FORM NRC-313 I (1-79) 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)*

	a. NEW LICENSE
XX	b. AMENDMENT TO: LICENSE NUMBER 20-14809-01
	c. RENEWAL OF: LICENSE NUMBER

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

New England Biolabs, Inc.

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
617-927-5054

3. NAME OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION

Donald G. Comb

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
617-927-5054

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)*

32 Tozer Road
Beverly, MA 01915

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

Same as #4

(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.	Dr. Mario Philipp	Research Scientist
b.		
c.		

Applicant 9155
Check No. 40-3K
Amount/Fee Category $ Amendment
Type of Fee 9/13/83
Date Check Rec'd
Received By Brown

RECEIVED BY LEMB
Date 9/13/83
Log Sept 17
By Brown
Orig. To 9/14/83

7. RADIATION PROTECTION OFFICER

Donald G. Comb

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.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	C NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)*	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	125I	NaI	---	5 mCi
(2)				
(3)				
(4)				

	E DESCRIBE USE OF LICENSED MATERIAL
(1)	Use of 1 m Ci or less for iodinations to label.
(2)	
(3)	
(4)	

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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)			
(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)	Scintillation Survey meter	Ludlum	#	1	Gamma	0-10,000 c/m
(2)	Geiger Counters	Eberline	E-120	1	Beta-gamma	0-50 mr/hr
(3)	"	Minimonitor		1	Beta-gamma	0-20 mr/hr
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY

See renewal, Section 11, dated 8/27/81

☐ b. CALIBRATED BY APPLICANT

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

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
☒ (1) FILM BADGE	Robert U. Johnson (see renewal dated 8/27/81)	☒ MONTHLY
☐ (2) THERMOLUMINESCENCE DOSIMETER (TLD)		☐ QUARTERLY
☐ (3) OTHER (Specify): _____		☐ 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.

See supplement, #15 Paragraph 4.

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:

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)* $40.00	b. CERTIFYING OFFICIAL *(Signature)*
	c. NAME *(Type or print)* Donald Comb, Ph.D.
(1) LICENSE FEE CATEGORY: 3K	d. TITLE President, New England Biolabs, Inc.
(2) LICENSE FEE ENCLOSED: $ 40.00	e. DATE July 1983

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SUPPLEMENT TO APPLICATION

#15

The iodinations will be carried out in an approved hood which has a flow rate of 150 linear feet/minute with the sash set at 18" high. The hood has a stainless steel base to minimize contamination problems. The iodinations will be carried out in a closed system to also minimize the release of free iodine to the environment by reaction of the chloramine -T with the NaI. The iodinations will be monitored for any potential release to the environment by sampling the exhaust at a point just prior to being discharged from the building. The sampling procedure involves collection of a calibrated flow rate of the exhaust from the duct through a tube into a pump which has a charcoal cartridge (standard iodine collection cartridge #605018 (4235TA) with TEDA impregnated carbon for adsorption of radioiodine, manufactured by Scott Safety Products, South Haven, Michigan, 49090). The concentration of radioiodine in the exhaust can then be determined by an evaluation of the uCI collected divided by the flow rate of air through the pump in cc. The resulting concentration in the exhaust will be minimized in order that the permissible discharge level of $8X10^{-11}$uCi/cc will not be approached.

The iodinator will conduct a survey after each use of 125I for the iodination to include a measurement of any potential contamination with the scintillation survey meter and wipes off the surfaces. A survey will also be made of the hands, (of course, gloves will be worn) clothing, surfaces, and floor. The waste will be double bagged to prevent any release of any volatile material.

Thyroid measurements will be made within two weeks of the initial iodinations and if the results prove to be minimal, the requirement will be established that the iodinator must have a thyroid measurement within a month of the iodination. The action level established will be 20% of the guidelines as set forth in Regulatory Guide 8.20, U. S. Nuclear Regulatory Commission Office of Standards Development.

The liquid waste will be stored for decay to a level for subsequent disposal through the sanitary sewerage system as set forth in 10-CFR-20.303 with a record maintained of any disposal. The solid waste will either be stored a minimum of 10 half-lives and until there is no detectable dose rate. The survey of this waste indicating that the radioactivity has decayed to background will be recorded. If necessary, and if the quantity precludes the decay process, the waste will be packaged and shipped via a commercial company, probably Interex Corporation.

SUPPLEMENT TO APPLICATION

#16 Donald G. Comb

I have handled radioisotopes for 30 years. Used 100 mc of ^{14}C to synthesize sugars from 1954 to 1960 at the University of Michigan. Supplied NEN with some of the first ^{14}C-glucose sold commercially. At Harvard Medical School I prepared labelled nucleic acids from bacteria using 50 mc of ^{14}C or ^{32}P substrates. Formal courses in radiation safety were taken at the University of Michigan. I provided the safety training for many graduate students at Harvard Medical School.

