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Radiation Safety

Manual

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Centers for Disease Control

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Radiation Safety Manual

This manual was prepared for the Centers for Disease Control, Office of Biosafety by Christie R. Eheman, Chronic Disease Division, Center for Environmental Health and the other members of the Radiation Safety Committee.

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Preface

These radiation safety guidelines are for Centers for Disease Control researchers who use radioactive material licensed by the Nuclear Regulatory Commission. Applicable regulations are incorporated in this manual, along with procedures for handling radioactive material. The manual is not a textbook and users are expected to have technical knowledge of radiation and some experience in handling radioactive materials.

The safety requirements provided are are not exhaustive, and radioisotope users must also comply with any additional procedures promulgated by the Office of Biosafety.

Emergency Telephone Numbers

Clifton Road and Chamblee--Ambulance, Fire, Police, 9-911

Lawrenceville--Fire/Ambulance, 963-0123/963-8154; Police, 962-1900

Employee Health Services Clinic

Bldg. 4, Rm. 121 (8:00 a.m. - 4:30 p.m.)

(404) 329-3385 Commercial, 236-3385 FTS

CDC Office of Biosafety

To report an emergency, (404) 329-3883 Commercial, 236-3883 FTS

After working hours, 329-2888

Emergency; Medical Service (EMS)

Clifton Road: During regular working hours, the Clinic should be called (ext. 3385) for any emergency treatment. If the Clinic is unable to respond, the employee's supervisor should contact the EMS directly. If EMS assistance is requested at the Clifton Road facility during working hours, the person requesting this service MUST also immediately lnotify the Office of Biosafety (OBS), ext. 3883. OBS personnel will meet the EMS team in the lobby and escort the team to the person in need of emergency medical care. During nonduty hours, the person requwsting EMS assistance MUST meet the team at a predetermined location and provide escort and access to controlled areas.

Chamblee and Lawrenceville: The person requesting EMS assitance MUST meet the team at a predetermined location and provide escort and access to controlled areas.

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I. ACCIDENTS

When an accident involving radiation occurs, address the greatest hazard first: lifesaving measures always take precedence above decontamination or other radiological concerns. Advise personnel working nearby of any hazard or accident as soon as possible, and prevent them from entering the hazardous area. Always notify the Office of Biosafety (OBS) when an accident occurs.

A. Explosion

1. If an explosion occurs, assume that the entire laboratory is contaminated.

2. Perform any possible lifesaving measures that are needed

3. Call the OBS immediately, or have someone call for you. Inform that Office of any injuries among laboratory personnel, particularly life-threatening conditions.

4. Turn on all fume hoods, and turn off other ventilation.

5. Evacuate the area of the explosion. Remove and leave behind your gloves, shoes and laboratory coats.

6. Take care to prevent the spread of contamination to other areas. If at all possible, do not touch objects or other persons before being checked for contamination.

7. Wash your hands and arms thoroughly with soap or an appropriate cleaning agent for the chemical compound being used. Scrub your hands for at least 3 minutes, and rinse them thoroughly.

8. If you or other personnel have superficial wounds, flush the wounds with water and cover them with clean, sterile material (something that was packaged airtight and is not contaminated).

9. Do not attempt cleanup without the supervision of a representative from the OBS

B. Fire

1. Try to extinguish the fire without risking the safety of personnel.

2. Call the fire department from a safe place.

3. Call the OBS from a safe place

4. Avoid spreading the contamination.

C. Large Spill or Spill Outside of a Hood

1. Cover the spill with absorbent material as quickly and as completely as possible to prevent spreading. Wipe inward toward the center of the spill to localize the contamination. Do not wipe back and forth or in a random fashion.

2. If toxic or radioactive fumes are generated outside the hood:
   a. Turn on all fume hoods and turn off other ventilation.
   b. Take off your gloves, shoes and laboratory coat and leave the area.
   c. Call the OBS immediately, or have someone who is uncontaminated do so.
   d. Take care to prevent the spread of contamination to other areas. If at all possible do not touch objects or people before being checked for contamination.

3. If toxic fumes are not in the room air:
   a. Remain in the laboratory.
   b. Call the OBS immediately, or have someone who is uncontaminated do so.
   c. Remove your gloves and laboratory coat, and segregate them as radioactive waste in the laboratory.

d. Wash your hands and arms thoroughly with soap or an appropriate cleaning agent for the chemical compound being used. Scrub your hands for at least three minutes and rinse them thoroughly.

e. Put on fresh gloves and protective clothing before attempting further cleanup of the spill.

D. Small Spill Inside a Hood

1. Cover the spill with absorbent material as quickly and as completely as possible to prevent spreading.

2. Remove your gloves carefully and leave them inside the hood or in a radioactive waste container.

3. Wash your hands thoroughly with soap or an appropriate cleaning agent for the chemical compound being used. Scrub your hands for at least 3 minutes, and rinse them thoroughly.

4. Call the OBS.

5. Put on fresh gloves before attempting to clean up the spill with absorbent materials. Wipe inward toward the center of the spill to localize the contamination. Do not wipe back and forth or in a random fashion.

6. Try to restrict the contamination to as small an area as possible, preferably within the hood or in a radioactive waste container.

E. Contamination on the Floor

1. Do not walk through the contamination or spread the radioactive material by walking around.

2. Have someone who is not contaminated call the Office of Biosafey

3. If your shoes are contaminated, do not walk around the laboratory without removing them. Once your shoes are removed, do not reenter the spill area.

4. Put on fresh gloves before attempting to clean up the spill with absorbent materials. Wipe inward toward the center of the spill to localize the contamination. Do not wipe back and forth or in a random fashion.

F. Gamma Exposure

1. If gamma exposure is the only danger in an accident, evacuate the area immediately.

2. Call the OBS.

3. Confine all persons who may have been exposed to a safe area for medical examinations.

G. Spills with a Biological Agents

1. Cover the spill with absorbent material as quickly and as completely as possible to prevent spreading.

2. Soak the area with disinfectant or some other chemical to inactivate the agent.

3. Remove your gloves and laboratory coat, and segregate them as radioactive waste in the laboratory.

4. If the infectious agent remains a hazard:
   a. Leave the area.
   b. Wash your hands and arms thoroughly with soap or an appropriate disinfectant. Scrub your hands for at least 3 minutes, and rinse them thoroughly.
   c. Call the OBS to report the incident and to obtain further advice on decontamination and disinfection.

5. If the infectious agent is no longer a biological hazard:
   a. Wash your hands and arms thoroughly with soap or an appropriate disinfectant. Scrub your hands for at least 3 minutes and rinse them thoroughly.
   b. Put on fresh gloves and protective clothing before attempting further cleanup of the spill. Wipe inward toward the center of the spill to localize the contamination. Do not wipe back and forth or in a random fashion.

c. Call the OBS to report the incident.

6. Segregate all gloves, absorbent materials, and other potentially contaminated items as radioactive waste.

II. DECONTAMINATION

A. To prevent most skin contamination use gloves and wear a laboratory coat when working with radioactive materials.

B. If an accident does occur, wash your hands and forearms thoroughly with soap, a detergent, or another appropriate cleaning agent for the radioactive materials being used. Scrub for at least 3 minutes before rinsing thoroughly with water.

C. When cleaning up spills, wipe inward toward the center of the spill to localize the contamination. Do not wipe back and forth or in a random fashion.

D. Always notify the OBS about an accident or about potential contamination. If washing and soft scrubbing do not remove the contamination, the Radiation Safety Officer (RSO) should supervise any further decontamination.

E. If in doubt about how to clean up a spill, wait in a safe area for a representative of the OBS to arrive and provide instructions.

III. GENERAL EMERGENCY PROCEDURES

A. Laboratory Personnel

1. Personnel safety is the foremost consideration in any accident; however, try to limit the spread of any contamination.

2. Handle radioactive materials with the same care that your use when handling other toxic materials. Good laboratory practices will prevent or minimize most accidents.

3. All laboratory personnel must cooperate with any investigation of an accident.

4. If your discover that any radioactive material is missing or lost, contact the OBS at once.

5. Report immediately to the OBS any actual or suspected inhalation or ingestion of radioactive material .

6. Monitor cleanup procedures with a radiation survey instrument as soon as possible, preferably when cleanup begins.

B. The Office of Biosafety

The OBS will:

1. Investigate all accidents, spills, fires, or other radiological incidents.

2. Survey any area where a spill has occurred.

3. Monitor all personnel for contaminations if they:
   a. were in the laboratory at the time of a spill,
   b. enter the laboratory before the area has been decontaminated, or
   c. have contact with either of the above persons immediately after the incident.

Part II. RADIATION SAFETY PROGRAM

I. FEDERAL REGULATIONS

A. Licenses

The Centers for Disease Control (CDC) operates under two general licenses from the United States Nuclear Regulatory Commission (NRC). CDC must comply with the terms of each license to continue using any radioisotopes that are by-products of nuclear fission. Other radionuclides (e.g., natural radionuclides like radium) are not under

the control of NRC; however, NRC assumes the authority to review all radiation safety procedures in any laboratory that uses by-product materials. Therefore, the same safety standards are required for natural radionuclides such as radium, cyclotron produced isotopes, and x-ray equipment.

B. Standards

Standards for protection from radiation are published in NRC's Rules and Regulations, Title 10, Chapter 1, Code of Federal Regulations, part 19 titled "Notices, Instructions and Reports to Workers, Inspections" and Part 20 titled "Standards for Protection Against Radiation". They are referred to in this report as "10 CFR 19 (Appendix A), and 10 CFR 20 (Appendix B) respectively. Additional requirements are included in the licenses. Any CDC employee may refer to these standards and the current licenses, with their additional requirements, in the OBS.

II. PROGRAM OPERATIONS

A. ALARA

The Radiation Safety Program at CDC fully supports the concept that all radiation doses should be "as low as reasonably achievable" (ALARA). This implies that no dose is acceptable if it can be avoided and is without benefit. Any ALARA program depends on the cooperation of Authorized Users and other laboratory workers. It includes the

use of shielding, gloves, and tongs where possible to lower radiation exposure. The OBS will investigate any whole-body dose of 125 millirem (mrem) or more to any individual in any one quarter. If any worker receives a dose of 375 mrem or more per quarter, direct actions must be taken to lower any future doses. These actions may require a change in laboratory procedure or an increase in shielding used during current procedures.

An audit of radiological safety procedures and of the entire ALARA program will be conducted annually by the OBS. The program will be altered as necessary to promote safety and lower radiation exposure.

The OBS through the Radiation Safety Officer (RSO) and the Radiation Safety Committee (RSC) have the responsibility to plan and to arrange emergency medical care for victims contaminated with radioactive material or overexposed to radiation at CDC facilities in Metro Atlanta. Procedures for emergency care and a list of phone numbers and contacts shall be made available to all Authorized Users.

B. Office of Biosafety

The OBS ~~(OBS)~~ has overall responsibility for occupational safety and health at CDC, including the radiation safety program. The RSO , a member of the OBS staff, serves on the Radiation Safety Committee (RSC). Several other members of the OBS staff, including the Director, serve as ex-officio members of the Committee.

1) Radiation Safety Officer

The RSO is a professional health physicist who provides day-to-day management and oversight of the radiation safety program and assures compliance with policies formulated by the RSC and the Director, OBS. Duties of the RSO include:

a) Consultation with members of the RSC and users of radioactive materials on all matters relating to use of radionuclides.

b) Assures compliance with regulations of the Nuclear Regulatory Commission and the requirements of the CDC license to use radioactive materials.

c) Develops and implements procedures for: periodic radiological surveys of laboratories, monitoring of personnel, handling and disposal of radioactive wastes, ordering, receiving and distribution of radioactive materials.

d) Reviews and submits to the RSC for approval protocols for use of radioactive materials.

e) Approves requests to purchase radioactive materials.

f) Maintains records of procurement, personnel monitoring, accidents and/or incidents, inventories, and other documents required by the program.

g) Responds to all emergencies involving radioactive materials, providing expert advice and assistance as required to resolve problems.

h) Provides liaison between OBS and the Employee Health Servicers Clinic on all matters relating to employee exposure to radiation, monitoring results, etc.

2) Radiation Safety Committee

The RSC, as required by NRC regulations and the conditions of CDC's license to use by-products of nuclear fission, oversees all operations involving radioactive materials and advises the OBS on matters of radiological safety. Duties of the committee include:

a) Review and approve or reject protocols for use of radioisotopes.

b) Review and investigate radiation exposures, accidents and violations of NRC regulations or the policies contained in this manual.

c) Review qualifications and designate authorized users of radionuclides.

d) Evaluate adequacy of facilities in laboratories using or proposing to use radionuclides.

e) Review data or procedures concerning other aspects of the radiation safety program when requested to do so by the RSO.

f) Suspend authority to use radioactive materials in cases of violations of regulations or other serious deficiencies.

Members of the RSC are appointed by the Director, CDC, upon recommendations of the Director, OBS.

3) Director, Office of Biosafety

The Director has authority to act for the RSC and RSO at any time when necessary to control or prevent a radiological

incident, including ordering cessation of laboratory operations or withholding authority to purchase or use radioisotopes.

C. Authorized Users

Authorized users are responsible for the use of radioisotopes in their respective laboratories. Authorized users may order, possess, and use radioisotopes. They, in turn, are responsible for the safety of those who use radioisotopes under their supervision who use radioisotopes.

The Radiation Safety Committee and the RSO must approve the appointment of all authorized users. Approval by the Committee carries with it many responsibilities. Each Authorized User must be familiar with 10 CFR 19 (Appendix A) and 10 CFR 20 (Appendix B), safe radiological procedures, and all requirements of the OBS. Authorized Users have direct responsibility for all radioisotopes in their laboratory. Any delegation of work does not shift responsibility from the authorized user. They must provide adequate supervision to ensure the safety of all personnel using radioisotopes and any persons who work in the vicinity of the radioactive materials. Authorized Users are expected to fully support the OBS and its ALARA program.

The authorized user must:

1. Inform laboratory personnel about correct laboratory procedures when using radioisotopes, and provide enough supervision to see that these procedures are followed.

2. Instruct lab laboratory personnel in the proper use of thermoluminescent dosimeters (TLD's), and see that they are worn during any radiological procedures if required by OBS.

3. Keep complete and accurate records of all radioisotopes received, used, and disposed of, and supply the OBS with this information quarterly or when requested.

4. Have radioactive waste properly packaged and labeled for removal to a radioactive waste storage area.

5. Properly label and secure all radioactive materials from theft or accidental use.

6. Inform the OBS immediately of any spill, fire, explosion, or other accident; any suspected or known overexposure; cessation of work with radioisotopes; and termination of work of his or her work or that of any other laboratory personnel who work with radioisotopes.

7. Cooperate with the OBS when performing surveys, investigating an accident, collecting TLD's, or doing any other procedure required by regulation or by the Radiation Safety Program.

8. Maintain exposures as low as reasonably achievable (ALARA) through laboratory procedures, shielding, and the use of gloves and other protective clothing.

9. Make sure that a hood is used whenever unsealed radioisotopes are being used.

10. Never transfer any radioisotopes to another Authorized User or other personnel without the direct knowledge and consent of the RSO.

11. Conduct a physical inventory every 6 months of all radioisotopes. The OBS requires a signed statement from the Authorized User stating the location and quantity of each source.

When work with radioisotopes is terminated , the Authorized User must return to the OBS all radioactive material, personnel monitoring badges, and any other materials or equipment issued by that Office.

Every two years all Authorized Users must fill out a renewal form to continue using radioisotopes. If the he/she does not plan to use radioisotopes within the renewal period, the authorization should be allowed to lapse. A renewal can be requested when authorization is again required.

Authorized Users are responsible for the safety of guest investigators. The OBS must be informed of any guest investigator who wishes to use radioisotopes. The Office requires the guest to meet the same criteria as other users and will assign an appropriate monitoring badge which must be worn during all radiological procedures.

