FORM NRC-313 I
(3-80)
10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

1. APPLICATION FOR: *(Check and/or complete as appropriate)*

X	a. NEW LICENSE
	b. AMENDMENT TO: LICENSE NUMBER
	c. RENEWAL OF: LICENSE NUMBER

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*

BioClinical Group, Inc.

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
(617) 497-2070

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION

Ernest V. Groman, Ph.D.

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
(617) 497-2070

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code) (Address to which NRC correspondence, notices, bulletins, etc., should be sent.)*

767B Concord Avenue
Cambridge, MA 02138

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*

767B Concord Avenue
Cambridge, MA 02138

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL
(See Items 16 and 17 for required training and experience of each individual named below)

	FULL NAME	TITLE
a.	Ernest V. Groman, Ph.D.	Senior Scientist
b.	Lee Josephson, Ph.D.	Senior Scientist
c.	Lewis Cantley	Research Coordinator

7. RADIATION PROTECTION OFFICER

Ernest V. Groman, Ph.D.

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.

8. LICENSED MATERIAL

LINE NO.	ELEMENT AND MASS NUMBER A	CHEMICAL AND/OR PHYSICAL FORM B	NAME OF MANUFACTURER AND MODEL NUMBER (If Sealed Source) C	MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME D
(1)	Iodine-125	Iodide [a]	NA	50 millicuries
(2)	Iodine-125	^{125}I-Thyroxine [b]	NA	10 millicuries
(3)	Iodine-125	^{125}I-Cortisol/Digoxin/HCG [b]	NA	15 millicuries
(4)	a. chemical form-a salt in aqueous solution. b. chemical form- a nonvolitile organic molecule			

	DESCRIBE USE OF LICENSED MATERIAL E
(1)	Synthesis of ^{125}I -Derivatives for use in radio immunoassay.
(2)	For use in development of radio immunoassays and sale in kit form for in-vitro Diagnostics.
(3)	
(4)	

R+D
Dr. John Glenn

License ... information
12/11/81
on ... file

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REG1 LIC30
20-20526-01 PDR

9. STORAGE OF SEALED SOURCES

LINE NO.	CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED. A.	NAME OF MANUFACTURER B.	MODEL NUMBER C.
(1)	NA	NA	NA
(2)			
(3)			
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	TYPE OF INSTRUMENT A	MANUFACTURER'S NAME B	MODEL NUMBER C	NUMBER AVAILABLE D	RADIATION DETECTED (alpha, beta, gamma, neutron) E	SENSITIVITY RANGE (milliroentgens/hour or counts/minute) F
(1)	Survey meter	Ludlum	177	1	Gamma	500-1,000,000 CPM
(2)	Geiger counter	Eberline	E-120	1	Gamma	0.5--50mr/hr
(3)	Automatic Gamma counter	Micrometics	4/200	1	Gamma	100-100,000 CPM
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY See attachment

Ludlum Model 177
Eberline E-120

☒ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments. See attachment

Micrometic 4/200

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
☐ (1) FILM BADGE ☒ 2) THERMOLUMINESCENCE DOSIMETER (TLD) ☐ (3) OTHER (Specify): _____	R.S. Landauer 3 New England Executive Park Suite 218 Burlington, MA 01803	☐ MONTHLY ☒ QUARTERLY ☐ OTHER (Specify): _____

13. FACILITIES AND EQUIPMENT (Check were appropriate and attach annotated sketch(es) and description(s).

☒ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (*Include filtration, if any*), ETC.
☐ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (*fixed and/or temporary*), ETC.
☐ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.
☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED

Interex Corporation

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

For Items 15, 16, 17 -- see attachment

15. RADIATION PROTECTION PROGRAM. Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.

16. FORMAL TRAINING IN RADIATION SAFETY. Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.

    a. Principles and practices of radiation protection.

    b. Radioactivity measurement standardization and monitoring techniques and instruments.

    c. Mathematics and calculations basic to the use and measurement of radioactivity.

    d. Biological effects of radiation.

