

U. S. ARMY MEDICAL RESEARCH AND NUTRITION LABORATORY
FITZSIMONS GENERAL HOSPITAL
DENVER, COLORADO, 80240

IN REPLY REFER TO
MEDEN-AD

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18 November 1966

Mr. Nathan Bassin
Isotopes Branch
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20345

Dear Mr. Bassin:

In accordance with our telephone conversation of several weeks back, I am forwarding herewith three copies of a "Request for Approval for Human Use of Radioisotopes in Tracer Amounts in Volunteer Experimental Research Subjects." This request is in support of our Application for Renewal and Amendment to AEC Byproduct Material License No. 5-46-13(A66) originally submitted on 23 June 1966.

This submission contains information on the past and proposed use of radioisotopes in humans by personnel assigned to this Laboratory. Also included is an updated curriculum vita on each individual who will use the radioisotopes.

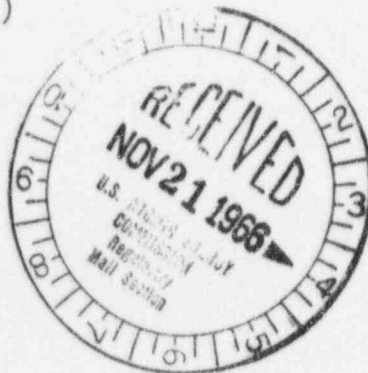
I trust this information will fulfill the requirements of the Commission.

Sincerely,

William O. Krause

1 Incl
as (trip)

WILLIAM O. KRAUSE
LTC, MSC
Chief, Administrative Division



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Act, exemptions 6
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REQUEST FOR APPROVAL FOR HUMAN USE OF RADIOISOTOPES
IN TRACER AMOUNTS IN VOLUNTEER EXPERIMENTAL RESEARCH SUBJECTS

Submitted by:

U. S. Army Medical Research and Nutrition Laboratory
Denver, Colorado

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Section I. General Introduction

1. Purpose of request

a. Par. 3b(3), AR 40-37, 'Radioisotope License Program (Human Use)', dated 12 August 1963, requires that written approval be obtained from the Secretary of the Army prior to the submission of license application (through channels to AEC) for human use (of radioisotopes), when volunteers are to be used as experimental research subjects. This paragraph (Par. 3b(3), AR 40-37) cites AR 70-25, 'Research and Development Use of Volunteers as Subjects of Research,' dated 26 March 1962 as the basis for the requirement.

b. AR 70-25 prescribes policies and procedures governing the use of volunteers as subjects, including research in nuclear, biological and chemical warfare, wherein human beings are deliberately exposed to unusual or potentially hazardous conditions. Par. 6 of this AR requires approval of the Chief of Research and Development prior to the research and, in the case of nuclear, biological or chemical agents, approval of the Secretary of the Army is required.

c. The Atomic Energy Commission will license the use of tracer amounts of radioisotopes in physiological studies in normal human beings done by competent medical research scientists. Such licenses have been granted to members of this organization in the past.

d. To comply with the requirements of Par. 3b(3), AR 40-37 and Par. 6, AR 70-25, this request is submitted for approval for human use of stated radioisotopes in tracer amounts in volunteer experimental research subjects at U. S. Army Medical Research and Nutrition Laboratory and Fitzsimons General Hospital and in field studies conducted by USAMRNL.

2. Scope of request

a. Experiments included in this request are not, in and of themselves, unusual or potentially hazardous under the definitions of AR 70-25. They would be considered potentially hazardous (and minimally so) only to the extent that radioactive isotopes in tracer quantities are used.

b. Therefore, this request seeks approval only for use of the specified radioisotopes, the experiments otherwise not requiring individual approval under AR 70-25. However, sufficient description is furnished to indicate importance of the studies in warranting use of radioisotopes.

c. For any studies later contemplated under the general description given in this request which would, in and of themselves (apart from the use of radioisotope tracers), constitute unusual or hazardous experiments, specific approval (directed to the non-isotope aspects) would then be requested per AR 70-25.

d. This request gives consideration to the health physics aspects of the radioisotope tracers required (Section II). Additional information as to health physics aspects was presented in the previous license amendment, including details as to research methods and approaches. Since no request has been made for the use of additional radioisotopes, those details will not be repeated.

3. General guidelines for requested studies

a. The administered radioactive material would, in no case, exceed a radiation dose high enough to approach the permissible dose indicated in CFR Title 10, Part 20, RC-12, 'The Medical Use of Radioisotopes--Recommendations and Requirements by the Atomic Energy Commission.' In fact, in no case will the dose exceed one-half that

of the permissible dose, and every attempt will be made to use even lesser amounts of isotope when compatible with obtaining reliable data. Acquisition of the most recently developed counting equipment enables minimal use of the isotopes.

b. All policies, procedures and regulations prescribed in AR 70-25 and AR 40-37 will be rigidly adhered to in all investigations.

c. The person in charge of each specific phase of the studies proposed herein will be formally designated prior to the research by the Commanding Officer, USAMRNL, from the Government scientists listed in this application, and the attending physician will similarly be designated from the Medical Officers among them. Medical officers are assigned a minimum of three years to USAMRNL. The staff of the Laboratory is approximately equally divided between military and civilian personnel.

4. History of USAMRNL isotope usage

a. This Laboratory has employed radioactive labeled compounds in studies with human subjects under AEC License Number 5-46-6 since 17 December 1957. Authorization was given initially to use ¹³¹Iodine-labeled human serum albumin to measure the turnover rate of albumin of ten normal young men in various nutritional states.

b. USAMRNL staff members have had experience in use of various radioisotopes in a number of chemical forms in collaborative clinical investigations with Fitzsimons General Hospital, involving the basic disease process or new treatment procedures. Such work has been carried out under the Fitzsimons General Hospital's AEC License 5-46-9 and has included the use of ¹³¹Iodine, ³²phosphorus, ⁵¹chromium, ⁶⁰cobalt and ⁵⁹iron.

c. On 11 December 1959, authorization was granted in License No. 5-46-12(L 61) for the use of carbon-14 labeled glucose, glucuronic acid, glucuronolactone and ascorbic acid to measure the pool size and turnover rate of body ascorbic acid in normal human subjects and for investigation of the possibility that humans may be able to synthesize small amounts of ascorbic acid.

d. License No. 5-46-12(L 61) was renewed on 24 October 1961 and expanded to include carbon-14 labeled glycine, cholesterol, mavalonic acid, acetate and carbon monoxide, in addition to the compounds previously authorized, for use in metabolism and physiological tracer studies in humans.

e. License No. 5-46-12 (including prior approval by the Secretary of the Army) was amended to permit the use of tritiated water for the determination of total body water in 112 human volunteers at Ft. Carson, Colorado.

f. Until recently, nutrition and metabolism tracer studies in human volunteers were conducted under AEC Radioisotope License No. 5-46-13(A 66), Amendment No. 1. This amendment was in effect for a period of eighteen months (31 July 1964 through 31 January 1966). Studies conducted during this limited period are indicated in Section III. Such studies have been discontinued until authorization has been received.

5. Specific radioisotopes to be used

a. Use of the following radioisotopes in volunteer human research in tracer dosages is requested:

By-product MaterialChemical and/or Physical Form

Carbon-14

Vitamins

Carbohydrates

Amino acids

Lipids

Acetate

Hydrogen-3

Vitamins (vitamin C, folacin,
vitamin B₆)

Water

Magnesium-28

MgO, MgCl₂, Mg citrate

Calcium-47

CaCl₂

Calcium-45

CaCl₂

b. All the labeled compounds to be employed are naturally occurring nutrients or metabolites for the human.

c. Except for hydrogen-3, the maximum amount of radioactivity which the licensee requests permission to possess at any one time is 10 millicuries of the individual chemical forms indicated. For hydrogen-3, 50 millicuries are requested.

d. Authorization is requested to use tracer quantities of ¹⁴C-labeled ascorbic acid and ³H-labeled ascorbic acid in human volunteers at the University of Iowa Medical School, Iowa City, Iowa, in the study outlined in this document.

e. According to current plans, personnel of USAIRNL will be associated with studies in Iran and Thailand involving the use of the above indicated radioisotopes in human volunteer tracer investigations on nutrition problems.

Section II. General Health Physics for Requested Isotopes

6. Carbon-14

Carbon-14 has a soft beta emission that lends itself to tracer studies. Fat in the body is usually considered the critical organ. The biological half-life for carbon-14 in fat is given as 35 days. The National Bureau of Standards Handbook No. 69 lists the maximum permissible burden in fat as 300 mc. Constants for calculating maximum permissible internal concentration of radioisotopes assume that 50% of the carbon-14 that is present in the blood is transferred to the critical organ, fat. However, based on animals, it can also be assumed that few of the carbon-14 labeled compounds proposed to be used would approach this retention in the critical organ. The majority of the compounds proposed are readily metabolized and removed from the body as expired CO_2 or metabolites in the urine, and would reduce even further the body burden of irradiation. Flushing procedures could also be employed in the case of the labeled vitamins to hasten their removal from the body upon completion of the studies. In all investigations, balances will be performed that will permit careful knowledge of the extent of retention and turnover of the labeled compound administered.

7. Hydrogen-3

Hydrogen-3 emits only a very soft beta particle, but with present counting instruments is a very useful isotope for tracer studies. The entire body is generally considered the critical organ, and the isotope has a biological half-life of approximately 12 days. The maximum permissible body burden is 1-2 mc. This approximate amount has been used

routinely in numerous laboratories for the determination of total body water in the human. Previously, permission has been granted this Laboratory to use this technique utilizing one millicurie of tritiated water on volunteers at Ft. Carson.

The use of tritiated vitamins is proposed since several vitamins are available only as the tritiated compounds. Because of the considerably smaller pool size, the dosage of tritium employed as a vitamin will be much less than that employed in the measurement of total body water. Amounts less than 0.1 mc are anticipated. Tritiated folic acid and pyridoxine are presently employed at a number of laboratories for studying malabsorption syndromes in humans such as may be encountered in tropical sprue.

