Sansur. (Unpublished data on the growth of an aquatic fungus on Aroclor 1221, 1016, 1242 and 1254.) New York University Medical Center.
- Liu, D. (1976). "PCB degradation," Mar. Pollut. Bull. 7: 83.
- MacRae, I.C., K. Raghu and E.M. Bautista. (1969). "Anaerobic degradation of the insecticide lindane by Clostridium sp.," Nature 221: 859.
- Matthews, H.B. and M. Anderson. (1975). "Effect of chlorination on the distribution and excretion of polychlorinated biphenyls," Drug Metab. Dispos. 3: 371.
- Matthews, H.B. and M. Anderson. (1976). "PCB chlorination versus PCB distribution and excretion," Nat'l Conf. on Polychlorinated Biphenyls, Chicago, Ill., p. 50.

- Munson, T.O., H.D. Palmer, and S.M. Forns. (1976). "Transport of chlorinated hydrocarbons in the Upper Chesapeake Bay," Natl'l Conf. on Polychlorinated Biphenyls, Chicago, Ill., p. 218.
- Nadeau, R.J. and R.A. Davis. (1976). "Polychlorinated Biphenyls in the Hudson River (Hudson Falls-Fort Edward), New York State," Bull. Environ. Contamin. Toxicol. 16: 436.
- Nebeker, A.V. and F.A. Puglies. (1974). "Effect of polychlorinated biphenyls on survival and reproduction of Daphnia, Gammarus, Tanytarsus," Trans. Amer. Fish. Soc. 722.
- New York State Dept. of Environmental Conservation. (1976). "In the matter of alleged violations of Sections 17-0501, 17-0511 and 11-0503 of the Environmental Conservation Law of the State of New York by General Electric Company," Interim Opinion and Order File No. 2833.
- Nimmo, D.R., D.J. Hansen, J.A. Couch, N.R. Cooley, P.R. Parrish, and J.I. Lowe. (1975). "Toxicology of Aroclor 1254 and its physiological activity in several estuarine organisms," Arch. Environ. Contamin. Toxicol. 3: 22.
- Nisbet, I.C.T. and A.F. Sarofim. (1972). "Rates and routes of transport of PCBs in the environment," Environ. Health Perspectives 1: 21.
- Norback, D.H. and J.R. Allen. (1972). "Chlorinated aromatic hydrocarbon induced modifications of the hepatic endoplasmic reticulum: concentration membrane arrays," Environ. Health Perspectives 1: 137.
- O'Connor, J.M., L. Peters, and R. Califano. (Unpublished data on the uptake on Aroclor 1254 from Hudson River water and Hudson River forage by Morone saxatilis.) New York University Medical Center.
- Raghu, K. and I.C. MacRae. (1966). "Biodegradation of the gamma isomer of benzene hexachloride in submerged soils," Science 154: 263.
- Risebrough, R.W. (1969). "Chlorinated hydrocarbons in marine ecosystems," In: Chemical Fallout. M.W. Miller and G.G. Berg (eds.), C.C. Thomas, Springfield, Ill., p. 5.
- Risebrough, R.W. and B.W. de Lappe. (1972). "Accumulation of polychlorinated biphenyls in ecosystems," Environ. Health Perspectives 1: 39.
- Roach, J.A.G. and I.H. Pomerantz. (1974). "The finding of chlorinated dibenzofurans in Aroclor PCBs of recent

As with the chlorinated pesticides the PCBs are relatively insoluble in water and are highly persistent in the environment (Risebrough and de Lappe, 1972). These compounds are not easily metabolized by enzyme systems presently found in nature (Choi et al., 1974; Alexander, 1975) and tend to accumulate in fatty tissues and oils of animals (Risebrough and de Lappe, 1972).

Because of their low water solubility, high specific gravity and high adsorbability, PCBs accumulate in anaerobic or reducing sediments of rivers, estuaries and the coastal zone. (Duke et al., 1970; Fulk et al., 1976; Munson et al., 1976).

Although PCBs were first detected as environmental contaminants in 1966 (Jensen, 1966), their potential impact as a health hazard was not realized until 1969, after the discovery and description in Japan of Yusho, a human disease caused by consumption of PCB-contaminated rice oil (Kuratsune et al., 1972). Since then, PCBs have been implicated in environmental and occupational diseases ranging from chloracne and liver damage to reproductive failure. They may also act as carcinogens or co-carcinogens (Norback and Allen, 1972; Kuratsune et al., 1972, 1976; Kimbrough, 1976; U.S. Department of Health, Education and Welfare, 1978).

Laboratory studies with industrial preparations of PCBs (e.g., Aroclor 1242, 1254 and others), and with pure isomers of chlorinated biphenyls have shown PCBs to be highly toxic

to many aquatic and terrestrial organisms (Bruckner et al., 1973; Grant and Phillips, 1974; Stalling and Mayer, 1972; Nebeker and Pugles, 1974; Nimmo et al., 1975; Vos, 1972; Walker, 1976). Those organisms which are not immediately affected by PCBs may accumulate them to high concentrations, thereby increasing the exposure of other organisms through food chain transport (Risebrough, 1969; Cahn et al., 1977; O'Connor et al., unpublished data).

It has been shown that the toxicity of a given PCB depends upon the degree of chlorination and its isomeric form. Chlorinated biphenyls that have a low percentage of chlorination tend to have a high acute toxicity compared to chlorinated biphenyls with a greater percentage of chlorination (Matthews and Anderson, 1975). The results from comparative studies of chronic exposures of animals to specific isomers are confusing and inconclusive, but the exposure of test animals to subacute levels of individual PCB preparations (e.g., Aroclor 1242, 1248, 1254, and 1260) resulted in varying degrees of liver dysfunction, which was inversely related to the chlorine content of the Aroclor (U.S. HEW, 1978). Lower homologs are also usually more soluble in water than the higher ones (Haque and Schmedding, 1975), and are therefore more available to, and more rapidly absorbed and metabolized by, aquatic organisms. PCBs which can be metabolized and excreted may introduce toxic metabolites to the environment, while the forms of PCB that are not readily

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A. INTRODUCTION

1. Objective: This research will investigate the rates at which aerobic or anaerobic microorganisms degrade PCBs in rivers, estuaries, or landfills. The investigation is designed also to test the hypothesis that the toxicity of PCB residues is gradually lessened in situ by the fact that the lower chlorinated isomers are more rapidly degraded than the higher chlorinated isomers which are known to be less active biologically and less toxic as well.

2. Background: Polychlorinated biphenyls (PCBs) are among the most persistent contaminants man has introduced to the environment. These compounds are a versatile group of industrial chemicals that have been widely used for more than 40 years. Two-hundred-nine possible isomers of chlorinated biphenyls exist, and each industrial PCB preparation may contain ten or more isomers, as well as impurities, such as polychlorinated dibenzofurans (PCDFs), polychlorinated dibenzodioxans (PCDDs) and other unidentified products (Vos et al., 1970; Roach and Pomerantz, 1974; Hutzinger et al., 1974).

These products have been released into the nation's fresh and coastal waters by deliberately discarding PCBs or PCB-laden products into landfills and dumps, or as effluents into rivers (Nisbet and Sarofim, 1972). A small amount is lost into the air from evaporation from plasticized products or from incomplete burning of substances containing PCBs.

metabolized have an extremely long biological half-life (Matthews and Anderson, 1976). It has been shown also that isomers having two adjacent unsubstituted carbons in the biphenyl ring are more readily metabolized than ones without the two adjacent unsubstituted carbons (Ecobichon, 1976).

The net effect of the above is that different PCBs have different toxicities and different rates of bioaccumulation and persistence. The evidence in general establishes that PCBs with five or more chlorine atoms are less biodegradable and are accumulated to higher levels in organisms and persist longer in the environment. PCBs from aquatic environmental samples, such as fish, show on analysis a pattern of peaks approaching that of PCB mixtures with more than 50% chlorination, while the major input of PCBs into the environment was PCB mixtures containing 42% or less chlorine (Matthews and Anderson, 1976). Highly chlorinated Aroclors, those containing 50% or more chlorine, comprised approximately 30% of sales prior to 1971; this figure was expected to decrease to 22% after 1971 (Nisbet and Sarofim, 1972). This lends support to the laboratory results described above, that the rate of metabolic attack on PCBs decreases with increasing chlorination. It is therefore possible that PCB residues found in natural waters and sediments and in aquatic organisms which concentrate PCBs via long food chains may not have originated entirely from one specific industrial preparation such as Aroclor 1242, 1016 or 1254. Instead, they may

represent only the higher homologs of several PCB preparations, the lower homologs of which were metabolized or otherwise degraded along the food chain.

The consumption of fish contaminated with PCBs from polluted lakes and streams appears to be the major source of PCB exposure for man and animals. However, there is no record of clinical damage to humans from such consumption (Humphrey et al., 1976; Hile, 1977), even though the amount of PCBs ingested was high compared to people who ate no fish. This being the case, it becomes unclear whether this lack of adverse health effects from the consumption of fish contaminated with PCBs from the environment is due to the low level of exposure or because the PCBs in the fish are primarily isomers that have a low-grade toxicity; if so, the more active, more toxic isomers may have been degraded in the environment to less toxic forms.