#17 See attached resume

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CURRICULUM VITAE

DONALD GEORGE COMB

Born:	July 10, 1927: Detroit, Michigan
1951	A.B., Wayne University, Michigan
1952	A.M., University of Michigan
1956	Ph,D., University of Michigan
1956-1958	Postdoctoral Fellow, American Cancer Society, Rackham Arthritis Research Unit, University of Michigan
1958-1960	Research Associate, Rackham Arthritis Research Unit, University of Michigan
1958-1960	Instructor in Biological Chemistry, Medical School, University of Michigan
1960-1964	Assistant Biochemist, Massachusetts General Hospital, Boston, Massachusetts
1961-1962	Research Associate in Biological Chemistry, Harvard Medical School, Boston, Massachusetts
1962-1964	Associate in Biological Chemistry, Harvard Medical School, Boston, Massachusetts
1964-1970	Assistant Professor of Biological Chemistry, Harvard Medical School, Boston, Massachusetts
1970-1971	Associate Professor of Biological Chemistry, Harvard Medical School, Boston, Massachusetts
1972-Present	President, New England Biolabs, Inc. Beverly, Massachusetts

PUBLICATIONS

1. Comb, D.G. and Roseman, S.: Glucosamine-6-phosphate deaminase. Biochim. Biophys. Acta, 21, 193, 1956.

2. Comb, D.G. and Roseman, S.: Composition and enzymatic synthesis of N-acetylneuramicic acid (sialic acid). J.Am. Chem. Soc., 80, 497, 1958.

3. Comb, D.G. and Roseman, S.: Glucosamine metabolism IV. Glucosamine-6-phosphate deaminase. J. Biol. Chem., 232, 807, 1958.

4. Comb, D.G. and Roseman, S.: Enzymic synthesis of N-acetyl-D-mannosamine. Biochim. Biophys. Acta, 29, 653, 1958.

5. Roseman, S. and Comb, D.G.: The hexosamine moiety of N-acetylneuraminic acid. J. Am. Chem. Soc., 80, 3166, 1958.

6. Comb, D.G., Shimizu, F., and Roseman, S.: Isolation of cytidine-5-monophospho-N-acetylneuraminic acid. J. Am. Chem. Soc., 81, 5513, 1959.

7. Comb, D.G. and Roseman, S.: Metabolism of the sialic acids I. Enzymatic synthesis of N-acetylneuraminic acid. J.Biol. Chem., 235, 25, 1960.

8. Comb, D.G. and Roseman, S.: Glucosamine-6-phosphate deaminase from Escherichia coli, in Colowick, S. P. and Kaplan, N.O. (Editors), Methods in Enzymology V, pp. 422-426, 1962.

9. Comb, D.G. and Roseman, S.: N-acetylneuraminic acid adlolase in Methods in Enzymology V, Colowick, S. P. and Kaplan, N. O. (Editors), pp. 391-398, 1962.

10. Comb, D.G., Chin, W., and Roseman, S.: Uridine nucleotides containing diaminopimelic acid from Escherichia coli. Biochim, Biophys. Acta, 46, 394, 1961.

11. Comb, D.G.: The enzymatic addition of D-alanyl-D-alanine to a uridine nucleotide-peptide. J. Biol. Chem., 237, 1601, 1962.

12. Comb, D.G. and Brown, R.: Preliminary studies on the degradation and synthesis of RNA components during sea urchin development. Exptl. Cell Res., 34, 360, 1964.

13. Katz, S. and Comb, D. G.: A new method for the determination of the base composition of RNA. J. Biol. Chem., 238, 3065, 1963.

14. Comb, D. G., Brown, R., and Katz, S.: The nuclear DNA and RNA components of the aquatic fungus Blastocladiella emerosonii. J. Mol. Biol., 8, 781, 1964.

15. Comb, D. G. and Katz, S.: Studies on the biosynthesis and methylation of transfer RNA. J. Mol. Biol., 8, 790, 1964.

16. Comb, D. G.: The association of methyl acceptor ribonucleic acid with ribosomes. J. Biol. Chem., 239, 3597, 1964.

17. Comb, D. G. and Pinzino, C. J.: The methylation of ribosomal ribonucleic acid in vivo. Biochim. Biophys. Acta, 87, 690, 1964.

18. Comb, D. G.: Methylation of nucleic acids during sea urchin embryo development. J. Mol. Biol., 11, 851, 1965.

19. Comb, D.G., Sarkar, N., DeVallet, J., and Pinzino, C.J.: Properties of transfer-like RNA associated with ribosomes. J. Mol. Biol., 12, 509, 1965.