8. Magnesium-28

This isotope is available as a cyclotron produced element. It has a very short half-life of only 21 hours. Magnesium-28 has been used in a number of laboratories with humans. Dr. J. K. Aikawa, Department of Medicine, University of Colorado School of Medicine, Denver, has administered 90 μ c of Mg-28 to normal subjects and patients and found essentially no activity in the urine or plasma after 40 hours. By this time, approximately 90% of the Mg-28 was accounted for in the feces and urine. (Peaceful Use of Atomic Energy, Vol. 24, p. 148, 1958; The Role of Magnesium in Biological Process. J. K. Aikawa, 1963, C. C. Thomas, Publisher, Springfield, Ill.)

9. Calcium-47

This isotope with a half-life of only 4.9 days has seen use in a number of studies with human subjects. The maximum permissible burden when the total body is considered the critical organ is approximately 10 μc ; with bone the critical organ, a permissible burden of 5 μc is allowed. For the proposed studies, a dose not to exceed 5 μc would be used, with an anticipation that a dose of only 2 μc may be sufficient.

10. Calcium-45

If the use of calcium-47 should prove not feasible because of the short half-life and transportation or delivery difficulties, calcium-45 would be employed instead. Calcium-45, with a soft beta emission and a half-life of 163 days, has a maximum permissible burden in bone of 30 μc or 200 μc for the total body. The dosage proposed for the anticipated studies would not exceed 15 μc .

All use of radioisotopes in humans would be in accordance with the following:

- a. Use will be confined to metabolic and physiological tracer studies.
- b. The licensee shall comply with the provisions of Title 10, Part 20, Code of Federal Regulations, Chapter 1, "Standards for Protection Against Radiation," and RC-12, "The Medical Use of Radioisotopes--Recommendations and Requirements by the Atomic Energy Commission."
- c. Radioisotopes for use in humans shall be acquired from a supplier other than an Atomic Energy Commission facility, who certifies the pharmaceutical quality and assay of such material.

d. The licensee, except as otherwise specifically provided for in the license, shall possess and use the material as described in this license in accordance with statements, representations and procedures contained in supplementary sheets attached to the application.

e. All rules, regulations and limitations set forth by Army, AEC and local authorities (including those set forth in AR 70-25, AR 40-37 and Handbook 69 of the National Bureau of Standards) will be complied with.

Section III. Proposed Research: Nutrition and Metabolism Tracer Studies

One of the missions of the U. S. Army Medical Research and Nutrition Laboratory (USAMRNL) has been to investigate the nutritional requirements of the human, both micro- and macronutrients, and to study factors that may influence these requirements. Factors under study include dietary imbalances; interactions of vitamins, minerals and macronutrients; mal-absorption; disease; adaptation and stress, including altitude, cold and heat. The studies have included the development of techniques for the evaluation of nutritional status and requirements. The initial phases of the studies have employed laboratory animals and non-radioisotopic human volunteer studies. The studies have been conducted at the Denver Laboratory, as well as at several continental U.S.A. locations and several foreign countries.

Following these initial phases, the use of tracer studies was essential in order to obtain additional desired information. During the past recent years, a limited number of such label experiments have been successfully conducted. In view of the expanding nutrition research program at USAMRNL, both domestic and international, it is essential that limited tracer studies be made available as a technique to aid the program in obtaining required answers to problems of both military and civilian importance. In addition to the studies in progress at the Denver Laboratory, personnel of USAMRNL are currently conducting nutrition research at other locations within the U.S.A., as well as in several other countries, with plans to conduct studies in several additional countries in the near future.

Indicated briefly below are current interests and recent activities in human nutrition and metabolism research at USAMRNL that have involved tracer studies.

11. Vitamins: Investigations on the vitamin requirements of the human and factors that influence the requirement with the use of carbon-14 or hydrogen-3 labeled vitamins or related compounds.

a. All studies on vitamins, as well as for the other indicated compounds, would be conducted in terms of dosage and administration of the labeled material in accordance with the procedures outlined in the document submitted for the previous license application. Every effort will be made to use the minimum dosage necessary to obtain valid and significant data, with oral administration whenever suitable for the study. Similarly, subjects, medical supervision, sample handling and other techniques as previously indicated would be adhered to in proposed studies. No changes or modifications appear to be necessary. An exception would be the request outlined below for the use of ^{14}C -labeled ascorbic acid and ^3H -labeled ascorbic acid in the study at the University of Iowa. As indicated earlier, personnel of USAIRNL would be associated overseas in studies involving the use of tracers in human volunteers.

b. The preliminary use of ^{14}C -labeled thiamine has already provided information as to the pool size, turnover rate and urinary metabolites of this vitamin. Thus, orally ingested 2- ^{14}C -thiazole labeled thiamine has demonstrated, for the normal young adult human, the following: (a) that the half-excretion time of the thiazole-labeled thiamine was shown to be 18 days, as compared to 9 days in the rat; (b) that no decarboxylation of the thiazole-labeled thiamine was seen; (c) that thiazole-labeled thiamine is efficiently absorbed; (d) that free thiamine was the only metabolite that was positively identified; and (e) that the total number of metabolites, as determined by column and paper chromatography, were 27 in number, of which 8 appear to be major metabolites. Current work is now in progress in an attempt to

identify the 27 labeled metabolites found in the urine. Future studies must include at least one more human study using the pyrimidine- ^{14}C labeled thiamine to determine if the metabolic pattern is similar to that seen in the thiazole-labeled thiamine studies in man. This Laboratory has recently spent \$6,000 for custom-synthesized pyrimidine- ^{14}C labeled thiamine for use in future human studies. These studies will be required to provide information on the metabolism of thiamine and an estimation of the pool size and turnover rate of the vitamin. Such information is needed to evaluate the human requirement for vitamin B_1 (thiamine). The nature of the metabolites, their function and biosynthetic sources remain under study. The relationship of the metabolites to thiamine requirements and to adaptations is also under investigation and requires the use of ^{14}C -labeled thiamine.

c. The human requirement for riboflavin (vitamin B_2) has received increasing attention at USAMRNL because of the lack of satisfactory information pertaining to needs and the worldwide occurrence of deficiencies of this vitamin. Studies thus far have been restricted to animal studies with the use of riboflavin-2- ^{14}C or to non-label human studies. Investigations in man employing ^{14}C -labeled riboflavin are planned for the immediate future. The objectives of the studies would be similar to those associated with the ^{14}C -thiamine experiments. The animal studies have been completed and techniques for the isolation and characterization of the urinary metabolites have been fully worked out. From the preliminary data obtained on the rat, it would appear that the metabolite pattern of riboflavin will not be as complex as that seen in the ^{14}C -labeled thiamine and pyridoxine studies. In the projected foreign studies, ^{14}C -labeled riboflavin is anticipated to be employed in Iran and

Thailand. Such studies will be conducted in cooperation with the governments of the respective countries. The investigations will involve administering small amounts of the ^{14}C -labeled riboflavin (20 to 50 μc) to individual volunteers resident in these countries with known intakes of the vitamin. The studies will be designed to evaluate the influence of deficiency, adaptation, stress, climate and other factors peculiar to the region on riboflavin requirements. Currently, uniformly labeled ^{14}C -riboflavin is in the process of being produced by fermentation. This has involved obtaining permission from both the U. S. Department of Agriculture and the State of Colorado to import a culture of Ashbya gossypii, the organism used in the fermentation. Approximately \$10,000 of radioactive precursors for the culture medium have been purchased. Low level fermentations have been conducted and the isolation techniques developed. The high specific activity riboflavin to be produced is intended for human nutrition investigations.

d. Of the B-complex vitamins under study at USAMRNL, vitamin B_6 (pyridoxine, pyridoxal, pyridoxamine) has received the greatest attention in the past several years. These studies have received international attention since they have established, within reasonable limits, the young adult human requirement for vitamin B_6 . Current studies are aimed at investigating nutritional interrelationships and other factors that may influence the requirement. The use of ^{14}C -labeled pyridoxine has been of assistance in this respect. Orally ingested ^{14}C -pyridoxine has demonstrated for the normal young adult human the following: (a) pyridoxine is efficiently absorbed; (b) the vitamin is not metabolized to

CO₂; (c) the half-time excretion of pyridoxine is approximately 15 to 20 days, subject to the level of intake of vitamin B₆; (d) the body pool of vitamin B₆ is approximately 22 to 27 mg, with normal intakes of the vitamin; and (e) the urinary metabolites of vitamin B₆ are numerous, with 4-pyridoxic acid representing approximately one-third of the vitamin B₆ ingested.

To date, only two human subjects have been studied; in both cases, the subjects received an oral dose of 30 µc of the ¹⁴C-labeled pyridoxine. Further studies will be required to provide information on the metabolism of pyridoxine and an estimation of the pool size and turnover rate of the vitamin. Such information would be valuable in evaluating the human requirement for vitamin B₆ and in studying nutritional and metabolic interactions that may influence the requirement. Studies on vitamin B₆ requirement are projected for both Iran and Thailand.

e. Vitamin C has received at USAMRNL the most intensive study of all the vitamins currently under investigation. Various facets are under study, including functions, metabolism, requirements, interactions, methodology and adaptation. Numerous reports have appeared as a result of the investigations and are indicated in the appendixes. Using the techniques of investigation as set forth in our previous human isotope license application, the following summation of the results obtained from isotope studies on vitamin C metabolism in the human is presented:

(1) Studies of body composition and the use of ¹⁴C isotopes have resulted in a method for stating the actual utilization of ascorbic acid by healthy men. In studies of 29 men of diverse body weight and

degree of fatness, it was found that ascorbate utilization, as expressed in terms of ^{14}C -oxalate excretion, occurred at a rate of 11 to 37 mg/day, with a mean of 21.5 mg and a standard deviation of 8.1 mg. If expressed on a fat-free, lean body basis, the rate would be 0.4 mg/day/kilogram of fat-free body weight. Rarely, if ever, do adult males exceed 90 kilograms in lean body mass. Therefore, 40 mg/day intake would exceed the greatest quantity of ascorbate metabolized by the largest healthy man.

(2) It has been shown that dehydroascorbic acid (dAs) is partially reduced to L-ascorbic acid in both animals and man. It has been further shown that only pure reduced L-ascorbic acid (AsH_2), and not any of its oxidized forms, is incorporated into the body ascorbate pool.

(3) It has been shown that the only known metabolic products of vitamin C labeled with ^{14}C carbon in the one position in man are oxalate, AsH_2 and dAs. In young, healthy male volunteers studied, the AsH_2 pool size is 2 to 3 grams, and the turnover half-time is about 20 days on AsH_2 intakes of about 100 mg/day.