17. EXPERIENCE. Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

18. CERTIFICATE

(This item must be completed by applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 30, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

WARNING.—18 U.S.C., Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

a. LICENSE FEE REQUIRED *(See Section 170.31, 10 CFR 170)* $190.00	b. CERTIFYING OFFICIAL *(Signature)* Ernest V Groman
	c. NAME *(Type or print)* Ernest V. Groman, Ph.D.
(1) LICENSE FEE CATEGORY: 3K	d. TITLE Senior Scientist, Health Physicist
(2) LICENSE FEE ENCLOSED: $ 190.00	e. DATE 12-11-81

FORM NRC-313 I (3-80)

GPO 866 632

Attachment for Item 11

Item 11a - Calibration of Instruments

Instrument	Calibrated by Service Company Name, Address, Frequency
Ludlum - Model 177	1) Ludlum Measurement, Inc. P.O. Box 248 501 Oak Sweetwater, Texas 79556 2) Nuclear Instrument Co. 65 Grove Rockland, Massachusetts 02370 Once a year
Eberline Model E-120	1) Eberline Instrument Corp. P.O. Box 2108 Santa Fe, New Mexico 87501 2) Nuclear Instrument Co. 65 Grove Rockland, Massachusetts 02370 Once a year

Item 11b

Micrometic 4/200 Automatic Gamma Counter	By Applicant -- See attachment 11b

Item 11a

HEALTH PHYSICS PROCEDURE

SURVEY METER CALIBRATION

Date Effective: 12/15/81

SCOPE

This procedure described methods, frequency, precision limits and documentation for the calibration of portable radiation detection instruments.

FREQUENCY

Calibration is to be performed at least once yearly.

Responsibility: By the manufacturer:
Ludlum Measurement Inc. and Eberline Instrument Corp.
or Nuclear Instrument Co., Rockland, MA 02370

PROCEDURE

1. Inspection

   1.1 Inspect line cord and plug, inspect probe cord.

   1.2 Remove cover and inspect for battery spillage.

   1.3 Clean probes and covers carefully with diluted Isoclean solution.

2. Calibration

   2.1 Measurements are to be taken in an open area away from all sources of radiation. Measurements are taken on a cardboard box to reduce scattered radiation, air attenuation is assumed to be minimal.

   2.2 Survey meter is set to operate, response is set to slow, background subtract is set to off. A ^{137}Cs source is used for calibration of all meters except Ludlum 177 with 44-3 gamma scintillation probe. An ^{129}I source is used for Ludlum calibration due to loss in detection above 40 KEV.

   2.3 Measurements are made at the probe surface and at regulated distances from the probe (1", 2", 4", 8", etc.). Two readings are taken for each meter scale. Care should be taken to insure that the source remains an even height from the probe at each distance. Calibration adjustments are made by using the calibration set screws for each scale.

LIMITATIONS

1. Measurements are checked to see that they follow the inverse square low. That is, the radiation from a point source is inversely proportional to the square of the distance from the source to the detector (probe). Each scale set is to be linear within $\pm$ 10% of every other scale. If these conditions are not met, proceed as in "Documentation".

DOCUMENTATION

1. Devices that are Within Calibration Limits

   Each calibration and inspection procedure shall be documented by completion of a survey meter calibration form. The form shall note the instrument number, the calibration, date, standards used, and results of the calibration and measurements. Completed calibration forms shall be maintained by the Health Physicist.

   A calibration certificate shall be attached to each meter showing date of calibration, calibrator, and due date for next calibration.

2. Devices that are Out of Calibration

   Equipment covered in this procedure which does not meet the requirements stated in Limitations shall be removed from the laboratory. Corrective action or repair shall be directed by the Health Physicist and noted on the calibration form. The instrument shall be recalibrated immediately following any repairs.