The persistence of some chlorinated pesticides and hydrocarbons and the apparent stability of some of these compounds in the environment fostered the idea of molecular recalcitrance (Alexander, 1965, 1975). As a result, the biodegradation of PCBs has received little attention and few data exist on the rate at which PCBs are being degraded in nature. However, it has been concluded by many investigators from laboratory studies that PCB isomers containing four or fewer chlorine atoms are degraded rapidly in the environment by microbial activity. Saylor et al. (1978) showed that PCB

resistant, or degrading, bacteria were ubiquitously distributed and indicated the potential for PCB degradation by natural microbial flora in estuarine and marine environments.

Available reports on PCB metabolism by microorganisms have dealt exclusively with aerobic bacterial systems (Ahmed and Focht, 1973; Kaiser and Wong, 1974; Wong and Kaiser, 1975; Furukawa and Matsumura, 1976; Liu, 1976; Sayler et al., 1977, 1978). Published works which indicate that chlorinated pesticides and other aromatic compounds are degraded under anaerobic conditions (Raghu and MacRae, 1966; Guenzi and Beard, 1967; MacRae et al., 1969; Focht and Ahmed, 1970) suggest that the lower PCB isomers in sediments may be degraded primarily by anaerobic bacteria.

Work begun in our laboratory with an aquatic fungus (Lee and Sansur, unpublished data), isolated from Hudson River water and grown in Aroclor 1254, together with the works of Sayler et al. (1978) and Kearney and Kaufman (1969) indicate that fungi may also be actively involved in the PCB degradation process.

3. Rationale: PCB contamination in the Hudson River is probably the most extensive in the nation. There are an estimated 450,000 to 600,000 pounds of PCBs in the bottom sediments of the upper Hudson River between Fort Edward and Troy, New York. Although no reliable estimates of PCB content in the bottom deposits of the lower Hudson from Troy to New York City are available, PCB content is expected to

be substantial. The major portion is adsorbed to particles deposited in anaerobic or reducing sediments near the point of PCB discharge. Even without further discharge, these PCBs will remain for some years and will continue to contaminate river biota unless the PCBs are degraded or are removed by water currents, dredging or by bioaccumulation in aquatic organisms. Thus far, degradation studies have centered on aerobic bacterial activity, whose results have little application to the problem at hand, because most of the PCBs are sequestered in anaerobic or reducing sediments. Until now, the role of fungi in PCB degradation has not been considered at all. This study is proposed to complement the existing work on PCB degradation to achieve a more complete understanding about the fate of these PCB deposits. As man is the ultimate consumer after eating contaminated fish, and in light of the uncertainties described above regarding the differential toxicities of different PCB preparations, it is our intent, also, to examine the toxicity of the PCB mixture remaining after microbial action on key Hudson River organisms relative to the documented toxicities of non-degraded PCB mixtures. This information will make it possible to predict the future public health and ecological significance of the PCB deposits.

B. SPECIFIC AIMS

1. To isolate and cultivate from Hudson River sediments anaerobic bacteria and fungi which are able to grow in the presence of PCBs (Aroclor 1242, 1016 and 1254) and to investigate their ability to degrade them. Initially, this will be done with mixed cultures; studies will be done with pure cultures as they become available. Aerobic bacteria will not be included in this work, as these organisms are being studied by other investigators.
2. To determine the rate of PCB degradation by anaerobic bacteria and fungi thus isolated and to characterize the resulting metabolites and residues.
3. To examine the relative toxicity of the PCB mixture remaining after microbial action against non-degraded PCB mixtures on some key Hudson River organisms such as Gammarus, Neomysis and striped bass larvae.

C. METHODS

1. Procedures for Specific Aim 1: Sediments for the isolation of anaerobic bacteria and fungi will be collected from at least two sites in the Hudson River known to be contaminated with PCBs, one in fresh water and the other in the saline portion of the river, with a sediment grab lowered from a boat. Immediately upon collection, the sediment will be transferred to duplicate sets of glass bottles which will be almost filled with filtered river water and sealed with serum caps. One set will be gassed with compressed nitrogen

to maintain reducing conditions necessary for anaerobes; the other will be maintained aerobic for fungal isolates. Both sets of samples will be returned to the laboratory for subsequent isolation of PCB degraders by enrichment culture.

Enrichment cultures for anaerobic bacteria will be set up by adding 1-2 g of sediments to a 250 ml flask containing 100 ml of an organic medium: glucose, 0.5 g; peptone, 0.5 g; KH_2PO_4 , 0.5 g; distilled water or water of appropriate salinity, 1 l (pH 7.0). Techniques for anaerobic cultures as described by Bryant (1972) will be strictly followed. Cultures will be incubated for 3 days at 26°C; intermittently, culture flasks will be shaken by hand. Isolation will be carried out in a second flask which contains 100 ml of a mineral salt solution: $(\text{NH}_4)_2\text{SO}_4$, 1 g; KH_2PO_4 , 0.2 g; K_2HOP_4 , 1.6 g; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.2 g; NaCl , 0.1 g; $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, 0.01 g; $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$, 0.02 g (pH 7.5) containing 0.05% of the appropriate PCB. Following standard anaerobic techniques 1 ml of the enrichment culture will be transferred to this second medium and incubated as before until substantial growth is observed. Such cultures will be maintained in duplicate or triplicate. One series will be incubated in the light and one in the dark to enable the growth of phototrophic bacteria as well as strict chemotrophs and heterotrophs.

Enrichment cultures for fungi will be started in Sabouraud dextrose agar (Difco) and incubated under aerobic conditions. After initial growth, 1 ml of the enrichment culture will be

transferred to the PCB-mineral salts medium (described above) but amended with 1 ml of a trace elements solution per liter. The trace elements solution contains 0.1 g H_3BO_3 , 0.05 g each of $CuSO_4 \cdot 5 H_2O$, $MnSO_4 \cdot H_2O$, $ZnSO_4 \cdot 7 H_2O$, Na_2MoO_4 , and $CoCl_2 \cdot 6 H_2O$ per liter.

After incubation for predetermined time intervals (4 days to 1 month), aliquots of the incubated samples will be transferred to separatory funnels and extracted with hexane. Gas chromatograms will be run with 1-5 μ l aliquots of the hexane extracts. Initially, only the disappearance of certain PCB isomers from the mixed culture systems will be measured. If the PCBs disappear or decrease in quantity, degradation products will be looked for, perhaps using thin-layer chromatographic techniques and with ^{14}C -labelled PCBs. Particular emphasis will be placed upon the water-soluble products. These will be isolated, after hexane extraction, by column chromatography on ion-exchange columns and resolved by thin-layer chromatography. Mixed cultures will be purified by plating onto mineral salts agar plates containing 0.05% PCBs.

2. Procedures for Specific Aim 2: Once the respective microbial systems capable of growth on PCBs are obtained, the kinetics of PCB degradation will be followed by analyzing the PCBs in the growth medium at different time intervals. The cells will be harvested by centrifugation and washed twice with 0.5 M phosphate buffer (pH 7.0). The washed cells will be

injected into culture tubes containing the mineral salts medium and PCB. The procedures employed will be similar to those described by Halvorson et al. (1971) who used resting suspensions of bacteria harvested from a sewage lagoon to examine the degradation of mixtures of pesticides. Comparisons will be made of gas chromatograms of PCBs before and after incubation with test organisms over the predetermined time interval. Metabolites and residual PCBs will be characterized by the use of column and thin-layer chromatographic techniques (Stalling and Huckins, 1973; Furukawa and Matsumura, 1976).

3. Procedures for Specific Aim 3: PCB residues and residual PCB isomers from microbial activity on the original Aroclor will be recovered from thin-layer chromatograms by scraping the respective spots off the plates and dissolving in acetone. Their toxic effects, if any, will be assessed on the physiology and population dynamics of some key Hudson River organisms (Gammarus, Neomysis and striped bass and other fish larvae) relative to the non-altered Aroclor. These organisms represent important fish food items and at times comprise the majority of zooplanktonic or benthic species in various portions of the Hudson River, and are routinely cultured in our laboratory. Cultures of each species will be established and exposed to varying levels of PCBs, PCB residues and metabolites in static systems. Biological effects of PCB exposure will be estimated from several critical parameters:

- a. rate of individual growth
- b. rate of respiration
- c. rate of production of young
- d. limits of tolerance to selected stresses: e.g.,
chlorine exposure, osmotic stress, thermal stress

All of the above parameters will be estimated for cultures receiving PCB stress, as well as those cultured in the absence of PCBs. The data gathered here will be analyzed following basic toxicological approaches to threshold sensitivity of organisms to toxicants and will be subjected to standard parametric and nonparametric statistical tests.