(4) The kinetic and metabolic fate of ascorbic-4- ^3H acid has been studied in a human subject. The radioactive label does not enter the body water pool, but instead is excreted as organic-bound tritium. The excretion products were found to be ascorbic acid and its immediate oxidation products, and an unknown organic compound(s). Kinetic analysis of the data shows half-times of 2 days and 46 days for turnover of the labeled ascorbic acid and the unknown compound, respectively. These results, combined with previous ascorbate-1- ^{14}C studies, indicate that the

unknown metabolite(s) is probably a derivative(s) of L-threose or L-threonic acid.

(5) Recent experiments using L-ascorbic-4-³H acid fed to a human volunteer subject have indicated that the tritium-labeled ascorbate may serve as a better method of evaluating the actual vitamin C metabolism and requirement in the human subjected to any stress situation.

(6) Currently, L-ascorbic-6-¹⁴C acid is being synthesized at USAMRNL. From the results of studies conducted, it was essential that this material be prepared in order to further the investigations on the fate, function and requirement of vitamin C. Considerable time, effort and expense have gone into developing synthetic procedures to produce L-ascorbic-6-¹⁴C acid. The synthesis of the compound is almost complete and, upon purification and characterization, the material will be available for human studies.

Immediate and future proposed studies employing the use of carbon-14 or hydrogen-3 labeled ascorbic acid (vitamin C):

Upon the availability of the ascorbic-6-¹⁴C acid, studies would be conducted with this material in the same manner as have been previously reported and as outlined in the previous license application. These studies are part of a series that represent an attempt not only to prescribe requirements, but to elucidate the metabolism and function of this unique vitamin.

All studies on the vitamin C requirement of humans, to date, have been conducted on normal young adult males. There have been no studies

performed on individuals who are existing on sub-optimal or deficient intakes of vitamin C. From the data obtained by the Nutrition Section, Office of International Research, National Institutes of Health during the nutrition surveys of Turkey and Iran, it would appear as though the human could adapt to very low intakes of vitamin C without developing scurvy. The question as to whether humans, adapted to low dietary intakes of vitamin C, would in a stressful situation develop frank scurvy, or other metabolic abnormalities, is academic because no work has been performed in this area in an attempt to define vitamin C requirement or metabolism. Therefore, the following studies are proposed.

(1) A joint study between Robert E. Hodges, M.D., of the University Hospitals, University of Iowa, Iowa City, and the Chemistry Division of USAMRNL, Denver, Colorado, is proposed to begin in November 1966. The objectives of this study are: To induce scurvy in six prison volunteers in order to permit a study of the clinical characteristics and accurate measurements of the pool size and utilization of vitamin C by means of isotopes. The recovery phase of the study will be designed to provide evidence of the true requirements for vitamin C. Initially, the six subjects will receive orally 50 μ c of L-ascorbic-1-¹⁴C acid to determine their pool sizes and rate of utilization of vitamin C. They will then be placed on a vitamin C-deficient diet and studied by measuring the rate of decrease of their pool sizes until such time as a decrease of 50% of their initial pool size is noted; at this time, they will be resupplemented with vitamin C. The subjects will then be re-labeled with 50 μ c of ascorbic-4-³H acid at the time they are resupplemented with vitamin C. The subjects will be given different controlled

intakes of ascorbic acid, varying from 2 to 70 mg per day, in order to determine the influence of these varying levels of vitamin C intake on the rate of saturation of the individual ascorbate pool size.

It is anticipated that the depletion phase of this study will take between 3 to 4 months, since the average individual has an ascorbate pool size of 2 to 3 grams and a daily utilization of 10 to 20 mg. The repletion phase will probably require a period of 2 months on the varied levels of ascorbate intake to obtain saturation of the ascorbate pool to its initial control level. The total amount of isotope to be received by each subject will not exceed 50 μ c of ascorbic-1-¹⁴C acid and 50 μ c of ascorbic-4-³H acid.

(2) Foreign studies: Studies similar to the above Iowa City study are proposed for the country of Iran. In areas of Iran that are found to have a populace with a deficient or low intake of vitamin C, it is proposed to label a small number of these people with 50 μ c of ascorbic-1-¹⁴C or ascorbic-4-³H acid to determine their ascorbate pool size and actual rate of utilization. Such studies will be conducted in cooperation with authorities of the foreign government involved. The research project in Iran will represent a program of a minimum of three years' duration.

Health physics were not discussed here since they were thoroughly discussed and considered in our original human isotope request. There have been no changes made in the methods and techniques as set forth in the original protocol in terms of isotope dosage and disposition.

12. Carbohydrates

As was indicated in the previous license application, this Laboratory has been investigating for some time the digestibility of cellulose and other complex carbohydrates. The earlier studies were concerned with the digestibility of ^{14}C -labeled cellulose, hemicellulose and various uncommon sugars by laboratory animals such as the rat, hamster and guinea pig. These studies were extended to include germ-free rats. Following completion of the animal studies, attention was directed to the digestibility of these complex carbohydrates by the human. Time has permitted the completion of only a single human experiment employing ^{14}C -labeled cotton cellulose. The labeled cotton was produced at USAMRNL by growing cotton plants in a controlled environment. The harvested mature cotton bolls were processed and the resulting pure alpha-cellulose was prepared for feeding studies.

In related studies, modified cellulose (Avicel-R), prepared by the American Viscose Company, has been investigated for nutritional properties in human volunteers. A portion of the ^{14}C -labeled cotton cellulose has been processed for us by American Viscose Company. In order to complete these studies on cellulose and related carbohydrates, additional tracer experiments need to be conducted.

In addition to the above studies, other human studies are being conducted on malabsorption and atherosclerosis which involve the use of carbohydrates. Studies on the interrelationship of various types of carbohydrates and other dietary components on serum triglycerides and cholesterol in the human have advanced to the state where tracer levels of common sugars are necessary to provide the desired information. Details as to procedures employed in the use of ^{14}C -labeled carbohydrates were included in the previous license application.

13. Minerals: Studies on mineral metabolism, interactions and requirements in the human with the use of radioisotopes.

The research program at USAMRNL includes investigations on the metabolism, interactions and requirements for the majority of both the macro- and micro-mineral nutrients. These investigations have employed the use of both laboratory animals and human volunteer subjects. Current major emphasis in the area of minerals, involving human subjects, has been related to magnesium, calcium, phosphorus, sodium and potassium balance studies and the sweat losses of all minerals. Special attention has been given magnesium because of the interest in determining the human requirement for this mineral and its relationship, along with calcium and phosphorus, to renal calculi formation. The previous license application outlined the background information on the renal calculi problem and the nature of the investigations being conducted at USAMRNL, requiring the need for the use of magnesium-28, calcium-45 and calcium-47. Although permission to use these isotopes was granted, they were not employed during the past eighteen months for several reasons. The availability of magnesium-28 is limited and its use must be timed exceedingly close with the experimental situation. Unfortunately, suitable patients with renal calculi problems did not become readily available for study locally during this period. With the present modifications in the Metabolic Ward of the Metabolic Division at USAMRNL, it is now anticipated that patients can be maintained readily locally for investigation. The procedures previously outlined would be followed. For each case study, considerable preliminary clinical and biochemical evaluations must be performed in order to ensure that the use of the radioisotopes of magnesium or calcium will provide the desired data.

Plans are also projected to study further calcium and magnesium metabolism and requirements in Thailand and possibly Iran. The studies in Thailand would be in support of studies (a) on the possible role of minerals in the etiology of bladder stones and (b) the influence of adaptation on calcium requirement. These studies would be conducted in cooperation with Thai investigators in collaboration with the SEATO Clinical Research Center, Bangkok, Thailand.

14. Other

Depending upon the rate of progress of the above indicated studies and the development of other current investigations, the use of additional carbon-14 or hydrogen-3 labeled biological compounds is desired. These compounds include additional vitamins, lipids and related compounds such as acetate, and amino acids. The use of tritiated water is desired for body water measurements, since it is more convenient and satisfactory to use than water labeled with deuterium. The malabsorption studies would be assisted if routinely employed test labeled compounds, including tritiated folacin and pyridoxine, could be permitted. As mentioned above, studies are being conducted on atherosclerosis which could be enhanced by the availability of ^{14}C -labeled lipids or ^{14}C -labeled acetate. The previous license application outlined several experiments that would have utilized carbon-14 labeled amino acids. These experiments were not conducted because a sufficient number of suitable volunteer subjects was not available at appropriate times during the period while licensed. The need to conduct the indicated studies remains.

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1 August 1966

LABORATORY FACILITY
INFORMATION

Brief History of the Laboratory

On 19 February 1942, The Surgeon General authorized the Director of Laboratories, Army Medical School, Washington, D. C., to establish a small laboratory designed to conduct research in matters concerning or relating to military nutrition. The transfer of the Laboratory to Chicago near the Quartermaster Food and Container Institute was authorized on 14 September 1944 in the Army Service Forces Circular Number 305. At that location, the activity was designated as the Medical Nutrition Laboratory. In May 1946, the Laboratory was reclassified from a Class IV installation to a Class II installation. A unit of the Laboratory was established at Fitzsimons General Hospital to study the nutritional aspects of pulmonary disease. In 1947, this unit was incorporated into the newly organized Fitzsimons Research and Development Unit to conduct research in the field of tuberculosis and surgery of the chest. In 1953, the Medical Nutrition Laboratory moved to Fitzsimons General Hospital which afforded metabolic ward facilities and excellent support and cooperation of the hospital. In September 1958, the U. S. Army Research and Development Unit, Fitzsimons Army Hospital, was combined with the U. S. Army Medical Nutrition Laboratory to form the U. S. Army Medical Research and Nutrition Laboratory. The research programs of both units continued uninterrupted by the merger; indeed, the larger combined facilities permit better support of the program as a whole.

Mission

1. To investigate the adequacy of the soldier's diet, determine the nutrient intake, and assess the health as related to nutritional status of troops in all environments: to recommend nutritional measures in support of optimum performance and the prevention of disease and injury under all conditions; to extend similar studies, recommendations and training to civilian groups and to civil and military populations of other countries as appropriate when such action is judged important to national policy and defense by higher authority.