Item 11b

HEALTH PHYSICS PROCEDURE

RADIOACTIVITY COUNTER MAINTENANCE AND CALIBRATION

Date Effective: 12/15/81

PURPOSE

To ensure the proper operation of all well type radioactivity counters.

To provide for the calibration and routine maintenance of radioactivity counters.

SCOPE

This procedure describes methods, frequency. precision limits and documentation for the calibration of liquid scintillation and auto gamma well counters.

PROCEDURE

1. Scheduled Calibration

   All counting equipment is maintained under service contract and is calibrated at least twice each year. The Health Physicist will arrange for contracted calibration and will maintain all counter calibration records.

2. Operational Calibration

   All counting equipment is checked weekly by department personnel for operating efficiency and background.

   2.1 Weekly efficiency and background for gamma counters:

   Counters are calibrated for ^{125}I and ^{57}Co efficiency with the in-house standards. Standards are counted for a full minute and % efficiency is calculated by CPM of standard ÷ known CPM of standard x 100. Blank tubes are run to determine background.

   Weekly efficiency and background check for LSC counters. Using the Internal Standard method, the sample is counted, then a known amount of activity is added to the sample and it is recounted. The incremental increase in count rate divided by the activity added x 100 give the % efficiency.

3. Calibration Standards for Operational Calibration

   3.1 ^{137}Cs Packard 0.1 nCi, for PHA and voltage calibration
   ^{137}Cs NEN 7.0 nCi, NES-139T, for PHA and voltage calibration
   ^{57}Co NEN 0.1 nCi, NES-137, for efficiency
   ^{125}I Searle RIA Standard Curve Set, for counter linearity.
   ^{125}I BCG in-house standards, for efficiency
   ^{57}Co BCG in-house standards, for efficiency

   3.2 In-House Standards

   BCG in-house standards are made using NEN ^{125}I and Duphar ^{57}Co by imbedding the activity in an epoxy bead in the bottom of a 12 x 75 mm tube. These standards are used due to the fact that:

a) Commercial and NBS standards do not come in 12 x 75 mm tubes and consequently do not fit into many counters, and b) Available ^{125}I standards have decay schemes different than ^{125}I. The short ^{125}I half-life make purchase of ^{125}I standards not financially feasible. In-house standards for ^{125}I are calibrated by the "Eldridge" Absolute Activity method.[1]

4. Limits

4.1 All background readings will be maintained below 100 cpm. Any counter with a background over 100 cpm will be immediately decontaminated.

4.2 Weekly counter efficiencies will be within ±5% of the previous calibration. Precision will be within the preset conditions of the counter.

4.3 Counter linearity will be within ±10% of each selected range.

4.4 PHA balance, voltages and resolution will be calibrated according to the manufacturers' specifications.

5. Documentation

5.1 Operating efficiencies and optimum window settings will be posted in each counting room.

5.2 A record will be kept of all counter calibration noting the data, name of calibrator, standards used, instrument number and results. The Health Physicist will maintain all counter calibration records and related information.

