TO: Mr. Richard Cunningham
Assistant Director for Materials
Fuels and Materials
Directorate of Licensing
Atomic Energy Commission
Washington, D.C. 20545

Date: 16 November 1972

SUBJECT: Request for AEC License Amendment to Permit Possession and Use of NEN Tc-99m Stannous Polyphosphate Agent

Dear Sir:

We hereby request an amendment to our AEC License Number 05-00046-13 to authorize us to possess and use at any one time, a maximum of 100 mCi of Tc-99m Stannous Polyphosphate Agent that we will make from previously authorized sources of Tc-99m pertechnetate and the NEN Tc-99m Stannous Polyphosphate Kit (Cat. No. NRP-158) in accordance with the manufacturer's directions.

The amendment is requested to permit us to participate in an USFDA Phase III (1573) clinical evaluation (IND No. 8865) of this product as a skeletal imaging agent.

The study will be conducted under the direction of the principal investigator(s),

THOMAS A. VERDON, LTC, MC M.D.

M.D.

(whose curriculum vitae is/are enclosed).

The institution at which the work will be performed is:

Name Fitzsimons General Hospital

Address Colfax Avenue

Denver, Colorado 80240

Identification No.

Department to use Agent Nuclear Medicine Service,

Department of Radiology

We hereby acknowledge receipt of NEN Stannous Polyphosphate Protocol No. AEC-1 as well as the NEN package insert on this product, and agree to follow this protocol during our clinical evaluation of the product.

Very truly yours,

THOMAS A. VERDON
LTC, MC
Title Chief, Nuclear Medicine Service

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Assistant Director for Materials
Fuels and Materials
Directorate of Licensing
Atomic Energy Commission
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Very truly yours,

THOMAS A. VERDON

Title

NEW ENGLAND NUCLEAR

PROTOCOL: AEC-1 -- NEN Stannous Polyphosphate

1. Title of Study: NEN Stannous Polyphosphate

2. Purpose of Study: The purpose of this study is to further clinically evaluate the New England Nuclear ^{99m}Tc Stannous Polyphosphate Kit in terms of safety and efficacy as a diagnostic bone imaging agent as part of Phase III of the USFDA Investigational New Drug Program for this product (IND No. 8865). A successful study of IND Phase II has been completed for this product involving over 100 patients. A similar product has been used successfully in over 360 patients (1).

3. The ^{99m}Tc Stannous Polyphosphate Agent will be tested for the following indications:

   a. Suspected bone lesions not shown on x-ray.
   b. Bone surveys performed as part of a work-up in patients with known or suspected malignancy.
   c. Follow-ups to the response of metastatic or primary bone lesions to radiation therapy.
   d. Unexplained bone pain.
   e. Metabolic bone disease.
   f. Selected cases of arthritis and osteomyelytis.
   g. Determination of the healing rate of certain fractures.
   h. Any pathological condition involving bone in which there is increased osteogenic activity or localized increased osseous perfusion.

A copy of the information to be requested from the investigators and the forms to be provided for reporting this information are attached.

i. Clinical Investigator's Case Report Form.

ii. Summary Report Form.

The patient population may approximate several hundred, dependent upon the institutional case load.

4. No complementary drug or radioisotope adminstration is contemplated in conjunction with the study. However, individual investigators may at their discretion wish to verify the diagnostic efficacy of this agent by use of the radioisotope they have been previously licensed to employ for these indications.

5. With respect to the expected fate of the administered Tc-99m nuclide, generally 20-40% will be excreted within 4 hours, and 60-80% decay with an effective half-life of 6 hours.

   This procedure is for diagnosis only.

6. Following its intravenous administration, Tc-99m stannous polyphosphate is rapidly cleared from the blood by deposition in bone and excretion into urine. The deposition in bone appears to be primarily a function of bone blood flow as well as being related to the efficiency of the bone in extracting the polyphosphate complex from the blood which perfuses bone.

   It has been shown that the NEN product accumulates in the skeleton of mice after 3 hours at levels of about 55% of the injected dose.

   For information on effective half-life and radiation dosage, see 10 A and 10 B.

   The specific NEN product is described in the attached product monograph. Further authority for information on localization, effective half-life, and radiation dosage is given in the following references:

(1) Subramanian, G., McAfee, J. G., O'Mara, R. E., et al. ^{99m}Tc-Polyphosphate PP-46: A New Radiopharmaceutical for Skeletal Imaging. J. Nucl. Med. 12: 399-400 (1971).

(2) Subramanian, G. and McAfee, J. G. A New Complex of ^{99m}Tc for Skeletal Imaging. Radiology 99: 192-196 (1971).

(3) Subramanian, G., McAfee, J. G., Bell, E. G., et al. ^{99m}Tc-Labeled Polyphosphate as a Skeletal Imaging Agent. Radiology 102: 701-704 (1972).

(4) Unpublished data on file at the NEN Radiopharmaceutical Division, with the USFDA (IND No. 8865), and with the USAEC.

(5) Roy, R. R., Nathan, B. E., Beales, J. S. M., and Chisholm, G. D. Fluorine-18 Total Body scans in Patients with Carcinoma of the Prostate. Brit. J. of Urology 43: 58 (1971).

(6) Principles of Nuclear Medicine, edited by H. N. Wagner, Jr., W. B. Saunders Co., Phila, 1968, p. 711.

(7) Personal communication to New England Nuclear, J. G. McAfee, E. G. Bell and G. Subramanian.

(8) Subramanian, G., McAfee, J. G., Blair, R. J., O'Mara, R. E., Green, M. W., and Lebowitz, E. ^{157}Dy-HEDTA for Skeletal Imaging. J. Nucl. Med., 12: 561 (1971).

7. (A) Persons without manifest disease will not selected.

(B) Patients will be selected as part of a normal clinical work-up where bone involvement is suspected. Both males and females of all ages will be studied.

Pregnant women and children under eighteen will ordinarily be excluded from this study unless the benefit to risk consideration outweighs this exclusion.

8. Consent of human subjects will normally be obtained unless this is contraindicated by the professional judgement of the investigator.

9. The dose range will vary between 5-15mCi, administered intravenously.

10. A. $T_{\frac{1}{2}}$ eff. for bladder = 3 hours

$T_{\frac{1}{2}}$ eff. for total body, bone, and marrow = 6 hours

A summary of the radiation dosimetry of ^{99m}Tc stannous polyphosphate agent and a comparison to ^{18}F and to several strontium nuclides is shown below on both a rad/mCi and on a rad/maximum injected dose basis.