20. Sarkar, N. and Comb, D. G.: The predominant site of in vitro uracil methylation of methyl-deficient transfer RNA. J. Mol. Biol., 17, 541, 1966.

21. Silver, D. J. and Comb, D. G.: Free amino acid pools in the developing sea urchin Lytechinus Variegatus. Exptl. Cell Res., 43, 699, 1966.

22. Zehavi-Willner, T. and Comb, D. G.: Studies on the relationship between transfer RNA and transfer-like RNA. J. Mol. Biol., 16, 250, 1966.

23. Comb, D. G., Sarkar, N., and Pinzino, C. J.: The methylation of lysine residues in protein. J. Biol. Chem., 241, 1857, 1966.

24. Comb, D. G. and Zehavi-Willner, T.: Isolation, purification and properties of 5 S Ribosomal RNA: a new species of cellular RNA. J. Mol. Biol., 23, 441, 1967.

25. Comb, D. G. and Sarkar, N.: The binding of 5 S ribosomal RNA to ribosomal subunits, J. Mol. Biol., 25, 317, (1967).

26. Silver, D. J. and Comb, D.G.: Synthesis of acetic acid soluble proteins during sea urchin development. Devel. Bio., 16, 107, (1967).

27. Comb, D. G. and Silver, D.J.: Sythesis of basic proteins and cellular RNA species during sea urchin development. Nat. Cancer Inst. Monogr., 23, 325,(1966).

28. Yang, S. S. and Comb, D.G.: Distribution of multiple forms of lysyl Transfer RNA during early embryogenesis of sea urchin, Lytechinus variegatus. J. Mol. Biol. 31, 139,(1968).

29. Sarkar, N. and Comb, D. G.: Studies on the attachment and release of 5 s ribosomal RNA from the large ribosomal subunit. J. Mol. Biol., 39, 31-44, (1969).

30. Hartmann, J. F. and Comb, D. G.: Transcription of nuclear and cytoplasmic genes during early development of sea urchin embryos. J. Mol. Biol., 41, 155, (1969).

31. Hartmann, J. F., Ziegler, M.M. and Comb, D. G.: Sea Urchin Embroyogenesis. I. Transcription of nuclear and cytoplasmic genes during early development. Devel. Biol. 25, 209 (1971).

32. Comb, D. G.: Seventh Report of the Special Commission on Marine Boundaries and Resources of the Commonwealth., Testimony on Off-Shore Oil Drilling: Environmental Effects. p. 398-414,(1972).

33. Comb, D. G.: Outer Continental Shelf Policy Issues. Hearings-Committee on Interior and Insular Affairs, United States Senate, Part 2, p1189 (1972).

SUPPLEMENT TO APPLICATION

#16 Mario Philipp

For the last six years I have used the following radioactive isotopes: 125-I, 131-I, 35-S, 14-C, 3-H and 22-Na.
125-I and 35-S-Methionine were used routinely for labelling of protein molecules, which were then characterized biochemically and immunologically and also employed in radioimmunoassays (Activity used: 0.1 - 20 m Ci).
14-C and 3-H labelled components were used in metabolic labelling experiments (Activity used: 0.1 - 5 m Ci) and 22-Na as a means to study the permeability of lipid vesicles (liposomes) to cations (Activity used: 0.05 - 0.2 m CI).

I interacted on a routine basis with the safety officer at the National Institute for Medical Research, of the Medical Research Council, in London, England, I am therefore familiar with the principles and practices of radiation protection and aware of the biological effects of radiation.

#17 See attached resume

CURRICULUM VITAE

MARIO PHILIPP

QUALIFICATIONS:

1970 B.Sc.: Organic Chemistry, University of Buenos Aires, Argentina.

1977 Ph.D.: Biochemistry. Centre for Research and Advanced Studies, Mexico City, Mexico.

POSITIONS HELD:

1970-1974: Research Fellow, (Physical Chemistry). University of Buenos Aires, Argentina.

1974-1977: Research Fellow, (Biochemistry and Biophysics). Centre for Research and Advanced Studies, Mexico City, Mexico.

1977-1979: EMBO Fellow, (European Molecular Biology Organization). Division of Immunology, National Institute for Medical Research, London, U.K. (N.I.M.R.)

Jan-May 1979: Wellcome Trust Fellow. Division of Parasitology, N.I.M.R.

1979-1983: Member of Scientific Staff. Division of Parasitology, N.I.M.R.

SOCIETY MEMBERSHIPS:

British Society of Parasitology

British Society of Immunology

British Society of Cell Biology.