2. To conduct research on medical and surgical problems of special interest to the Army, including support of approved clinical research, with particular attention to collaborative research in pulmonary disease with Fitzsimons General Hospital; to study the physiology of exercise and

fatigue in coordination with other laboratories of the U. S. Army Medical Research and Development Command; and to conduct research on the application of computer techniques in medical research and medicine.

3. To conduct the basic research vital to competence and progress in the aforementioned areas.

Facilities

The Laboratory, excluding EM billets, occupies 4-3/4 semi-permanent two-story masonry buildings and one wooden structure containing 91,623 square feet of floor space and houses the following facilities:

- Research laboratories
- Small animal and dog facilities
- Research library (approximately 6,000 volumes)
- Metabolic ward
- Storage facilities

Special Equipment

- Preparative ultracentrifuges
- Walk-in cold rooms for biochemical studies
- French pressure cell for disruption of subcellular components
- Liver perfusion apparatus
- Acrylamide gel electrophoresis, analytical
- Mass spectrophotometers
- Eight-channel Electronics for Medicine oscillographic recorders
- Texas Instrument Oscilloriter
- Multiple recorders of varied types and designs
- Cary and Beckman recording spectrophotometers and other research laboratory spectrophotometers
- Radiometer blood gas and titration equipment
- Keithley microvolt-ammeter
- Bicycle ergometers
- Human whole-body bath calorimeter
- General Electric x-ray fluoroscope apparatus with high-speed cassette changer and Cordis high pressure injection system
- Medicon sine wave electromagnetic flowmeter
- Various alpha and gamma counters including automatic liquid scintillation counters, autogamma counter and low level automatic beta counter
- Arriflex movie camera and accessories
- Expandable laboratory-trailer for field studies
- Electron microscope
- Multiple automatic fraction collectors
- Gas-liquid chromatography instruments for various applications
- Technicon auto-analyzers
- Atomic absorption spectrophotometers

Multiple continuous respiration gas analyzer systems for measurement of expired CO_2 - O_2 , volume and temperature with associated parameters for pulse rate, respiration rate, body temperature, environmental temperature and humidity and barometric pressure
 Portable metabolimeters for measuring energy expenditure in the field
 Human and animal treadmills
 Cardiometers for monitoring pulse rate
 Body volumeter for measurement of body composition
 Cary vibrating reed electrometers for volume and CO_2
 Computer, RCA 301, punched paper tape input-output
 Frieden Flexowriters, off-line to RCA 301 computer
 Amino acid auto-analyzers
 Technicon peptide analyzers
 Applied Physics respirometer and ^{14}C analyzer for human ^{14}C carbon trace studies
 Mechrolab Osmometer for large molecular weight determinations
 Germ-free animal facilities
 C,H,N Analyzer
 Research model Coulter counter
 Infotronics analog/digital converter
 Perkin-Elmer 220 IR spectrophotometer
 Farrand research fluorometer and other fluorometers
 Fisher titrialyzer
 Automatic and other model Warburg apparatus
 Constant temperature and humidity room - walk-in
 Numerous items of equipment for extensive biochemical, physiological and histopathological studies
 Beckman ultracentrifuge, analytical
 RCA 301 computer for medical research
 Gamma cell 220
 Environmental chamber
 Liquid scintillation system
 Ortholux microscope

Research Program

The work of the Laboratory is accomplished by seven professional Divisions.

The Chemistry Division has a broad program in biochemistry and nutrition; it also provides analytical chemistry support for the entire Laboratory. Examples of particular interest are amino acid requirements, imbalances and toxicities; fundamental aspects of lipid metabolism; vitamin nutrition; metabolism and requirements; nutritional value of cellulose trace mineral metabolism; carbohydrate, protein and macromolecular biochemistry; adaptive and control mechanisms.

The Physiology Division conducts research in three rather broad areas; environmental physiology, nutritional physiology and performance physiology. Environmental work is primarily directed toward the cardiopulmonary, metabolic; endocrine and cellular (intermediary metabolism) responses of humans and animals to high altitude and cold exposure. Work in nutritional physiology is concerned with effects of various nutritional and environmental stress on body functions. Performance physiology studies include an assessment of the physiological and psychological variables which control and limit work capacity, psychomotor skills and the interrelationships of these variables. Studies of physical training, drug action, environmental stress, intermediary metabolism and cardiovascular and pulmonary function are included.

The Microbiology Division works very closely with the hospital on tuberculosis, mycology, virology and clinical microbiology projects and collaborates with the rest of the Laboratory in studying the nutritional aspects of microbiology. Studies include the evaluation of the microbial metabolic events leading to the development or loss of antibiotic resistance.

The Metabolic Division performs both laboratory and clinical research studies. Clinical studies utilizing human volunteers are directed towards various metabolic and nutritional problems, for example: metabolic effects of various nutritional deficiency states; determines adult human pyridoxine requirements; the human digestibility of microcrystalline cellulose; lipid and sterol balance; the effect of gluten loading on normal gastrointestinal absorption; and studies of steroid metabolism and the effect of diet of various cationic contents on exercise. In particular, it is planned to study the metabolism of bile steroids in the normal human and as a manifestation of various types of liver disease. Liver metabolism is studied by liver perfusion techniques. Physicians of this Division serve as consultants and teachers in the hospital's endocrinology and metabolism clinics.

The Bioenergetics Division conducts dietary surveys in Army messes and, in collaboration with the Office of International Research, in worldwide areas. Has conducted field studies for evaluation of various rations for proposed use in combat situations. Studies energy metabolism, work physiology and fatigue mechanisms in extreme environments such as heat, cold and high altitude. Measures body composition under various nutritional and environmental conditions and relates composition to work performance. Recent accomplishments include a better definition of the caloric requirements in extremely hot and cold environments, and the demonstration of significant nutrient losses in sweat in hot environments under conditions of profuse sweating.

The Pathology Division provides pathology and animal service to the rest of the Laboratory, and conducts an active program dealing with the toxicology of solutions for intravenous alimentation, techniques in histochemistry and irradiated food research.

The Computer Division is studying the use of automatic data processing systems in medicine. The initial project involved the analysis of data from large numbers of patients with pulmonary diseases. A project to study computer-instrument linkage systems has been designed. The project is to achieve on-line linkage between laboratory instruments and the digital computer.

Provisions are made for independent in-house laboratory research.

The Laboratory conducts an annual two-week training period for USAR Mobilization Designees and other Reserve Officers. On-the-job training in nutrition is provided for officers (as assigned by higher authority) of allied nations.

Personnel

Military - 36 officers, 52 enlisted personnel
Civilian - 87

Form AEC-313

Item 8. Type of Training:	Where Trained	Duration of Training	
a. Principles and practices of radiation protection	U. of Tenn.	5 mos	Formal
	Auburn U.	6 yrs	Formal
	U. of Indonesia	18 mos	Formal
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	"	"	"

Item 9 Experience with radiation

Isotope	Maximum amount	Where experience gained	Duration	Type of Use
Ca ⁴⁵	1 Mc	U. of Tenn.	5 mos	Microbiology,
		Auburn U.	6 yrs	analytical research &
		U. of Indonesia	18 mos	nutrition studies
		USAMRNL	7 yrs	
Co ⁶⁰	"	"	"	"
P ³²	"	"	"	"
Fe ⁵⁵	"	"	"	"
Fe ⁵⁹	"	"	"	"
C ¹⁴	"	"	"	"
Zn ⁶⁵	"	"	"	"
I ¹³¹	"	"	"	"

1951: Research Fellow, University of Tennessee, Knoxville and Oak Ridge, Tennessee (Dr. C. L. Comar). Research on blood volume measurements; vitamin B₁₂ and cobalt metabolism and calcium nutrition; studies employed radioactive compounds. Various publications.

1957 - 1959: Professor of Animal Nutrition and Microbiology, University of Kentucky, Lexington, Kentucky (Dr. O. Aamrod, group leader). Served as a member of the team of the University of Kentucky performing a contract with International Cooperation Administration, the University of Indonesia and the Government of the Republic of Indonesia at Bogor, Indonesia. Acted in the capacity of Head of the Department of Microbiology at the University of Indonesia, Bogor, to develop the teaching, research and administration program of each. In addition to a teaching load, assisted in the development and training of Indonesian scientific and educational personnel, directed doctoral theses, assisted in extension services, etc. Research was conducted in the area of protein and amino acid nutrition; measurement of amino acid content, protein content and protein nutritive value and quality of feeds and foods important to the Indonesian economy and diets. Several publications.

1959: Associate Professor of Animal Husbandry and Food Technology, Iowa State University, Ames, Iowa (Dr. L. Johnson). The position was concerned with the development of a research program in the area of meat technology, including basic and applied studies; investigations on means of improving the quality of meats; including production, processing, storage and consumer phases. The program included direction of graduate students, technicians and graduate teaching.

1959-Present: Chief, Chemistry Division, U. S. Army Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colorado.

Membership in Societies:

1. American Society of Biological Chemists
2. American Institute of Nutrition
3. American Association for Cancer Research
4. American Chemical Society
5. Society for Experimental Biology and Medicine
6. American Society for Microbiology
7. American Society of Animal Science

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8. New York Academy of Science
9. American Society for Clinical Nutrition
10. Sigma Xi
11. Phi Beta Kappa
12. Gamma Sigma Delta (Hon. Agric. Soc.)

HOWERDE E. SAUBERLICH, Ph.D.

Author or co-author of over 100 publications in the fields of protein and amino acid metabolism, imbalances, toxicities, methodology and value as related to animal, human and microorganisms; lipid and carbohydrate metabolism; studies on the vitamin B complex, especially pyridoxine, folacin, choline and biotin; kwashiorkor and nutritional edema; microbial nutrition and metabolism; nucleic acid metabolism; cancer research; irradiated foods; antibiotics and growth factors; enzymology; radioisotopes, etc. Publications from 1961 to present time are listed.