The OBS will provide an application form for those wishing to become Authorized Users. The form requires the following information:

1) the name of the authorized user and alternate(s) supervising use of radioisotopes;
2) the specific radioisotopes and maximum quantities;
3) the chemical and physical forms of the radioisotopes;
4) the list of those who will require personal monitoring (TLDs, bioassays);
5) protocols for each radioisotope, including a brief description of experimental procedures, how contamination will be controlled, and where the material will be stored;
6) the maximum quantity of material used in each process or experiment;
7) the training or experience of authorized user and alternate;
8) any monitoring instrumentation available in the laboratory;
9) disposal methods for each radioisotope;
10) any other information deemed necessary to insure the safe use of radioisotopes.

D. Laboratory Techniques

Although laboratory procedures vary for each radioisotope, the following techniques for handling radioactive materials are essential:

1. Confine radioactive materials to as small an area as possible at all times, especially during any mixing, measuring, or chemical processes.

2. Line hoods where unsealed radioactive materials are stored or used with absorbent paper with plastic backing. Change this paper frequently.

3. Do not pipette any radioactive solution by mouth.

4. Always use a hood when working with radioactive materials (excluding sealed sources).

5. Wear gloves when using radioisotopes in unsealed sources. These gloves must be composed of a material such as rubber that will prevent the radioisotopes from migrating through them to the skin.

6. Maintain ALARA exposures by:
   a. Using tongs and shielding where possible.
   b. Performing the experiment or the procedure as quickly and as efficiently as possible without increasing the probability of a spill or an accident.

c Using distance from radioisotopes to lower the dose (e.g., stepping away from sources while doing calculations or waiting for a reaction to finish).

7. Wear protective clothing such as a laboratory coat during any radiological procedure. If contamination is possible, do not wear this clothing outside the laboratory.

8. Keep the laboratory clean, with radioactive material and contaminated glassware clearly segregated from other materials and equipment.

9. Never smoke, eat, or drink in work areas where radioisotopes are being used.

10. Wash your hands thoroughly after using radioisotopes in unsealed sources.

11. Label all refrigerators used to store radioisotopes as containing radioisotopes (radioactive materials caution sign). Never use such refrigerators for storing food.

12. Label hoods used to store radioisotopes with the radioactive materials caution sign.

13. Label radiation waste containers with an appropriate sign, and store then in a secured area when unattended.

14. Assume that all equipment that comes in contact with radioactive materials is contaminated. Do not use such equipment for other purposes or release it for maintenance until it is shown to be uncontaminated.

E. Laboratory Supplies and Equipment

The following supplies and equipment are required in all laboratories where radioisotopes are used:

1. Fume Hood with minimum flow rate of 100 cubic feet per minute (cfm).

2. Shielding, transparent beta shield, lead bricks for gamma emitters.

3. Secure storage area.

4. Remote pipetting devices.

5. Absorbent paper with impervious backing.

6. Appropriate personnel monitoring badges.

7. Labels for doors, hoods, and glassware.

8. Waste containers.

9. Laboratory record book for maintaining inventories.

10. Copy of this manual.

F. Training

All personnel who work with radioisotopes receive written instruction on radiation safety, biological effects of radiation, regulatory requirements, and laboratory techniques. Before beginning work with radioisotopes, each employee must pass a test on this material and on points covered in the Radiation Safety Manual.

At least twice a year, CDC provides a Radiation Safety Course for laboratory personnel who use radioisotopes. Workers will attend the first class offered after they begin using radioisotopes. This course includes a discussion of all radiological hazards that workers may encounter, including spills or other incidents. In this course workers are informed of their rights and responsibilities as described in 10 CFR 19 (Appendix A).

All persons who frequent restricted areas, such as janitorial workers, secretarial staff, and security personnel receive instruction in accordance with 10 CFR 19.

Personnel using the Cobalt-60 (Co-60) gamma-cell irradiator must do so in the presence and under the supervision of those individuals listed in the license as authorized to use this source. Each worker using the Co-60 source must meet the requirements outlined above and must be specifically trained to use the gamma-cell irradiator in accordance with the CDC license requirements.

G. Procurement

1. Radioisotopes

Only authorized users may order radioisotopes. Each order must be sent through the OBS for approval BEFORE the material is ordered. The time required for approval will vary with the radioisotope and quantity ordered. The OBS will verify that the order does not violate NRC regulations and OBS rules and that the user is capable of handling the material safely.

Orders submitted for approval should describe:

a. why the material is needed;
b. who the Authorized User is;
c. where the material will be used and stored;
d. where the material should be delivered; and
e. what isotopes and how many of each are ordered.

If the order is approved, it is forwarded to the Procurement and Grants Office. If disapproved, a reason is given for the disapproval and the order form is returned.

If the material is for a new procedure or process, a complete explanation of how it will be used is required. The OBS may inspect the area where the material will be used and/or review the procedure to ensure that safety requirements are met.

2. Other Materials

The Radiation Safety Committee maintains control over certain items that are not by-product materials, such as natural radioisotopes, and x-ray equipment, and the same procurement procedures as stated above are followed for these items.

3. Receiving Radioactive Packages

All packages containing radioactive materials except commercial radioimmunoassay (RIA) kits must be channeled through the OBS for wipe testing to determine if external contamination exists or if the contents have leaked. Packages will be tested and the wipes monitored promptly (within 3 hours if received during business hours, or within 18 hours if received after 5 pm) so that the shipper can be notified of any contamination. After the package has been monitored, it is delivered to the Authorized User.

When the Health Physics Technician delivers a package containing radioactive materials, the Authorized User must sign for it and immediately enter the quantity, the isotope, and the source number in the laboratory log book. If the Authorized User is not available at the time of delivery, the package may be retained by the OBS.

If an Authorized User opens any radioactive package (including RIA kits) and discovers that the contents have been spilled or that the container has been broken or cracked, he/she must notify the OBS immediately. The package should be left undisturbed until the Health Physics Technician or the RSO arrives.

4. OBS Procedures for Opening Packages

   a. Read the radioactive label.

   b. Record quantities, date assayed, isotopes, and Authorized User's name in the log book.

   c. Assign a unique number to the source for that Authorized User, and prepare a label with that number for the radioactive source container.

d. Find out if the package is perishable and where it is to be delivered.

e. Visually inspect the package for damage or leaking.

f. Measure the exposure rate from hard beta and gamma sources.

g. Wipe-test the package for external contamination.

h. Open the outer package in a fume hood, and remove the shipping papers.

i. Visually inspect the packing material for changes in color or wetness.

j. Inspect the inner package for leakage and broken seals.

k. Ensure that outer package labels and inner labels correspond and that labels correspond with contents.

l. Wipe-test the inner package.

m. If no leakage is obvious, label the inner container with a source number label.

n. If the inner package is free from contamination, repack and deliver it to the authorized User, or store the package securely until delivery is possible. Refrigerate perishable packages.

5. Action Levels for Contamination

If a delivered package is found to have contamination at or above levels of 0.01 microcurie or 22,000 disintegrations per second (dps) per 100 square centimeter (sq cm), the OBS shall immediately notify the final carrier and the NRC.

If the external surface of any package has a radiation level at or above 200 mrem per hour, the OBS shall notify the NRC immediately.

H. Inventory and Records

1. Inventory

The OBS will keep a current inventory of all radioactive materials ordered, received and disposed of as waste. This inventory is required by NRC and must be as accurate and as up to date as possible. It shall be updated as new materials are ordered, received, and disposed of.

Authorized Users must keep an account of all radioactive materials received and a record of the disposal method used. This record must be updated as soon as the radioisotopes are received and used, not completed at some other date. Authorized Users will mail a copy of

the inventory to the OBS either once each quarter or whenever that Office requests a copy. The OBS will provide a form for this inventory report.

All quantities reported must include the assay date (date activity was determined). The date of assay is required so that the isotopes can be "decay corrected". By "decaying" the isotopes, the exact activity remaining at any date can be determined. The Authorized User may either use the date of assay on the original container if he/she does not wish to decay correct the material, or he/she may decay correct the material to the date of the inventory. In both cases, the date to which the activity was corrected (date of assay) must be included on the inventory for each isotope.

If the Office of Radiation Safety has assigned a source number has been assigned to the material, include this number on the inventory form.

Three inventory files are maintained in the OBS.

a. materials received;
b. current inventory of each Authorized User;
c. material shipped out as waste.

The importance of these inventories cannot be overemphasized. They are used to determine if the requirements of the NRC license have been

exceeded for any isotope and also if any Authorized User has more material than he/she is authorized to have. No more radioisotopes can be obtained until previous quantities have been accounted for.

2. Records

The OBS maintains the following records:

a. Calibration records and calibration curves for all radiation detectors.
b. Laboratory survey results in disintegrations per minute (dpm) per 100 sq cm
c. Leak-test results on sealed sources in microcuries of removable contamination.
d. Package wipe tests in dpm per 100 sq.
e. Dose records for all previous and current radiation workers.
f. Record of any incident, spill, or exposure requiring an investigation.
g. Any corrective actions taken after incidents, spills, or other exposures.
h. Any violations and corrective actions.
i. Any warning or disciplinary action within CDC.
j. Training records.
k. Physical inventory records submitted by Authorized Users.
l. Approved and renewed appointments of Authorized Users.
m. Results of any bioassays.

I. Personnel Monitoring

1. Dosimeters

Personal monitoring devices (dosimeters) are required for those workers who may receive 25% of the maximum dose of radiation permissible under NRC's regulations (Table 1). The OBS will also provide, at its discretion, dosimeters to persons who work directly with radioisotopes or who work in any laboratory where unsealed radioactive materials are used or stored.

The OBS may use radiation dosimeters to monitor levels of radiation in laboratories or other areas. Area monitors may also be used in laboratories where contamination has recurred.

Thermoluminescent dosimeters (TLD's) will be used for monitoring all gamma and high-energy beta-emitting radioisotopes. They will not be used for monitoring for tritium or carbon-14 exposure because they are insensitive to low-energy beta particles. Film dosimeters will be issued only to persons using x-ray equipment.

The OBS will obtain records of the employee' prior radiation exposures from previous employers. Any previous radiation exposure history not contained in thes records must also be reported to the OBS. If a worker is occupationally exposed to radiation somewhere

other than at CDC, the authorized user concerned must report this to the OBS so that an accurate record of the worker's total radiation exposure can be maintained.

Employees must wear a dosimeters during any radiological procedure and while working in any restricted area. While not being worn, dosimeters should be stored away from all radiation sources in a desk drawer or in some other location where they will not be exposed to excessive heat, sunlight, or moisture (for example, left not in a car). They are not to be worn during medical x-rays or off CDC premises. Individuals who do not work directly with radioisotopes or in a laboratory where radioisotopes are used will not be issued dosimeters.

Any dosimeter contaminated or exposed to heat, moisture, or medical x-rays should be returned to the OBS for replacement. After any accident or if an overexposure is suspected, the dosimeters should be returned immediately to the OBS to be read.

Employee's dosimeter should be worn on a shirt, coat pocket, lapel, or in some other position, between the waist and the shoulders that will be representative of his/her exposure. In instances where a whole body dose is not significant, but the hands will be exposed, a ring dosimeter will be issued to be worn on one hand during any radiological process. When both whole body and hand doses can occur, two dosimeters will be issued, one for the whole body and one for the hands.

Authorized Users must collect dosimeters for pickup by the Health Physics Technician and must distribute those provided to the appropriate laboratory personnel. Ring dosimeters will be counted monthly and whole body TLD's quarterly through the OBS. The OBS will keep a record of any dose received and will send each worker a copy of his/her exposure record quarterly, or as required by regulation.

2. Maximum Permissible Doses

Federal limits for radiation doses are provided in Table 1; however, all doses must be maintained ALARA (as low as reasonably achievable). The OBS will investigate any whole-body dose of 125 mrem or more per quarter to determine how the exposure was obtained and how future exposures can be avoided. If a whole-body dose of 375 mrem is received in one quarter, corrective action must be taken to lower any future exposures.

Table 1

Maximum Permissible Dose Equivalent in REM (mrem)

Organ	weekly	quarterly	annually
Total body, head and trunk, lens, gonads, blood-forming organs	0.1 (100)	1.25 (1,250)	5.0 (5,000)
Skin of whole body, thyroid	0.6 (600)	7.5 (7,500)	30.0 (30,000)
Hand, forearms, feet, ankles	1.5 (1,500)	18.75 18,750)	75.0 (75,000)

The maximum permissible dose for minors (persons under 18 years of age) is 10% of the doses shown in Table 1. In addition, exposure to pregnant women shall be controlled so that the fetus will not receive more than 0.5 rem (500 mrem) during the entire gestation period. The OBS shall be informed of any minors (those under 18) and of any pregnant employees who may be exposed to radiation. These persons must wear a TLD while working with radioisotopes. The OBS through the Radiation Safety Committee and the RSO shall take any action deemed necessary to protect these employees without affecting employment status.

The RSO and/or the Radiation Safety Committee may require a complete physical examination of any employee when work with radiation begins and/or ends. Medical histories may be required if considered necessary by the Radiation Safety Committee. Bioassays are mandatory for certain employees and may be requested for others (see section J, "Bioassay").

Internal exposures must be prevented. Respirators are not approved for protection against airborne radioactive material. Work procedures and equipment must be designed to prevent the release of any radioactive substance into room air. Processes that involve volatile or gaseous material or that generate particulates must be confined to a fume hood operating at 100 cfm or a glove box. Air flow rates on all hoods should be monitored at least every 6 months.

J. Bioassay

1. Tritium

To conform with license requirements, individuals shall have bioassays performed if they are involved in operations that use tritium (hydrogen 3—"H-3") in any form other than metallic foil and in quantities greater than those given in Table 2. Any employee who works with quantities exceeding those shown in the Table 2 during a single operation or in 1 month shall provide urine samples within 1 week after exposure or weekly during chronic exposure. The OBS may also require urinalysis at other times.

Table 2

Bioassay Levels for Tritium

Process	HTO* Form (Ci)	HT* or T-2* Gas* in Sealed Vessels (Ci)	HTO Mixed with More Than 10 kg of Inert Water or Other Substances (Ci/kg)
Processes in open room with possible escape of tritium	0.01	10	0.001
Processes within fume hood of adequate design	0.1	100	0.01
Processes carried out within glove boxes	1.0	1000	0.1

*HTO - tritiated water composed of oxygen, normal hydrogen, and H-3 atoms.

Ci - curie

HT - gas with molecules composed of regular hydrogen and H-3 atoms.

T-2 - pure tritium gas

Every employee should have a baseline bioassay performed both before and after working with tritium in the forms and quantities given (Table 2). A post work assay shall be taken within 1 month of the employee's last exposure to tritium (that is, when he or she resigns, transfers, etc.)

Tritium oxides (HTO) can be absorbed into the body through the lungs or through the skin; therefore, unsealed sources of tritium should be used only in a fume hood. Employees should wear rubber gloves when working with tritium. The gloves should be changed every hour to prevent the tritium from penetrating through the material.

Metal systems should be used when possible to reduce breakage and diffusion through stopcock grease. Laboratory equipment used to process tritium should be considered contaminated.

If accidental exposure to tritium occurs, the OBS must be informed immediately. A urine sample or samples from the employee(s) concerned must be provided as requested. Authorized Users must inform the OBS about any workers whose exposure requires periodic bioassay.

2. Iodine 125 and Iodine 131

Employees must undergo thyroid monitoring if they handle, in an open form, quantities of iodine 125, iodine 131, or both that exceed those given in Table 3 in one operation or over a 3-month period. For one exposure, monitoring should be done between 6 and 72 hours after the exposure; for chronic exposure, quarterly monitoring is adequate.