4. The research tasks will be performed in the following sequence, assuming a beginning data of January 1, 1979:

January to March: Sample collection and culture isolation

March to July: Degradation experimentation and analysis

July to October: Toxicity experimentation

November and December: Report preparation

D. SIGNIFICANCE

In light of our present knowledge about the toxicological properties of certain PCB isomers on living organisms and the knowledge that there might exist different rates of degradation for each of the 209 PCB isomers, it is expected that the health risks from PCB accumulations may change with time. This study should provide data for the assessment of long term health risks from PCBs and their residues in the aquatic environment.

E. FACILITIES AVAILABLE

The proposed research will be carried out using the facilities of the analytical chemistry and aquatic ecology sections of the Laboratory for Environmental Studies. The proposed research will be carried out in the culture and analytical facilities at the A.J. Lanza Laboratory, Tuxedo, New York, and at the Hudson River field station maintained by the Medical Center at Buchanan, N.Y. NYU boats equipped for collection of samples and certain field analytical procedures are berthed at Stony Point, N.Y. and operate throughout the open-water months. Dock facilities are available at the Buchanan wet-lab, but only on a temporary basis.

Equipment available for this project includes apparatus for:

Extraction/concentration of organics

Freeze-dry techniques

Scintillation spectrometry (low level - beta)

Gel electrophoresis

Thin-layer chromatography

Gas-liquid chromatography

High-pressure liquid chromatography

Respiration studies

Water quality analysis

Autoradiography

Culture facilities and equipment for aerobic and anaerobic
microorganisms

Culture of aquatic organisms

Maintenance of aquatic organisms

Computer data analysis

F. PRINCIPAL INVESTIGATOR ASSURANCE

"The undersigned agrees to accept responsibility for
the scientific and technical conduct of the research project
and for provision of required progress reports if a grant is
awarded as a result of this application."

Date

10-27-78

C. C. Lee
Principal Investigator

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PROTECTION OF HUMAN SUBJECTS
Assurance/Certification/Declaration
(Pursuant to Federal and State Law)☒ Grant☐ Follow

STATEMENT OF POLICY: Safeguarding the rights and welfare of subjects at risk in activities supported under grants and contract from NYSHRC is primarily the responsibility of the institution which receives or is accountable to NYSHRC for the funds awarded for the support of the activity. In order to provide for the adequate discharge of this institutional responsibility it is the policy of NYSHRC that no activity involving human subjects to be supported by NYSHRC grants or contracts shall be undertaken unless the Institutional Review Board has reviewed and approved such activity, and the institution has submitted to NYSHRC a certification of such review and approval, in accordance with the requirements of Chapter 450, NYS Laws of 1975.

1. **TITLE OF PROPOSAL OR ACTIVITY:** The Environmental Health Implications of Aerobic and Anaerobic Decomposition of Polychlorinated Biphenyls (PCBs) in the Hudson Estuary

2. **Principal Investigator/Activity Director/Fellow**

Chun C. Lee, Ph.D.

3. **Declaration that Human Subjects Either Would or Would Not Be Involved**

- ☒ A. No individuals who might be considered human subjects, including those from whom organs, tissues, fluids, or other materials would be derived, or who could be identified by personal data, would be involved in the proposed activity. (If no human subjects would be involved, check this box and proceed to Item 5. Proposals determined by the Agency to involve human subjects will be returned.)
- ☐ B. Human subjects would be involved in the proposed activity as either: ☐ None of the following, or including: ☐ Minors, ☐ Fetuses, ☐ Abortuses, ☐ Pregnant Women, ☐ Prisoners, ☐ Mentally Retarded, ☐ Mentally Disabled. Under Section 7, Cooperating Institutions, on reverse of this form, give name of institution and name and address of official(s) authorizing access to any subjects in facilities not under direct control of the applicant or offering institution.

4. **Declaration of Assurance Status/Certification of Review**

- ☐ A. This institution has not previously filed an assurance and assurance implementing procedures for the protection of human subjects with the Council that applies to this application or activity. Assurance is hereby given that this institution will comply with requirements of Chapter 450, NYS Laws of 1975, that it has established an institutional review board for the protection of human subjects and, when requested, will submit documentation and certification of such reviews and procedures as may be required for implementation of this assurance for the proposed project or activity.
- ☐ B. This institution has an approved general assurance or an active special assurance for this ongoing activity, on file with the Council. The signers certify that all activities in this application proposing to involve human subjects have been reviewed and approved by this institution's institutional review board in a convened meeting on the date of _____.

THE INSTITUTIONAL REVIEW BOARD HAS DETERMINED, AND THE INSTITUTIONAL OFFICIAL SIGNING BELOW CONCURS THAT: Either ☐ human subjects will not be at risk, or ☐ human subjects will be at risk.

5. **Name and Address of Institution**

6. **Title of Institution Official**

Signature of Institutional Official

Date

phone:

Title of Invention Grant or Contract Under Which Developed Identifier Date of Report

Inventor's Name(s) Official Title(s) Business Address

Facility Where Invention Made Name of Unit or Building Address

DESCRIBE INVENTION IN DETAIL FOLLOWING OUTLINE BELOW. ATTACH MAPS, SKETCHES, PRINTS, PHOTOS TO DESCRIPTION.

- A. General Purpose - State in general terms the purpose and object of the invention
- B. Background - Describe prior art (identify by patent number or journal citation)
- C. Description and operation
 1. Describe completely the construction of invention using reference characters to identify components in attached illustrations.
 2. Describe one (1) complete operational cycle.
 3. If invention relates to a synthesis or identification of a new composition of matter, describe the product in structural form, if possible, and the process of making it. Include all available information regarding physical characteristics and all test data evidencing utility.

DESCRIBE COMMERCIAL POSSIBILITIES (INCLUDE QUANTITY AND PRICE RANGE IF AVAILABLE)

STATE REASONS FOR APPLYING FOR PATENT

STATE PLANS TO PUBLISH NAME OF PUBLICATION, ATTACH OUTLINE OF ARTICLE. IF ALREADY PUBLISHED, INCLUDE JOURNAL CITATION OR ATTACH REPRINT.

DESCRIBE AND GIVE DATE(S) OF ANY SALE OR PUBLIC USE OF INVENTION (SPECIFY IF USE WAS OPERATIONAL OR FOR TESTING PURPOSES)

CONTRIBUTIONS TO THE INVENTION BY: GRANTEE NYSHR COUNCIL OTHER (Identify)

PERSONNEL (No. of Personnel)

MATERIALS (List Type and Value)

FINANCIAL CONTRIBUTION

EXECUTION OF DISCLOSURE

I, _____, state the above information with regard to the invention of
name of inventor

_____ is a true and correct disclosure of data pertinent
title of invention
the invention.

(1) _____
Technical Witness

Signed _____

MONS 009154

(2) _____
Technical Witness

Date _____

7. Cooperating Institutions - Additional Reporting Requirement

Use Following Report Format for Each Institution Other Than Grantee or Contracting Institution with Responsibility for Human Subjects Participating in this Activity: (Attach additional report sheets as necessary)

INSTITUTIONAL AUTHORIZATION FOR ACCESS TO SUBJECTS

Subjects: Status (Wards, Residents, Employees, Patients, Etc.) _____

Number _____ Age Range _____

Title _____ Phone _____

Name and Address of Cooperating Institution _____

Official Signature _____

NEW YORK STATE
HEALTH RESEARCH COUNCIL

PATENT AND COPYRIGHT AGREEMENT

The undersigned applicant, in consideration of a grant/contract awarded by the New York State Health Research Council, does hereby agree as follows:

- (a) To keep the Council informed of any potentially patentable device or technique conceived or developed by the undersigned, in whole or in part, individually or with others.
- (b) That a patentable device or technique conceived or developed in the course or working on programs or projects funded by the Council shall be the property of the Council.
- (c) That royalties, or any other remuneration received by the applicant will be promptly remitted to the Council and redistributed to the applicant and the inventor (s) pursuant to Council policy.
- (d) Upon instruction of the Council, to apply for a patent on any such patentable device or technique and assign to the Council or its nominee all my right, title and interest in such patentable device and execute, acknowledge and deliver to the Council any instruments necessary or required by the Council to effectuate such application, assignment of this agreement.
- (e) To conform with and adhere to the patent and copyright policy of the Council, a copy of which has been received by the undersigned, as the same may from time to time be amended.
- (f) To give appropriate credit to the Council in any publication or other form of disclosure or at the request of the Council to provide an appropriate disclaimer to the effect that the publication or disclosure does not represent the official position of the Council.
- (g) A description of any invention, whether made or conceived by employees or agents of the undersigned prior to funding by the Council, whether patented or not, is appended hereto and such inventions shall be excluded from this agreement. I (we) represent that the absence of any invention in the attached schedule shall indicate that I (we) own no such invention at the time of signing this agreement.