	Nuclide			
Organ	^{99m}Tc	^{18}F	^{87m}Sr	^{85}Sr
Skeleton	0.07	0.15	0.07	26.0
Whole Body	0.01	0.05	-	-
Bladder	0.21	2.0	-	-
Marrow	0.01	0.04	0.02	9.0
Maximum Recommended Dose	15	4	10	0.15
	rad/maximum injected dose			
Skeleton	1.0	0.6	0.71	3.9
Total Body	0.15	0.2	-	-
Bladder	3.2	8.0	-	-
Marrow	0.15	0.16	0.21	1.35

Pregnant women and children under eighteen will ordinarily be excluded from this study unless the benefit to risk consideration outweighs this exclusion.

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Total Body	0.15	0.2	-	-
Bladder	3.2	8.0	-	-
Marrow	0.15	0.16	0.21	1.35

C. The selected dose 5-15mCi provides optimum photon yield for imaging.

D. No other isotopes will be administered simultaneously during this study.

11. A. This institution is equipped with facilities and equipment satisfying AEC licensing requirements and has available the specialized equipment required for imaging ^{99m}Tc as the ^{99m}Tc Stannous Polyphosphate Agent and camera equipment for adequate imaging of Technetium-99m.

B. The stannous polyphosphate kit will be supplied by New England Nuclear. Technetium-99m will be purchased from a licensed source.

C. The staff of the Dept. of Nuclear Medicine and/or Radiology will normally be available to assist during the study. The sponsor is the Radiopharmaceutical Division of the NEN Corporation.

12. Herewith enclosed is a copy of the curriculum vitae of the proposed investigator.

13. It is anticipated that the study may take more than one year to complete.

14. Interim reports will be submitted which will include the information listed in the summary report form (cf. section 3 ii). Significant adverse effects will immediately be reported to the sponsor.

TECHNETIUM-99m STANNOUS POLYPHOSPHATE SKELETAL IMAGING AGENT

NAME

NEN-Tc-99m Stannous Polyphosphate Agent, to be administered intravenously after the addition of ^{99m}Tc sodium pertechnetate.

DESCRIPTION

The NEN Stannous Polyphosphate Kit provides lyophilized stannous polyphosphate to be used in preparing ^{99m}Tc-stannous polyphosphate agent for diagnostic skeletal imaging by the addition of ^{99m}Tc sodium pertechnetate ($Na^{99m}TcO_4$ in isotonic saline).

ACTIONS

Following its intravenous adminstration, Tc-99m stannous polyphosphate is rapidly cleared from the blood by deposition in bone and excretion into urine. The deposition of the Tc-99m stannous polyphosphate in bone appears to be primarily a function of bone blood flow as well as being related to the efficiency of the bone in extracting the polyphosphate complex from the blood which perfuses bone.

In patients with normal renal function, approximately 30-60% of the radiopharmaceutical is cleared into the urine within the first 3 - 6 hours following its intravenous administration.

It has been shown that NEN's ^{99m}Tc stannous polyphosphate accumulates into the skeleton at levels of 55% of the injected dose. The deposition in the skeleton (1,2,3) is bilaterally symmetrical with increased accumulation being present in the axial skeleton as compared to the appendicular skeleton. There is increased activity in the distal aspect of long bones as compared to shafts of the long bones. In pediatric

patients, in whom the epiphyseal centers are still open, there is more marked accumulation of the radiopharmaceutical in the distal aspects of long bones than is seen in adult patients in whom the epiphyseal centers are closed. Localized areas of abnormal accumulation of the radiopharmaceutical may be seen in primary malignancies of the bone, metastatic malignancies to bone, acute or chronic osteomyelytis, arthritides, recent fractures, areas of ectopic calcification, Paget's disease, regional migratory osteoporosis, areas of aseptic necrosis, and in general, any pathological situation involving bone in which there is increased osteogenic activity or localized increased osseous blood perfusion. Localized areas of decreased accumulation of the radiopharmaceutical may be noted in areas of bone which have received localized fields of external radiation.

The acute toxicity level in mice ($LD_{50/30}$) has been determined to be 150mg/kg (4). Subacute toxicity studies in mice have shown no signs of toxicity after 15 daily injections at dose levels as high as 63mg/kg/day of ^{99m}Tc stannous polyphosphate agent (4). A similar 14 day subacute study in dogs indicates no signs of toxicity at a dose level of 3.6mg/kg/day, and no changes as monitored in a battery of hematology and blood chemistry tests, including serum calcium levels.

INDICATIONS

Technetium-99m Stannous Polyphosphate (3) is used as a skeletal imaging agent to visualize areas of altered blood flow to bone and altered osteogenic activity. Specifically. it may be used for the following: Suspected bone lesions not shown on x-ray (5,6); bone survey performed as part of a work-up in patients with known or suspected malignancy; to follow the response of metastic or primary bone lesions to radiation

therapy; unexplained bone pain; metabolic bone disease; selected cases of arthritis and osteomyelytis; to determine healing rate of certain fractures; any pathological condition involving bone in which there is increased osteogenic activity or localized increased osseous perfusion.

CONTRAINDICATIONS

To our knowledge, there are no contraindications to the diagnostic use of ^{99m}Tc stannous polyphosphate agent.

WARNINGS

Radioactive preparations such as ^{99m}Tc stannous polyphosphate should not be administered to pregnant or lactating women, or to persons under the age of 18 unless the benefits to be gained outweigh the risks.

Medical judgement appropriate for any new agent not as yet subjected to widespread use should be maintained. As polyphosphates are known to complex cations such as calcium, particular caution should be used with patients potentially suffering from hypocalcemia.

Radiopharmaceuticals should be used only by physicians who are qualified by specific training in the safe use and handling of radionuclides and whose experience and training have been approved by the appropriate Federal or State agency authorized to license the use of radionuclides.

The ^{99m}Tc labeling reactions involved in preparing the ^{99m}Tc stannous polyphosphate agent depends on maintaining the tin in the reduced, or stannous (Sn^{+2}) state. Any oxidant present in the ^{99m}Tc sodium pertechnetate supply may thus adversely affect the quality of the prepared agent. Hence, ^{99m}Tc sodium pertechnetate containing oxidants should not be employed without first demonstrating that it is without adverse effect

on the properties of the resulting agent.