Table 3

Bioassay Levels for Iodine 125 and 131

Process	Forms	
	Volatile or Dispersible (mCi)	Bound to a Nonvolatile Agent (mCi)
Processes in open room or bench with possible escape from process vessels	0.1	1
Processes with possible escape of iodine carried out within fume hood of adequate design	1.0	10
Processes carried out with glove boxes, but with possible leakage or box contamination	10.0	100

A new employee should receive thyroid monitoring before beginning work with iodine 125 or 131 when regular bioassays will be required. Thyroid monitoring shall also be done when an employee's work with the above quantities of radioiodine is ending.

Persons whose radioiodine exposure is through the use of commercial RIA kits exclusively should refer to the second column in Table 3 to determine if they need bioassay.

K. Labeling

1 Definitions

A restricted area at CDC is any area where access is controlled by the Radiation Safety Office to protect individuals from exposure to radiation and/or radioactive materials.

An unrestricted area cannot contain radiation levels such that a person continuously present could receive more than 2 mrem in any 1 hour or 100 mrem in 7 consecutive days.

A radiation area is defined as an area accessible to employees where radiation levels are such that a major portion of the body could receive more than 5 mrem in 1 hour or 100 mrem in 5 consecutive days. Radiation areas will be marked conspicuously with a radiation insignia (as defined in 10 CFR 20.203; Appendix B) and must bear the words "Caution (or Danger), Radiation Area." Such an area shall be locked at all times, with access granted only to individuals approved by the RSO and/or the Radiation Safety Committee.

A high radiation area is defined as an area in which a major portion of the body could receive 100 mrem in 1 hour. Such an area is unlikely to be created at CDC. Regulations (outlined in 10 CFR 20; Appendix B) are extensive for maintaining a high radiation area and will not be included here. The establishment of such an area shall

require approval by the RSO and the Radiation Safety Committee only after a thorough investigation of the need for and the safety of such an area. No high radiation area will be permitted without this approval.

CDC has no airborne radioactivity areas, and none are needed. An airborne radioactivity area is defined as an area where airborne radioactivity exceeds 25 % of the amounts specified in Appendix B, page 19, when averaged over the number of hours when individuals are present in any 1 week. The formation of a airborne radioactivity area requires the approval of the Radiation Safety Committee after a thorough investigation of the need for and the requirements of establishing such an area.

2. Labeling Requirements

Each area or laboratory used to store or contain licensed radioactive material (other than natural uranium or thorium) in excess of 10 times quantities given in Appendix C of 10 CFR 20 (see Appendix B, page 21 of this manual) shall be conspicuously posted with a sign bearing the radiation caution symbol and the words "Caution (or Danger), Radioactive Materials."

Rooms containing natural uranium or thorium in quantities exceeding 100 times those listed in Appendix C of 10 CFR 20 (Appendix B, page 21, of this manual) must bear the same caution label as above.

Containers holding radioactive material shall bear a durable, clearly visible label that identifies the contents. The label shall have the radiation caution symbol and the words "Caution (or Danger), Radioactive Materials."

Each label shall also provide the quantity contained, the isotopes, and the date the activity was determined.

The following are exempt from this requirement

a. Containers holding materials that do not exceed the quantities specified in Appendix C of 10 CFR 20 (Appendix B, page 21, of this manual).

b. Containers with natural thorium or uranium that do not exceed 10 times the quantities in Appendix C of 10 CFR 20 (Appendix B, page 21, of this manual).

c. Containers that do not exceed applicable concentrations listed in column 2, Table I, Appendix B of 10 CFR 20 (Appendix B, pages 14-19 of this manual)

Beakers, test tubes, and other glassware that contain radioactive material transiently during an experiment need not be labeled. However, containers that will be left unattended must be labeled according to the rules set above.

Refrigerators, fume hoods, and other areas where radioactive materials are stored must be marked with a Radioactive Materials Label even if the laboratory itself does not require labeling.

An NRC Form 3 "Notice to Employees" must be posted so that it can be easily seen by persons entering or leaving a restricted area. Authorized Users are responsible for posting all signs required and/or provided by the CBS. Authorized Users must also remove signs that are no longer needed or that have become incorrect or inappropriate for their laboratory.

L. Surveys

Laboratories where unsealed radioactive material is stored or used will be surveyed once a month. Laboratories with sealed sources will be surveyed quarterly. Routine surveys for tritium and Carbon-14 will be conducted with wipes. Other laboratories may be surveyed with a suitable survey instrument. A diagram of the laboratory showing benches, desks, sinks, and hoods will be made, and each area tested will be numbered. The filter paper wipes or counts from survey instruments will be numbered according to this diagram so that any area that becomes contaminated can be readily identified. Areas tested should be representative of places where contamination might be expected (for example, hoods, sinks, counter tops, note pads, telephone, door handles, soap dishes).

In addition to routine surveys, laboratories or other potentially contaminated areas will be surveyed:

1) after any spill, leak, fire, or other disturbance in a laboratory.
2) when work with radioactive materials is completed.
3) before and after laboratory modifications.
4) before maintenance or removal of any equipment that may have come in contact with radioactive material or that contains radioactive material.

The Authorized User is responsible for making the laboratories or other areas accessible for surveys. They should also monitor their own operations whenever possible to ensure contamination is not present.

The following sealed sources will be surveyed for leakage and external contamination at least once every 6 months. They will also be surveyed before and after they are moved within one laboratory or to another laboratory, after being dropped or otherwise damaged, and before and after maintenance.

Sealed sources:

1) Gammacell 220 irradiator
2) gas chromatographs containing radioactive foil
3) any other equipment containing a radioactive source on a permanent basis

Any instrument used in determining any quantity of radioactive material either for surveys, leak tests, package testing, or any other procedure must be calibrated for the isotope in question, and all measurements must be recorded as disintegrations per unit time or in units of a curie. This calibration will be conducted at every 6 months.

Calibration curves and records of calibration will be available for all instruments used by the OBS.

When necessary, the OBS will supply survey instruments to Authorized Users for monitoring radiological procedures.

Action levels for decontamination and a summary of contamination levels and appropriate actions are shown in Tables 4 and 5, respectively.

Table 4

Action Levels for Decontamination

Smear Results	Action
A) 100 dpm/100 sq cm (beta and gamma) or 20 dpm/100 sq cm (alpha)	No action required by Radiation Safety Officer. Left to discretion of Authorized User.
B) 100-350 dpm/100 sq cm (beta and gamma) or 20-100 dpm/100 sq cm (alpha)	RSO shall inform the Authorized User that area or surfaces should be cleaned as soon as possible by the Authorized User or laboratory personnel. Shoe covers and step pads shall be used if contamination is on floor.
C) 350-2000 dpm/100sq cm (beta and gamma) or 100-200 dpm/100 sq cm (alpha)	RSO shall inform Authorized User that contamination should be cleaned immediately under supervision of Radiation Safety Office. Shoe covers and step-off pads are required for entry into area. Only essential personnel will have access.
D) 2000 dpm/100 sq cm (beta and gamma) or 200 dpm/100 sq cm (alpha)	RSO shall inform Authorized User to shut off air flow and prevent entry of personnel into area until a representative of Radiation Safety Office arrives. Cleanup should begin immediately by Authorized User under supervision of Radiation Safety Office. Shoe covers and stop pads are required.

Cleanup must be undertaken by authorized users or laboratory personnel, not by custodial workers.

Table 5

Summary of Contamination Levels and Appropriate Actions

	A	B	C	D
Shut off air flow				X
Prevent entry			X	X
Shoe covers and step off pad required		required if on floor	X	X
Cleaned under supervision of authorized user	X	X		
Cleaned under supervision of Office of Radiation Safety			X	X
Immediate cleanup			X	X
Cleanup as soon an possible	X	X		

M. Waste Disposal

No radioactive material may be disposed of without the knowledge and consent of the OBS and the RSO. Methods for disposal must be approved before actual disposal.

Scintillation vials should not be disposed of as radioactive waste IF they contain LESS then 0.05 microcuries tritium or carbon-14 per gram of sciatillatis medium. These vials will be disposed of as chemical waste. All other scintillation vials containing radioactivity must be labeled as radioactive waste and must be left in their original vials for disposal.

Animals that contain less than .05 microcuries of tritium or carbon-14 per gram should be treated as other biological waste. At concentrations higher than this or for other isotopes, the animal must be disposed of as radioactive waste.

All radioactive waste containers must be marked with a radioactive waste label that includes on it all isotopes, their quantities, date assayed, and physical form. Any chemical information that might be useful should also be included (for example strong acid).

Solid radioactive wastes must be placed in plastic bags for disposal. Liquids must be stored in unbreakable, airtight containers or in double containers with sufficient absorbent material in the outer container to absorb any leak or spill of the contents. Any radioactive material contaminated with any biological organism (virus or bacteria) must be

autoclaved or treated in a manner that destroys all living organisms before disposal. All containers used for waste disposal must be provided by or approved by the OBS.

Containers bearing a radioactive label but that no longer contain radioactivity may be disposed of as ordinary trash only after the radioactive label is defaced or removed.

No liquid radioactive waste shall be disposed of by sewage system unless:

1) The liquid is readily soluble or dispersible in water and

2) The material is diluted to the concentrations shown in column 2, Appendix B, Table I, column II before disposal or flushed simultaneously with measured amounts of water sufficient to achieve those concentrations.

Only one sink in each laboratory shall be used for this purpose and shall be appropriately labeled. After each disposal the sink shall be flushed with water. Authorized Users shall keep a record of quantities and isotopes disposed of in this manner and include such disposals on quarterly inventory reports.

All radioactive waste shall be stored in a restricted area and labeled with a radioactive waste sign. This area shall be locked when unattended. Authorized Users are responsible for securing all radioactive waste until it is in the possession of the OBS.

Improperly labeled waste containers will not be accepted for disposal by the OBS. Radioactive waste shall be stored in an area designated by the OBS.

N. Specific Instructions

1. Cobalt-60 Irradiator

Only persons listed on the NRC license as users shall operate the Gammacell irradiator without personal supervision. All others must have one of the listed Authorized Users present. The room housing the irradiator must be locked at all times, and a TLD must be worn when using the Gammacell. Each user must also sign and date a logbook before using the irradiator. All notices from NRC concerning the Gammacell irradiator must be provided to each user.

The Gammacell will be tested for contamination and leakage at least once every 6 months. This test must be capable of detecting 0.05 microcurie of contamination. If 0.05 microcurie of removable contamination is found, the Gammacell will be removed from operation immediately.

2. Gas Chromatograph Detectors

All gas chromatograph units containing radioactive material must be registered with the Radiation Safety Office. These sources are subject to the same regulations as other radioactive material at CDC, and the following requirements must be satisfied for each unit:

1) Each piece of equipment must be marked with a radioactive label identifying the isotope, quantity, and date activity was determined.

2) Radioactive foils must not be removed from their cells or transferred to another chromatograph.

3) Chromatographs must be done on absorbent paper, in a hood. Gloves must be worn during cleaning operations.

4) Units with titanium foil must be used with a properly operating temperature control mechanism to prevent the foil temperature from exceeding 325 degrees Centigrade.

5) All new equipment or newly repaired chromatographs must be leak tested by the Office of Biosafety before being operated.

6) Gas chromatography units with radioactive foils must be vented into a fume hood or room exhaust with plastic tubing to prevent contamination of work areas.

7) Units must be operated according to manufacturer's instructions.

8) Authorized Users of gas chromatographs with radioactive material are responsible for the security of the source. The equipment or source must not be moved to another location or transferred to another user without permission from the OBS.

9) The Radiation Safety Office must be informed of any radioactive foil that is no longer in use.

Each chromatograph will be tested for leakage every 6 months and alpha emmitters will be tested every 3 months by the OBS. Test wipes will be made from the surface of the device where the foil is mounted according to instructions enclosed with the chromatographs. The radiation detector and the method used for testing must be capable of detecting 0.005 microcurie of contamination. If 0.005 microcuries or more of contamination is detected, the unit must be immediately withdrawn from use. All new equipment or newly repaired chromatographs must be leak tested by the OBS before being operated.

3. X-ray Machines

Only Authorized Users will be permitted to use x-ray-producing equipment. These Authorized Users must meet the same general requirements and will have the same responsibilities as other Authorized Users. All applicable sections of the Radiation Safety Manual must be followed as with other users. The following is a partial list of requirements.

a) Process all orders for x-ray equipment through the Radiation Safety Office.

b) Complete an Authorized User form and wait for its approval before using the equipment.

c) Obtain approval for the location and operating procedures for the machine by the Radiation Safety Office before use.

d) If the beam is not fixed in position, check and record its alignment quarterly.

e) Enforce security precautions stringent enough to prevent any nonauthorized personnel from using the equipment at any time.

f) Test safety interlocks every 6 months to see that they are functional.

g) Follow guidelines provided by the Radiation Safety Office for the specific conditions under which the x-ray equipment is used.

h) Authorized Users must meet the requirements established by the OBS.

4. Radioactive Phosphorus

Phosphorous-32 emits high-energy beta radiation. Shielding for this type of radiation should be composed of a material with a low atomic number

Bibliography

International Commission on Radiological Protection Publication 28. The Principles and General Procedures for Handling Emergency and Accidental Exposure to Workers, Pergamon Press, Elmsford, N.Y.

Nuclear Regulatory Guides

8.10 Operating Philosophy for Maintaining Occupational Exposures As Low As Reasonably Achievable.

8.20 Applications of Bioassay for I-125 and 131.

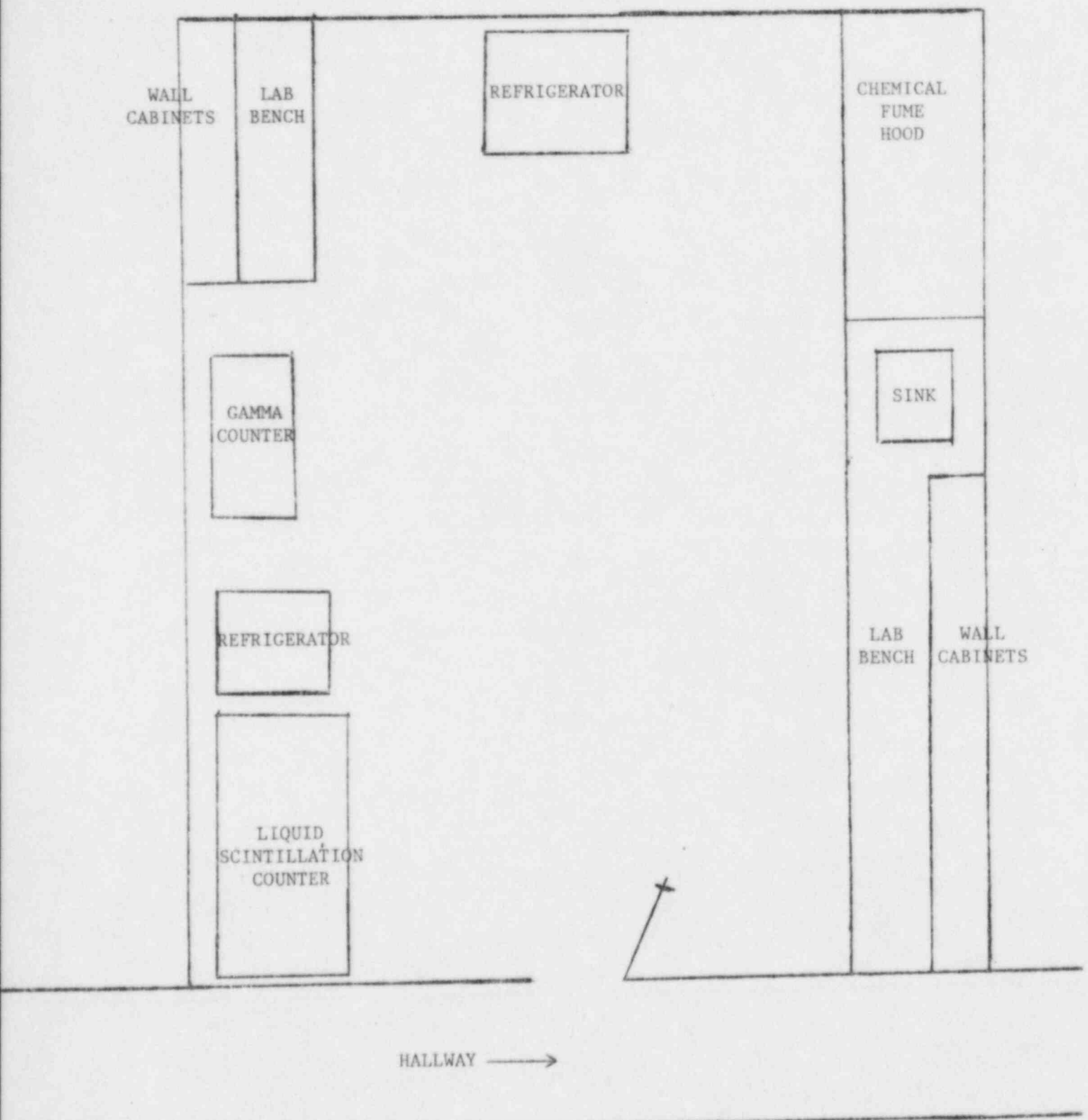
8.13 Instruction Concerning Prenatal Radiation Exposure.