PUBLICATIONS

Fernandez-Prini, R. & Philipp, M. (1976) Tracer diffusion coefficients of counter ions in homo- and hetero-ionic poly-(styrensulphonate) resins. J. Phys. Chem. 80, 2041-46.

Darzon, A., Montal, M. & Philipp, M. (1977) Formation of detergent-free proteolypids from biological membranes. Applications to rhodopsin. FEBS Lett. 74, 135.

Ph.D. Tesis (1977) Rhodopsin of vertebrates: I. Conductance changes it induces in planar lipid bilayers. II. A procedure for its extraction from rod-outer segments without the aid of detergents.

Darzon, A., Philipp, M., Zarco, J. & Montal, M. (1978) Rhodopsin-phospholipid complexes in apolar solvents. Formation and properties. J. Membr. Biol. 43, 71-90.

Ramakrishnan, V., Darzon, A., Philipp, M. & Montal, M. (1980) Rhodopsin in Model Membranes: the kinetics of channel opening and closing in rhodopsin containing planar lipid bilayers. Ann. N.Y. Acad. Sci. 358, 36-42.

Philipp, M., Parkhouse, R.M.E. & Ogilvie, B.M. (1980) Changing proteins on the surface of a parasitic nematode. Nature 287, 538-540.

Philipp, M., Parkhouse, R.M.E. & Ogilvie, B.M. (1980) Biochemical characterisation of stage-specific antigenic proteins on the surface of Trichinella spiralis. in: The Host-Invader Interplay. H. Van den Bossche, ed. Janssen Research Foundation. Elsevier/North Holland Biomedical Press. Amsterdam, pp. 147-150.

Philipp, M., Parkhouse, R.M.E. & Ogilvie, B.M. (1981) Molecular basis for stage-specificity of the primary antibody responses to the surface of Trichinella spiralis. in: Trichinellosis. C.W. Kim, E.J. Ruitenberg, eds. pp. 59-63. Reedbooks, Surrey, England.

Philipp, M., Taylor, P.M., Parkhouse, R.M.E. & Ogilvie, B.M. (1981) Immune response to stage-specific surface antigens of the parasitic nematode Trichinella spiralis. J. Exp. Med. 154, 210-15.

Parkhouse, R.M.E., Philipp, M. & Ogilvie, B.M. (1981) Characterisation of surface antigens of Trichinella spiralis infective larvae. Parasite Immunology, 3, 339-352.

Ogilvie, B.M. & Philipp, M. (1980) The Host-Parasite Interaction. in: Molecules, Cells and Parasites in Immunology. (C. Larralde, K. Willms, L. Ortiz, M. Sela, eds). pp. 179-189. Academic Press.

Ogilvie, B.M., Lee, G.B., Philipp, M. & Parkhouse, R.M.E. (1980) The Antigenicity of the nematode surface. Les Colloques de l'INSERM. Cancer Immunology and Parasite Immunology. L. Israel, P. Lagrange, S.C. salomon, eds. 97, 443-448.

Ogilvie, B.M., Philipp, M., Jungery, M., Maizels, R.M., Worms, M.J. & Parkhouse, R.M.E. (1980) The surface of nematodes and the immune response of the host. in: The Host-Invader Interplay. H. Van den Bossche, ed. Janssen Research Foundation. Elsevier/North Holland Biomedical Press, Amsterdam. 99-104.

Maizels, R.M., Philipp, M. and Ogilvie, B.M. (1982) Molecules on the surface of parasitic nematodes as probes of the immune response in infection. Immunological Reviews: 61, 109-136.

Ogilvie, B.M., Maizels, R.M. & Philipp, M. (1982) Surface antigens of nematodes and the immune response of the host. Fortschritte der Zoologie, Band 27. Gustav Fischer Verlag, Stuttgart-New York.

Clark, N.W.T., Philipp, M. & Parkhouse, R.M.E. (1982) Non-covalent interactions result in aggregation of surface antigens of the parasitic nematode Trichinella spiralis. Biochemical Journal, 206, 27-32.

Philipp, M., Worms, M.J., Maizels, R.M. and Ogilvie, B.M. (1982) Rodent models of Filariasis. Contemporary Topics in Immunobiology. In press.

Philipp, M. & Rumjaneck, F.D.R. (1983) Antigenic and dynamic properties of helminth surface structures. Mol. Biochem. Parasitol. In press.

Philipp, M., Worms, M.J., McLaren, D.J., Ogilvie, B.M., Parkhouse, R.M.E. and Taylor, P.M. (1983) A single parasite antigen and a host component on the surface of Litomosoides carinii. Parasite Immunology. In Press.