PRECAUTIONS

In the use of any radiopharmaceutical, care should be taken to insure minimal radiation exposure to the patient as well as to personnel involved in the procedure, by using the smallest dose of radioactivity consistent with safety and the relative value of the diagnostic information. The bladder dose may be minimized by encouraging the patient to drink fluids immediately before and after the administration of the radiopharmaceutical, and to void approximately 0.5 hours after the administration and then as frequently as it is convenient. If the pelvic region is to be imaged, it is recommended that the patient be encouraged to void immediately prior to the imaging procedure in order to visualize the bony detail of the pelvis and to minimize the bladder contribution to the image.

ADVERSE REACTIONS

There have been no adverse reactions noted in over 100 studies performed with the NEN agent in the Phase II clinical trials.

DOSAGE

Technetium-99m stannous polyphosphate agent may only be administered by intravenous injection: satisfactory studies may not be obtained following its oral administration. Dosage varies according to the technique used and must be determined according to the requirements of the patient. In making dosage calculations, corrections must be made for radioactive decay.

Satisfactory clinical studies have been performed following the intravenous adminstration of between 5 and 15mCi of the NEN agent. It is

recommended that the dosage of Tc-99m stannous polyphosphate agent used in a given patient study not exceed 15mCi. Imaging may begin as early as one hour after administration, but current experience suggests that 3 - 4 hours may be optimal.

RADIATION DOSIMETRY

Technetium-99m decays with a physical half life of 6 hours by isomeric transition to ^{99}Tc, emitting gamma radiations of 0.140 MeV (98.6%) and 0.142 MeV (1.4%). There are no primary beta emissions. Technetium-99 has a half life of 2.1×10^5 years, decaying to stable ruthenium-99. One millicurie of ^{99m}Tc produces a negligible activity (approximately 3×10^{-6} microcuries) of ^{99}Tc.

A comparison of the radiation dosimetry of ^{99m}Tc stannous polyphosphate agent to ^{18}F and several strontium nuclides is shown below on both a rad/mCi and on a rad/maximum injected dose basis.

Organ	Nuclide ^{99m}Tc (4)	^{18}F (4)	^{87m}Sr (8)	^{85}Sr (8)
		rad/mCi		
Skeleton	0.07	0.15	0.07	26
Total Body	0.01	0.05	-	-
Bladder	0.21	2.0	-	-
Marrow (3)	0.01	0.04	0.02	9.0
Maximum Recommended Dose, mCi	15	4	10	0.15
		rad/maximum injected dose		
Skeleton	1.0	0.6	0.71	3.9
Total Body	0.15	0.2	-	-
Bladder	3.2	8.0	-	-
Marrow	0.15	0.16	0.21	1.35

HOW SUPPLIED

The NEN ^{99m}Tc-Stannous Polyphosphate Kit, NRP-158, consists of 5 vials. Each vial contains, in lyophilized form, 40mg of sodium polyphosphate and 1mg of stannous chloride. The contents are sterile and non pyrogenic. For prolonged storage (more than 1 - 3 weeks), keep refrigerated.

INSTRUCTIONS FOR PREPARATION OF ^{99m}Tc STANNOUS POLYPHOSPHATE AGENT

Aseptically inject 3 to 7ml of technetium-99m sodium pertechnetate into the supplied vial of stannous polyphosphate contained in a radiation shield. Swirl to dissolve completely. Label appropriately. Use within sixteen hours of preparation.

DECAY CHART

For convenience, the decay factors for ^{99m}Tc are listed on the following page.

TECHNETIUM-99m

Half Life: 6.0 Hrs.

Hours	Pre-calibration Decay Factor	Post-calibration Decay Factor
1	1.12	.89
2	1.26	.79
3	1.41	.71
4	1.59	.63
5	1.78	.56
6	2.00	.50
7	2.25	.45
8	2.52	.40
9	2.82	.35
10	3.17	.32
11	3.56	.28
12	4.00	.25
13	4.48	.22
14	5.05	.20
15	5.65	.18
16	6.37	.16

DOSIMETRY

A. Biodistribution Model

1. 50% of the injected dose is taken up immediately by the bone and remains permanently bound. $T_{eff} = T_{phys} = 6$ hrs. Mass of bones: 5000 g.
2. 35% of the injected dose is immediately accumulated in the bladder and is eliminated via the urine with T_B of 6 hrs. Thus, $T_{eff} = 3$ hrs. Mass of bladder: 509 g.
3. 15% of the injected dose is immediately and uniformly distributed throughout the body and remains there permanently. $T_{eff} = T = 6$ hrs. Mass of total body: 70,000 g.

B. Basis for Calculations

The absorbed dose to a given target organ from the different source tissues in the body may be calculated by the following formula:

$$D=\left[\frac{\hat{A}_t}{\bar{M}_t}\sum\Delta_{n-p}\cdot\phi_{n-p}\right]+\left[\frac{\hat{A}_t}{\bar{M}_t}\sum_i\Delta_i\cdot\phi_{i(t\leftarrow\rightarrow s)}\right]+\left[\sum_i\left(\frac{\hat{A}_{s_i}}{\bar{M}_t}\sum_i\Delta_i\cdot\phi_{i(t\leftarrow s)}\right)\right]$$

Where each term corresponds to the following:

First term: Self-dose to the target organ from non-penetrating radiation.

Second term: Self-dose to the target organ from penetrating radiation.

Third term: Sum of the dose to the target organ from penetrating radiation with a source in other specified organs.

The symbols represent:

D absorbed dose, in rad.

$\hat{A}$ cumulative activity of the source region in μCi-hr; $\hat{A} = 1.44 \times T_{eff} \times A_o$

Δ_i equilibrium absorbed dose constant in g.rad.μCi^{-1} hr^{-1}

ϕ_i absorbed fraction

M_t mass of target organ, in grams

A_o activity originally present in the source region

C. Calculations

The following calculations are based on a 1mCi injected dose.