8.29 Instruction Concerning Risks from Occupational Radiation Exposure.

Radiation Protection, Jacob Shapiro, second edition. Harvard University Press, 1981.

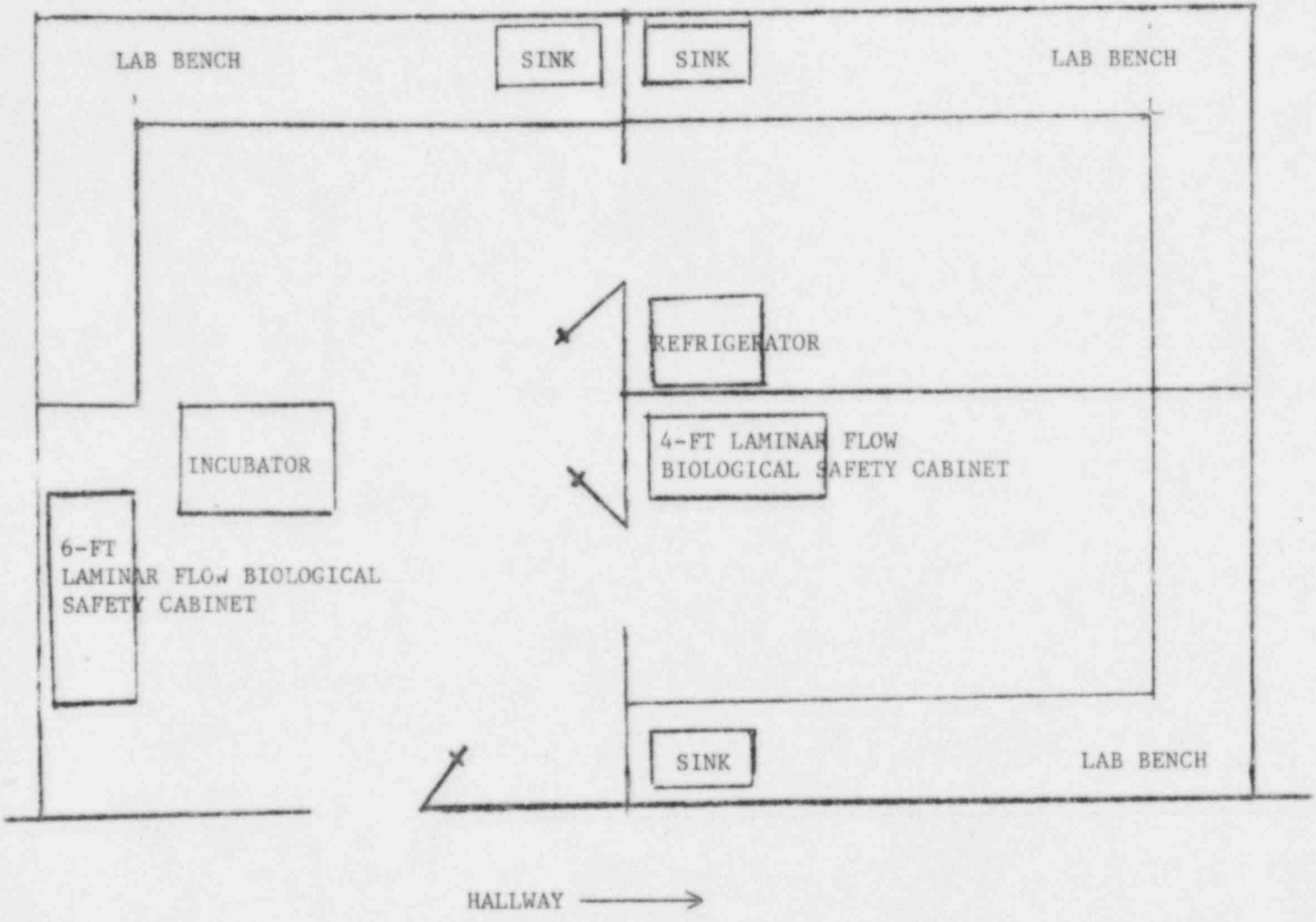
TYPICAL LABORATORY AT THE

CDC CLIFTON ROAD FACILITY



TYPICAL LABORATORY AT THE

LAWRENCEVILLE, GA FACILITY



CURRICULUM VITAE

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PERSONAL

Born: 1946, Cleveland, Ohio
Married: 1969, 2 children
Military Status: Active Duty, CDR, Senior Scientist
05 Regular, U.S. Public Health Service

EDUCATION

1968 — Emory University, Atlanta, Georgia
B.A. Degree, Physics

1969 — Georgia Institute of Technology, Atlanta, Georgia
M.S. Degree, Physics

1976 — Johns Hopkins School of Public Health and Hygiene
Baltimore, Maryland
Sc.D., Environmental Health (Radiobiology)

WORK EXPERIENCE

1982 - Present — Physical Science Consultant, Executive Assignment to
Task Force on Environmental Health Laboratory Services
Office of the Director, Laboratory Program Office
Centers for Disease Control, Atlanta, Georgia

1980 - Present — Physical Science Consultant
Laboratory Training and Consultation Division
Laboratory Program Office
Centers for Disease Control, Atlanta, Georgia

1979 - 1980 — Health Scientist Administrator
Structure and Function Branch, Division of Lung Diseases,
National Heart, Lung, and Blood Institute
Bethesda, Maryland

1977 - 1980 — Instructor, Graduate School at NIH
Foundation for Advanced Education in the Sciences
NIH, Bethesda, Maryland

1975 - 1979 — Deputy Radiation Safety Officer, NIH, Bethesda, MD
Assistant Chief for Operations, Radiation Safety Branch
Environmental Health and Safety Program
Division of Research Services, NIH, Bethesda, MD

1974 - 1977	Guest Researcher, Biochemical Section, Pulmonary Branch National Heart, Lung, and Blood Institute, Bethesda, MD (Doctoral and Post Doctoral Research)
1974	Consultant, Radiation Physicist Oyster Creek Nuclear Power Plant, Oyster Creek, NJ
1969 - 1975	Health Physicist, Radiation Safety Program Department of Nuclear Medicine, Clinical Center National Institutes of Health, Bethesda, MD

CERTIFICATION

1979	Hazard Control Manager, International Hazards Control Managers Certification Board

HONORS

1968 Sigma Pi Sigma (Physics Honor Society)
1976 Certificate of Appreciation, North Carolina State Health Dept.
1977 Medal of Commendation, U.S. Public Health Service
1979 Letter of Commendation, American Lung Association

COMMITTEES

1980 - Present	Board of Examiners Hazard Control Managers Certification Board
1980 - Present	Centers for Disease Control Radiation Safety Committee
1977 - 1980	National Institutes of Health Radiation Committee
1977 - 1978	Committee, Mid-Atlantic Chapter American Association of Physicists in Medicine
1979 - 1980	President, Parent-Teacher Association Fallsmead Elementary School

PROFESSIONAL TRAINING

A. Scientific

1970	USPHS-BRH	Reactor Safety and Hazard Evaluation
1970	FAES-NIH	Scientific German
1970	USPHS-BRH	Fundamentals of Non-Ionizing Radiation Protection
1970	American Board of Health Physicists - Certification Preparation Course	
1971	USPHS-BRH	Accelerator Radiation Protection
1972	USPHS-NIH-DCRT,	Computer Training in CPS-IBM Language
1972	NIH-DCRT	CPS for Programmers
1974	FAES-NIH	Human Genetic Disease
1974	NIH-DCRT	Introduction to IBM-Time Sharing Options
1976	FAES-NIH	Organic Chemistry
1976	FCRC-NIH	Biological Safety Conference
1977	STEP-NIH	DNA Research Lecture
1977	DRS-NIH	Requirements for Sponsored Research in Higher Education
1977	Baker Chem. Corp. - NIH	Safe Handling of Chemical Carcinogens
1977	FCRC-NIH	Hazardous Chemical Safety
1980	Johns Hopkins University - NIH	Control of Biological Hazards

B. Management

1975	USPHS-NIH	Management for the 70's
1975	NIH	Advanced Supervisory Development
1976	DRS-NIH	Adverse Actions
1976	AMA-NIH	Time Management for Senior Federal Executives
1977	AMA-NIH	Management Style Self-Directed Growth
1977	NIH	Position Management

C. Administration

1976	USPHS-NIH	Federal Budget
1976	NIH	Program Planning, Evaluation and Analysis
1977-1978	NIH-DRG	NIH Grants Associates Seminar Series for Health Sciences Administrators
1978	NIH-STEP	Implementation in the NIH
1980	CDC	Teaching by telephone

PROFESSIONAL AFFILIATIONS

Foundation for Advanced Education in the Sciences, NIH
Board of Certified Hazard Control Managers
Sigma Xi

PUBLICATIONS

1. Buchignani, J., Wagner, W., Howley, J. Radiation Dosimetry in Full Chest Tomography, Radiology, Vol. 99, No. 1, 175, 1971.

2. Wagner, W., Buchignani, J., Howley, J. Reduction of Patient Exposure by Body Positioning, Health Physics, Vol. 22, 398, 1972.

3. Wagner, W., Howley, J. Simultaneous Radiation Dosimetry During Routine Fluoroscopic Procedures in Diagnostic Radiology, Symposium Publication, DHEW, #(FDA) 73-8009 BRH/DMRE-73-1 Reduction of Radiation Dose in Diagnostic X-Ray Procedures, 161, 1972.

4. Hance, A., Crystal, R., Wagner, W., et al. Biochemical Approaches to Investigation of Febrotic Lung Disease, Chest, 69, 2(Suppl), 1976.

5. Aamodt, R., Broseus, R., Swain, R., Wagner, W. Radiation and Radiobiology, Human Health and Disease, FASEB, 1977.

6. Wagner, W. Laboratory Used Radioactive Materials, Laboratory Update Series, Department of Health and Human Services, Public Health Service, Centers for Disease Control, (80-97), 1980.

THESIS

"The Effects of Varied X-Ray Energy and Absorbed Dose on the Production of Pulmonary Fibrosis in Rabbits." The Johns Hopkins University, 1979.

CURRICULUM VITAE AND QUALIFICATIONS

Daniel W. Bradley, Ph.D.
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Home Telephone: (404) 979-2407
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Personal Data: Married, 2 children; 5'10", 175 pounds; DOB - July 13, 1941

Research Experience

Molecular virology; molecular and immuno diagnostics; virology; immunology; clinical chemistry; tissue culture.

Education

B.A., 1964, San Jose State College, San Jose, CA

Major: Chemistry
Minor: Biology
Special emphasis in coursework on biochemistry and biology.

M.A., 1968, University of California, Davis, CA

Major: Biochemistry
Minor: Organic Chemistry
Research involved the automated analysis of lysosomal enzymes. Special emphasis in research on the design and development of electromechanical components and systems. Other research experience included use of the Beckman Model E ultracentrifuge, use and/or development of Fortran IV computer programs for sedimentation velocity analysis of proteins; enzyme kinetics; subcellular fractionation techniques for selected animal tissues; column chromatography of lysosomal enzymes.

Ph.D., 1971, University of Arizona, Tucson, AZ

Major: Biochemistry
Minor: Physiology
Developed in vitro TMV-RNA replicase assay using tritium-labeled RNA precursors and liquid scintillation techniques; analyzed RNA products of in vitro reactions on sucrose gradients and on polyacrylamide-agarose gels. Other research experience included UV-visible spectroscopy, subcellular fractionation of plant homogenates, and development of numerous analytical biochemistry techniques.

Qualifications

1964-66, Research Chemist, Division of Air Pollution (now EPA) U.S. Public Health Service, Cincinnati, Ohio

Developed specific ppb method for detecting atmospheric

Qualifications (continued)

ozone. Other research involved the analysis of atmospheric carcinogens using column chromatography and UV spectroscopic quantitation.

Majority of research was analytical-organic in nature with an emphasis on the development of instrumental methods.

1971-1973, Supervisory Research Chemist and Chief, Biochemistry Unit, Disease Investigations Section, Phoenix Laboratories, Ecological Investigations Program, Center for Disease Control, U.S. Public Health Service, Phoenix, Arizona.

Extensive research experience in analytical and clinical biochemistry. Studies of nutrition-infection interactions, particularly interactions between ascorbic acid, vitamin A, FAD, and upper respiratory viruses. Biochemical lesion studies of vitamin deficiency states (e.g., serum cholesterol levels and ascorbic acid as an enzyme cofactor). Isolation and purification of human serum albumin variants by anion exchange-pH gradient (isoelectric) elution chromatography; albumin- ligand (drug) binding studies with "slow" and "fast" variants. Enzymology of human erythrocyte glutathione reductase and the determination of optimum kinetic parameters of assay for use in clinical test of riboflavin (vitamin B_2) status. Utilized and/or refined manual and automated clinical methods for the determination of serum iron, blood proteins, cholesterol, vitamins A and C, and serum enzymes of clinical importance. Collaborated in international human nutrition surveys requiring biochemical assessment of nutritional status. Supervised two chemists, 1 BS, 1 MS.

1973-1981, Supervisory Research Chemist and Chief, Immunochemistry Section, Hepatitis Laboratories Division, Bureau of Epidemiology, Center for Disease Control, U.S. Public Health Service, Phoenix, Arizona.

Responsible for the isolation, purification and characterization of hepatitis A, B, and non-A, non-B viruses and antigens using immunochemical, biochemical, and biophysical techniques. Responsible for the development of viral antigen and antibody radioimmunoassays and enzyme-linked immunoassays using antigens purified by isopycnic and rate-zonal ultracentrifugation and by column chromatographic procedures. Used and/or refined procedures for the

Qualifications (continued)

purification of IgG and IgM from convalescent and acute phase sera obtained from human or animal sources. Responsible for the design and operation of a biological containment facility required for the isolation and purification of pathogenic viruses and their antigens. Refined and utilized liver function test enzymes, including SGOT, SGPT, and SICD for monitoring viral hepatitis. Employed DNA polymerase assays for the detection of viremia in hepatitis B virus infected patients and in experimentally infected chimpanzees and/or marmosets. Used radial immunodiffusion, immunoelectrophoresis, and protein electrophoresis methods for tests of protein purity. Collaborated in development of immune electron microscopic assays for the detection of viral antigens and anti-viral antibodies. Purified hepatitis A virus (HAV) from liver necropsy specimens and stools by isopycnic banding in CsCl and by sepharose gel chromatography. Participated in development of immune adherence assay for detection of anti-HAV antibody in convalescent human sera. Was principal investigator in the development of solid-phase radioimmunoassays for hepatitis A virus and anti-HAV antibody. Developed serodiagnostic RIA test for viral hepatitis A (IgM anti-HAV). Directed research activities of five laboratory personnel, including 1 Ph.D., 1 MS electron microscopist, and 3 BS microbiologists.