MONS 009156

C. C. Lee
(Signature)

10-27-78
(Date)

HRC-23

APPENDIX: NYU Organism Culture

The New York University Medical Center presently maintains in culture several aquatic species, including protozoa, algae, zooplankton, benthic biota, fish, and fish larvae. The species of algae in culture include: Chlorella, Nannochloris, Chlamydomonas, Melosira, Synedra, Anacystis, and others. Protozoan species include Strombidium, Euplotes, Uronychia, and Paramecium. Many different types of microzooplankton have been maintained at the Medical Center. Included among them are: Mesocyclops edax, Eurytemora affinis, Acartia clausi, Daphnia magna, and Cyclops bicuspidatus. Ostracods are presently being cultured in the laboratory for a study of breeding behavior. Benthic biota maintained at the Laboratory include Carcinus maenas, Rithropanopeus harrisi, and various species of gastropods. The crabs have been used in a series of PCB uptake studies, as well as in studies of respiration as affected by hydrogen sulfide and low oxygen tension.

Several macrozooplankters are maintained at the Laboratory at all times. These include Gammarus daiberi, B. tigrinus, G. fasciatus, Neomysis americana, and the larvae of Chaoborus punctipennis. The three species of Gammarus have been maintained for more than four years in aquarium culture, and in incubators at a variety of different temperatures.

Morone saxatilis, Cyprinus carpio, Fundulus heteroclitus, and Microgadus tomcod are examples of fishes and fish larvae which have been raised and maintained in our laboratory facility. Striped bass and tomcod have been spawned and raised in NYU facilities each year since 1975. These laboratory-raised organisms have been used successfully in studies of temperature tolerance, chlorine toxicity, behaviour, and growth.

The following references provide examples of studies conducted by the

NYU staff using organisms produced at, or maintained in, NYU culture facilities:

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Eichorn, K.L., 1977. The response of striped bass (Morone saxatilis) to heated and chlorinated power plant effluent. M.S. Thesis, Biology Dept. New York University.

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Jinks, S.M., 1975. An investigation of the factors influencing radiocesium concentrations of fish inhabiting natural aquatic systems. Ph. D. Diss. Biology Dept., New York University.

Paschoa, A.S., 1975. The natural radiation dose from radium to Gammarus in the Hudson River. Ph.D. Diss. Sch. Eng. and Science, New York University.

Poje, G.V., 1977. Growth and reproduction of Gammarus tigrinus Sexton, 1939. M.S. Thesis., Biology Dept. New York University.

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Ginn, T.C., W. Waller, and G.J. Lauer., 1974. The effects of power plant condenser cooling water entrainment on the amphipod Gammarus spp. Water Res. 8:937-945.

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O'Connor, J.M. and S. Schaffer. 1977. Survival of striped bass ichthyoplankton in nets. Ches. Sci., 18:312-315.

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Rachlin, J., A.P. Beck and J.M. O'Connor. 1978. Karyotypic analysis of Hudson River striped bass (Morone saxatilis). Copeia, 1978: in press.

Zubarik, L.S. and J.M. O'Connor. 1978. A radioisotopic study of mercury uptake by Hudson River biota. In: Thorp, J. and J.W. Gibbons (eds.). Energy and environmental stress in aquatic systems. Symposium of the Savannah River Ecology Laboratory, 1977.

3. PUBLICATIONS IN REVIEW

Ginn, T.C. and J.M. O'Connor. The distribution of Gammarus daiberi in the Hudson River estuary with a note on a range extension for the species. Crustaceana...

O'Connor, J.M., K.L. Eichorn and T.C. Ginn. Behavioral response of larval and juvenile striped bass to heated and chlorinated power plant effluents. Estuaries...

O'Connor, J.M., G. Poje and S. Rigdon. Respiration of larval forms of the striped bass (Morone saxatilis) following short-term exposure to elevated temperatures. Exp. Mar. Biol. Ecol...

4. PRESENTATIONS

- Ginn, T.C., K.L. Eichorn and J.M. O'Connor. 1976. Response of the striped bass Morone saxatilis and the amphipod Gammarus to chlorinated power plant effluent. Northeast Fish and Wildlife Conference. April 26-29, Hersey, Pennsylvania.
- O'Connor, J.M., C.C. Coutant and J.P. Lawler. 1977. Environmental impact assessment as ecological research. Symposium on Energy and Environmental Stress in Aquatic Systems. Augusta, Georgia, November, 1977.
- Poje, G.V., T.C. Ginn and J.M. O'Connor. 1977. Use of a condenser tube simulator for evaluating power plant entrainment effects. Northeast Fish and Wildlife Conference, Boston, Massachusetts. April 3-6, 1977.
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- Poje, G.V. and J.M. O'Connor. 1976. Gammarus tigrinus: an estuarine predatory carnivore. Presented to the Atlantic Estuarine Research Society, May, 1976.
- Zubarik, L.S. and J.M. O'Connor. 1977. A radioisotopic study of mercury uptake by Hudson River biota. Symposium on Energy and Environmental Stress in Aquatic Systems, Augusta, Georgia, November, 1977.

CURRICULUM VITAE

January 1978

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Assistant Professor
Laboratory for Environmental Studies

Education: 1962 - B.S. in Zoology
Colorado State University

1969 - Doctor of Philosophy in
Marine Science
University of Miami (Florida)

Positions Held: New York University Medical Center
Department of Environmental Medicine
1975 - Present

Course Offering: Aquatic and Estuarine Microbiology
(Department of Environmental
Medicine and Department of
Biology)

University of Miami (Florida)
Rosenstiel School of Marine and
Atmospheric Science, 1969-1975

Research Scientist, Functional
Biology 1969 - 1973

Research Assistant Professor
Biology and Living Resources
1973 - 1975

Positions Held:

University of Miami (Florida)
Institute of Marine Science
1962 - 1969

NDEA Fellow, Marine Biology
1962 - 1965

Graduate Assistant
1965 - 1967

Senior Field Biologist
McMurdo Sound, Antarctica
1967 - 1968

Senior Field Biologist
First International Weddell Sea
Oceanographic Expedition
1968 - 1969

Colorado State University
Department of Botany and Plant Pathology
1958 - 1962

Research Assistant, 1958 - 1962

Professional Societies:

American Association for the
Advancement of Science

American Society of Limnology
and Oceanography

Research Interests:

Microbiology
Algal and Protozoan Physiology and
Ecology
Biochemistry of Organic Matter in
Aquatic Sediments

Awards and Grants:

Achievement Award in Biological Science
Colorado State University, 1962

National Defense and Educational Act
Predoctoral Fellowship, 1962 - 1965

National Science Foundation Grant
University of Miami, \$44,000
1973 - 1975

National Science Foundation Grant
New York University Medical Center,
\$3,900
1976

PUBLICATIONS

C. C. LEE

1. Meyers, S. P., W. A. Feder and King Tsue. Nutritional relationships among certain filamentous fungi and a marine nematode. Science, 141, 520-522 (1963).
2. Meyers, S. P., W. A. Feder and King Tsue. Studies of relationships among nematodes and filamentous fungi in the marine environment. Dev. Indus. Microbiol., 5, 354-364 (1964).
3. Altman, J. and King Tsue. Changes in plant growth with chemicals used as soil fumigants. Plant Disease Reporter, 49, 600-602 (1965).
4. Bunt, J. S. and C. C. Lee. Observations within and beneath antarctic sea ice in McMurdo Sound and the Weddell Sea. Methods and Data. IMAS Special Publ., Univ. of Miami, 69-1 (1969).
5. Bunt, J. S. and C. C. Lee. Seasonal primary production within and beneath antarctic sea ice. J. Mar. Res., 28(3), 304-320 (1970).
6. Bunt, J. S., K. E. Cooksey, M. Heeb, C. C. Lee and B. F. Taylor. Algal nitrogen fixation in the marine subtropics: Assay by acetylene reduction. Nature, 227, 1163 (1970).
7. Corcoran, E. F. and C. C. Lee. The distribution of chlorinated hydrocarbon pesticides in the Mississippi River Delta and the adjacent Gulf of Mexico. Joint Southeast and Southwest ACS Meeting, New Orleans (Abst.). Dec. 2-4, 1970. p. 88.
8. Taylor, D. L. and C. C. Lee. A new Cryptomonad from Antarctica: Cryptomonas cryophila sp. Nov. Archiv fur Mikrobiol., 75, 269-280 (1971).
9. Bunt, J. S., C. C. Lee and E. L. Lee. Primary productivity and related data from tropical and subtropical marine sediments. Mar. Biol., 16, 28-36 (1972).
10. Bunt, J. S. and C. C. Lee. Data on the composition and dark survival of four marine microalgae. Limnology and Oceanogr., 17, 458-461 (1972).
11. Fenchel, T. and C. C. Lee. Studies on ciliates associated with sea ice from Antarctica. I. The nature of the fauna. Archiv fur Protistenk., 114, 231-236 (1972).
12. C. C. Lee and T. Fenchel. Studies on ciliates associated with sea ice from Antarctica. II. Temperature responses and tolerances in comparison with ciliates from temperate and tropical habitats. Archiv fur Protistenk., 114, 237-244 (1972).