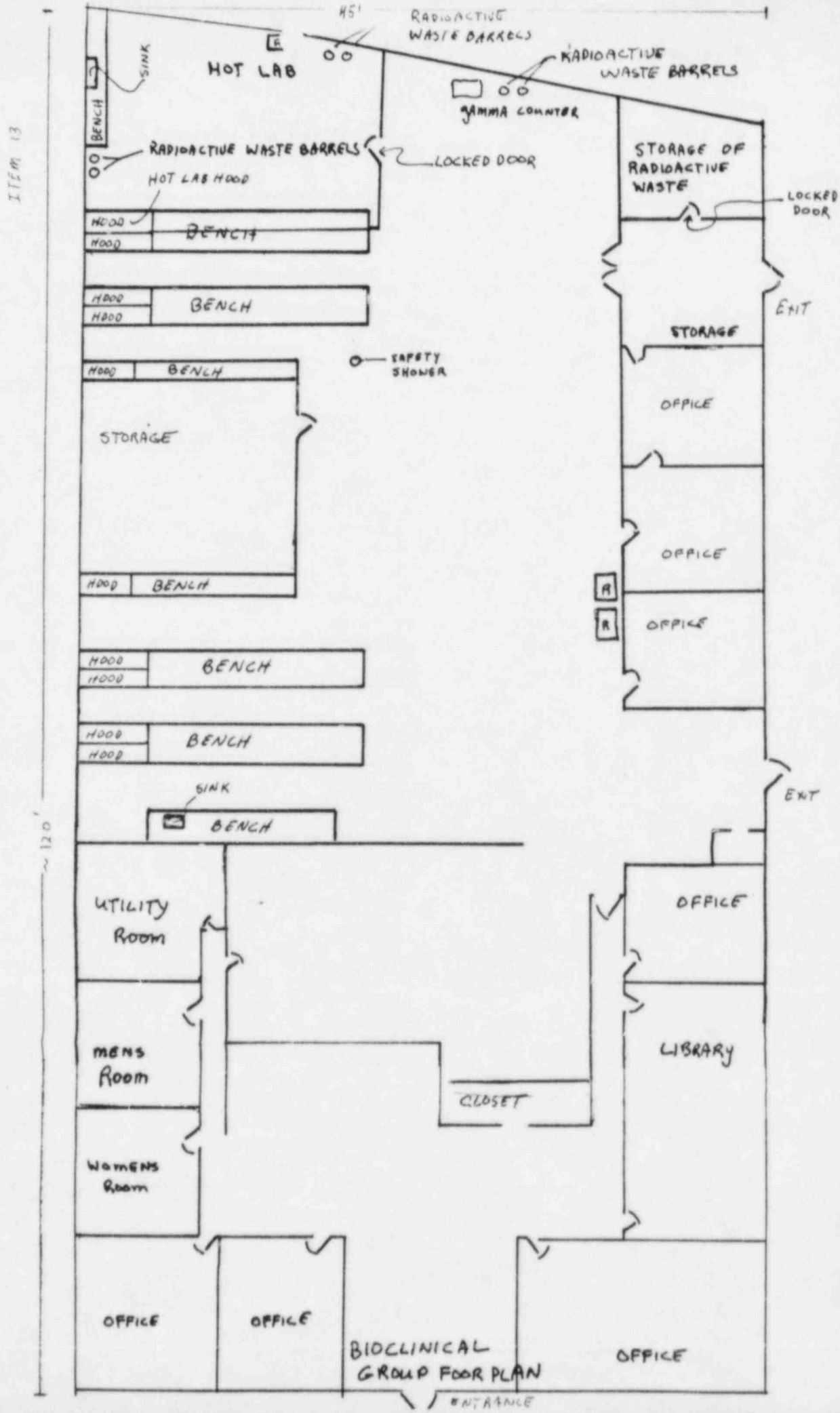
5.3 All counters are maintained under service contract with the manufacturer. All service is recorded by the Health Physicist and counters are recalibrated prior to reuse after any service of a non-mechanical nature which could affect data output.

5.4 Equipment covered in this procedure which does not meet the requirements of Section 4 will be tagged out of service. Corrective action or repair will be initiated by the Health Physicist. All service and adjustments will be recorded by the Health Physicist.

[1]Reference: NUCLEONICS, 22(b), 56, 1964

Attachment for Item 13

IODINATIONS WILL BE PERFORMED IN A 5 FOOT CHEMICAL FUME HOOD equipped with an AF-1000 charcoal filter (American Air Filter, Louisville, Ky) at the end of the stack on the roof of the building. All fittings downstream of the fan will be caulked to force all exhaust gasses to pass through the charcoal filter before exiting into the atmosphere. The exhaust ductwork from the hood to the roof is about 20 feet in length.