Journal Publications:

1. Leveille, G. A. and H. E. Sauberlich. Influence of dietary protein level on serum protein components and cholesterol in the growing chick. *J. Nutrition* 74: 500, 1961.
2. Leveille, G. A., J. W. Shockley and H. E. Sauberlich. Influence of the presence of cholesterol and fatty acids on plasma glyceride determinations in the chick. *Poultry Sci.* 40: 1361, 1961.
3. Farish, P. T., W. D. Salmon and H. E. Sauberlich. Effect of choline deficiency and methionine feeding on nucleic acid content of rat livers. *J. Nutrition* 73: 23, 1961.
4. Sauberlich, H. E. Growth of rats fed protein-free diets supplemented with purified amino acid mixtures. *J. Nutrition* 74: 298, 1961.
5. Sauberlich, H. E. Effect of vitamin B₆ on the growth of rats fed diets limiting in an essential amino acid and on the utilization of isomers of tryptophan, methionine and valine. *J. Nutrition* 74: 289, 1961.
6. Sauberlich, H. E. Studies on the toxicity and antagonism of amino acids for weanling rats. *J. Nutrition* 75: 61, 1961.
7. Leveille, G. A., H. E. Sauberlich and J. W. Shockley. The sulfur amino acid requirement for growth of mice fed two levels of nitrogen. *J. Nutrition* 75: 455, 1961.
8. Leveille, G. A., J. W. Shockley and H. E. Sauberlich. Influence of dietary factors on plasma lipid relationships in the growing chick. *Proc. Soc. Exp. Biol. Med.* 108: 313, 1961.

9. Leveille, G. A., J. W. Shockley and H. E. Sauberlich. Lipid distribution in lipoproteins separated by polyanion precipitation. *Proc. Soc. Exp. Biol. Med.* 108: 544, 1961.
10. Leveille, G. A., H. E. Sauberlich and J. W. Shockley. The protein value and the amino acid deficiencies of various algae for growth of rats and chicks. *J. Nutrition* 76: 423, 1962.
11. Leveille, G. A., H. E. Sauberlich, R. C. Powell and W. T. Nunes. Influence of dietary protein on plasma lipids in human subjects. *J. Clin. Invest.* 41: 1007, 1962.
12. Leveille, G. A., J. W. Shockley and H. E. Sauberlich. Influence of dietary protein level and amino acids on plasma cholesterol of the growing chick. *J. Nutrition* 76: 321, 1962.
13. Leveille, G. A., J. W. Shockley and H. E. Sauberlich. Lipid content of chick erythrocytes and plasma. *Proc. Soc. Exp. Biol. Med.* 109: 345, 1962.
14. Baker, E. M., H. E. Sauberlich et al. Tracer studies of vitamin C utilization in men; metabolism of D-glucuronolactone-6-C¹⁴, D-glucuronic-6-C¹⁴ acid and L-ascorbic-1-C¹⁴ acid. *Proc. Soc. Exp. Biol. Med.* 109: 737, 1962.
15. Leveille, G. A., H. E. Sauberlich and M. E. McDowell. The nutrient content of various algae and the amino acid adequacy for growth of rats and chicks. Report AMRL-TDR-62-116, Symposium-Workshop on Biologistics for Space Systems, Dayton, Ohio, 1-3 May 1962, 6570th Aerospace Medical Research Laboratories.
16. Leveille, G. A., H. E. Sauberlich and R. D. Hunt. Effect of dietary lithocholic acid on liver size of the chick. (Research Note) *Poultry Sci.* 41: 1991, 1962.
17. Union of Burma Nutrition Survey Report (Preliminary), September 1962 (assisted in development and preparation). Final Report, May 1963.
18. Shore, J. D., B. M. Tolbert and H. E. Sauberlich. The effects of ionizing radiation on trypsin. I. Losses of esterase and protease activities of trypsin and trypsin-inhibitor compound. *Arch. Biochem. Biophys.* 102: 125, 1963.

19. Bunce, C. E., P. G. Reeves, T. S. Taba and H. E. Sauberlich. The influence of dietary protein level on the magnesium requirement. *J. Nutrition* 79: 220, 1963.
20. Leveille, G. A. and H. E. Sauberlich. Lipid changes in plasma, alpha-lipoproteins, liver and aorta of chicks fed different fats. *Proc. Soc. Exp. Biol. Med.* 112: 300, 1963.
21. Baker, E. M., N. G. Levandowski and H. E. Sauberlich. Respiratory catabolism in man of the degradative intermediates of L-ascorbic-1-C¹⁴ acid. *Proc. Soc. Exp. Biol. Med.* 113: 379, 1963.
22. Leveille, G. A., R. C. Powell, H. E. Sauberlich and W. T. Nunes. Effect of orally and parenterally administered neomycin on plasma lipids of human subjects. *Am. J. Clin. Nutrition* 12: 421, 1963.
23. Leveille, G. A., H. E. Sauberlich and R. D. Hunt. Dietary bile acids and lipid metabolism. I. Influence on lipids and liver size of chicks. *Proc. Soc. Exp. Biol. Med.* 114: 334, 1963.
24. Hunt, R. D., G. A. Leveille and H. E. Sauberlich. Dietary bile acids and lipid metabolism. II. The ductular cell reaction induced by lithocholic acid. *Proc. Soc. Exp. Biol. Med.* 113: 139, 1963.
25. Leveille, G. A., J. A. Tilletson and H. E. Sauberlich. Fatty acid composition of plasma and liver lipid components as influenced by diet in the growing chick. *J. Nutrition* 81: 357, 1963.
26. Collaborative study of vitamin B₆ methodology. *J. Assoc. Office Ag. Chemists* 46: June 1963.
27. Raica, N., M. McDowell and H. E. Sauberlich. QM Contractors' Meeting, 7-9 October 1963, Natick, Mass., "Wholesomeness of Foods Preserved by Cold-Sterilization and Induced Radioactivity," and "Present Status of the Wholesomeness Program."
28. Sauberlich, H. E. Human requirement for vitamin B₆. *Vitamins and Hormones* 22: 807, 1964.

29. Federation of Malaya Nutrition Survey, A Report of the ICNND, September 1964.
30. Baker, E. M., N. G. Levandoski and H. E. Sauberlich. Review of "Respiratory Catabolism of L-Ascorbic Acid," *Nutrition Rev.* 22: 7, January 1964.
31. Baker, E. M., J. E. Canham, W. T. Nunes, H. E. Sauberlich and M. E. McDowell. Vitamin B₆ requirement for adult men. *Am. J. Clin. Nutrition* 15: 59, 1964.
32. Hunt, R. D., G. A. Leveille and H. E. Sauberlich. Dietary bile acids and lipid metabolism. III. Effects of lithocholic acid in mammalian species. *Proc. Soc. Exp. Biol. Med.* 115: 277, 1964.
33. Leveille, G. A., R. D. Hunt and H. E. Sauberlich. Dietary bile acids and lipid metabolism. IV. Dietary level of lithocholic acid for chicks. *Proc. Soc. Exp. Biol. Med.* 115: 569, 1964.
34. Leveille, G. A., R. D. Hunt and H. E. Sauberlich. Dietary bile acids and lipid metabolism. V. Reversibility of the effects of lithocholic acid in chicks. *Proc. Soc. Exp. Biol. Med.* 115: 573, 1964.
35. Leveille, G. A., R. D. Hunt and H. E. Sauberlich. Dietary bile acids and lipid metabolism. VI. Protective effect of cholic acid in lithocholic acid fed chicks. *Proc. Soc. Exp. Biol. Med.* 116: 92, 1964.
36. Leveille, G. A. and H. E. Sauberlich. Plasma and liver lipids of mice as influenced by dietary protein and sulfur-containing amino acids. *J. Nutrition* 84: 10, 1964.
37. Raica, N., Jr., and H. E. Sauberlich. Blood cell transaminase activity in human vitamin B₆ deficiency. *Am. J. Clin. Nutrition* 15: 67, 1964.
38. Leveille, G. A. and H. E. Sauberlich. Relative distribution of cholesterol in plasma and liver compartments of chicks fed different fatty acids. *Proc. Soc. Exp. Biol. Med.* 117: 653, 1964.
39. Ziporin, Z. Z., W. T. Nunes, R. C. Powell, P. P. Waring and H. E. Sauberlich. Thiamine requirement in the adult human as measured by urinary excretion of thiamine metabolites. *J. Nutrition* 85: 297, 1965.

40. Ziporin, Z. Z., W. T. Nunes, R. C. Powell, P. P. Varing and H. E. Sauberlich. The excretion of thiamine and its metabolites in the urine of young adult males receiving restricted intakes of the vitamin. *J. Nutrition* 85: 287, 1965.
41. Bunce, G. E., H. E. Sauberlich, P. C. Reeves and T. S. Oba. Dietary phosphorus and magnesium deficiency in the rat. *J. Nutrition* 86: 406, 1965.
42. Leveille, G. A. and H. E. Sauberlich. Mechanism of the cholesterol-depressing effect of pectin in the cholesterol-fed rat. *J. Nutrition* 88: 209, 1966.
43. Leveille, G. A., W. C. Goad and H. E. Sauberlich. Lipogenesis and cholesterol turnover in the chick as influenced by dietary lithocholic acid. *Proc. Soc. Exp. Biol. Med.* 120: 856, 1965.
44. Harding, R. S., J. E. Canham and H. E. Sauberlich. The free amino acids in the plasma and urine of human subjects on a vitamin B₆-deficient diet. In *Technicon Symposium, 1965, Automation in Analytical Chemistry*. L. T. Skeggs, Jr. (ed.), Mediad Inc., N. Y., 1966.
45. Sauberlich, H. E. Vitamin B₆: Biosynthesis, active forms, antagonists, biochemical functions. Vol. III, Chapter 13, *The Vitamins*. Academic Press, Harris & Sebrell, eds. (In press).
46. Sauberlich, H. E. Determination of the vitamin B₆ group (pyridoxine, pyridoxal, pyridoxamine and associated compounds; 4-pyridoxic acid; tryptophan load test and xanthurenic acid measurements). *Vitamin Methods*, Vol. IV. Academic Press, Gyorgy & Pearson, eds. (In press).
47. Canham, J. E. and H. E. Sauberlich. Vitamin B₆. Chapter 15, Section 1, In the *Handbook of Nutrition*, pub. Am. Med. Assoc., Council on Food and Nutrition (In press).
48. Leveille, G. A., N. W. King, H. E. Sauberlich and D. G. Fairchild. Induction and regression of biochemical and morphological changes induced by dietary lithocholic acid in chickens. *J. Vet. Res.* (In press).
49. Leveille, G. A. and H. E. Sauberlich. Influence of dietary lithocholic acid on hepatic lipid transport. *Proc. Soc. Exp. Biol. Med.* (In press). -

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50. Saari, J. C., E. M. Baker and H. E. Sauberlich. A simplified method for the isolation of urinary ascorbic acid as the 2,4-dinitrophenylosazone. Anal. Biochem. 15: , 1966 (in press).