PUBLICATIONS CONT'D.

13. Bunt, J. S., C. C. Lee and M. A. Heeb. The site off Freeport intended for Hydro-Lab. Hydro Lab J., 1:3-6 (1972).
14. Bunt, J. S., C. C. Lee. An exploratory study of benthic primary production. Hydro Lab J., 1:7-10 (1972).
15. Taylor, B. F., C. C. Lee and J. S. Bunt. Nitrogen-fixation associated with the blue-green alga, Trichodesmium, as measured by the acetylene-reduction technique. Archiv fur Mikrobiologie, 88:205-212 (1973).
16. C. C. Lee, E. L. Lee and J. S. Bunt. Distribution of biomass in a coral reef transect. In: Results of the Tektite Program, coral reef invertebrates and plants (Sylvia Earle and Robert Lavenberg, editors), Natural History Museum, Los Angeles County, Science Bull., 20:69-75 (1975).

CURRICULUM VITAE

July 1977

Theodore J. Kneip

Date and Place of Birth: December 20, 1926 - St. Paul, Minnesota

Marital Status: Married, Six children

Residence: 162 E. Fairmount Avenue
Maywood, New Jersey 07607

Professional Address: New York University Medical Center
Institute of Environmental Medicine
550 First Avenue
New York, New York 10016
Telephone: (212) 679-3200, Ext. 5232

Title: Research Professor,
Deputy Director
Laboratory for Environmental Studies

Education: 1950 - B. of Chemistry (with
distinction) University of Minnesota

1952 - Master of Science
University of Illinois

1954 - Doctor of Philosophy
University of Illinois

Positions Held: New York University Medical Center
Department of Environmental Medicine
1967 - present

Senior Research Scientist
1967 - 1975

Adjunct Associate Professor
1969-1971

Adjunct Professor
1971-1975

Research Professor
1975 -

Acting Director, Laboratory for
Environmental Studies
1968-1970

Deputy Director, Laboratory for
Environmental Studies
1970-present

Curriculum Vitae
Page 2

Course Offerings:
(Department of Environmental
Medicine)

Analytical Chemistry of Environmental
Contaminants.

Radiochemistry.

Positions Held:
(continued)

Mallinckrodt Chemical Works
St. Louis, Missouri
1954-1966

Research Chemist, Uranium Division
1954-1957

Group Leader, Uranium Division
1957-1959

Head, Analytical Research Laboratory
1959-1961

Asst. Manager, Analytical Laboratory,
1961-1963 Uranium Division

Manager, Laboratory Products Research
1963-1966

Honor Societies:

Phi Lambda Upsilon, 1950
Sigma Xi, 1954

Professional Societies:

American Chemical Society
American Association for the
Advancement of Science
American Public Health Association
American Industrial Hygiene
Association
Air Pollution Control Association
American Conference of Governmental
Industrial Hygienists

The New York Academy of Sciences

Vice Chair - Environmental Sciences
Section - 1976

Chair - Environmental Sciences
Section - 1977 - 78

Elected Fellow - 1977

Committees:

Chairman of Subcommittee # 6
Metals 1, Intersociety Committee
on Manual of Methods for Ambient
Air Sampling and Analysis
1971-1977 -
Member 1971-present

Member of International Meeting on
Effects and Dose-Response Relationships
of Toxic Metals, Tokyo, November 18-23,
1974.
Organized by: The Subcommittee on
Toxicology of Metals of the Permanent
Commission and International Association
on Occupational Health.

Member of American Society for Testing
and Materials Committee D-22:
Methods of Sampling and Analysis
of Atmospheres,
Subcommittees D-22.04, 1973-Present.
D-22.09, 1975-Present.

New York State - Governor's ad hoc
committee on PCB's, 1975.

Secretariat, International Standards
Organization/Technical Committee 146
(Air Quality)/Working Group 3 -
Nitrogen Compounds, 1975-1976.

Secretariat, International Standards
Organization/Technical Committee 146
(Air Quality)/Subcommittee 2 -
Workplace Atmospheres, 1976-present.

Consulting:

Various corporate organizations
including Consolidated Edison,
RSR Corporation, Equitable Environmental
Health.

United States Department of Commerce,
National Oceanic and Atmospheric
Administration,
Marine Ecosystems Analysis Project,
New York Bight Contaminants Panel.

Cornell University, New York State
College of Agriculture and Life Sciences
and New York State College of Human
Ecology, Cooperative Extension,
New York City Urban Gardening Program.

List of Published Works:

1. Laitinen, H. A. and T. J. Kneip. "Polarographic and Coulometric Study of p-Dimethylaminobenzene," Journal of the American Chemical Society, 78:736-740 (1956).
2. King, P., E. Bretz and T. J. Kneip. "Determination of Iodine in Mineral Premixes," Analytical Chemistry, 34:565-567 (1962).
3. Kneip, T. J., T. H. Beasley, P. King and W. K. Dean. "Programmed Temperature Gas Chromatography with Dual Electron Capture Detector for Pesticide Residue Analysis," Analytical Chemistry, 39:1510-1512 (1967).
4. Cohen, N. and T. J. Kneip. "A Method for the Analysis of ^{210}Pb in Urine of Uranium Miners," Journal Health Physics, 17:125-130 (1969).
5. Strehlow, C. D. and T. J. Kneip. "The Distribution of Lead and Zinc in the Human Skeleton," Journal American Industrial Hygiene Association, 30:372-378 (1969).
6. Kneip, T. J., G. P. Howells and M. E. Wrenn. "Trace Metals, Radionuclides and Pesticides in the Hudson River," Symposium on Hudson River Ecology, October 1969, Proceedings of the Symposium, New York State Department of Environmental Conservation, Albany, New York.
7. Furtado, V. C., T. J. Kneip and M. Eisenbud. "Measurement of Low Levels of ^{131}I in Reactor Atmospheres," Nuclear Applications and Technology, 9:268-273 (1970).
8. Kneip, T. J., M. Eisenbud, C. D. Strehlow and P. C. Freudenthal. "Airborne Particulates in New York City," Journal Air Pollution Control Association, 20:144-149 (1970).
9. Howells, G. P., T. J. Kneip and M. Eisenbud. "Water Quality in Industrial Areas: Profile of a River," Environmental Science and Technology, 4:26-35 (1970).
10. Kneip, T. J. "Atomic Absorption Spectrophotometry," AIHA Conference on Advances in Instrumental Method of Analyses, Environmental Trace Substances Center, University of Missouri, Columbia, Missouri (May, 1970).

11. Laurer, G. R., T. J. Kneip, R. E. Albert and F. S. Kent. "In Situ Determination of Lead on Painted Surfaces for the Prevention of Childhood Lead Poisoning," Proceedings of the Third Symposium on Low Energy X- and Gamma Ray Sources and Applications, Boston, Gordon and Breach Science Publishers, New York, pp. 289-301 (1971).
12. Lentsch, J. W., M. E. Wrenn, T. J. Kneip and M. Eisenbud. "Manmade Radionuclides in the Hudson River Estuary," Proc. 5th Annual Midyear Topical Symposium, Health Physics Society, Idaho Falls, Idaho, p. 499 (1970).
13. Howells, G. P., M. Eisenbud and T. J. Kneip. "Ecology of the Estuary of the Lower Hudson River," Proc. FAO Tech. Conf. on Marine Pollution and its Effects on Living Resources and Fishing, Publ. FIR:MP/70/E-20, Food and Agriculture Organization of the United Nations, New York (1970).
14. Kneip, T. J. "Concentration Factors, Environmental Complexity and the Analytical Chemist," American Chemical Society, Analytical Division--National Bureau of Standards Summer Symposium: Key to Progress in National Problem Areas, Washington, D. C. June 1971, Proceedings of the Symposium
15. Kneip, T. J., G. P. Howells and M. E. Wrenn. "Trace Elements, Radionuclides and Pesticide Residues in the Hudson River," Proc. FAO Tech. Conf. on Marine Pollution and its Effects on Living Resources and Fishing, Publ. FIR:MP/70/E-20, Food and Agriculture Organization of the United Nations, New York (1970).
16. Laurer, G. R., T. J. Kneip, R. E. Albert and F. S. Kent. "X-ray Fluorescence: Detection of Lead in Wall Paint," Science, 172: 466-468 (1971).
17. Kneip, T. J., N. Cohen, D. H. Goldstein and E. A. S. Muchmore, "Experimental Studies of Lead Toxicity in Trace Substances in Environmental Health - V," Proceedings of University of Missouri's 5th Annual Conference on Trace Substances in Environmental Health (ed. by D. D. Hemphill), pp. 349-361, (June 1971).
18. Eisenbud, M. and T. J. Kneip. "Trace Metals in the Atmosphere," Tech. Paper #16, New York State Department of Environmental Conservation, Environmental Quality Research and Development Unit (July, 1971).
19. Lentsch, J. W., T. J. Kneip, M. E. Wrenn, G. P. Howells and M. Eisenbud. "Stable Manganese and Manganese-54 Distributions in The Physical and Biological Components of the Hudson River Estuary," Proc. Third National Symposium on Radioecology, Oak Ridge (1971).