1981-1983, Chief, Hepatitis Virus Section (includes Electron Microscopy Laboratory, Viral Diagnostics Activity, and Immunovirology Laboratory), Hepatitis and Viral Enteritis Division (Phoenix), Center for Infectious Diseases, U.S. Centers for Disease Control (Atlanta).

Responsible for the management and scientific direction of 5 professional personnel (including 1 Ph.D. immunovirologist) concerned with 1) the development and standardization of serodiagnostic tests and test reagents (ELISA, SPRIA, immunofluorescent assay, ets.) 2) studies of the pathogenesis of viral hepatitis, 3) biochemical/biophysical characterization of viral antigens and particles, 4) production of monospecific and monoclonal antibodies, 5) production of prototype synthetic hepatitis virus vaccines using recombinant DNA techniques, 6) hepatitis virus diagnostics, and 7) training of domestic and foreign physicians and scientists in hepatitis virus diagnostics and related research topics.

Qualifications (continued)

Additional Hepatitis Virus Section activities included 1) development and standardization of generic ELISA and ELFA tests for the detection of HBsAg and IgM anti-HAV antibody, 2) cloning of HAV-RNA (using a lambda phage vector) for use in the development of a polypeptide vaccine, 3) biochemical studies of virus-specific polypeptides and nucleic acids synthesized in FRhK-4 cells infected with wild and attenuated HAV strains, 4) isolation, purification, and characterization of circulating immune complexes associated with hepatitis A, 5)studies of the ultrastructural changes in non-A, non-B infected hepatocytes , 6) characterization of the basic biochemical and biophysical properties of non-A, non-B viruses recovered from infected liver, plasma, or tissue culture, and 7) production of monospecific and monoclonal anti-HAV antibodies using HAV purified from infected primate liver tissue. Also responsible for presenting lectures and seminars on various research and diagnostic aspects of viral hepatitis. Consults with physicians, scientists, and government health agencies in East and West European and third-world countries on viral hepatitis.

1983-Present, Chief, Molecular Virology Laboratory, Hepatitis Branch, Division of Viral Diseases, Centers for Disease Control, Atlanta, Georgia.

Responsible for the management and general scientific direction of 5 professional personnel (including 1 Ph.D. molecular virologist/biochemist, 1 Ph.D. electron microscopist, 2 MS microbiologists) concerned with the above-described functions with an emphasis on the molecular virology of hepatitis viruses. Studies include cloning and sequencing of viral RNA, production of monospecific and monoclonal antibodies against virus and virus capsid polypeptides, capsid epitope mapping, T1 RNase mapping of wild and attenuated HAV-RNA, production of synthetic (polypeptide) vaccines utilizing information derived from specific capsid polypeptide sequences, and dual-label analysis of virus-specific nucleic acids and polypeptides synthesized in cell culture. Additional studies include isolation and characterization (biochemical/biophysical) of non-A, non-B hepatitis viruses associated with contaminated blood, food, and other environmental vehicles. Other responsibilities include those described above (1981-1983).

Daniel W. Bradley, Ph.D. - Curriculum Vitae and Qualifications

Publications and Other Activities	See attachments nos. 1 and 2.
Military Service	Commissioned Officer in U.S. Public Health Service, 1964-1966, Cincinnati, Ohio
Professional Organizations	American Society for Microbiology, American Chemical Society, American Society for Virology.
Languages	French, German, Spanish (reading knowledge of each).
Outside Interests	Classic car restoration, volley ball, golf, photography, aviation/space technology, astronomy, hiking, camping.

ATTACHMENT No. 1

Bibliography

1. Bradley DW: Fabrication technique for limiting orifice of glass for air flow control. Chemist-Analyst 55:93-94, 1966.

2. Hauser TR, Bradley DW: Specific spectrophotometric determination of ozone in the atmosphere using 1,2-di(4-pyridyl)ethylene. Anal. Chem. 38:1529-1532, 1966.

3. Hauser TR, Bradley DW: Effect of interferring substances and prolonged sampling on the 1,2-di(4-pyridyl)ethylene method for determination of ozone in air. Anal. Chem. 39:1184-1186, 1967.

4. Bradley DW, Tappel AL: Automated multiple enzyme analysis systems. Anal. Biochem. 33:400-413, 1970.

5. Bradley DW, Zaitlin M: Replication of tobacco mosaic virus. II. The in vitro synthesis of high molecular weight virus-specific RNA's. Virol. 45:192-199, 1971.

6. Bradley DW: Tobacco mosaic virus replicase and the in vitro synthesis of virus-specific products. Ph.D. Dissertation, 1971.

7. Bradley DW, Hornbeck CL: A clinical evaluation of an improved TFA micro-method for plasma and serum vitamin A. Biochem. Med. 7:78-86, 1973.

8. Bradley DW, Emery G, Maynard JE: Comparison of ascorbic acid concentrations in whole blood obtained by venipuncture and by finger prick. Clin. Chem. 18:968-970, 1972.

9. Bradley DW, Maynard JE, Emery G, Webster H: Long-term hemodialysis patients and serum transaminase activities. Clin. Chem. 18:1442, 1972.

10. Bradley DW, Hornbeck CL: Serum albumin polymorphisms in Whiteriver Apache Indians. Biochem. Med. 8:92-97, 1973.

11. Bradley DW, Emery G, Maynard JE: Vitamin C in plasma: A comparative study of the vitamin stabilized with trichloroacetic acid or metaphosphoric acid and the effects of storage at -70°C, -20°C, 4°C, and 25°C on the stabilized vitamin. Clin. Chim. Acta. 44:47-52, 1973.

12. Bradley DW, Maynard JE, Webster H: Plasma and whole blood concentration of ascorbic acid in patients undergoing long-term hemodialysis. Amer. J. Clin. Path. 59:145-147, 1973.

13. Bradley DW, Maynard JE, Emery G: Serum cholesterol and whole blood ascorbic acid in children. Lancet 2:201, 1973.

14. Bradley DW, Hornbeck CL: QAE-Sephandex chromatography of human serum albumin variants. Biochem. Med. 9:85-89, 1974.

15. Murphy BL, Krushak DH, Maynard JE, Bradley DW: Ascorbic acid (vitamin C) and its effects on Parainfluenza type III virus infection in cotton-topped marmosets. Lab. Anim. Sci. 24:97-100, 1974.

16. Bradley DW, Krushak DH, Maynard JE: Viroids and viral hepatitis in marmosets. Nature 248:172, 1974.

17. Bradley DW, Maynard JE, Berquist KR, Krushak DH: Hepatitis B and serum DNA polymerase activities in chimpanzees. Nature 251:356-357, 1974.

18. Coulehan JL, Reisinger KS, Rogers KD, Bradley DW: Vitamin C prophylaxis in a boarding school. N. Engl. J. Med. 290:6-10, 1974.

19. Hornbeck CL, Bradley DW: Concentrations of FAD and glutathione as they affect values for erythrocyte glutathione reductase. Clin. Chem. 20:512-513, 1974.

20. Maynard JE, Bradley DW, Gravelle CR, Hornbeck CL, Cook EH: Virus-like particles in hepatitis A. Lancet 2:1207, 1974.

21. Maynard JE, Krushak DH, Bradley DW, Berquist KR: Infectivity studies of hepatitis A and B in non human primates. International Association of Biological Standardization - Symposium Volume, 1974.

22. Gravelle CR, Hornbeck CL, Maynard JE, Schable CA, Cook EH, Bradley DW: Hepatitis A: Report of a common-source outbreak with recovery of a possible etiologic agent. Part 2 - Laboratory studies. J. Infect. Dis. 131:167-171, 1975.

23. Maynard JE, Bradley DW, Gravelle CR, Ebert JW, Krushak DH: Preliminary studies of hepatitis A in chimpanzees. J. Infect. Dis. 131:194-197, 1975.

24. Bradley DW, Hornbeck CL, Gravelle CR, Cook EH, Maynard JE: CsCl banding of hepatitis A-associated virus-like particles. J. Infect. Dis. 131:304-305, 1975.

25. Maynard JE, Lorenz D, Bradley DW, Feinstone SM, Krushak DH, Barker LF, Purcell RH: Review of infectivity studies in non-human primates with virus-like particles associated with MS-1 hepatitis A. Amer. J. Med. Sci. 270:81-85, 1975.

26. Hollinger FB, Bradley DW, Maynard JE, Dreesman DR, Melnick JL: Detection of hepatitis A viral antigen by radioimmunoassay. J. Immunol. 115:1464-1466, 1975.

27. Maynard JE, Barrett DH, Murphy BL, Bradley DW, Berquist KR, Bender TR: Relation of e antigen to hepatitis B virus infection in an area of hyperendemnicity. J. Infect. Dis. 133:339-342, 1976.

28. Moser MR, Petersen KM, Bradley DW, Berquist KR: Unresolved hepatitis in a patient with hepatitis A and B. Lancet 2:705, 1975.

29. Bradley DW, Hollinger FB, Hornbeck CL, Maynard JE: Isolation and characterization of hepatitis A virus. Amer. J. Clin. Path. 65:876-889, 1976.

30. Hollinger FB, Bradley DW, Dreesman GR, Melnick JL: Detection of viral hepatitis type A. Amer. J. Clin. Path. 65:854-865, 1976.

31. Bradley DW, Murphy BL, Smith JL, Maynard JE, Gitnick GL: Naturally occurring antibody against unusually high serum DNA polymerase activity. Nature 259:594-596, 1976.

32. Bradley DW, Fields RM, Maynard JE: Distinct deoxribonucleic acid polymerase activities associated with Dane particles and naked Dane cores. Infect. Immun. 13:1001-1004, 1976.

33. Hornbeck CL, Gravelle CR, Hollinger FB, Bradley DW: Agarose gel filtration of concentrated fecal extracts containing virus-like particles associated with hepatitis A. Intervirology 6:309-314, 1975/76.

34. Hindman SH, Gravelle CR, Murphy BL, Bradley DW, Budge WR, Maynard JE: "e" antigen, Dane particles, and serum DNA polymerase activity in HBsAg carriers. Ann. Intern. Med. 85:458-460, 1976.

35. Bradley DW, Hornbeck CL, Cook EH, Maynard JE: Purification of hepatitis A virus from chimpanzee stools, J. Virol. 22:228-231, 1977.

36. Hindman SH, Maynard JE, Bradley DW, Denes AE, Berquist KR: Simultaneous infections with type A and B hepatitis viruses. Amer. J. Epidem. 105:135-139, 1977.

37. Maynard JE, Bradley DW, Hornbeck CL, Fields RM, Doto IL, Hollinger FB: Preliminary serologic studies of antibody to hepatitis A virus in a population in the United States. J. Infect. Dis. 134:528-530, 1976.

38. Cook EH, Bradley DW, Gravelle CR, Maynard JE: Ultrastructural studies of hepatitis A virus by electron microscopy. J. Virol. 20:687-689, 1976.

39. Hall WT, Bradley DW, Madden DL, Zimmerman DH, Koval DEL: Comparison of the sensitivity of radioimmunoassay and immune electron microscopy for detection of hepatitis A antigen in fecal extracts. Proc. Soc. Exptl. Biol. Med. 155:193-198, 1977.

40. Bradley DW, Gravelle CR, Cook EH, Field RM, Maynard JE: Cyclic excretion of hepatitis A virus in experimentally infected chimpanzees: biophysical characterization of the associated HAV particles. J. Med. Virol. 1:133-138, 1977.

41. Denes AE, Giller J, Bradley DW: Severe respiratory alkalosis--an unusual manifestation of acute viral hepatitis. Postgrad. Med. 63:240-242, 1978.

42. Bradley DW, Maynard JE, Hindman SH, Hornbeck CL, Fields HA, McCaustland KA, Cook EH: Serodiagnosis of viral hepatitis A: detection of acute phase IgM anti-HAV by radioimmunoassay. J. Clin. Micro. 5:521-530, 1977.

43. Bradley DW, McCaustland KA, Schreeder MT, Cook EH, Gravelle CR, Maynard JE: Multiple buoyant densities of hepatitis A virus in cesium chloride gradients. J. Med. Virol. 1:219-226, 1977.

44. Ebert JW, Maynard JE, Bradley DW, Lorenz D, Krushak DH: Experimental infection of marmosets with hepatitis A virus. (in Proceedings, "Marmosets in Experimental Medicine," held in Oak Ridge Tenn., Mar. 16-18, 1977). Prim. Med. 10:295-299, 1978.

45. Bradley DW, Maynard JE: Serodiagnosis of viral hepatitis A by radioimmunoassay. Lab. management 16:29-34, 1978.

46. Bradley DW: Hepatitis A: Current perspectives with review of new laboratory techniques. CDC Hepatitis Surveillance Report no. 40, March, 1977, pp. 12-16.

47. Bradley DW: Recovery of virus-like particles associated with non-A, non-B hepatitis. CDC Morbidity and Mortality Weekly Report 27:199-200, 1978.

48. Bradley DW: Serodiagnosis of viral hepatitis A by radioimmunoassay. CDC Hepatitis Surveillance Report no. 42, June 1978, pp. 36-43.

49. Almeida JD, Atanasin P, Bradley DW, Gardner PS, Maynard JE, Schuurs AW, Voller A, Yolken RH: Manual for rapid laboratory viral diagnosis. WHO Publication no. 47, WHO, Geneva, 1979, pp. 39-43, Chapter 8. "Serodiagnosis of acute viral hepatitis A by radioimmunoassay for IgM anti-HAV."

50. Bradley DW: Laboratory studies in non-A, non-B hepatitis. CDC Hepatitis Surveillance Report no. 44, October, 1979, pp. 4-6.

51. Bradley DW, Krugman S, Rosenkranz MA, Schill G, Tong MJ: Viral hepatitis: diagnosis, prophylaxis, and treatment. Pub. by Pro Clinica (Cutter Biologicals), July, 1979, pp. 8-11, "Clinical significance of hepatitis B viral structure."

52. Murphy BL, Maynard JE, Bradley DW, Ebert JW, Mathiesen LR, Purcell RH: Immunofluorescence of hepatitis A virus antigen in chimpanzees. Infect. Immun. 21:663-665, 1978.

53. Bradley DW, Fields HA, McCaustland KA, Cook EH, Gravelle CR, Maynard JE: Biochemical and biophysical characterization of light and heavy density hepatitis A virus particles: evidence HAV is an RNA virus. J. Med. Virol. 2:175-187, 1978.

54. Bradley DW, Fields HA, McCaustland KA, Maynard JE, Decker RH, Whittington R, Overby L: Serodiagnosis of viral hepatitis A by a modified competitive binding radioimmunoassay for immunoglobulin M anti-hepatitis A virus. J. Clin. Micro. 9:120-127, 1979.

55. Fields HA, Bradley DW, Davis CL, Maynard JE: Purification and partial characterization of hepatitis e antigen (HBeAg). Infect. Immun. 20:792-803, 1978.

56. Fields HA, Bradley DW, Davis CL, Murphy BL, Schable CA, Maynard JE: Radioimmunoassay for the detection of hepatitis e antigen (HBeAg) and antibody (anti-HBe). J. Immunol. 121:930-935, 1978.

57. Bradley DW, Murphy BL, Ebert JW, McCaustland KA, Anderson TE, Fields HA, Maynard JE: "Isolation and partial characterization of HAV from stool and liver of experimentally infected marmosets" in Viral Hepatitis, pp. 31-39, 1978 (Vyas, Cohen, Schmid, eds) (proceedings, Second Symposium on Viral Hepatitis, Univ. of Calif., San Francisco, CA, March, 1978). The Franklin Institute Press, Philadelphia, PA.

58. Fields HA, Bradley DW, Davis CL, Murphy BL, Schable CA, Maynard JE: "Micro solid-phase immunoradiometric assay (micro-SPRIA) for the detection of hepatitis e antigen (HBeAg) and antibody (anti-HBe)". (ibid, pp. 173-176).