Laboratory Reports:

1. Leveille, G. A., J. W. Shockley and H. E. Sauberlich. The influence of cholesterol on the determination of serum glycerides. USAMRNL Report No. 255, 1961.
2. Leveille, G. A., H. E. Sauberlich and J. A. Edelbrock. The influence of enzyme supplementation on the digestibility of algae. USAMRNL Report No. 259, 1961.
3. Leveille, G. A., H. E. Sauberlich and J. W. Shockley. The influence of dietary protein level on the essential amino acid requirement of the weanling rat. USAMRNL Report No. 262, 1961.
4. Leveille, G. A., J. W. Shockley and H. E. Sauberlich. The influence of dietary factors on plasma cholesterol of growing mice. USAMRNL Report No. 265, 1962.
5. Leveille, G. A., J. A. Tillotson and H. E. Sauberlich. Fatty acid composition of plasma and liver lipid components as influenced by dietary protein and cholesterol in growing chicks. USAMRNL Report No. 269, 1962.
6. Leveille, G. A. and H. E. Sauberlich. An evaluation of an immunochemical and a polyanion precipitation method for the quantitative analysis of beta-lipoproteins. USAMRNL Report No. 272, 1963.
7. Leveille, G. A. and H. E. Sauberlich. Influence of orally administered antibiotics on growth and plasma lipid levels of growing chicks. USAMRNL Report No. 276, 1963.
8. Leveille, G. A. and H. E. Sauberlich. Plasma and liver lipids, fecal bile acid and sterol excretion of rats fed pectin and saponin. USAMRNL Report No. 277, 1963.
9. Leveille, G. A., H. E. Sauberlich and W. C. Goad. A simple and versatile punch card system for bibliographic use. USAMRNL Report No. 281, 1963.

Abstracts:

1. Baker, E. M., H. E. Sauberlich and S. J. Wolfskill. Metabolism of C^{14} -6-D-glucuronolactone and C^{14} -6-D-glucuronic acid in man. *Fed. Proc.* 20: 85, 1961.
2. Leveille, G. A. and H. E. Sauberlich. Influence of dietary protein level on amino acid requirement of the rat. *Fed. Proc.* 20: 370, 1961.
3. Sauberlich, H. E. and G. Guroff. Tracer studies on aspartic acid metabolism and interrelationships in certain lactic acid bacteria. Presented at the Vth International Congress of Biochemistry, Moscow, U.S.S.R., August 1961 (Congress Abstracts, p. 200, 1961).
4. Leveille, G. A., R. D. Hunt and H. E. Sauberlich. Influence of dietary lithocholic acid on plasma and liver lipids and liver size of growing chicks. *Fed. Proc.* 22: 490, 1963.
5. Baker, E. M., H. E. Sauberlich and J. E. Canham. Vitamin B_6 requirement of the human. *Fed. Proc.* 22: 222, 1963.
6. Sauberlich, H. E., E. M. Baker, J. E. Canham, H. Raica, Jr. Vitamin B_6 requirement of the human. Vth International Congress of Nutrition, Abstracts, p. 100, 1963.
7. Sauberlich, H. E., G. E. Bunce, C. A. Moore and O. G. Stonington. Oral magnesium administration in the treatment of renal calculus formation. 4th Annual Meeting, Am. Soc. for Clinical Nutrition, American Institute of Nutrition, Atlantic City, N. J., 2 May 1964. *Am. J. Clin. Nutrition* 14: 240, 1964.
8. Goad, W. C., G. A. Leveille and H. E. Sauberlich. Lipid metabolism in lithocholic acid fed chicks. Proc. 35th Annual Meeting, Colorado-Wyoming Academy of Science, Golden, Colorado, 8-9 May 1964.
9. Baker, E. M., J. E. Canham and H. E. Sauberlich. Further studies on the vitamin B_6 requirement for the young adult male. Proc. 35th Annual Meeting, Colorado-Wyoming Academy of Science, Golden, Colorado, 8-9 May 1964.

10. Harding, R. S., J. E. Canham and H. E. Sauberlich. The free amino acids in the plasma and urine of human subjects on a vitamin B₆-deficient diet. Proc. 35th Annual Meeting, Colorado-Wyoming Academy of Science, Golden, Colorado, 8-9 May 1964.
11. Raica, N., Jr. and H. E. Sauberlich. Current status of the U. S. Army Food Irradiation Program. Proc. 35th Annual Meeting, Colorado-Wyoming Academy of Science, Golden, Colorado, 8-9 May 1964.
12. Harding, R. S., J. E. Canham and H. E. Sauberlich. The free amino acids in the plasma and urine of human subjects on a vitamin B₆-deficient diet. Technicon Symposium, Automation in Analytical Chemistry, New York, N. Y., 8 September 1965.
13. Baker, E. M., H. E. Sauberlich, W. H. Amos and J. A. Tillotson. Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine and L-ascorbic acid. Am. J. Clin. Nutr. 18: 302, 1966.
14. Raica, N., Jr., Y. F. Herman, W. H. Amos, Jr., W. K. Evans, P. Rullan-Vargas and H. E. Sauberlich. Germ-free studies. I. Riboflavin. Proc., Colorado-Wyoming Academy of Science, Colorado Springs, Colorado, 22-23 April 1966.
15. Baker, E. M., M. Balaghi, R. S. Pardini and H. E. Sauberlich. Metabolism of 2-¹⁴C-thiazole labeled thiamine in man. Fed. Proc. 25: 245, 1966.
16. Sauberlich, H. E., E. M. Baker, W. H. Amos and J. A. Tillotson. Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine. VIIIth International Congress of Nutrition, Hamburg, Germany, 2-10 August 1966.
17. Amos, W. H., Jr., M. Balaghi, O. Ramirez, Jr. and H. E. Sauberlich. Metabolism of ¹⁴C-riboflavin in the rat. Fed. Proc. 25: 245, 1966.
18. Stevens, C. O., H. E. Sauberlich and G. R. Bergstrom. Radiation produced aggregates from egg-white lysozyme. Fed. Proc. 25: 527, 1966.
19. Raica, N., Jr., Y. F. Herman, W. H. Amos, Jr. and H. E. Sauberlich. Riboflavin nutrition in the germ-free and pathogen-free rat. Fed. Proc. 25: 245, 1966.

HOWERDE E. SAUBERLICH, Ph.D.

Honors, Meetings and Other Special Activities:

1. Phi Beta Kappa (Honorary Scholastic Society).
2. Sigma Xi (Honorary Scientific Society).
3. Gamma Alpha (Honorary Graduate Student Society).
4. Gamma Sigma Delta (Honorary Agricultural Society).
5. Listed in: Who's Who in the South and Southwest.
6. Listed in: Leaders in American Science, American Men of Science.
7. Listed in: Who's Who in Education.
8. Scholarship granted by Lawrence College for graduate studies at the University of Wisconsin, 1944.
9. Recipient of the Jonathan-Bowman Fellowship for cancer research at the University of Wisconsin, 1944-1948.
10. Recipient of a Research Fellowship from the Oak Ridge Institute for Nuclear Studies for research at the University of Tennessee, 1951.
11. Recipient from the American Institute of Nutrition of the Meade-Johnson Award for outstanding research in the field of the vitamin B complex, 1952.
12. Recipient of National Science Foundation Travel Award to attend 11th International Biochemical Congress, Paris, France, 1952.
13. Auburn, Alabama, Junior Chamber of Commerce Award in years 1952 and 1953 as the "Outstanding Young Man of the Year."
14. Recipient of a research travel grant from the Oak Ridge Institute for Nuclear Studies, 1952-1954.
15. Recipient of Fellowship from the Oak Ridge Institute for Nuclear Studies to attend the Conference on Advanced Biochemical use of Radiolabeled, 1954.
16. Chairmanships at Scientific Meetings, e.g., Federation Meetings.
17. Served as Consultant to various organizations, e.g., Southern Research Institute, Birmingham, Alabama (cancer research); Nohl Company, Columbus, Georgia (nutrition); Interdepartmental Committee on Nutrition for National Defense, National Institutes of Health, Washington, D. C. (nutrition); Food and Nutrition Board, National Research Council, Washington, D. C. (Irradiated foods, etc.).

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31. Participated in conference on results of the Burma Nutrition Survey, Washington, D. C., 27-29 May 1962.

32. Army Science Conference, West Point, New York; co-author of paper presented at conference, "Tracer studies of vitamin C utilization in man," 19-22 June 1962.

33. Reserve Officers' Training Program in Nutrition, USAMRNL, 29 July - 12 August 1962.

34. National Academy of Sciences-National Research Council ad hoc Committee Meeting on vitamin B₆, USAMRNL, 6-7 August 1962; served as Chairman and participant.

35. Served as Laboratory Chief and Deputy Director of ICNND Nutrition Survey of Malaya from 1 September to 5 November 1962. Two-week preliminary trip made in July 1962; consulted with officials in Philippines, Malaya and Taiwan.

36. Served as Special Consultant to ICNND, with visits to Indonesia, Burma, India and Italy, 5-21 November 1962.

37. Served as coordinator for meeting of Advisory Committee on Nutrition to The Surgeon General held at USAMRNL, 6-8 December 1962.

38. Participated in briefing sessions of team being sent to give consultive advice and collaborative assistance in nutrition research and the epidemiology of nutritional diseases in Venezuela, 7-9 March 1963.

39. Panel member on "Nutritional Studies," American College of Physicians, 44th Annual Session, Denver, Colorado, 1-5 April 1963.

40. 47th Annual Meeting, Federation of American Societies for Experimental Biology; acted as Session Chairman on American Institute of Nutrition's program entitled, "Vitamin B₆;" panel member at symposium on "Biological Instrumentation," 16-20 April 1963, Atlantic City, New Jersey.

41. First Commanders' Conference, Monterey, California, 1-3 May 1963.

42. Preparation of preliminary report of Malaya survey, ICNND, Bethesda, Maryland, 14-16 June 1963.

43. Annual Advisory Meeting of ICNND Committee and Consultants, Bethesda, Maryland, 24-25 June 1963.

44. Attended meeting of Food and Nutrition Board, National Academy of Sciences-National Research Council, Washington, D. C., 1 November 1963.