20. Kneip, T. J. "Sampling and Analytical Problems in a Complex Natural System: The Hudson River Estuary," American Laboratory 3:47-52 (1971).
21. Cohen, N., T. J. Kneip, D. Goldstein and E.A.S. Muchmore, "The Juvenile Baboon as a Model for Studies of Lead Poisoning in Children," Journal of Medical Primatology 1: 142-155 (1972).
22. Kneip, T. J. and G. R. Laurer. "Isotope Excited X-ray Fluorescence," Analytical Chemistry, 44:57A-66A (1972).
23. Laurer, G., M. Eisenbud, R. E. Albert, T. J. Kneip and N. Nelson. "New York City Health Research Council X-ray Fluorescence Analyzer for Lead," Isotopes and Radiation Technology 9:275-277 (1972).
- *24. Kneip, T. J., et al., "Tentative Method of Analysis for Inorganic Lead Content of the Atmosphere," Health Laboratory Science 9(1):79-83 (1972).
25. Laurer, G. R., R. E. Albert, T. J. Kneip, B. Pasternack, C. Strehlow, N. Nelson and F. S. Kent, "The Distribution of Lead Paint in New York City Tenement Buildings," AJPH 63: 163-168 (1973).
26. Kneip, T. J. and G. J. Lauer. "Trace Metal Concentration Factors in Aquatic Ecosystems," in Vol. 5, Progress in Analytical Chemistry, Plenum Press, New York, New York (1973).
27. Ahuja, S., E. M. Cohen, T. J. Kneip, J. L. Lambert, G. Ziweig, eds. Chemical Analysis of the Environment and Other Modern Techniques, Plenum Press, New York, New York (1973).
28. Kleinman, M. T., T. J. Kneip and M. Eisenbud, "Meteorological Influences on Airborne Trace Metals and Suspended Particulates," Proceedings, 7th Annual Conference on Trace Substances in Environmental Health, University of Missouri, Columbia, Missouri, June 12-14 (1973).
- *29. Kneip, T. J., et al., "Tentative Method of Analysis for Cadmium Content of Atmospheric Particulate Matter," Health Laboratory Science 10(3):214-217 (1973).
- *30. Kneip, T. J., et al., "Tentative Method of Analysis for Molybdenum Content of Atmospheric Particulate Matter by Atomic Absorption Spectrophotometry," Health Laboratory Science 10(3):218-220 (1973).
- *Reprinted in Methods of Air Sampling and Analysis, Second edition, Katz, M., ed. American Public Health Association, Washington, D.C. (1977).

- *31. Kneip, T. J., et al., "Tentative Method of Analysis for Nickel Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 10(3):221-225 (1973).
- *32. Kneip, T. J., et al., "Tentative Method of Analysis for Copper Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 10(3):226-230 (1973).
- *33. Kneip, T. J., et al., "Tentative Method of Analysis for Chromium Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 10(4):358-361 (1973).
- 34. Kneip, T. J., G. P. Howells, M. E. Wrenn, "Trace Elements, Radionuclides and Pesticide Residues in the Hudson River," In: Marine Pollution and Sea Life. Fishing News (Books) Ltd., Surrey, England, p. 169 (1973). (Reprinted from Ref. 15)
- 35. Kneip, T. J., M. T. Kleinman and M. Eisenbud, "Relative Contributions of Emission Sources to the Total Airborne Particulates in New York City," Proceedings, Third International Clean Air Congress, October 8-12, 1973 (1974).
- 36. Cohen, N., T. J. Kneip, V. Rulon and D. Goldstein, "Biological and Toxicological Response of Infant Baboons to Lead Driers in Paint," Env. Hlth. Perspectives, Experimental Issue #7, DHEW Pub. # NIH 74-218, U.S. Gov't Printing Office, Washington, D.C., p. 161 (1974).
- 37. Kneip, T. J., N. Cohen and V. Rulon, "Potential Sources of Analytical Error in the Erythrocytic δ -Aminolevulinic Acid Dehydratase Test for Lead Exposure," Analytical Chemistry, 46:1863-1866, (1974).
- 38. Bernstein, D. M., T. J. Kneip, M. T. Kleinman, R. Riddick and M. Eisenbud, "Uptake and Distribution of Airborne Trace Metals in Man," Proceedings of the 8th Annual Conference of Trace Substances in Environmental Health, University of Missouri, Columbia, Missouri, June (1974).
- 39. Kneip, T. J., G. Ré and T. Hernandez, "Cadmium in an Aquatic Ecosystem: Distribution and Effects," Trace Substances in Environmental Health - VIII, 1974. A Symposium. D. D. Hemphill, ed., University of Missouri, Columbia (1974).

40. Bondietti, E. A., F. H. Sweeton, T. Tamura, R. M. Perhac, L. D. Nulett, and T. J. Kneip, "Characterization of Cadmium and Nickel Contaminated Sediments from Foundry Cove, New York," In: Proceedings of the First Annual NSF-RANN Trace Contaminants Conference, Oak Ridge, Tennessee, August, 1973, pp. 211-224. CONF-730802, ORNL, Oak Ridge, Tennessee (1974).
- *41. Kneip, T. J., et al., "Tentative Method of Analysis for Cadmium Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 11(2):112-116 (1974).
- *42. Kneip, T. J., et al., "Tentative Method of Analysis for Iron Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 11(2): 118-121 (1974).
- *43. Kneip, T. J., et al., "Tentative Method of Analysis for Lead Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 11(2): 122-127 (1974).
- *44. Kneip, T. J., et al., "Tentative Method of Analysis for Manganese Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 11(2):128-133 (1974).
- *45. Kneip, T. J., et al., "Tentative Method of Analysis for Zinc Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 11(2): 134-139 (1974).
- *46. Kneip, T. J., et al., "Tentative Method of Analysis for Vanadium Content of Atmospheric Particulate Matter by Atomic Absorption Spectroscopy," Health Laboratory Science 11(3):240-245 (1974).
- *47. Kneip, T. J., et al. Tentative Method of Analysis for Elemental Mercury in Ambient Air by Collection on Silver Wool and Atomic Absorption Spectroscopy," Health Laboratory Science 11(4):342-346 (1974).

- *48. Kneip, T. J., M. Eisenbud, M. T. Kleinman and D. M. Bernstein, "Studies of Trace Substances in an Urban Atmosphere," Proceedings of the International Symposium of Recent Advances in the Assessment of the Health Effects of Environmental Pollution, Paris, June 24-28, 1974 (1975).
- *49. Goldstein, D. H., T. J. Kneip, V. Rulon and N. Cohen, "Erythrocytic δ -Aminolevulinic Acid Dehydratase (δ -ALAD) Activity as a Biological Parameter for Determining Exposures to Lead," Journal of Occupational Medicine, 17:157-162 (1975).
50. Kneip, T. J., "Potential Applications of X-ray Analytical Method in Paint Analysis," Journal of Paint Technology, 47:71-76 (1975).
51. Kneip, T. J., T. Hernandez and Gary Ré, "Cadmium in an Aquatic Ecosystem: Transport and Distribution," In: Trace Contaminants in the Environment," Proceedings of the Second Annual NSF-RANN Trace Contaminants Conference, Asilomar, Pacific Grove, California, 29-31 August, 1974 (1975).
52. Kneip, T. J., et al., "Tentative Method of Analysis for Elemental Mercury in the Working Environment by Collection on Silver Wool and Atomic Absorption Spectroscopy," Health Laboratory Science 12(2):158-162 (1975).
53. Kneip, T. J., et al., "Lead in Blood and Urine," Health Laboratory Science 12(4):375-378 (1975).
54. Kneip, T. J., et al., "Mercury in Urine," Health Laboratory Science 12(4):379-382 (1975).
55. Kneip, T. J., et al., "General Atomic Absorption Procedure FOR Trace Metals in Airborne Material Collected on Membrane Filters," Health Laboratory Science 12(4):383-393 (1975).
56. Kneip, T.J., N. Cohen, V. Rulon, David Goldstein and N. Nelson, "Factors Influencing Dose-Response Relationships for Toxic Metals," In: Effects and Dose-Response Relationships of Toxic Metals, G.F. Nordberg, ed., Associated Scientific Publishers, Amsterdam (1976).
57. Eisenbud, M., T. J. Kneip, M. T. Kleinman, D. M. Bernstein, "Trace Metals in Urban Aerosols," Final Report to Electric Power Research Institute, October, 1975. NTIS # Pb-248-324 (1976).