59. Fields HA, Bradley DW, Davis CL, Maynard JE: "Purification and partial characterization of hepatitis e antigen (HBeAg)". (abstract) (ibid, p.720).

60. Maynard JE, Bradley DW: "The hepatitis A virus", in Falk Symposium no. 28: Virus and the Liver, pp. 9-15, 1979 (proceedings, 5th International Congress of Liver Diseases, Basel, Switzerland, October, 1979). MTP Press Ltd., lancaster, England.

61. Bradley DW: (round-table discussion) "Non-A, non-B hepatitis." (ibid, pp. 119-127).

62. Guyer B, Bradley DW, Bryan JA, Maynard JE: Non-A, non-B hepatitis among participants in a plasmapheresis stimulation program. J. Infect. Dis. 139:634-640, 1979.

63. Bradley DW, Cook, EH, Maynard JE, McCaustland KA, Ebert JW, Dolana GH, Petzel RA, Kantor RJ, Heilbrunn A, Fields HA, Murphy BL: Experimental infection of chimpanzees with antihemophilic (factor VIII) materials: recovery of virus-like particles associated with non-A, non-B hepatitis. J. Med. Virol. 3:253-269, 1979.

64. Ahtone J, Francis D, Bradley D, Maynard J: Non-A, non-B hepatitis in a nurse after percutaneous needle exposure. Lancet 2:1142, 1980.

65. Bradley DW: Hepatitis A virus infection: Pathogenesis and serodiagnosis of acute disease. J. Virolog. Meth. 2:31-45, 1980.

66. Bradley DW, Maynard JE, Cook EH, Ebert JW, Gravelle CR, Tisquaye KN, Kessler H, Zuckerman AJ, Miller MF, Ling C-M, Overby LR: Non-A, non-B hepatitis in experimentally infected chimpanzees: cross-challenge and electron microscopic studies. J. Med. Virol. 6:185-201, 1980.

67. Bond WW, McCaustland KA, Bradley DW: Effect of drying and storage at 25°C on immunological reactivity of hepatitis A virus antigen in stool specimens. Lancet 2:100-101, 1981.

68. Bradley DW, Maynard JE, Popper H, Ebert JW, Cook EH, Fields HA, Kemler BJ: Persistent non-A, non-B hepatitis in experimentally infected chimpanzees. J. Infect. Dis. 143:210-218, 1981.

69. McCaustland KA, Bond WW, Bradley DW, Favero MS, Petersen NJ, Maynard JE: Evaluation of a finger-stick specimen collection method for seroepidemiology of antibody to hepatitis A virus. J. Clin. Micro. 13:217-218, 1981.

70. Grabow WOK, Prozesky OW, Bradley DW, Maynard JE: Response of Galago bushbabies to the hepatitis A virus. South African J. Science (Pretoria) 77:314-318, 1981.

71. Fields HA, Davis CL, Dreesman GR, Bradley DW, Maynard JE: Enzyme potentiated radioimmunoassay (EPRIA): a sensitive third-generation test for the detection of hepatitis B surface antigen. J. Immunolog. Meth. 47:145-159, 1981.

72. Fields HA, McCaustland KA, Bradley DW, Maynard JE: Purification of acute-phase anti-hepatitis A virus (HAV) IgM and development of an IgM solid-phase radioimmunoassay for the detection of HAV. J. Immunolog. Meth. 51:149-157, 1982.

73. Maynard JE, Bradley DW: Chapter 4. "Hepatitis A Virus", (Lloyd C. Olson, ed.). Marcel Dekker, Inc. (Pub.), New York, NY, 1982.

74. Bradley DW, Maynard JE: Chapter 5. "Non-A, non-B Hepatitis", (ibid).

75. Gravelle CR, Bradley DW, Cook EH, Maynard JE: Temporal patterns of ultrastructural alterations in hepatocytes of chimpanzees infected with non-A, non-B hepatitis. J. Infect. Dis. 145:854-858, 1982.

76. Fields HA, Wheeler CM, Davis CL, Bradley DW, Maynard JE: Purification and radiometric assay detection of glutamate decarboxylase. J. Applied Biochem. 4:271-279, 1982.

77. Bradley DW, McCaustland KA, Fields HA, Frosner GG, Maynard JE: Dissociation of hepatitis A virus antigen anti-HAV antibody complexes by 2-mercaptoethanol and dithiothreitol. J. Med. Virol. 9:311-325, 1982.

78. Bradley DW, Arnold W: "Summary of Workshop 1: HBV Markers", in proceedings, The 1981 International Symposium on Viral Hepatitis, New York, N.Y. (March-April, 1981), Alter, Maynard, Szmuness, (eds.) The Franklyn Institute Press, Philadelphia, PA, 1982.

79. Bradley DW, Maynard JE, Popper H, Krawczynski KZ, Cook EH, Gravelle CR, Ebert JW: "Non-A, non-B hepatitis in chimpanzees infected with a factor VIII agent: evidence of persistent hepatic disease." (ibid).

80. Bradley DW, Maynard JE, Popper H, Ebert JW: (workshop abstract) "Persistent non-A, non-B hepatitis in experimentally infected chimpanzees". (ibid).

81. Maynard JE, Bradley DW: Chapter 5. "Transmission of non-A, non-B Hepatitis by Blood Products and Plasma Derivatives", in Non-A, Non-B Hepatitis (R. J. Gerety, ed.), pp. 71-95, 1981. Academic Press, New York, N.Y.

82. McCaustland KA, Bond WW, Bradley DW, Ebert JW, Maynard JE: Survival of hepatitis A virus in feces after drying and storage for 1 month. J. of Clin. Microbiol., no. 5, 16:957-958, 1982.

83. Krawczynski KZ, Bradley DW, Murphy BL, Ebert JW, Anderson TE, Doto IL, Nowoslawski A, Duermeyer W, Maynard JE: Pathogenetic aspects of hepatitis A virus infection in enterally inoculated marmosets. Am. J. of Clin. Path. 76:698-706, 1981.

84. Fields HA, Bradley DW, Maynard JE: Non-A/non-B hepatitis detection methodology: a review. Ligand Quarterly. 5:29-33, 1982.

85. Bradley DW, Krawczynski KZ, Cook EH, Gravelle CR, Ebert JW, Maynard JE: Recrudescence of non-A, non-B hepatitis in persistently infected chimpanzees. Proceedings from International Hepatitis Workshop, Edinburgh, Scotland, pp. 43-48, 1982.

86. Bradley DW, Maynard JE, McCaustland KA, Murphy BL, Cook EH, Ebert JW: Non-A, non-B hepatitis in chimpanzees: interference with acute hepatitis A virus and chronic hepatitis B virus infections. J. of Med. Virol. 11:207-213, 1983.

87. Bradley DW, Maynard JE: Non-A, non-B hepatitis: Research progress and current perspectives. Develop. Biol. Standard. 54:463-473, 1983.

88. Fields HA, Berninger M, Nath N, Davis CL, Hammer M, Margolis HS, McCaustland KA, Wheeler CM, Maynard JE, Bradley DW: Unrelatedness of factor VIII-derived non-A/non-B hepatitis and hepatitis B virus. J. of Med. Virol. 11:59-65, 1983.

89. Bradley DW, Maynard JE, Popper H, Cook EH, Ebert JW, McCaustland KA, Schable CA, Fields HA: Posttransfusion non-A, non-B hepatitis: physicochemical properties of two distinct agents. J. of Infect. Dis. 148:254-265, 1983.

90. Bradley DW, Maynard JE: Viral hepatitis A: research progress and current perspectives. Viral Hepatitis: CDC-WHO Investigations and Control Series. July, 1983.

91. Bradley DW: Transmission, etiology, and pathogenesis of viral hepatitis non-A, non-B in non-human primates. Advances in Hepatitis Research (F.V. Chisari, ed.) Chapter 31, p. 268-280, 1984.

92. Bradley DW, McCaustland KA, Cook EH, Schable CA, Ebert JW, Maynard JE: Posttransfusion non-A, non-B hepatitis: Physicochemical properties of a tubule-forming agent purified from chronic-phase chimpanzee plasma. Proceedings from 1984 International Symposium on Viral Hepatitis, San Francisco, Ca., March, 1984. Abstract (in press).

93. Bradley DW, McCaustland KA, Cook EH, Ebert JW, Maynard JE: Posttransfusion non-A, non-B hepatitis: effects of immunosuppression on course of disease and recovery of tubule-forming agent. Proceedings from 1984 International Symposium on Viral Hepatitis, San Francisco, Ca., March, 1984. Abstract (in press).

94. Bradley DW, McCaustland KA, Cook EH, Ebert JW, Maynard JE: Posttransfusion non-A, non-B hepatitis: Effects of immunosuppression on course of disease and recovery of tubule-forming agent from infected liver. Proceedings from 1984 International Symposium on Viral Hepatitis, San Francisco, Ca., March, 1984. in press.

95. Bradley DW: Research perspectives in posttransfusion non-A, non-B hepatitis. Proceedings from American Red Cross XVI Annual Scientific Symposium on Infection, Immunity, and Blood Transfusion, Washington, D.C., May, 1984. in press.

96. Bradley DW, Schable CA, McCaustland KA, Cook EH, Murphy BL, Fields HA, Ebert JW, Wheeler CM, Maynard JE: Hepatitis A virus: Growth characteristics of in vivo and in vitro-propagated wild and attenuated strains. J. Med. Virol. (in press).

97. Bradley DW, McCaustland KA, Cook EH, Schable CA, Ebert JW, Maynard JE: Posttransfusion non-A, non-B hepatitis: Physicochemical evidence the tubule-forming agent is a small, enveloped RNA virus. submitted for publication.

98. Kane MA, Bradley DW, Shrestha SM, Maynard JE, Cook EH, Mishra RP, Joshi DD, McCaustland KA, Ebert JW: Epidemic non-A, non-B hepatitis in Nepal: Recovery of a possible etiologic agent and transmission studies in marmosets. submitted for publication.

ATTACHMENT NO. 2

Invited Presentation, Consultations, and Chairmanships (Partial Listing)

1. Presentation: "Isolation and Characterization of Hepatitis A Virus" (Tenth Annual American Society of Clinical Pathologists (ASCP) Research Symposium, "Viral Hepatitis: Present Status of Basic Clinical and Laboratory Studies", Chicago, Ill., Oct., 1975).

2. Presentation, Consultation: "Serodiagnosis of Viral Hepatitis" (Kuwait, Arabian Gulf, Sept., 1978; invited guest of the Undersecretary of Public Health). Consulted on viral hepatitis testing in blood banks and hospitals; advised on in-house development of serologic test technology and methodology (see attached).

3. Consultation: Advised Christ Hospital Institute of Medical REsearch (Gilbert, Schiff, M.D., Director) in Cincinnati, O. on hepatitis A virus tissue culture techniques (Nov., 1979).

4. Consultation: Select Committee on Immune Complexes in Non-A, Non-B Hepatitis; NIH, Wash., DC (Nov., 1979).

5. Consultation: Serodiagnosis and pathogenesis of viral hepatitis A; National Institute of Hygiene, Warsaw, Poland (Nov., 1978).

6. Presentation: "Current Perspectives in Non-A, Non-B Hepatitis"; Annual Meeting, American Public Health Association, Los Angeles, CA (Mar., 1978).

7. Presentation: "Transmission of non-A, non-B Hepatitis to Chimpanzees: Recovery of Virus-like Particles"; 79th Annual Meeting of the American Society for Microbiology, Los Angeles, CA (May, 1979).

8. Presentation: "Non-A, Non-B Viral Hepatitis"; Annual Meeting of the Association of State and Territorial Public Health Laboratory Directors, Research Triangle Park (Burroughs-Wellcome), N.C. (April, 1979).

9. Presentation: "Electron Microscopy of Non-A, Non-B Hepatitis Virus"; V International Congress of Liver Diseases, "Virus and the Liver", Basel, Switzerland (Falk Foundation) (Oct., 1979).

10. Presentation: "Markers of Hepatitis A Virus Infection"; International Symposium on Serological Diagnosis of Viral Hepatitis, Oss, Holland (May, 1980).

11. Presentation: "Cross-Challenge and Electron Microscopic Studies of Non-A, Non-B Hepatitis Virus in Experimentally Infected Chimpanzees"; International Symposium on Non-A, Non-B Hepatitis; Vienna, Austria (sponsor: Univ. of Vienna) (June, 1980).

12. Consultation: Non-A, non-B hepatitis research; National Institute of Hygiene, Warsaw, Poland (June, 1980).

13. Presentation: "Current Perspectives in Non-A. Non-B Viral Hepatitis"; New York Academy of Sciences, N.Y. (Oct., 1980).

14. Presentation: (symposium) "Epidemiology and Laboratory Diagnosis of Hepatitis A Virus Infection"; Recent Advancements in Viral Hepatitis, Hamilton, Ont., Canada (sponsor: Abbott Laboratories) (Nov., 1980).

15. Presentation: "Hepatitis A and B: State of the Art of Laboratory Diagnosis"; 32nd Annual Institute of the California Public Health Laboratory Directors, Asilomar, CA (April, 1981).

16. Chairmanship: (Workshop) HBV Markers-I, in 1981 International Symposium on Viral Hepatitis, New York, N.Y. (March-April, 1981).

17. Presentation: (Workshop) "Persistent Non-A, Non-B Hepatitis in Experimentally Infected Chimpanzees", in 1981 International Symposium on Viral Hepatitis, New York, N.Y.

18. Presentation: (Plenary session)"Animal Transmission Studies in Non-A, Non-B Hepatitis" in 1981 International Symposium on Viral Hepatitis, New York, N.Y.

19. Presentation: "Pathogenesis and Serodiagnosis of Viral Hepatitis A"; Symposium of Viral Hepatitis, sponsored by the Clinical Ligand Assay Society (New York Metropolitan Chapter), Teaneck, N.J. (December, 1981).

20. Presentation: "Non-A, Non-B Hepatitis" in Viral Hepatitis Roundtable, sponsored by Clinical Assays, Cambridge, Mass. (November, 1982).

21. Presentation: "Pathogenesis of Hepatitis A", in Future Directions for Hepatitis A Research, Walter Reed Army Institute of Research, Wash., D.C. (March, 1982).

22. Presentation: "Non-A, Non-B Hepatitis: Research Progress and Future Prospects", in Hepatitis Workshop 1982, Stirling, Scotland (September, 1982).

23. Presentation: "Non-A, Non-B Hepatitis: Current Status of Post-Transfusion Hepatitis", in Viral Hepatitis: Current Concepts and Prospects for Control, IV International Conference on Comparative Virology, Banff, Alberta (October, 1982).

24. Presentation: "Current Perspectives in Serologic Test Development", in Second International IABS Symposium on Standardization in Immunoprophylaxis of Hepatitis Virus Infections, Athens, Greece (November, 1982).

25. Presentation: "Non-A, Non-B Hepatitis", in Symposium on Viral Hepatitis XVII International Congress of Pediatrics, Manila, Philippines (November, 1983).

26. Presentation: "Hepatitis Agents in Animal Models", in 1984 International Symposium on Viral Hepatitis and Liver Disease, San Francisco, CA (March, 1984).

27. Presentation: "Current Perspectives in Non-A, Non-B Hepatitis Research", in XVI Annual (American Red Cross) Scientific Symposium on Infection, Immunity, and Blood Transfusion, Wash., D.C. (May, 1984).