1. Dose to bone

a. <u>from skeleton</u>

$$\hat{A}_{sk} = 1.44 \times 6\text{hr} \times 500\mu\text{Ci} = 4{,}320\mu\text{Ci} - \text{hr}.$$

$$D_a = \frac{4{,}320\mu\text{Ci} - \text{hr}}{5{,}000\ \text{g}} \left[(0.0036 \times 1)+(0.0225 \times 1)+ (0.0032 \times 1) + (0.0011 \times 1) + (0.0001 \times 1) + (0.0025 \times 1)+ (0.0009 \times 1) + (0.0003 \times 1) + (0.0005 \times 1) + (0.0002 \times 1)+ (0.0004 \times 1) + (0.0010 \times 1)\right] \frac{\text{g-rad}}{\mu\text{Ci-hr}} + \frac{4{,}320\mu\text{Ci} - \text{hr}}{5000\ \text{g}} \left[(0.2643 \times 0.153)+(0.0017 \times 1)+(0.0008 \times 1)+(0.0005 \times 1)+ (0.0001 \times 1)\right] \frac{\text{g-rad}}{\mu\text{Ci} - \text{hr}}$$

$$D_a = 0.864 \frac{\mu\text{Ci} - \text{hr}}{\text{g}} \left(0.0362 \frac{\text{g-rad}}{\mu\text{Ci} - \text{hr}} + 0.0404 \frac{\text{g-rad}}{\mu\text{Ci-hr}} + 0.0030 \frac{\text{g-rad}}{\mu\text{Ci-hr}}\right)$$

$$D_a = 0.0688 \text{ rad/mCi}$$

b. <u>from bladder</u>

$$\hat{A}_{bl.} = 1.44 \times 3 \text{ hrs} \times 350\mu\text{Ci} = 1{,}510\mu\text{Ci} - \text{hr}.$$

$$D_d = \frac{1{,}510\mu\text{Ci} - \text{hr}}{5{,}000\ \text{g}} \times 0.2643 \frac{\text{g-rad}}{\mu\text{Ci-hr}} \times 0.037 = 0.0029 \text{ rad/mCi}$$

c. from total body

$\hat{A}_{t.b.} = 1.44 \times 6 \text{ hr} \times 150\text{uCi} = 1{,}296\text{uCi} - \text{hr}.$

$D_c = \frac{1{,}296\mu\text{Ci-hr}}{5{,}000\ \text{g}} \times 0.2643\ \frac{\text{g-rad}}{\mu\text{Ci-hr}} \times 0.070 = 0.0048\ \text{rad/mCi}$

$D_{bone} = D_a + D_b + D_c = 0.0765\ \text{rad/mCi}$

2. Dose to total body

a. from total body

$D_a = \frac{1{,}296\mu\text{Ci} - \text{hr}}{70{,}000\ \text{g}} \left[(0.0362 \times 1)+(0.0032 \times 1)+(0.2643 \times 0.357)\right] \frac{\text{g-rad}}{\mu\text{Ci-hr}} = D_a = 0.0025\ \text{rad/mCi}$

b. from bladder

$D_b = \frac{1{,}510\mu\text{Ci} - \text{hr}}{70{,}000\ \text{g}} \times 0.2643\ \frac{\text{g-rad}}{\mu\text{Ci-hr}} \times 0.485 = 0.0028\ \text{rad/mCi}$

c. from skeleton

$D_c = \frac{4{,}320\mu\text{Ci} - \text{hr}}{70{,}000\ \text{g}} \times 0.2643\ \frac{\text{g-rad}}{\mu\text{Ci-hr}} \times 0.354 = 0.0058\ \text{rad/mCi}$

$D_{\text{total body}} = D_a + D_b + D_c = 0.011\ \text{rad/mCi}$

3. Dose to bladder

a. from bladder

$D_a = \frac{1{,}510\mu\text{Ci} - \text{hr}}{509\ \text{g}} \left[(0.0362 \times 1)+(0.0032 \times 1)+(0.2643 \times 0.117)\right] \frac{\text{g-rad}}{\mu\text{Ci} - \text{hr}}$

$D_a = 0.2086\ \text{rad/mCi}$

b. from total body

$D_b = \frac{1{,}296\mu\text{Ci} - \text{hr}}{509\ \text{g}} \times 0.2643\ \frac{\text{g-rad}}{\mu\text{Ci} - \text{hr}} \times 0.003 = 0.0020\ \text{rad/mCi}$

c. from skeleton

$D_c = \frac{4{,}320\mu\text{Ci} - \text{hr}}{509\ \text{g}} \times 0.2643\ \frac{\text{g-rad}}{\mu\text{Ci} - \text{hr}} \times 0.001 = 0.[illegible]2\ \text{rad/mCi}$

$D_{bladder} = D_a + D_b + D_c = 0.2128\ \text{rad/mCi}$

D. Summary of dosimetry calculations

Organ	Dose (rad/mCi)
Bones	0.07
Total Body	0.01
Bladder	0.21

E. Comparative dosimetry

A comparison of dosimetry of the ^{99m}Tc stannous polyphosphate agent to other nuclides suitable for skeletal imaging is shown in the product monograph attached.

CURRICULUM VITAE

Name: Thomas A. Verdon, Jr., M. D., Social Security No. 140 24 9979

Date and Place of Birth: [redacted]

Marital Status: [redacted]

Citizenship: U. S. A.

Present Position: Chief, Nuclear Medicine Service, Fitzsimons General Hospital, Denver, Colorado from July 1971 to present. Lieutenant Colonel, U. S. Army Medical Corp

Licensure: Missouri 1958, California 1967

Education: 1949 to 1950 - Seton Hall University, South Orange, New Jersey, Chemistry Major
1950 to 1954 - Fordham University College of Pharmacy Bachelor of Science Degree in Pharmacy 1954
1954 to 1958 - St. Louis University School of Medicine, St. Louis, Mo., M. D. Degree 1958

Internship:
1 July 1958 to 30 June 1959 - Walter Reed General Hospital, Washington, D. C. Rotating Internship.

Residencies:
1 September 1959 to 30 August 1962 - Walter Reed General Hospital, Washington, D. C Three years residency in Internal Medicine.

Special Training:
Post graduate fellowship in Nuclear Medicine at the Donner Laboratory, Lawrence Radiation Laboratory, University of California, Berkeley, California, July 1970 to July 1971

Professional Experience:

September 1962 to August 1965, Chief of Nuclear Medicine Service, U. S. Army Hospital, Landstuhl, Germany. Also served in capacity of Consultant in Nuclear Medicine to Surgeon, US Army, Europe

September 1962 to August 1963, Assistant Chief of Gastroenterology Service, U. S. Army General Hospital, Landstuhl, Germany

September 1963 to August 1964, Assistant Chief of Cardiology Service, U. S. Army Hospital, Landstuhl, Germany

September 1964 to August 1965, Assistant Chief of Pulmonary Disease Service, U. S. Army Hospital, Landstuhl, Germany

September 1965 to August 1967, Chief of General Medicine Service, Letterman General Hospital, San Francisco, California

September 1965 to July 1969, Chief of Nuclear Medicine and Consultant to the Surgeon, 6th US Army for Nuclear Medicine, Letterman General Hospital, San Francisco, California

July 1970 to July 1971, Chief, Medical Consultant to the Surgeon U. S. Army, Vietnam

Educational Experiences:

Director of Intern Training and Education, Letterman General Hospital, San Francisco, California, July 1966 to July 1969.