ITEM 13
~120'
45'
RADIOACTIVE WASTE BARRELS
RADIOACTIVE WASTE BARRELS
HOT LAB
SINK
BENCH
GAMMA COUNTER
RADIOACTIVE WASTE BARRELS
LOCKED DOOR
STORAGE OF RADIOACTIVE WASTE
LOCKED DOOR
HOT LAB HOOD
HOOD
HOOD
BENCH
HOOD
HOOD
BENCH
EXIT
STORAGE
SAFETY SHOWER
HOOD
BENCH
OFFICE
STORAGE
OFFICE
HOOD
BENCH
R
R
OFFICE
HOOD
HOOD
BENCH
HOOD
HOOD
BENCH
EXIT
SINK
BENCH
OFFICE
UTILITY Room
MENS Room
CLOSET
LIBRARY
WOMENS Room
OFFICE
OFFICE
OFFICE
BIOCLINICAL GROUP FOOR PLAN
ENTRANCE

Attachment for Items 16 and 17

ERNEST V. GROMAN

Present position

Senior Scientist
BioClinical Group
767B Concord Avenue
Cambridge, MA 02138
(617) 497-2070

Education

University of North Carolina - Chapel Hill
B.S. Mathematics 1966
University of California - Berkeley
Ph.D. Biochemistry 1972

Experience

1980-1981 Section Manager at Clinical Assays in the Department of Research and Development

1976-1979 Group Leader at Clinical Assays in the Department of Research and Development

1972-1976 Associate in Biological Chemistry at Harvard Medical School and Massachusetts General Hospital in the Laboratory of Dr. Lewis L. Engel

Awards

Predoctoral Fellow on U.S. Public Health Training Grant, 1966-1971
Technical Achievement Award Baxter Travenol Laboratories, 1978

Society Memberships

AAAS
American Chemical Society
American Association of Clinical Chemistry

Personal Data

Born: August 9, 1945 - Brooklyn, New York
Married: Mary Alyce Watson, June 25, 1967
Children: Two
SS #231-60-9597
Citizenship: United States

Training in Radiation Safety

Formal training at Clinical Assays, Div. of Travenol Laboratories, 600 Memorial Drive, Cambridge, MA 02139 - 3 days (1976-1981)

Harvard Medical School - a 9-session course taught by Robert Johnson (1975)

The course at Harvard Medical School considered the following areas related to the use of radioactivity:

A. Principles and practice of radiation protection including calculation of exposure limitations, monitoring and shielding techniques.

B. Radioactivity measurement standardization for geiger counters, survey meters and β and γ counters.

C. Mathematics basic to the use of radioactivity including biological and physical half-lives, cpm to dpm conversions, time averaged body burden exposure to radioactivity.

D. Biological effects of radiation - both external and internal exposure.

Experience Working with Radioactive Materials

Clinical Assays, Div. of Travenol Laboratories:

Performed laboratory experiments using up to 5mCi of ^{125}I and 100μCi of ^{57}Co (1976-1978)

Directed a group of 4 to 12 people in the development of immunoassays using ^{125}I and ^{57}Co. The maximum amount of ^{125}I used for iodinations was 5mCi. Responsibilities included assuring that supervisors understood the principles and practices of radiation safety; radioactivity measurement standardization and monitoring, techniques, and instruments; calculations basic to the use of radioactivity; and the biological effects of radioactivity.

During the transfer of products to manufacturing, supervised the iodination of tracers for the production department on a scale ranging from 5 to 50 mCi. (1976-1981)

From 1979-1981 was the Radiation Safety Officer for the Research and Development Department, a group of 30 individuals. The maximum allowed amount of ^{125}I in the department was 50mCi; ^{57}Co was 5mCi.