58. Bernstein, D. M., M. T. Kleinman, T. J. Kneip, T. L. Chan and M. Lippmann, "A High-Volume Sampler For the Determination of Particle Size Distributions in Ambient Air," Journal of the American Air Pollution Control Association 26(11), 1069-1072 (1976).
59. Kleinman, M. T., T. J. Kneip and M. Eisenbud, "Seasonal Patterns of Airborne Particulate Concentrations in New York City," Atmospheric Environment 10:9-11 (1976).
60. Kleinman, M. T., D. M. Bernstein and T. J. Kneip, "An Apparent Effect of the Oil Embargo on Total Suspended Particulate Matter and Vanadium of New York City Air," J. Air Poll. Con. Assoc. 27:65-67 (1977).
61. Kneip, T.J., R. Peter Mallon and Virginia P. Rulon, "The Effects of Anemia on Heme Synthesis Parameters During Lead Exposure," American Industrial Hygiene Association Journal 37, 578-585 (1977).
62. Kneip, T. J., et al., "Analytical Method for Antimony in Air and Urine," In: Methods of Air Sampling and Analysis, Second edition, Katz, M., ed. American Public Health Association, Washington, D. C., pp. 765-769 (1977).
63. Kneip, T. J., et al., "Analytical Method for Arsenic in Urine and Air," In: Methods of Air Sampling and Analysis, Second edition, Katz, M., ed. American Public Health Association, Washington, D. C., pp. 769-773 (1977).
64. Kneip, T. J., et al., "Analytical Method for Arsenic, Selenium and Antimony in Urine and Air by Hydride Generation and Atomic Absorption Spectroscopy," In: Methods of Air Sampling and Analysis, Second edition, Katz, M., ed. American Public Health Association, Washington, D. C., pp. 774-780 (1977).
65. Kneip, T. J., et al., "Analytical Method for Chromic Acid Mist in Air," In: Methods of Air Sampling and Analysis, Second edition, Katz, M., ed. American Public Health Association, Washington, D. C., pp. 785-788 (1977).
66. Kneip, T. J., et al., "Analytical Method for Lead in Air," In: Methods of Air Sampling and Analysis, Second edition, Katz, M., ed. American Public Health Association, Washington, D. C., pp. 808-818 (1977).
67. Hazen, R. E. and T. J. Kneip, "The Distribution of Cadmium in the Sediments of Foundry Cove," In: Hudson River Ecology, Proceeding of a Symposium, Hudson River Environmental Society, ed. March 28-30, 1976 (1977).

68. Kneip, T. J., M. T. Kleinman, R. Riddick and D. M. Bernstein, "Trace Elements in Human Tissues," Proceedings of the International Workshop on Biological Specimen Collections, April 18-22, 1977, Luxembourg, (In press, 1977).
69. Kneip, T. J., "Effects of Cadmium in an Aquatic Environment," In: Cadmium 77, Edited Proceedings First International Cadmium Conference, San Francisco, 31 Jan.-2 Feb., 1977. Metal Bulletin Limited, London, pp. 120-124, (1978).
70. Daisey, J. M., I. Hawryluk, T. J. Kneip and F. Mukai, "Mutagenic Activity in Organic Fractions of Airborne Particulate Matter," Presented at the Carbonaceous Particles in the Atmosphere Conference, March 20-24, 1978, Berkeley, California.
71. Kneip, T. J., M. A. Leyko, M. T. Kleinman, M. Lippmann and J. M. Daisey, "Organic Matter in New York City TSP: Comparisons of Seasonal Variations and Relationships to Source Tracers," Presented at the Carbonaceous Particles in the Atmosphere Conference, March 20-24, 1978, Berkeley, California.
72. Lioy, P. J., G. T. Wolff and T. J. Kneip, "Toxic Airborne Elements in the New York Metropolitan Area," J. Air Poll. Con. Assn., 28(5):510-512 (1978).
73. Leaderer, B. P., D. M. Bernstein, J. M. Daisey, M. T. Kleinman, T. J. Kneip, E. O. Knutson, M. Lippmann, P. J. Lioy, K. A. Rahn, D. Sinclair, R. L. Tanner, and G. T. Wolff, "Summary of the New York Summer Aerosol Study (NYSAS)," J. Air Poll. Con. Assn., 28(4):321-327 (1978).
74. Fennikoh, K. B., H. I. Hirshfield and T. J. Kneip, "Cadmium Toxicity in Planktonic Organisms of a Freshwater Web," Environ. Res. (In press, June, 1978).
75. Kneip, T. J. and M. T. Kleinman, "Sampling and Multielement Analysis of Ambient Aerosols," In: Special Environmental Report No. 10, Air Pollution Measurement Techniques, Proceedings of the WMO Air Pollution Measurement Techniques Conference (APOMET), Gothenburg, 11-15 October, 1976. World Meteorological Organization, Geneva, Switzerland (1977).
76. Laurer, G. R. and T. J. Kneip, "Portable X-ray Units for Analyzing Lead in Paint," In: A Report of the Committee on Environmental Improvement: Assessing the Problem of Lead-Based Paint Hazards, pp. 13-17, American Chemical Society, Washington, D.C. (August, 1978).

CURRICULUM VITAE

JOSEPH MARTIN O'CONNOR

PERSONAL

Born: November 19, 1944,
Boston, Massachusetts
Married: 2 children

EDUCATION

Bachelor of Science, Biology (Philosophy minor)
June, 1966
College of the Holy Cross
Worcester, Massachusetts

Doctor of Philosophy, Ecology/Physiology
November, 1971
State University of New York at Albany
Albany, New York

Dissertation Title:
Photoperiodic control of pituitary gonadotropin
release in trout (Salmo gairdneri Richardson
and Salvelinus fontinalis (Mitchell) and in the
leopard frog (Rana pipiens Shreber)

HONORS

Sigma Xi
Beta Beta Beta Biological Society
Student representative to Faculty Senate
State University of New York at Albany

AWARDS

R.E.S.A. (Sigma Xi) Research Grant-in-Aid
N.S.F. Pre-doctoral fellowship (Honorable)
Research Grant-in-Aid, Edmund Niles Hyuck Preserve
Fellowship, Research Foundation of New York State

SOCIETIES

New York Academy of Sciences
American Society of Limnology and Oceanography
Estuarine Research Federation
Atlantic Estuarine Research Society
AAAS
American Society of Natural History
Ecological Society of America
American Fisheries Society
Sigma Xi
Great Lakes Research Society

AFFILIATIONS

Florida Defenders of the Environment
Board of Consultants, Lawler, Matusky and Skelly
Engineers, Tappan, New York

EXPERIENCE

present Research Assistant Professor
Department of Environmental Medicine, and
Assistant Director
Laboratory for Environmental Studies
New York University Medical Center
Sterling Forest, Tuxedo, New York

1974-75 Senior Biologist
Office of Professional and Technological
Development
Lawler, Matusky and Skelly Engineers
415 Rt. 303, Tappan, New York

1973-74 Director
Biological Studies Section and
Laboratory Office of Research and Technology
Quirk, Lawler and Matusky Engineers and
QLM Laboratories, Inc.
Tappan, New York

1970-73 Research Associate
University of Maryland
Natural Resources Institute
Hallowing Point Field Station
Prince Frederick, Maryland

1967-70 Graduate Research Fellow
Dept. of Biological Sciences
State University of New York at Albany

1965-67
(summers) Faculty Research Assistant
University of Maryland
Natural Resources Institute
Chesapeake Biological Laboratory
Solomons, Maryland

PROFESSIONAL ACTIVITIES

Member, Advisory Committee
Chesapeake Bay R.A.N.N. Program of the National
Science Foundation
1971-1972

U.S. Dept. of Agriculture Graduate School
Programs in Aquatic Ecology and Pollution Biology

Counselor
Rockland County Guidance Center for Women
Guidance in Career Programs

Adjunct Assistant Professor
Inst. of Mar. and Atmos. Sciences
of the City University of New York

Advisor, Fisheries Biology U.S. Dept. of
Commerce
National Oceanic and Atmospheric Administration
New England Offshore Mining Environmental Study
1972-1974

Visiting Investigator
University of Delaware
College of Marine Studies
Bayside Laboratory
Lewes, Delaware
1972

RESEARCH
INTERESTS

Population dynamics
Community dynamics
Respiratory physiology of fishes
Reproductive physiology of fishes
Chemical-biological interrelationships in ecology
Ethology of fishes

TEACHING
INTERESTS

Physiological ecology
General physiology
General ecology
Pollution biology
Ichthyology

PUBLICATIONS

O'Connor, J.M. 1969. The effects of melatonin on in vitro ovulation of frog ovarian oocytes. Amer. Zool. 9:549.

O'Connor, J.M. and R.G. Stross. 1970. Photoperiodic control of the pituitary gonadotropin release pattenr of the frog, Rana pipiens Shreber. Abstr. Proc. N.E. Division Comp. Physiology section, Amer. Soc. Zool.

O'Connor, J.M. 1970. The effects of thermal shock on the tidal activity patterns of the hogchoker, Trinectes maculatus. Abstr. Amer. Society of Ichthyologists and Herpetologists, Ann. Mtg., New Orleans, La.