Director of Clinical Clerks, Education and Training, Letterman General Hospital, San Francisco, Calif., July 67 to July 69.

Director of Nuclear Medicine Fellow Training Program, Letterman General Hospital, San Francisco, Calif., September 1967 to July 1969.

Assistant Clinical Professor of Medicine, University of California, San Francisco, California, July 1967 to July 1969.

Assistant Clinical Professor or Radiology, (Nuclear Medicine), University of California, San Francisco, California, July 1967 to July 1969.

Lecturer in Medical Physics, Donner Laboratory, University of California, Berkeley, California, July 1970 to July 1971.

Consultant, Nuclear Medicine Institute, Cleveland, Ohio, January 1969 to present.

Visiting Physician, University of Colorado, Nuclear Medicine Service, University of Colorado, August 1971 to present.

Committee for Nuclear Medicine Technology, Colorado-Wyoming Regional Medical Program, Denver, Colorado, Community College.

Board Certification:

1. Diplomate of American Board of Internal Medicine, March 18, 1966.

2. Diplomate of American Board of Nuclear Medicine, March 25, 1972

Special Honors:

Elected directly to Fellowship of the American College of Physicians, 1966.

Selected for "Who's Who in America" (Western United States), April 1971.

Appointed member of the Advisory Committee of the History of Internal Medicine in the US Army Medical Department of Vietnam and South East Asia, March 1971.

Memberships in Professional Societies:

Fellow, American College of Physicians

American Medical Association

Past Membership Chairman, Northern California Chapter, Society of Nuclear Medicine 1968 - 1969

Vice President Rocky Mountain Chapter, Society of Nuclear Medicine 1972 - 1973

West German Medical Society

American Heart Association Council on Cardiology Radiology

PUBLICATIONS

1. Verdon, Thomas A., Jr.; Bruton, Joseph; Herman, Robert H. and Beisel, William R.: Clinical and Chemical Response of Functioning Adrenal Cortical Carcinoma to Ortho, Para-DDD. Metabolism, Vol. 11, No. 2, 226, Feb. 1962.

2. Verdon, Thomas A., Jr.; Forrester, Ralph H. and Crosby, William H.: Hemolytic Anemia After Open Heart Repair of Ostium-Primum Defects. New Eng. Journal of Med., 444, Aug 1963.

3. Verdon, Thomas A., Jr.: Radioisotope Clinic. Med Bulletin US Army Europe, Vol. 20, No.3, 68, March 1963.

4. Verdon, Thomas A., Jr.: Mannitol in Acute Renal Insufficiency. Med Bulletin. US Army, Europe, Vol. 20, No.6, 179, June 1963.

5. Verdon, Thomas A., Jr.; Beach, Prince D., and Huycke, Edward G.: Renal Scans Performed with Radioactive Mercury. Med Bulletin US Army, Europe. Vol. 20, No. 12. 371, December 1963.

6. Verdon, Thomas A., Jr.: Hepatoma. Med. Bulletin, US Army, Europe, Vol. 21, 220, July 1964.

7. Verdon, Thomas A., Jr.: Primary Hyperparathyroidism Presenting as Peptic Ulcer Disease. Med. Bulletin, US Army; Europe, Vol. 22, No. 8, 312, Aug. 1965.

8. Verdon, Thomas A., Jr.; Chandler, Bruce F. and Thurmond, Nicholas: Diagnostic Value of Lung Scans in a General Hospital Population. Journal of Nuclear Medicine, Vol. 8, No.5, 402, May 1967. (Abstract)

9. Verdon, Thomas A., Jr.; Barrett, O'Neill, Jr. and Panettiere, Frank: Significance of Spleen Pickup of Radioactive Gold-198. Journal of Nuclear Medicine, Vol. 8, No.5, 402, May 1967. (Abstract)

10. Verdon, Thomas A., Jr.; Hamilton, George D. and Cohen, Arthur.: The Usefulness of The Liver Scan in Detection and Treatment of Amoebic Abscess. Journal of Nuclear Medicine, Vol. 8, No. 5, 402,May 67. (Abst.)

11. Verdon, Thomas A., Jr.; Cohen, Arthur and Allen, Frank H.: Use of the Brain Scan in Determining Optimum Time for Carotid Artery Surgery. Journal of Nuclear Medicine, Vol. 9, No. 6, 357, June 1968. (Abstract)

12. Verdon, Thomas A., Jr.; Cohen, Arthur and Allen, Frank H.: Dynapix. A New Concept in Rapid Rectilinear Scanning. Journal of Nuclear Medicine Vol. 9, No.6, 374, June 1968. (Abstract)

13. Allen, Frank H.; Verdon, Thomas A., Jr. and Chandler, Bruce F.: Lung Scan. An Adjunct in the Study of Pulmonary Carcinoma. Journal of Nuclear Medicine, Vol. 9, No. 6, 365, June 1968. (Abstract)

14. Cohen, Arthur; Verdon, Thomas A., Jr.; Blaisdell, William F. and Fish, Mathews B.: Blood Brain Barrier as a Guide to Surgical Revascularization. American Journal of Surgery, Vol. 116, No.2, 158, Aug 1968.

15. Mante, Carl M.; Allen, Frank H. and Verdon, Thomas A.,Jr.: Photo Scan Reversal. A Valuable Aide in Photo Scan Interpretation. Journal of Nuclear Medicine, Vol. 9, No. 12, page 610-612, December 1968.

16. LaBan, Myron M.; Johnson, Herbert E.; Verdon, Thomas A.,Jr. and Grant, Arthur E.: Blood Volume Following Spinal Cord Injury in the Archives of Physical Medicine and Rehabilitation, Vol. 50, page 439-441, 1969.

17. Verdon, Thomas A., Jr. and Allen, Frank H.: Dynapix. A New Concept in Rapid Rectilinear Scanning. Medical Radioisotope Scintigraphy, Vol. 1, page 177-186, 1969. International Atomic Energy Agency, Vienna.