CURRICULUM VITAE
September 6, 1984

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Academic Preparation:

B.S. (1967) University of South Carolina
Columbia, SC

Major: Biology Pre-med
Minors: Chemistry, French

MT(ASCP) (1969) South Carolina Baptist Hospital
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Additional graduate courses beyond B.S (1975-1980):
Georgia State University
Atlanta, Georgia

Graduate Courses	Credit Hours	Grade
BIO 802 Microbiology III	5	A
BIO 688 Virology	5	A
BIO 678 Immunobogy	5	A
BIO 686 Microbial Physiology	5	A
BIO 898 Yeasts	5	B
CHEM 660 Biochemistry I	4	B
CHEM 890e Clinical & Forensic Toxicology	3	B
CHEM 890e Clinical & Forensic Toxicology II 3	3	A

Other: Federal Program Managers Seminar, Oak Ridge, TN,
Jan 21-Feb 2, 1984

Publications and Presentations:

1. Turner, W.E., Gunter, E.W., and McGrath, C.R. Health and Nutrition Examination Survey II (HANES II). Field Laboratory Staff Procedure Manual. Prepared and distributed, 1976.

2. Sections on Folic Acid, Vitamin B_6 and Vitamin B_{12} "Proposal for a Program of Methodological Research in Nutrition: An Aspect of the Comprehensive Nutritional Status Monitoring System." Dec. 4, 1978.

3. Gunter, E.W. and Turner, W.E. A Comparison Study of Radioimmunoassay Kits for Vitamin B_{12} Using Purified and Non-purified Intrinsic Factor Binders. In preparation.

4. Gunter, E.W., and Turner, W.E. A Comparison Study of Microbiological and Radioimmunoassay Methods for Serum and Red Cell Folic Acid. In preparation.

5. Gunter, E.W., Turner, W.E., Neese, J.W., and Bayse, D.D. Laboratory procedures used by the Clinical Chemistry Division, Centers for Disease Control, for the Second Health and Nutrition Examination Survey (HANES II), 1976 - 1980, Centers for Disease Control, Center for Environmental Health, Nutritional Biochemistry Branch, 1981. (Revised edition, 1984)

6. Gunter, E.W., Orti, D.L., and Branch, K.W. A Quality Control Program for the LKB 1270 Rackgamma II gamma counter. Prepared and distributed in-house 1978, and used in four training courses for laboratory examiners, 1978-1979.

7. Gunter, E.W. Plasma Thromboplastin A and Plasma Thromboplastin C: A Case Study of Simultaneous Deficiencies in One Family. Journal of the South Carolina Society for Medical Technology, 28:34, 1969.

8. Fulwood, R., Johnson, C.L., Bryner, J.D., Gunter, E.W., and McGrath, C.R. Hematological and nutritional biochemistry reference data for persons 6 months - 74 years of age: United States 1976 - 1980. Vital and Health Statistics, Series II, No. 232. DHHS Publication No. (PHS) 83-1682, Washington, D.C: U.S. Government Printing Office, 1982.

9. Gunter, E.W., McGrath, C.R., and Lewis, B.G. Hispanic Health and Nutrition Examination Survey (HHANES). Field Laboratory Staff Procedure Manual. Prepared and distributed, 1982.

Professional Societies:

American Society for Medical Technology
Georgia Society for Medical Technology
American Society of Clinical Pathology
Association for Executive Women, CDC

CDC Professional Contributions:

Member, CDC Institutional Biosafety Committee, 1982 -
Member, CDC Radiological Safety Committee, 1984 -
Member, Clinical Chemistry Safety Committee, 1983 -

Awards:

$500 Cash Award for the HANES II Survey supervision and completion, 1981

$500 Cash Award for Outstanding Performance, 1979 as laboratory coordinator for the Triana, Alabama, DDT Survey.

3 CDC Suggestion Awards, 1977 - 1978

Outstanding student paper, 1969, South Carolina Society for Medical Technology

Radioassay - Related Experience:

1. Methodology comparison and selection of ^{125}I radioassay for serum and red cell folate for HANES II, 1978. (This assay has been performed continuously since 1978. I have maintained the quality control, training, and supervision for this method since then, for over 30,000 specimens.)

2. Methodology comparison and selection for ^{57}Co radioassay of vitamin B-12 for HANES, 1977. (This method was used from 1977 to 1980 with extensive comparison work done on different types of binder-intrinsic factor combinations, for approximately 8,000 specimens.)

3. Vitamin B-6 methodology development, ^{3}H-competitive protein binding assay, 1980-1982, for HANES. (I was involved in selection of beta counter and monitored adherence to proper safety conditions.)

4. Methodology comparison and selection of method for serum ferritin (^{125}I-IRMA) for Hispanic HANES, 1984. (Total supervision of method for approximately 10,000 specimens)

5. Supervision of c-peptide ^{125}I competitive-binding assay, 1983, for ETDRS.

Radiation Safety Courses Taken:

1. "Ionizing Radiation," CDC, June, 1975.

2. "Radiation Safety and Laboratory Technique," Georgia Tech, December, 1975.

3. "Radiation Safety in the Lab," CDC, November, 1980.

CURRICULUM VITAE - Paul David Simpson, Jr.

TITLE (CIVILIAN):

Computer Programmer Analyst — 1983-1984
Centers for Disease Control (CDC)
Center for Environmental Health (CEH)
Chronic Diseases Division (CDD)
Agent Orange Project (AOP)

TITLE (MILITARY):

Nuclear Medical Science Officer (Captain), 818th Hospital Ctr, Ft. Gillem, Georgia — 1981-1984

EDUCATION:

B.S.(physics) - Virginia State University — 1963
M.S.(physics) - Howard University — 1967
M.S.(health physics) - Georgia Institute of Technology — 1977
Ph.D.(health physics) - Georgia Institute of Technology — 1985 (Est)

MILITARY EDUCATION:

Basic Officer's Course - U.S. Army Air Defense School
Ft. Bliss, Texas — 1970

Advanced Officer's Course - U.S. Army Transportation School, Fort Eustis, Virginia — 1979

Command and General Staff Officer Course
Fort Leavenworth, Kansas — 1982

HONORS:

Oak Ridge National Laboratory Best Paper Award ($500), American Nuclear Society Student Conference — 1982

State of Georgia Regents Opportunity Fellowship — 1979-1982

Ferst Foundation Grant ($5000) — 1979

IBM Corp. 100% Club — 1974-1975

Honor Graduate, IBM Marketing School — 1973

National Bureau of Standards Research Fellow — 1969-1970

COLLEGE HONORS:

Phi Beta Sigma (Scientific)
Sigma Pi Sigma (Physics)
Pi Mu Epsilon (Mathematics)
Alpha Gamma Mu (Foreign Language)
Who's Who in American Colleges and Universities

Paul D. Simpson, Jr.

MEMBERSHIPS:

Washington Philosophical Society
Atlanta Chapter of the Health Physics Society
Health Physics Society
American Association of Physicists in Medicine
American Nuclear Society
American Physical Society

EXPERIENCE:

Computer Programmer, CDC, CEH, CDD, Birth Defects Branch	1983
Computer Programmer, CDC, Ofc. Dir., Center for Infections Diseases, Ofc. of Admin. Services	1982-1983
Health Physicist/Graduate Student, Neely Nuclear Research Center, Georgia Institute of Technology (See Publications and Research)	1977-1982
Medical Physicist, Walter Reed Medical Center, Washington, D.C.,	Military-1983
Radiological Safety Office, Dwight D. Eisenhower Hospital, Augusta, Georgia	Military-1982
Data Processing Project Manager, U.S. Army Forces Command	1975-1976
Marketing Representative, IBM	1972-1975
Physicist/Graduate Fellow, National Bureau of Standards	1969
Physicist, U.S. Naval Ordance Lab and Aberdeen Proving Grounds	1963&1965

PRESENTATIONS:

"The Update and Distribution of I-125 Labelled Estradiol in Mammary Tumors with Estogen Receptors," American Nuclear Society Conference, Washington, D.C., 1982

"The Distribution of I-125 labelled Estradiol in Mammary Tumors with Estrogen Receptors, American Nuclear Society Student Conference, Atlanta, Georgia, 1982

"Heating Patterns in Phantoms containing Simulated Bone and Muscle Components Exposed to 434-MHZ Electromagnetic Radiation", Eastern American Society Student Conference, University of Tennessee, Knoxville, 1980

"Computional Analysis and Dosimetric Evaluation of a Commercial Irregular Fields Computer Program," Southeast Regional Nuclear Science and Engineering Conference, University of Florida, Jacksonville, Florida, 1978

"Health Physics Hazard and Solutions Associated with the Nuclear Reactor, Hatch I, "Eastern American Nuclear Society Student Conference, North Carolina State University, Raleigh, North Carolina, 1977

"The Use of the Electronic Warfare Data Aquisition System," Sixteenth Annual Joint ECM Planning Conference, Monterey, California, 1970

"Electron Impact Spectroscopy for the Analysis of an Anomaly in the Nitrogen Molecule and the Strongly-Coupled Excited States of Formaldehyde, American Physical Society Meeting, Washington, D.C., 1970

PUBLICATIONS AND RESEARCH:

"The Uptake of I-125 Labelled Estradiol in Tumors with Estrogen Receptors," Transactions of the American Nuclear Society, 43 (Nov. 82)

Performed research on Ph.D. thesis entitled: Effects of Blood Flow Convection, Thermal Conductivity and Other Heat Transfer Phenomenon in Tumor Systems in Vivo Experiencing Hyperthermia due to Non-ionizing Electromagnetic Irradiation, Georgia Institute of Technology and Emory University Clinic, 1970-1984 (To be Published)

"Influence of Bone on Temperature Patterns Produced by 434 MHZ Electromagnetic Radiations," with J.R. McLaren and P.H. McGinley, Radiology, 141 (Dec. 81)

Worked on a research project: The Transport of Actinide Elements through Simulated Rock Formations by Suspended Matter, funded by the Environmental Protection Agency, 1979

Performed an internship as a Medical Physicist, Georgia Baptist Medical Center, Atlanta, Gerogia, 1977

Conducted research on the subject: "Ultrasonic Dosimetry in Simulated Tissue Materials," sponsored by the Department of Health, Education and Welfare, Georgia Insitute of Technology, 1977

Masters Thesis entitled "Adiabatic Motion of Charged Particles in Magnetic Fields," Howard University, 1966

RECOMMENDATIONS:

Will provide on request.

CURRICULUM VITAE

PERSONAL

Name: Kathryn Louise Kellar, Ph.D.

Home Address: 4933 Parkwest Drive
Stone Mountain, GA 30088
(404) 469-6522

Work Address: Division of Host Factors
Building 1, Room 1354
Center for Infectious Diseases
Centers for Disease Control
Atlanta, GA 30333
(404) 329-3966

Social Security Number: 080-38-7520

Date of Birth: June 4, 1947

Place of Birth: Watertown, NY

Marital Status: Single

EDUCATION

Secondary: Wurzburg American High School, Wurzburg, Germany, 1961-1963.
Columbus High School, Columbus, GA; graduated June 1965.

College: Furman University, Greenville, SC, B.S., cum laude, June 1969.
Major: Biology. Minor: Secondary Education.

Graduate: University of Georgia, Athens, GA, M.S. Degree in Zoology, June 1973.
Emory University School of Medicine, Atlanta, GA, Ph.D. Degree in Biochemistry, August 1978.

AWARDS

University of Georgia Research Assistantships
Nov. 1969 to Aug. 1970
Jan. 1971 to Aug. 1971
Feb. 1972 to Mar. 1972
July 1972 to Sept. 1972

Emory University Graduate School Tuition Awards (Competitive, one of five for Basic Science Division)
Sept. 1974 to May 1975
Sept. 1975 to May 1976

ORGANIZATIONS

Sigma Xi, Emory University Chapter, 1977.
Interdepartmental Graduate Program in Genetics, Emory University, 1977.
Association of Executive Women, Centers for Disease Control, 1984.

EMPLOYMENT

Research Technician, Department of Biochemistry, Emory University, Oct. 1972 to Aug. 1974.
Research Chemist, Division of Host Factors, Center for Infectious Diseases, Centers for Disease Control, June 1983 to present.

TEACHING EXPERIENCE

Practice Teaching: Greenville School System, Greenville, SC, Jan. to Mar. 1969. Courses: Biology and Advanced Biology.

Laboratory Instructor: Introductory Biology, Fall 1970, 1971, Spring 1972. University of Georgia.

Lecturer (10 lectures): Physicians Associate Biochemistry (Allied Health Program), Winter 1978. Emory University.

FELLOWSHIPS

Hemophilia of Georgia, Inc., Atlanta, GA. 1978 to 1982.

National Research Service Award. National Heart, Lung, and Blood Institute. 1979-1982.

Staff Fellow, Division of Host Factors, Center for Infectious Diseases, Centers for Disease Control, Atlanta, GA. 1982 to 1983.

PUBLICATIONS

Kellar KL, Vogler WR, Kinkade JM, Jr. Colony stimulating factor (CSF) from human leukemic urine: Affinity chromatography and isoelectric focusing. Proc Soc Exp Biol Med 1975;150:766-772.

Ross DD, Groth DP, Kinkade JM, Jr., Kellar KL, Dame LD, Vogler WR. Effects of urinary proteins from certain leukemics upon macromolecular synthesis and enzyme levels in bone marrow cultures. J Biol Chem 1975;250:8829-8833.

Winton EF, Vogler WR, Kellar KL, Parker MB, Kinkade JM, Jr. Slide chamber culture system for the in vitro study of humoral regulation of granulocyte and monocyte-macrophage proliferation and differentiation. Blood 1977; 50:289-302.

Kinkade JM, Jr, Kellar KL, Winton EF. Immunochemical quantitation of in vitro neutrophilic granulocyte differentiation. Nature 1979;277:225-227.

Pember SO, Kellar KL, Winton EF, Kinkade JM, Jr. Chromatographic isolation of two murine leukocyte peroxidases distinct from eosinophil peroxidase: Isoenzymes or cell line-specific proteins? J Reticuloendothel Soc 1981;29:451-458.

Evatt BL, Kellar KL. Evolution of techniques for the study of megakaryocyte growth factors. In: Evatt BL, Levine RF, Williams NT, eds. Megakaryocyte biology and precursors: In vitro cloning and cellular properties. Elsevier/North Holland, New York, 1981:15-19.

Kellar KL, Evatt BL, McGrath CR, Ramsey RB. Stimulation of DNA synthesis in megakaryocytes by thrombopoietin in vitro. In: Evatt BL, Levine RF, Williams NT, eds. Megakaryocyte biology and precursors: In vitro cloning and cellular properties. Elsevier/North Holland, New York, 1981:21-37.

Rolovic Z, Kellar KL, Evatt BL. An agar culture system that promotes the growth of megakaryocytes from rat bone marrow. Submitted for publication, May 1984.

Kellar KL, Rolovic Z, Sewell ET, Evatt BL. The effects of thrombopoietin on rat megakaryocytopoiesis in agar cultures. Submitted for publication, August 1984.

REFERENCES

Joseph M. Kinkade, Jr., Ph.D. Associate Professor, Department of Biochemistry, Emory University School of Medicine, Atlanta, GA 30322. Doctoral program advisor.

Bruce L. Evatt, M.D. Director, Division of Host Factors, Center for Infectious Diseases, Centers for Disease Control, Atlanta, GA 30333.

Gordhan L. Patel, Ph.D. Chairman, Department of Zoology, University of Georgia, Athens, GA 30601. Masters program advisor.