O'Connor, J.M. 1971. Photoperiodic control of the pituitary gonadotropin release patterns in the rainbow trout (Salmo gairdneri (Rich.)), the brook trout (Salvelinus fontinalis Mitchell) and in the leopard frog (Rana pipiens Shreber). Ph.D. Thesis. Library, State University of New York at Albany, and University Microfilms, Ann Arbor, Mich.

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O'Connor, J.M. 1972. Tidal rhythm in the activity patterns of the hogchoker, Trinectes maculatus (Bloch and Schneider). Exp. Mar. Biol. Ecol. 9:173-178.

Sherk, J.A., J.M. O'Connor and D.A. Neumann. 1972. The effects of suspended and deposited sediments on estuarine organisms. Univ. Md. N.R.I. ref. 72-9.

Sherk, J.A., J.M. O'Connor and D.A. Neumann. 1973. The effects of suspended and deposited sediments on estuarine organisms. Univ. Md. N.R.I. ref. no. 73-4.

O'Connor, J.M., R.W. Williams and J. Converse. 1974. Studies of fish impingement at the Nine Mile Point Nuclear Station, Lake Ontario. Abstr. 17th Conference on Great Lakes Research. Int'l Assn. for Great Lakes Research.

O'Connor, J.M. and J.A. Sherk. 1974. The responses of some estuarine organisms to concentrations of suspended solids. Proc. of the Seventh Dredging Seminar, Ctr. for Dredging Studies, Texas A&M University.

Sherk, J.A., J.M. O'Connor and D. Neumann. 1975. The effects of suspended sediments on estuarine environments. IN: L.E. Cronin (Ed.). Estuarine Research, Vol. II. Geology and Engineering, Academic Press, N.Y. pp. 541-557.

Neumann, D.A., J.M. O'Connor and J.A. Sherk. 1975. Respiratory and hematological responses of the oyster toadfish (Opsanus tau) to suspended sediments. Trans. Amer. Fish. Soc. 104:775-781.

Sherk, J.A. and J.M. O'Connor. 1976. Effects of sedimentation on coastal zone organisms. Proc. III Federal Inter-Agency Sedimentation Conference.

O'Connor, J.M. and S. Schaffer. 1977. Effects of sampling gear on striped bass ichthyoplankton. Chesapeake Science 18:312-315.

Sherk, J.A., J.M. O'Connor and D.A. Neumann. 1976. Effects of suspended solids on selected estuarine plankton. U.S. Army Corps of Engineers Coastal Engineering Research Center. Misc. Rept. 76-1. 50 pp. Jan. 1976.

O'Connor, J.M., D.A. Neumann, and J.A. Sherk, Jr. 1976. Lethal effects of suspended sediments on estuarine fish. Technical Paper No. 76-20, U.S. Army, Coastal Engineering Research Center, 38 pp.

O'Connor, J.M., D.A. Neumann, and J.A. Sherk. 1977. Sublethal effects of suspended sediments on estuarine fish. Technical Paper No. 77-3, U.S. Army, Coastal Engineering Research Center, 90 pp.

Rachlin, J., A.P. Beck, and J.M. O'Connor. 1978. Karyotypic analysis of Hudson River striped bass, Morone saxatilis (Walbaum). *Copeia* 1978(2):334-336.

Ginn, T.C. and J.M. O'Connor. 1978. Responses of the estuarine amphipod Gammarus daiberi to chlorinated power plant effluent. *Estuarine Coastal Mar. Sci.* 6:459-469.

Poje, G.V., T.C. Ginn, and J.M. O'Connor. 1978. An operational system for simulating the physical and chemical environment of the condenser tubes of a power plant. IN: Thorp, J. and J.W. Gibbons, eds. *Energy and Environmental Stress in Aquatic Systems* (in press).

Zubarik, L.S., and J.M. O'Connor. 1978. A radioisotopic study of mercury uptake by Hudson River biota. IN: Thorp, J. and J.W. Gibbons, eds. *Energy and Environmental Stress in Aquatic Systems* (in press).

O'Connor, J.M., C.C. Lee, and M. Eisenbud. Environmental Health. M.E.S.A. New York Bight Atlas Monograph 32 (in press).

Ginn, T.C., G.V. Poje, and J.M. O'Connor. 1978. Survival of planktonic organisms following passage through a simulated power plant condenser tube. *Proc. Fourth Nat'l Workshop on Entrainment and Impingement.* pp. 91-101.

PUBLICATIONS IN REVIEW

O'Connor, J.M., D.A. Neumann and J.A. Sherk. The responses of estuarine fishes to highly turbid environments. *Water Res.*

O'Connor, J.M. and J.A. Sherk. The effects of suspended mineral solids on the white perch, Morone americana. *Trans. Amer. Fish. Soc.*

O'Connor, J.M. and J.A. Mihursky. The effects of thermal shock on the activity patterns of the hogchoker, Trinectes maculatus. *Ches. Sci.*

MANUSCRIPTS IN PREPARATION

Eichorn, K.L., T.C. Ginn and J.M. O'Connor. Response of striped bass (Morone saxatilis) to chlorinated cooling water.

O'Connor, J.M., G.V. Poje, and S. Rigdon. Respiration of striped bass (Morone saxatilis) eggs and larvae.

Becker, A.J. and J.M. O'Connor. Aerobic shutdown in the green crab (Carcinus maenas) in response to temperature, salinity and sulfide.

Steinhausler, F., S. Schaffer, N. Cohen, C. Lee, J. O'Connor and M. Wrenn. Effect of high LET radiation on intracellular ATP content of prokaryotic and eukaryotic algae.

Hendrick, E., J.M. O'Connor, and G.R. Laurer. A method for analysis of trace mineral content of fish otoliths using X-ray fluorescence spectroscopy.

PRESENTATIONS

O'Connor, J.M. 1969. The effects of melatonin on in vitro ovulation of ovarian oocytes in the frog, Rana pipiens. Amer. Soc. Zool.

O'Connor, J.M. and R.G. Stross. 1969. Photoperiodic control of the pattern of pituitary gonadotropin release in the frog Rana pipiens Shreber. Amer. Soc. Zool.

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O'Connor, J.M. and J.A. Sherk. 1971. The lethal effects of suspended solids on estuarine fishes. Joint Mtg. Atlantic Estuarine Research Society and the Estuarine Research Federation. Pleasantville, N.Y. October, 1971.

Neumann, D.A., J.M. O'Connor and J. Sherk. 1972. Studies of the respiration of the striped bass and the white perch exposed to suspended sediments. Atlantic Estuarine Research Soc. Ocean City, Md. April, 1972.

O'Connor, J.M., J.A. Sherk and D. Neumann. 1973. "Inert" mineral compounds as potential factors in mortality and toxin transport in estuarine organisms. E.P.A. Workshop on Chemical Pathogens in the Environment. Pensacola, Fla., May, 1973.

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O'Connor, J.M., and J.A. Sherk. 1974. The responses of some estuarine organisms to concentrations of suspended solids. Seventh Dredging Seminar. Sp. by the Center for Dredging Studies, Texas A&M University, New Orleans, La. November, 1974.

O'Connor, J.M., R. Williams and J. Converse. 1974. Impingement studies at the nine mile point nuclear power station, Lake Ontario. 17th Conference on Great Lakes Research, August, 1974. Hamilton, Ontario, Canada.

O'Connor, J.M., and S.G. O'Connor. 1975. Seasonal compartmentalization of primary productivity in the New York Bight, 1973-74. Am. Soc. of Limnology and Oceanography, Halifax, N.S., Canada, June, 1975.

O'Connor, J.M. 1976. Assessment of entrainment impact at the Indian Point Nuclear Station. Third National Workshop on Entrainment and Impingement, New York City.

Poje, G.V. and J.M. O'Connor. 1976. Gammarus tigrinus: an estuarine predatory carnivore. Presented to the Atlantic Estuarine Research Society. May 1976.

Ginn, T.C., K.L. Eichorn and J.M. O'Connor. 1976. Response of the striped bass Morone saxatilis and the amphipod Gammarus to chlorinated power plant effluent. Northeast Fish and Wildlife Conference. April 26-29, Hershey, Pennsylvania.

Poje, G.V., T.C. Ginn and J.M. O'Connor. 1977. Use of a condenser tube simulator for evaluating power plant entrainment effects. Northeast Fish and Wildlife Conference, Boston, Massachusetts. April 3-6, 1977.

Poje, G.V., T.C. Ginn, and J.M. O'Connor. 1977. An operational system for simulating the physical and chemical environment of the condenser tubes of a power plant. Symposium on Energy and Environmental Stress in Aquatic Systems, Augusta, Georgia, November, 1977.

Zubarik, L.S., and J.M. O'Connor. 1977. A radioisotopic study of mercury uptake by Hudson River biota. Symposium on Energy and Environmental Stress in Aquatic Systems, Augusta, Georgia, November, 1977.

O'Connor, J.M., C.C. Coutant, and J.P. Lawler. 1977. Environmental impact assessment as ecological research. Symposium on Energy and Environmental Stress in Aquatic Systems, Augusta, Georgia, November, 1977.

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