18. Bernard, David J.; McDonald, Robert A., and Verdon, Thomas A., Jr.: Brain Scanning for Subdural Hematoma and Problems in Interpretation. Journal of Nuclear Medicine, Vol. 10, pate 322, 1969. (Abstract)

19. Christopherson, William J., Jr.; Bergeron, Dale A. and Verdon, Thomas A., Jr.: Liver Scans with 99m Technetium Sulfur Colloid. Report of 1,000 cases. Journal of Nuclear Medicine, Vol. 10, page 327, 1969.(Abst)

20. Christopherson, William J., Jr. and Verdon, Thomas A., Jr.: Lung Scans with 99m Technetium MAA: Report of 100 cases. Journal of Nuclear Medicine, Vol. 10, page 394, 1969. (Abstract)

21. Morel, Donald E.; Allen, Frank H. and Verdon, Thomas A.,Jr.: Delayed 203 Mercury Chlormerodran and 99m Technetium Pertechnetate Brain Scans. Journal of Nuclear Medicine, Vol.10, page 423, 1969.

22. Verdon, Thomas A., Jr.; Morel, Donald E.; Morita, Eugene T. and Allen, Frank H.: Combined Liver-Lung Scans and the Diagnosis of Subphrenic Abscess. Journal of Nuclear Medicine, Vol. 10, page 448, 1969. (Abstract)

23. Verdon, Thomas A.,Jr.; Morel, Donald E.; Morita, Eugene T. and Allen, Frank H.: Placenta Scanning. Rapid Imaging with a Ten Crystal Detector. Journal of Nuclear Medicine, Vol. 10, page 449, 1969. (Abstract)

24. Verdon, Thomas A., Jr.; Morita, Eugene T.; Morel, Donald E. and Allen, Frank H.: Hepatoma. Variable Scan Appearance. Journal of Nuclear Medicine, Vol. 10, page 449, 1969. (Abstract)

25. Wagner, Stanley C. and Verdon, Thomas A., Jr.: Use of Liver-Spleen Scan in the Clinical Staging of Patients with Hodgkin's Disease. Journal of Nuclear Medicine, Vol. 10, page 450. (Abstract)

26. Rameriz, Marcelino, Jr.; Green, Michael V. and Verdon, Thomas A., Jr.: Pre-Eluting and Fractional Eluting of 99mo-99m Technetium Generators. Journal of Nuclear Medicine, Vol. 10, page 461, 1969. (Abstract)

27. Verdon, Thomas A., Jr.; Morel, Donald E. and Morita, Eugene T.: The Liver Scan. A Useful Diagnostic Tool. Present concepts in Internal Medicine. Vol. 2, No.8, August 1969, page 385-393.

28. Verdon, Thomas A., Jr. and Thomas, Evan T.: Current Problems with Neisseria Gonorrhea in Vietnam. Medical Bulletin of US Army, Vietnam, July - August 1970, page 9-11.

29. Verdon, Thomas A., Jr.: Forward on Symposium of Infectious Diseases of Military Significance. Present Concepts in Internal Medicine, Vol. 3, No.12, page 1, December 1970.

30. Verdon, Thomas A., Jr.: "Vietnam 1970." Present Concepts in Internal Medicine, Vol. 3, No. 12, page 1149-1153, 1970.

31. Verdon, Thomas A., Jr.: Editorial. Medical Bulletin US Army Vietnam, January - February 1970.

32. Verdon, Thomas A., Jr.: Editorial. Medical Bulletin, US Army Vietnam, March - April 1970.

33. Verdon, Thomas A., Jr.: Editorial. US Army Medical Bulletin, Vietnam, May - June 1970.

34. Verdon, Thomas A., Jr.; Yano, Yukio and Anger, Hal O.: The Use of Radionuclides in the Detection of Bone Metastases. Journal of Surgical Oncology, Vol. 3, No. 6, page 169, 1971.

35. Yano, Yukio; VanDyke, Donald; Verdon, Thomas A., Jr. and Anger, Hal O.: Cyclotron Produced 157 Dy compared with 18f as Bone Scanning Agent Using the Whole Body Scanner and the Scintillation Camera. Lawrence Radiation Laboratory Technical Report UCRL-20233, February 1971.

36. Yano, Yukio; VanDyke, Donald; Verdon, Thomas A., Jr. and Anger, Hal O.: Cyclotron Produced 157 Dy compared with 18f as Bone Scanning Agent Using the Whole Body Scanner and the Scintillation Camera. Journal of Nuclear Medicine, Vol. 12, No. 6, page 407, June 1971. (Abstract)

37. Yano, Yukio; VanDyke, Donald; Verdon, Thomas A., Jr. and Anger, Hal O.: Cyclotron Produced 157 Dy compared with 18f as Bone Scanning Agent Using the Whole Body Scanner and the Scintillation Camera. Journal of Nuclear Medicine, Vol. 12, No. 12, 815-819, December 1971 (Publication)

38. Verdon, Thomas A., Jr.; Anger, Hal O ; Yano, Yukio and VanDyke, Donald: 99m Technetium Spherodized Albumin (human Microspheres for Long Imaging. Journal of Nuclear Medicine, Vol. 12, No.6, page 469, Jun 71.

39. MacDonald, Robert A.; Nesmith, Jerard A.; Bernard, David J. and Verdon, Thomas A , Jr.: Reduction of Residual Activity in Syringes by Flushing with Blood. Journal of Nuclear Medicine, Vol 12, page 480, June 1971.

40. Verdon, Thomas A., Jr.; Anger, Hal O.; Yano, Yukio,; VanDyke, Donald and MacRae, James: Whole Body Distribution of Commonly Used Radionuclides in Man. International Journal of Applied Radiation and Isotopes.

41. Verdon, Thomas A., Jr.; Anger, Hal O.; Yano, Yukio; VanDyke, Donald and MacRae, James: Whole Body Distribution of Commonly Used Radionuclides in Man. ZAED, 1971 No. 8.

42. Hartman, Charles R., Hofeldt, Fred D. and Verdon, Thomas A: The Invalidity of 131_I Urinary Excretion Studies in Patients with Thyroid Carcinoma. Journal of Nuclear Medicine, Vol. 13, No. 6, page 434-435, June 1972.