45. Participated in preparation of preliminary report, Malaya Survey, USAMRNL, 14-15 November 1963.

46. Rocky Mountain Section, Society for Experimental Biology and Medicine Annual Meeting, Colorado State University, Fort Collins, Colorado, 16 November 1963.

47. Appointed to ad hoc Committee on Careers in Nutrition, American Institute of Nutrition, May 1963.

48. Appointed a member of the Isotope Committee, FGH-USAMRNL, 1 June 1963.

49. 146th National American Chemical Society Meeting, Denver, Colorado, 20-24 January 1964.

50. Presentation of preliminary report of the nutrition survey to the Government of Malaya. Also visited SEATO Medical Research Laboratory, Bangkok, and U. S. Army Medical Research Unit, Kuala Lumpur, Malaysia, 22 March - 5 April 1964.

51. Annual Meeting, Federation of American Societies for Experimental Biology, Chicago, Illinois, 12-17 April 1964. Participated in colloquium on scientific instrumentation, attended by scientists and industry representatives, 14 April.

52. General orientation on USAMRNL, The SGO Advisory Committee on Environmental Medicine Meeting, USAMRNL, 13-14 May 1964.

53. In consultation on various medical research projects, visited the Medical Research Unit, SEATO Laboratory, Bangkok, Thailand; NAMRU-2 Laboratory, Taipei, Taiwan; Institute for Human Nutrition, Bogor and Djakarta, Erlangga University, Surabaya, Indonesia, at request of ICNND, U. S. Public Health Service, National Institutes of Health, 18 June - 10 July 1964.

54. VIth International Congress of Biochemistry, New York, 26 July - 1 August 1964.

Howerde E. Sauberlich - Honors, etc. - Page 5

55. Lecture on "Biochemical methods for assessment of nutriture," "Nutritional factors in urolithiasis," and "Current status of irradiated food program," Nutrition Review for the Therapeutic and Research Dietitian, Walter Reed Army Hospital, 5-10 August 1964.

56. Assisted in high altitude investigation at Natick, Massachusetts, and attended meeting of the Food and Nutrition Board of the National Academy of Sciences, Washington, D. C., 26-30 October 1964.

57. Consulted with the Ministries of Health and Agriculture, Medical & QM personnel of Federation Armed Forces; Institute for Medical Research, Kuala Lumpur, Malaysia; U. S. Army Medical Research Unit, Kuala Lumpur; members of the University of Malaya; conferred with officials of U. S. Army SEATO Medical Research Laboratory and Thailand Institute of Clinical Nutrition, Bangkok, Thailand, officials of U. S. Operations Missions (USOM): FAO; and Thailand Ministry of Health. Conferred with personnel of Medical College II, Mingaladon, Burma, American Embassy officials and the staff of the Burma Institute for Medical Research; 19 November - 8 December 1964.

58. Attended Computer Programming Course, Colorado University Medical School, 7-week course, January and February 1964.

59. Received Meritorious Civilian Service Award from Department of the Army for research in preserving food by use of ionizing radiation, 2 April 1964.

60. Attended USAMRNL-RCA Bio-computer Course, 11 May - 22 May 1964.

61. Appointed Affiliate Professor, Colorado State University, Fort Collins, Colorado, 1 July 1964.

62. Appointed Chairman, Medical Library Committee, USAMRNL, 27 July 1964.

63. Appointed member of Panel to Evaluate Research Positions, FGH, 23 November 1964.

64. Member of the Nominating Committee of the American Institute of Nutrition.

65. Chairman of the Awards Committee (Meade-Johnson) of the American Institute of Nutrition.

66. Member of the Membership Committee of the American Society for Clinical Nutrition.

67. Selected to serve as a member of the Editorial Board of the Journal of Nutrition for period of May 1965 - May 1968.

68. Nutrition Seminar, Colorado State University, Fort Collins, Colorado, 14 January 1965.

69. Conference on Plasma Amino Acid Concentrations, sponsored by National Research Council Committee on Amino Acids and the Rutgers Biological Bureau, Rutgers University, New Brunswick, New Jersey, 1-2 February 1965 (by invitation).

70. 49th Annual Meeting, Federation of American Societies for Experimental Biology, Atlantic City, New Jersey, 9-14 April 1965.

71. Conference on Vitamin B₆ Assay Methods, Oregon State University, Corvallis, Oregon, 2-4 June 1965 (by invitation).

72. Brookings Institution's Conference for Federal Science Executives, Williamsburg Lodge, Williamsburg, Virginia, 17-22 October 1965.

73. Food and Nutrition Board and Committee on Recommended Dietary Allowances, Washington, D. C., 28-30 October 1965.

74. Western Hemisphere Nutrition Congress organized by the Council on Food and Nutrition, American Medical Association, Chicago, Illinois, 8-11 November 1965.

75. Association of Military Surgeons of the United States, Washington, D. C., 16-17 November 1965. Also received McLester Award for 1965.

76. Participated in ICNND-Institute of Nutrition of Central America and Panama, giving consultive advice and collaborative assistance in nutrition research and the epidemiology of nutritional diseases in Guatemala, 5 March - 5 April 1965.

77. Participated in briefing session, giving consultive advice and collaborative assistance to team members being sent to Paraguay on nutrition survey. National Institutes of Health, ICNND, Bethesda, Maryland, 7-9 April 1965.

78. Participated in workshop on clinical and experimental studies on urolithiasis at Naval Medical Research Institute, a cooperative project between ICNND and Naval Medical Research Institute, under the Advanced Research Projects Agency, Bethesda, Maryland, 7-9 June 1965 (by invitation).

79. Appointed member of Committee on Dietary Allowances, Food and Nutrition Board, National Academy of Sciences-National Research Council, Washington, D. C., July 1965.

80. Appointed member of Membership Committee, American Society for Clinical Nutrition for 1965 - 1966.

81. Appointed Affiliate Professor, Department of Chemistry, Colorado State University, Fort Collins, Colorado, 1 July 1965 - 30 June 1969.

82. Participated in Conference on Human Requirements for Vitamin A, Thiamine, Riboflavin and Niacin, Food and Agriculture Organization, World Health Organization, United Nations Meeting, Rome, Italy, 6-17 September 1965 (by invitation).

83. Participated in briefing session of team being sent to give consultive and collaborative assistance in nutrition research and the epidemiology of nutritional diseases in Nicaragua, National Institutes of Health, Bethesda, Maryland, 6 January 1966.

84. Participated in discussion concerning future anemia research, sponsored by Public Health Service, National Institutes of Health, Vanderbilt University, Nashville, Tennessee, 9-12 January 1966.

85. Participated in the nutrition study section, Division of Grants, of the National Institutes of Health at Fitzsimons General Hospital, 13-15 January 1966.

86. Selected to attend and participate in Executive Seminar, International Affairs and Federal Operations, Office of Career Development, Kings Point, New York, 28 February - 11 March 1966.

87. Attended and participated in Nutrition Advisory Committee Meeting, Washington, D. C., 11-12 March 1966.

88. Attended and participated in meeting of the Food and Nutrition Board, National Academy of Sciences-National Research Council. Included in this meeting was the Committee on Dietary Allowances, NAS-NRC, Washington, D. C., 30 March - 3 April 1966.

89. As a member of the Editorial Board of the Journal of Nutrition, attended the annual meeting of the Editorial Board, Atlantic City, New Jersey, 13 April 1966.
90. Laboratory representative at the Nutrition Study Section, National Institutes of Health, Bethesda, Maryland, 21-23 April 1966.
91. 57th Annual Meeting, American Association for Cancer Research, Hilton Hotel, Denver, Colorado, 26-28 May 1966.
92. Appointed member of Editorial Board, American Journal of Clinical Nutrition (5-year term), 7 June 1966.
93. Reappointed as a member of the Committee on Dietary Allowances of the Food and Nutrition Board, National Academy of Sciences-National Research Council, 7 June 1966.
94. Reappointed as Chairman of the Subcommittee on Vitamin B₁₂, Folic Acid and Biotin of the Committee on Dietary Allowances, Food and Nutrition Board, National Academy of Sciences-National Research Council, 7 June 1966.
95. Appointed member of the American Institute of Nutrition Committee on Nomenclature, 13 June 1966.
96. Appointed American Institute of Nutrition representative to the Food and Agriculture Organization (2-year term), 13 June 1966.
97. Served as Chairman of the session on "Proteins" of the VIIIth International Congress of Nutrition, Hamburg, Germany, 4 August 1966.

Oral Presentations:

1. American Association for the Advancement of Science, "The biochemical changes induced in humans by a deficiency of thiamine," by Z. Z. Ziporin, W. T. Nunes, R. C. Powell, D. C. Holland and H. E. Sauberlich, Denver, Colorado, 29 December 1961.
2. Meeting of Medical Education for National Defense Representatives (Nutrition for National Defense), "Vitamins: How "micro" are "micronutrient" requirements?" Fitzsimons General Hospital, Denver, Colorado, 14-16 May 1962.
3. Meeting of Medical Education for National Defense Representatives (Nutrition for National Defense), "Nutritional biochemistry studies in Burma," Fitzsimons General Hospital, Denver, Colorado, 14-16 May 1962.
4. Addressed Pima County Nutrition Council, University of Arizona and Nutrition Council of Phoenix on "International aspects of nutrition," Tucson, Arizona, 14 March 1963.
5. Lecture, Medical Laboratory Procedures Advanced Course, "Microbiological techniques; vitamin B₆, tryptophan," Bi-monthly orientation during 1963.
6. Reserve Officers' Training Program in Military Nutrition, "Biochemical findings from the Burma and Malaya nutrition surveys," USAMRNL, 16 July 1963.
7. VIth International Congress of Nutrition, "Vitamin B₆ requirement of the human," Edinburgh, Scotland, 9-15 August 1963.
8. Sigma XI Organization and Nutrition Seminar, "Vitamin B₆," Colorado State University, Ft. Collins, Colorado, 6 March 1964.
9. University of Colorado Medical Technology Postgraduate Course, USAMRNL, 19-20 March 1964.
10. 4th Annual Meeting of the American Society for Clinical Nutrition, "Oral magnesium administration in the treatment of renal calculus formation," Atlantic City, New Jersey, 2 May 1964.
11. Reserve Officers' Training Program, "Magnesium metabolism and its relationship to renal calculi," USAMRNL, 12-24 July 1964.