EXPERIENCE WITH RADIOACTIVE MATERIALS

Experience with an RIA using ^{125}I-lactoferrin

Experience with binding studies using ^{3}H-Colony-Stimulating Factor (CSF)

Experience with ^{3}H-TdR labeling of DNA in cell cultures, including autoradiography and scintillation counting

Experience with commercial RIAs using ^{125}I-Platelet Factor 4 and ^{125}I-Beta-Thromboglobulin

Curriculum Vitae

Name: Christie Rice Eheman

Address: Centers for Disease Control
1600 Clifton Road
Chamblee 5-A
Atlanta, GA 30333

Phone: 404-452-4072
FTS 236-4072

Education:

M.S. in Health Physics
September 1983
Georgia Institute of Technology
Atlanta, Georgia

B.S. in Applied Biology
June 1982
Georgia Institute of Technology

Gordon Junior College
June 1977 - December 1978
Barnesville, Georgia

Additional Health Physics Training:

Low Level Nuclear Waste Cleanup
April 16 - 17, 1984
Center for Energy and Environmental Management
Fairfax, Virginia

Radiation Safety Officer's Course
May 21 - 25, 1984
University of Texas Medical School Continuing Education Services
San Antonio, Texas

Society Membership:

Atlanta Health Physics Society
Health Physics Society

Employment:

Health Physicist
Cancer Branch
Center for Environmental Health
Centers for Disease Control

10/18/83 - present

Duties:

Evaluation of hazardous radiation waste sites
Emergency Preparedness and Response
Health Physics input into Epidemiology studies
Response to Public Inquiries

Curriculum Vitae

Name	Charles D. Stutzman
Address	2498 Brookcliff Way Atlanta, GA 30345
Phone Number	Business: 404-452-4072 Residence: 404-329-1612
Date of Birth	October 3, 1947
Education	BS (Physics) - University of Pittsburgh, 1969 MS (Radiation Health) - University of Pittsburgh, 1973 MD - Jefferson Medical College, 1978 MPH - Johns Hopkins University, 1980
Internship	Flexible (Rotating) - USPHS Hospital at Baltimore, 1978-79
Residency	General Preventive Medicine - USPHS Hospital at Baltimore / Johns Hopkins University, 1979-80 Radiation Oncology - Vanderbilt University Hospital, 1982-83 General Preventive Medicine - USPHS Centers for Disease Control, 1983-84
Medical Licenses	Georgia Maryland

Training / Education / Employment - Chronological Listing

1983-84 Medical Epidemiologist
Chronic Diseases Division, Centers for Disease Control
Atlanta, GA

1982-83 Radiation Oncology Resident
Vanderbilt University Hospital, Nashville, TN

1978-82 Medical Officer, US Public Health Service
1980-82 Chronic Diseases Division, Centers for Disease Control
Atlanta, GA
1978-80 USPHS Hospital, Baltimore, MD

1974-78 Medical Student
Jefferson Medical College, Philadelphia, PA

1973-74 Radiation Health Physicist
Pennsylvania Bureau of Radiological Health, Pittsburgh, PA
Health Physics Technician
University of Pittsburgh, Pittsburgh, PA

1971-73 Graduate Student/Teaching Fellow
Graduate School of Public Health, University of Pittsburgh
Pittsburgh, PA

1969-71 Research Technician/Graduate Student
Physics Department, University of Pittsburgh, Pittsburgh, PA

1965-69 Undergraduate Student
Physics Department, University of Pittsburgh, Pittsburgh, PA

CURRICULUM VITAE

NANCY J. COX

Nancy J. Cox, Ph. D.
952 Rosedale Road, NE
Atlanta, Georgia 30306
Telephone: (404) 875 7575 (Home); (404) 329-3591 (Office)
Social Security Number: 485-60-4083

Date and Place of Birth: July 21, 1948; Emmetsburg, Iowa

Husband: M. Evan Lindsay

Education:

	Ayrshire High School, Ayrshire, Iowa	
B. S.	Iowa State University, Ames, Iowa	1970
Ph. D.	University of Cambridge, Cambridge, England	1975
Postdoctoral	University of Maryland Baltimore County, Maryland	1975

Professional Experience:

1975-76	Muscular Dystrophy Postdoctoral Fellow, University of Maryland Baltimore County, Maryland
1976-78	Research Chemist, Centers for Disease Control, Atlanta, Georgia
1978-80	Staff Fellow, Centers for Disease Control, Atlanta, Georgia
1980-present	Research Chemist, Centers for Disease Control, Atlanta, Georgia

Membership in Professional Societies:

American Society for the Advancement of Science
American Society for Microbiology
American Society for Virology
Research Society of America, Sigma Xi, CDC Branch

Research Interests:

Major research interests center on the replication of RNA animal viruses with particular emphasis on biochemical and genetic analyses of influenza A viruses. Recent studies have concentrated on the genotypic analysis of cold-adapted, live candidate influenza vaccine strains, directed toward the understanding of the molecular basis for attenuation of these viruses. A second area of research is the molecular epidemiology of influenza viruses.

Honors:

Phi Beta Phi (1970), Marshall Scholarship (1970-1974)

Experience with radioactive materials includes 13 years of laboratory involvement in research with a variety of isotopes including P^{32}, S^{35}, H^{3}, and I^{125}. In addition to practical experience acquired in the USA, time has been spent working on research projects requiring radioactive isotopes in laboratories in England, Germany, and the USSR where regulations and procedures vary somewhat from those encountered here.

Publications:

Mahy, B. W. J., N. J. Cox, S. J. Armstrong and R. D. Barry. 1973. Multiplication of influenza viruses in the presence of cordycepin, an inhibitor of cellular RNA synthesis. Nature New Biology 243:172-174.

Cox, N. J. and R. D. Barry. 1975. Nucleotide sequences homologous to cellular DNA in influenza RNA. IN "Negative Strand Viruses," B. W. J. Mahy and R. D. Barry, Eds., Academic Press, London, pp. 501-511.

Cox, N. J. 1975. Ph. D. Dissertation, Cambridge University.

Cox, N. J. and R. D. Barry. 1976. Hybridization studies of the relationship between influenza virus RNA and cellular DNA. Virology 69:304-313.

Cox, N. J. and A. P. Kendal. 1976. Presence of a segmented single-stranded RNA genome in influenza C virus. Virology 74:239-241.

Cox, N. J., M. C. O'Neill and A. P. Kendal. 1977. Replication of animal viruses in differentiating muscle cells: Influenza virus A. J. gen. Virol. 37:161-173.

Kendal, A. P., N. J. Cox, B. R. Murphy, S. B. Spring and H. F. Maassab. 1977. Comparative studies of wild-type and "cold-mutant" (temperature-sensitive) influenza viruses: Genealogy of the matrix (M) and nonstructural (NS) proteins in recombinant cold-adapted H3N2 viruses. J. Gen. Virol. 37:145-159.

Kendal, A. P., N. J. Cox, S. B. Spring and H. F. Maassab. 1977. Biochemical characteristics of recombinant viruses derived at suboptimal temperatures: Evidence that ts lesions are present in RNA segments 1 and 3 and that RNA 1 codes for the virion transcriptase enzyme. IN "Negative Strand Viruses and the Host Cell," B. W. J. Mahy and R. D. Barry, Eds., Academic Press, London, pp. 733-743.

Maassab, H. F., N. J. Cox, B. R. Murphy and A. P. Kendal. 1977. Biological, genetic and biochemical characterization of a cold-adapted A/Victoria/3/75 virus and its evaluation in volunteers. Int. Symp. on Influenza Immunization (II), Geneva (S. Karger, Basel), Develop. Biol. Standard. 39:25-31.

Cox, N. J., H. F. Maassab, and A. P. Kendal. 1977. Analysis of cold-adapted temperature-sensitive influenza recombinants. American Society for Microbiology. New Orleans, LA, April, 1977.

Cox, N. J. and A. P. Kendal. 1978. Effect of temperature on the order of electrophoretic migration of influenza virus neuraminidase and nucleoprotein genes in gels lacking denaturing agents. J. Gen. Virol. 40:229-232.

Cox, N. J. and A. P. Kendal. 1978. Replication of animal viruses in differentiating muscle cells: Vaccinia and herpes simplex virus type 1. J. Gen. Virol. 41:635-640.

Kendal, A. P., N. J. Cox, J. C. Galphin and H. F. Maassab. 1979. Comparative studies of wild-type and cold-mutant (temperature-sensitive) influenza viruses: Independent segregation of temperature-sensitivity of viral replication from temperature-sensitivity of virion transcriptase activity during recombination of mutant A/Ann Arbor/6/60 with wild-type H3N2 strains. J. Gen. Virol. 44:443-456.

Cox, N. J., H. F. Maassab and A. P. Kendal. 1979. Comparative studies of wild-type and cold-mutant (temperature-sensitive) influenza viruses: Non-random reassortment of genes during preparation of live virus vaccine candidates by recombination at 25° between recent H3N2 and H1N1 epidemic strains and cold-adapted A/Ann Arbor/6/60. Virology 97:190-194.

Cox, N. J., A. P. Kendal, C. Scholtissek, H. F. Maassab. 1979. Genetic characterization of cold-adapted recombinant influenza vaccine strains. American Society for Microbiology, Los Angeles, CA, March 4-8, 1979.

Murphy, B. R., L. J. Markoff, R. M. Chanock, S. B. Spring, H. F. Maassab, A. P. Kendal, N. J. Cox, M. M. Levine, R. G. Douglas, Jr., R. F. Betts and R. B. Couch. 1980. Genetic approaches to attenuation of influenza A viruses in man. Phil. Trans. R. Soc. Lond. B188:401-415.

Bean, W. J., N. J. Cox and A. P. Kendal. 1980. Recombination of human influenza A viruses in nature. Nature. 284:638-640.

Beare, A. S., A. P. Kendal, N. J. Cox and C. Scholtissek. 1980. Human trials with wild-type H1N1 and recombinant H3N2-H1N1 influenza A viruses of 1977-1978. Infect. Immun. 18:753-761.

Bean, W. J., N. J. Cox and A. P. Kendal. 1980. Naturally occurring recombinants of human influenza A viruses. IN "Structure and Variation of Human Influenza A Viruses," G. Laver and G. Air, Eds., Elsevier/North Holland, New York, pp. 105-114.

Nakajima, S., N. J. Cox and A. P. Kendal. 1980. Analysis using monoclonal antibodies and RNA mapping procedures of influenza A(H1N1) viruses from different regions of the world, February 1978 to February 1980. Infect. Immun. 32:287-294.

Cox, N. J., A. P. Kendal, H. F. Maassab, C. Scholtissek, and S. B. Spring. 1980. Genetic synergism between matrix protein and polymerose protein required for temperature sensitivity of the cold-adapted influenza A/Ann Arbor/6/60 mutant virus. International Symposium on Negative Strand Viruses. October 26 - November 1, 1980, St. Thomas, Virgin Islands.

Cox, N. J., I. Konnecke, A. P. Kendal, and H. F. Maassab. 1981. Genetic and biochemical analysis of the influenza A/Ann Arbor/6/60 cold-adapted mutant. ICN-UCLA Symposium, Genetic Variation Among Influenza Viruses. Salt Lake City, UT, March 8-13, 1981.

Maassab, H. F., C. W. Smitka, A. M. Donabedian, A. S. Monto, N. J. Cox and A. P. Kendal. 1981. Characterization of influenza virus "cold" recombinants derived at the non-permissive temperature (38°). IN "Replication of Negative Strand Viruses," D.H.L. Bishop and D. Compans, Eds., Elsevier/. North Holland, New York, pp. 396-404.

Cox, N. J., A. P. Kendal, H. F. Maassab, C. Scholtissek and S. B. Spring. 1981. Genetic synergism between matrix protein and polymerase protein required for temperature sensitivity of the cold-adapted influenza A/Ann Arbor/6/60 mutant virus. IN "Replication of Negative Strand Viruses," D.H.L. Bishop and D. Compans, Eds., Elsevier/North Holland, New York, pp. 405-414.

Kendal, A., N. Cox, S. Nakajima, R. Webster, W. Bean and P. Beare. 1981. Natural and unnatural variation in influenza A(H1N1) viruses since 1977. ICN-UCLA Symposia on Molecular and Cellular Biology, Vol. XXII, "Genetic Variation Among Influenza Viruses," D. Nyak and F. Fox, Eds., Academic Press, New York, pp. 489-504.

Maassab, A. S. Monto, D. C. DeBorde, N. J. Cox and A. P. Kendal. 1981. Development of cold recombinants of influenza virus as live virus vaccines. ICN-UCLA Symposia on Molecular and Cellular Biology, Vol. XXII, "Genetic Variation Among Influenza Viruses," D. Nyak and F. Fox, Eds., Academic Press, New York, pp. 617-637.

Cox, N. J., I. Konnecke and A. P. Kendal. 1981. Genetic and biochemical analysis of the A/Ann Arbor/6/60 cold-adapted mutant. ICN-UCLA Symposia on Molecular and Cellular Biology, Vol. XXII, "Genetic Variation Among Influenza Viruses," D. Nyak and F. Fox, Eds., Academic Press, New York, pp. 639-652.

Murphy, B. R., R. M. Chanock, M. L. Clements, W. C. Anthony, A. J. Sear, L. A. Cisneros, M. B. Rennels, E. H. Miller, R. E. Black, M. M. Levine, R. F. Betts, G. Douglas, Jr., H. F. Maassab, N. J. Cox and A. P. Kendal. 1981. Evaluation of A/Alaska/6/77(H3N2) cold-adapted recombinant viruses derived from A/Ann Arbor/6/60 cold-adapted donor viruses in adult seronegative volunteers. Infect. Immun. 32:693-697.

Cox, N. J., Z. S. Bai and A. P. Kendal. 1983. Laboratory-based surveillance of influenza A(H1N1) and (H3N2) viruses in 1980-1981: Antigenic and genomic analyses. Bull. Wld. Hlth. Org. 61:143-152.

Cox, N. J., J. B. McCormick, K. M. Johnson and M. P. Kiley. 1983. Evidence for two subtypes of Ebola virus based on oligonucleotide mapping of RNA. J. Inf. Dis. 147:272-275.

Both, G. W., J. M. Sleigh, V. J. Bender, P. A. Underwood, R. Wittaker, B. A. Moss, N. J. Cox and A. P. Kendal. 1983. A survey of antigenic drift in the haemmagglutinin of H3N2 influenza virus isolates since 1968. Peking Symposium. IN The Origin of Pandemic Influenza Viruses, (ed. W. G. Lancet, Elsevier), pp. 39-46.

Both, G. W., M. J. Sleigh, N. J. Cox and A. P. Kendal. 1983. Antigenic drift in H3 influenza haemagglutinin from 1968 to 1980: Multiple evolutionary pathways and sequential amino acid changes at key antigenic sites. J. Virol. 48:52-60.

Patriarca, P. A., A. P. Kendal, P. Zakowski, N. J. Cox, J. D. Cherry, M. S. Trautman, D. M. Auerbach, J. McCusker, R. R. Belliveau and K. D. Kappus. 1984. Lack of significant person-to-person spread of swine influenza-like virus following infection in an immunocompromised child. Am. J. Epi. 119:152-158.

Cox, N. J. and A. P. Kendal. 1984. Stability of the genes of live attenuated influenza vaccine donor strain A/Ann Arbor/6/60: Analysis by oligonucleotide mapping of recombinant vaccine strains before and after replication in human volunteers. J. of Inf. Diseases. 149:194-200.

Kendal, A., N. Cox, S. Nakajima, K. Nakajima, L. Raymond, A. Caton, G. Brownlee, and R. Webster. 1983. Analysis of the Antigenic Structures of Influenza A/USSR/90/77 hemagglutinin. Moscow Symposium on Recombinant DNA. In press.

Cox, N. J. and A. P. Kendal. Genetic stability of A/Ann Arbor/6/60 cold-mutant (temperature-sensitive) live influenza vaccine strains. In "Molecular Biology of Negative Strand Viruses." D.H.L. Bishop and D. Compans, Eds. Academic Press. In press.

Cox, N. J. and A. P. Kendal. Genetic stability of A/Ann Arbor/6/60 cold-mutant (temperature-sensitive) live influenza vaccine strains. National Symposium on Negative Strand Viruses. Hilton Head, SC, September 11-17, 1983.

Cox, N. J., S. Nakajima R. Black, and A. P. Kendal. Application of RNA oligonucleotide mapping as an aid to identifying laboratory contaminants of influenza virus. (Submitted for Publication).

Cox, N. J., F. Kitame, A. P. Kendal, A. Klimov and I. Konnecke. Comparative studies of wild-type and cold-mutant (temperature sensitive) influenza virus: Detection of mutations in all genes of the A/Ann Arbor/6/60(H2N2) mutant vaccine donor strain. In preparation.

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