Commercial Publications:

1. Verdon, Thomas A., Jr.: A New Concept in Rapid Rectilinear Scanning. Clinical Stintillator, Vol. 12, No 2 Jun 68.

2. Verdon, Thomas A., Jr.: Case Histories in Nuclear Medicine, Vol. 1, 67.

3. Verdon, Thomas A , Jr.: Case Histories in Nuclear Medicine , Vol 2, 68.

4. Verdon, Thomas A., Jr.: Case Histories in Nuclear Medicine, Vol. 3, 69.

Illustrations Supplied and Acknowledgments:

1. Auroscan-198 Information Booklet

2. Radioactive Nuclides in Medicine and Biology: Medicine by Solomon Silver, published by Lea and Febiger

3. Potential Early Diagnosis of Cancer and Radioactive Compounds by Rashid A. Fawwaz. Chapter 1 in Progress in Atomic Medicine: Recent Advances in Nuclear Medicine, Vol. 3, John H. Lawrence, M. D., Editor, 1971 by Gruen & Stratton Inc.

In Preparation:

Verdon, Thomas A. Jr.; Anger, Hal O.; Van Dyke, Donald C. and Yano, Yukio: Whole Body Distribution of Commonly Used Radionuclides in Man. In preparation to be released as an Atomic Energy Commission Supplement

Verdon, Thomas A., Jr.; Anger, Hal O.; VanDyke, Donald C and Yano, Yukio: Whole Body Distribution of I-131 in Patients with Thyroid Carcinoma, In preparation.

Verdon, Thomas A., Jr.; Anger, Hal O., VanDyke, Donald C. and Yano, Yukio: Whole Body Distribution of 99m Tecnetium Pertechnetate. In preparation.

Exhibits:

Verdon, Thomas A., Jr.; Huycke, Edward G. and Beach, Prince D.: The Use of Radioisotopes in the Diagnosis of Kidney Disease was displayed at the Medical Surgical Training Conference, Garmisch, Germany May 1965.

Verdon, Thomas A., Jr.; Chandler, Bruce F.: The Lung Scan. A Rapid Accessment of Pulmonary Artery Blood Flow Patterns. The American College of Cardiology Meeting, Feb 28, 1968 and March 3, 1968, San Francisco, California.

Verdon, Thomas A.; Cohen, Arthur; Coodding, Charles; Allen, Frank H.: The Use of the Brain Scan in Determining Optimum Time for Carotid Artery Surgery. March 1968, San Francisco, American College of Cardiology.

Verdon, Thomas A., Jr.; Chandler, Bruce F. and Allen, Frank H.: The Lung Scan. A Rapid Accessment of Pulmonary Artery Blood Flow Patterns. Shown at the Pulmonary Disease Symposium, Fitzsimons General Hospital, Denver, Colorado, September 1968.

Verdon, Thomas A., Jr. and Powell, Malcolm R.: Paired Gamma Images Obtained by two Major Systems. Displayed at the Society of Nuclear Medicine Meeting, June 1968, St Louis, Missouri, 27-30 June 1968.

Verdon, Thomas A., Jr. and Chandler, Bruce F.: Rapid Accessment of Pulmonary Artery Blood Flow Patterns. American Medical Association Scientific Session, June 16 - 20, 1968.

Verdon, Thomas A., Jr.; Anger, Hal O.; Yano, Yukio and VanDyke, Donald: Whole Body Distribution of Commonly Used Radionuclides in Man as shown by the Mark II Whole Body Scanner. Society of Nuclear Medicine Meeting, July 1972, Boston, Mass.

Verdon, Thomas A., Jr.; Anger, Hal O.; Yano, Yukio and VanDyke, Donald: Whole Body Distribution of Commonly Used Radionuclides in Man as shown by the Mark II Whole Body Scanner. Rocky Mountain Radiological Society Meeting, Denver, Colorado, August 1972.

SPEECHES

Presentations at Universities and Medical Schools:

1. University of California at San Francisco Medical School, 1966, 1967 and 1968.
2. Washington University, St Louis, Missouri, 1967 and 1968
3. St Louis University, St Louis, Missouri, 1967 and 1968
4. Stanford University, Palo Alto, California, May 1968
5. University of Zurich, Switzerland, 1968
6. University of Saigon, Vietnam, 1970
7. University of California, Berkeley, Donner Laboratory, 1970 and 1971
8. Ohio State University Medical School, 1971 - 1972
9. University of Colorado Medical School, 1971 - 1972
10. University of New Mexico, Albuquerque, New Mexico, February 1972

Presentations at National and International Meetings:

1. Bio-Medical Symposium, San Diego, California, March 1966
2. University of California, San Francisco, California, Nuclear Medicine Symposium, October 1967
3. First Annual Tri-Service, Nuclear Medicine Symposium, Letterman General Hospital, San Francisco, California, April 1967
4. Second Annual Tri-Service, Nuclear Medicine Symposium, Long Beach, California, April 1968
5. Washington University, St Louis, Missouri, Nuclear Medicine Symposium, January 1968
6. Society of Nuclear Medicine Meeting, St Louis, Missouri, June 1968
7. International Atomic Energy Agency Symposium on Scanning, Salzburg, Austria, August 1968
8. Nuclear Medicine Institute, Cleveland, Ohio, May 1969
9. Twelfth International Congress of Radiology, Tokyo, Japan, 1970,Oct.
10. Federation of Western Societies of Neurological Science, San Francisco California, February 1971
11. First Scientific Assembly, World Federation of Nuclear Medicine and Biology, Los Angeles, California, June 1971
12. Nuclear Medicine Institute, Cleveland, Ohio, November 1971
13. Thyroid Seminar, Broadmoor Hotel, Colorado Springs, Colo, June 1972.
14. Society of Nuclear Medicine Meeting, Boston, Mass., July 1972.
15. Society of Nuclear Medicine Technologist, National Meeting, Denver, Colorado, October 1972.

Regional Meetings:

1. Society of Nuclear Medicine Meeting, Northern California Chapter, San Francisco, California, March 1966

2. American College of Physicians Meeting, Monterey, California, February 1967

3. Society of Nuclear Medicine, Rocky Mountain Chapter, Denver Colorado, April 1968

4. Society of Nuclear Medicine, Rocky Mountain Chapter, Colorado Springs, Colorado, November 1971

Lectures to Technologists:

1. Northern California Society of Nuclear Medicine Technologist, San San Francisco, California, May 1969

2. Northern California Society of Nuclear Medicine Technologist, San Joaquin General Hospital, Stockton, California, April 1971

3. Northern California Society of Nuclear Medicine Technologist Oakland Coliseum, May 1971

4. Rocky Mountain Society of Nuclear Medicine Technologist, Denver, Colorado, September 1971

5. 6th Annual Symposium, Nuclear Medicine Technology, April 1972, Denver, Colorado.