Harvard Medical School

Worked generally with 50μCi amounts of ^{3}H and ^{14}C. On one occasion, worked with 1 curie of $^{3}H\text{-}H_2O$. (1970-1976)

Curriculum Vitae

LEE JOSEPHSON

11 Martin Street
Arlington, MA 02174

Present Position: Senior Scientist
BioClinical Group
767B Concord Avenue
Cambridge, MA 02138

Birthdate: December 16, 1945; Citizenship: USA

Marital Status: Married; two children, 3 and 8 years of age

Education:

State University of New York at Stony Brook
Ph.D., Biochemistry, 1975

University of Wisconsin
B.S., Chemistry, 1967

Northeastern University
Enrolled in M.S. Program in Clinical Chemistry, 1978-1979

Research Interests:

1. Methods of measuring antibody levels in specific classes of immunoglobulins
2. Detection of cancer by immunological assays of proteins, e.g. alphafetoprotein, prostatic acid phosphatase
3. Immunoenzymatic detection methods

Research and Professional Experience:

1980-1981

Section Manager
Clinical Assays, Div. of Travenol Laboratories
Responsible for immunoenzymatic methods particularly as applied to assays in the infectious disease area; supervisory responsibility for Senior Research Scientists.

1977-1979

Senior Research Scientist
Clinical Assays, Div. of Travenol Laboratories
Supervised the development of radioimmunoassays for alphafetoprotein, prostatic acid phosphatase, trobramycin, gentamicin, aldosterone and others. My duties included the transfer of assays from research to manufacture.

1975-1977

Postdoctoral Fellow in the laboratory of
Dr. Guido Guidotti, Harvard University

1970-1975

Graduate Student, State University of
New York at Stony Brook. Thesis: The
Regulation of the Na-K ATPase in the Electric
Organ of Electrophorus Electricus.

1969-1970

Research Technician
Mt. Sinai Medical Center, NYC.
I worked on projects related to membrane
enzymes and the effects of pharmacological
agents on these enzymes. I took graduate
courses in Human Physiology and the
Biosynthesis of Macromolecules at the
Mt. Sinai Campus of the City University of NY.

1967-1969

Research Technician
University of Wisconsin Medical Center
I worked on projects related to lipid metabolism.

Training in Radiation Safety

Formal training at Clinical Assays, Div. of Travenol Laboratories,
600 Memorial Drive, Cambridge, MA 02139 - 3 days (1976-1981)

Harvard University: was instructed in the handling of ^{3}H, ^{32}P, and ^{14}C by Ed Lenhoff, Radiation Safety Officer at the Biological Laboratory (1975-1977)

Experience Working with Radioactive Materials

Clinical Assays, Div. of Travenol Laboratories:

Directed a group of 2 to 8 people in the development of immunoassays using ^{125}I. The maximum amount of ^{125}I used for iodinations was 5mCi. (1976-1980)

Was the Radiation Safety Officer for the Research and Development Department, a group of 20 to 25 individuals. The maximum allowed amount of ^{125}I in the department was 50mCi; ^{57}Co was 5mCi. (1978-1979)

Harvard University

Worked with the following amounts of indicated isotopes:

5mCi -- ^{32}P
1mCi -- ^{3}H
1mCi -- ^{14}C

ML18

LEWIS CANTLEY

Present Positions

Research Coordinator
BioClinical Group
767B Concord Avenue
Cambridge, MA 02138

Associate Professor
Department of Biochemistry and Molecular Biology
Harvard University
Cambridge, MA 02139

Education

Wesleyan College (W. Virginia), B.S., Chemistry, 1971
Cornell University, Ph.D., Chemistry, 1975

Experience

1981 - Present	Associate Professor, Harvard University
1978 - 1981	Assistant Professor, Harvard University
1975 - 1978	Postdoctoral Fellow, Harvard University

Training in Radiation Safety

One-day course at Cornell University while a graduate student.

Experience Working with Radioactive Materials

Supervises a laboratory consisting of 12 people and uses the following amounts of indicated isotopes:

1mCi -- ^{22}Na
1mCi -- ^{48}V
1mCi -- ^{125}I
1mCi -- ^{86}Rb
1mCi -- ^{3}H
1mCi -- ^{14}C
1mCi -- ^{57}Co