Military Meetings:

1. Present Concepts in Internal Medicine, Letterman General Hospital San Francisco, Calif, 1965, 1966, 1967 and 1968

2. Pulmonary Disease Symposium, Fitzsimons General Hospital, Denver, Colorado, 1966, 1967 and 1968

3. The Kimbrough Urology Seminar, Walter Reed General Hospital, Washington, D C. 1967

4 Annual Medical Surgical Training Conference, Garmisch, Germany 1963, 1964 and 1965

5. The 3rd Annual Internal Medicine Meeting, Camranh Bay, Vietnam, April 1970

6. The First Corps Medical Meeting, Danang, Republic of Vietnam, May 1970

7. First Annual Surgeons Meeting, Long Binh, Republic of Vietnam, December 1969

Professional Conferences Presented in U. S. Army Hospitals:

1. U. S. Army Hospital, Heidelberg, Germany, 1963, 1964 and 1965
2. U. S. Army Hospital, Neubiucke, Germany, 1963
3. U. S. Army Hospital, Kruznach, Germany, 1963 and 1964
4. U. S. Army Hospital, Verdun, France, 1963
5. U. S. Army Hospital, Landstuhl, Germany, 1962, 1963, 1964 and 1965
6. U. S. Army Hospital, Stuttgart, Germany, 1963 and 1964
7. U. S. Army Hospital, Wurzburg, Germany, 1963
8. U. S. Army Hospital, Munich, Germany 1963 and 1964
9. U. S. Army Hospital, Augsburg, Germany, 1963 and 1965
10. U. S. Army Hospital, Muenchweiler, Germany, 1964 - 1965
11. U. S. Army Hospital, Verona, Italy, 1964
12. U. S. Army Hospital, Vicenza, Italy, 1964
13. U. S. Army Hospital, Livorno, Italy, 1964
14. U. S. Army Hospital, Ft Ord, California, 1965, 1966, 1967 and 1968, 1969 and 1971
15. Walter Reed General Hospital, Washington, D. C. 1961 and 1962
16. Letterman General Hospital, San Francisco, California, 1965, 1966, 1967, 1968 and 1969
17. Brooke General Hospital, San Antonio, Texas, 1969
18. Fitzsimons General Hospital, Denver, Colorado 1971 and 1972
19. U. S. Army Hospital, Camp Zama, Japan, 1961 and 1970
20. U. S. Army Hospital, Kishine, 1969
21. U. S. Army Hospital, Camp Drake, 1969 and 1970
22. 5th Field Hospital, Bangkok, Thailand, 1970
23. 3rd Field Hospital, Saigon, Vietnam 1969 and 1970

23. 3rd Surgical Hospital, Cantho, Republic of Vietnam, 1969 and 1970

24. 12th Evac Hospital, Cuchi, Republic of Vietnam, 1969 and 1970

25. 24th Evac Hospital, Long Binh, Republic of Vietnam, 1969 and 1970

26. 93rd Evac Hospital, Long Binh, Republic of Vietnam, 1969 and 1970

27. 6th Convalescence Center, Camranh, Republic of Vietnam 1969 and 1970

28. 8th Field Hospital, Nhatrang, Republic of Vietnam 1969 and 1970

29. 71st Evac Hospital, Pleiku, Republic of Vietnam 1969 and 1970

30. 67th Evac Hospital, Qui Nhon, Republic of Vietnam, 1969 and 1970

31. 17th Field Hospital, An Khe, Republic of Vietnam 1969 and 1970

32. 311th General Hospital, Phuthanh, Republic of Vietnam, 1969 and 1970

33. 91st Evac Hospital, Chulai, Republic of Vietnam, 1969 and 1970

34. 27th Surgical Hospital, Chulai, Republic of Vietnam, 1969 and 1970

35. 95th Evac Hospital, Danang, Republic of Vietnam, 1969 and 1970

36. 85th Evac Hospital, Phubai, Republic of Vietnam, 1969 and 1970

37. Patterson Army Hospital, Ft Monmouth, New Jersey, July 1972

Military Honors Awarded:

1. Legion of Merit
2. Army Commendation Medal
3. Vietnam Service Medal, 4 Campaign Stars
4. Vietnamese Campaign Medal with '60 Device, Republic of Vietnam
5. National Service Medal
6. Meritorious Service Plaque from the Armed Forces of the Republic of Korea
7. Certificate of Achievement Award, U. S. Army Europe

CURRICULUM VITAE

Name: Thomas A. Verdon, Jr., M. D., Social Security No. 140 24 9979

Date and Place of Birth: [redacted]

Marital Status: [redacted]

Citizenship: U. S. A.

Present Position: Chief, Nuclear Medicine Service, Fitzsimons General Hospital, Denver, Colorado from July 1971 to present. Lieutenant Colonel, U. S. Army Medical Corp

Licensure: Missouri 1958, California 1967

Education: 1949 to 1950 - Seton Hall University, South Orange, New Jersey, Chemistry Major
1950 to 1954 - Fordham University College of Pharmacy Bachelor of Science Degree in Pharmacy 1954
1954 to 1958 - St. Louis University School of Medicine, St. Louis, Mo., M. D. Degree 1958

Internship:
1 July 1958 to 30 June 1959 - Walter Reed General Hospital, Washington, D. C. Rotating Internship.

Residencies:
1 September 1959 to 30 August 1962 - Walter Reed General Hospital, Washington, D. C Three years residency in Internal Medicine.

Special Training:
Post graduate fellowship in Nuclear Medicine at the Donner Laboratory, Lawrence Radiation Laboratory, University of California, Berkeley, California, July 1970 to July 1971

Professional Experience:

September 1962 to August 1965, Chief of Nuclear Medicine Service, U. S. Army Hospital, Landstuhl, Germany. Also served in capacity of Consultant in Nuclear Medicine to Surgeon, US Army, Europe

September 1962 to August 1963, Assistant Chief of Gastroenterology Service, U. S. Army General Hospital, Landstuhl, Germany

September 1963 to August 1964, Assistant Chief of Cardiology Service, U. S. Army Hospital, Landstuhl, Germany

September 1964 to August 1965, Assistant Chief of Pulmonary Disease Service, U. S. Army Hospital, Landstuhl, Germany

September 1965 to August 1967, Chief of General Medicine Service, Letterman General Hospital, San Francisco, California

September 1965 to July 1969, Chief of Nuclear Medicine and Consultant to the Surgeon, 6th US Army for Nuclear Medicine, Letterman General Hospital, San Francisco, California

July 1970 to July 1971, Chief, Medical Consultant to the Surgeon U. S. Army, Vietnam