12. International Symposium on Vitamin B₆, "Human requirements for vitamin B₆," New York, 23-24 July 1964.
13. Nutrition Seminar, "Nutritional problems in Thailand," Colorado State University, Fort Collins, Colorado, 11 February 1965.
14. Advisory Committee on Nutrition to The Surgeon General, "Brief summary of other research activities of the Chemistry Division," and "USAMRNL's projected interests in nutrition studies in foreign countries," USAMRNL, 5-6 March 1965.
15. Annual Meeting, Western Division of the Dairy Science Association and Society of Animal Production, "World nutrition problems," Colorado State University, Fort Collins, Colorado, 12 July 1965 (by invitation).
16. Reserve Officers' Training Program in Military Nutrition, "Other research developments within the Chemistry Division," USAMRNL, 18-31 July 1965.
17. Seminar, "Food Agriculture Organization/World Health Organization (FAO/WHO) Expert Group on Vitamin Requirements," USAMRNL, 16 December 1965.
18. Biochemistry Seminar, "Anemias in children," report of meeting attended at Vanderbilt University on 10-11 January 1966, USAMRNL, 21 January 1966.
19. 5th Annual Natrona County Farm and Nutrition Institute, "World nutrition problems," Casper, Wyoming, 12 February 1966.
20. VIIIth International Congress of Nutrition, "Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine," by H. E. Sauberlich, E. M. Baker, W. H. Amos and J. A. Tillotson, Hamburg, Germany, 2-10 August 1966.

CURRICULUM VITAE

BAKER, Eugene M., Lt. Colonel, MSC

Position: Assistant Chief, Chemistry Division

Born: [REDACTED]

Married: [REDACTED]

Military Service: 1943-45 Served in Infantry, South Pacific (Enlisted)
1945-49 Inactive
1949-53 Research and Graduate School, Walter Reed Army
Hospital Center. Served as Research Assistant,
Department of Biochemistry
1953-56 Far East Command 406 MGL (1953-55, Assistant Chief;
1955-56, Chief, Department of Chemistry)

Jan 1949 - Aug 1951, 2nd Lt., MSC

Aug 1951 - Mar 1954, 1st Lt., MSC

Mar 1954 - May 1961, Capt., MSC

October 1955 Capt., Regular Army, MSC

May 1961 - May 1965, Maj., MSC

May 1965 - Date Lt. Col., MSC

Education: Georgia Institute of Technology, Atlanta, Georgia.
Interrupted by World War II; degree awarded in absentia.
1946, B.S.
1940-1943, Ch E.

Tulane University, 9 months' special course to obtain biological
credits for entrance to either graduate or medical school,
1946-1947.

Georgetown University, M.S., June 1951

Georgetown University, Ph.D., June 1953

**Membership in
Societies:**

American Society of Clinical Chemistry
American Board of Clinical Chemistry
American Institute of Nutrition
American Society for Clinical Nutrition

Affiliate Professor of Chemistry, Colorado State University,
Fort Collins, Colorado

PUBLICATIONS

EUGENE M. BAKER, Lt. Colonel, MSC

1. Baker, E. M., M. E. Webster and M. E. Freeman. Purification of hyaluronidase from Clostridium perfringens. Bact. Proc. 54: 1954.
2. Mannering, G. J., E. M. Baker, A. C. Dixon and T. Asami. The in vivo liberation of morphine from codeine in man. J. Pharmacol. Therapeutics 111: 1942, 1954.
3. Baker, E. M., M. E. Webster, M. E. Freeman, A. C. Saunders and C. Carey. Purification of hyaluronidase from Clostridium perfringens. Proc. Soc. Exp. Biol. Med. 91: 24, 1956.
4. Plough, I. C., J. H. Sellars, V. E. McGary, J. Nuss, E. M. Baker, R. S. Harding, R. L. Taylor and O. L. Weiser. An evaluation in human beings of the acceptability, digestibility and toxicity of pork sterilized by gamma radiation and stored at room temperature. USAMRNL Rep. No. 204, 17 May 1957.
5. Bierman, E. L., I. C. Plough, J. H. Sellars, V. E. McGary, E. M. Baker, R. S. Harding and B. Bowman. Short-term human feeding studies of foods sterilized by gamma radiation and stored at room temperature. USAMRNL Rep. No. 224, 1 July 1958.
6. Bierman, E. L., E. M. Baker and I. C. Plough. The effect of intravenous administration of D-ribose and D-xylase on urinary excretion of ketopentose in man. USAMRNL Rep. No. 232, 21 April 1959.
7. Plough, I. C. and E. M. Baker. Maximum physiological concentration of sodium in human urine. J. Appl. Physiol. 14: 1036, 1959.
8. Bierman, E. L., E. M. Baker, I. C. Plough and W. D. Hall. Metabolism of D-ribose in diabetes mellitus. Diabetes 8: 455, 1959.
9. Baker, E. M., E. L. Bierman and I. C. Plough. Factors influencing the urinary excretion of ketopentoses by normal men. Metabolism 9: 478, 1960.

10. Baker, E. M., E. L. Bierman and I. C. Plough. Effect of D-glucuronic acid and D-glucuronolactone on blood and urine ascorbic acid levels in man and dog. *Am. J. Clin. Nutr.* 8: 369, 1960.
11. Powell, R. C., I. C. Plough and E. M. Baker. The use of nitrogen to creatinine ratios in random urine specimens to estimate dietary protein. *J. Nutrition* 73: 47, 1961.
12. Baker, E. M., H. E. Sauberlich, S. J. Wolfskill, W. T. Wallace and E. E. Dean. Tracer studies of vitamin C utilization in men; metabolism of D-glucuronolactone-6-C¹⁴, D-glucuronic-6-C¹⁴ acid and L-ascorbic-1-C¹⁴ acid. *Proc. Soc. Exp. Biol. Med.* 109: 737, 1962.
13. Baker, E. M., I. C. Plough and T. H. Allen. Water requirements of man as related to salt intake. *Am. J. Clin. Nutr.* 12: 394, 1963.
14. Baker, E. M., N. G. Levandoski and H. E. Sauberlich. Respiratory catabolism in man of the degradative intermediates of L-ascorbic-1-C¹⁴ acid. *Proc. Soc. Exp. Biol. Med.* 113: 379, 1963.
15. Baker, E. M., J. E. Canham, W. T. Nunes and H. E. Sauberlich. Vitamin B₆ requirement for adult men. *Am. J. Clin. Nutr.* 15: 59, 1964.
16. Levandoski, N. G., E. M. Baker and J. E. Canham. A monodehydro form of ascorbic acid in the autooxidation of ascorbic acid to dehydroascorbic acid. *Biochem.* 3: 1465, 1964.
17. Respiratory catabolism of L-ascorbic acid. Reviewed in *Nutrition Rev.* 22: 7, 1964.
18. Saari, J. C., E. M. Baker and H. E. Sauberlich. A simplified method for the isolation of urinary ascorbic acid as the 2,4-dinitrophenylazone. *Anal. Biochem.* (In press).
19. Bell, E. M., E. M. Baker and B. M. Tolbert. Synthesis of L-ascorbic-4-³H acid. *J. Labeled Compounds* (in press).

ABSTRACTS

EUGENE M. BAKER, Lt. Colonel, MSC

1. Plough, I. C., E. M. Baker and E. L. Bierman. Alternate pathways of glucose metabolism in man; factors influencing the excretion of ketopentose. Clin. Res. 6: 406, 1958.
2. Baker, E. M., I. C. Plough and E. L. Bierman. Can humans synthesize vitamin C? Fed. Proc. 18: 6, 1959.
3. Baker, E. M., H. E. Sauberlich and S. J. Wolfskill. Metabolism of D-glucuronolactone-6-C¹⁴ and D-glucuronic acid-6-C¹⁴ in man. Fed. Proc. 20: 85, 1961.
4. Levandoski, N. G., E. M. Baker and J. E. Canham. Studies on the auto-oxidation of L-ascorbic acid. Sixth International Congress of Biochemistry, N.Y., Pub. I.U.D. 32, Sec. V, G-176: 432, 1964.
5. Baker, E. M., M. Balaghi, R. S. Pardini and H. E. Sauberlich. Metabolism of 2-¹⁴C-thiazole labeled thiamine in man. Fed. Proc. 25: 245, 1966.
6. Sauberlich, H. E., E. M. Baker, W. H. Amos and J. A. Tillotson. Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine. VIIIth Int. Cong. Nutr. (in press).
7. Tolbert, B. M., E. M. Baker and J. C. Saari. Ascorbic acid metabolism in man. Fed. Proc. 25: 218, 1966.
8. Canham, J. E., E. M. Baker and N. Raica, Jr. Vitamin B₆ requirements of adult men. VIIIth Int. Cong. Nutr. (in press).
9. Baker, E. M., H. E. Sauberlich, W. H. Amos and J. A. Tillotson. Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine and L-ascorbic acid. 6th Annual Meeting, Am. Soc. for Clin. Nutr. (in press). Am. J. Clin. Nutr. 18: 302, 1966.
10. Baker, E. M., H. E. Sauberlich and J. E. Canham. Vitamin B₆ requirement of the human. Fed. Proc. 22: 322, 1963.
11. Sauberlich, H. E., E. M. Baker, J. E. Canham and N. Raica. Vitamin B₆ requirement of the human. Proc., VIII International Congress of Nutrition. E & S Livingstone Ltd., Edinburgh and London, 1964, p. 538.

Abstracts, Eugene M. Baker, Lt. Col., MSC - Page 2

12. Baker, E. M. and J. E. Canham. Xanthurenic acid excretion after loading with various forms of tryptophan in the evaluation of vitamin B₆ status. Fed. Proc. 24: 624, 1965.

ORAL PRESENTATIONS

EUGENE M. BAKER, Lt. Colonel, MSC

1. Postgraduate Course of Medical Technology, "Leukocyte isolation technique for biochemical studies: Leukocyte vitamin C determination," USAMRNL in collaboration with University of Colorado School of Medicine, 19-20 March 1964.
2. 35th Annual Meeting, Colorado-Wyoming Academy of Science, "Further studies on the vitamin B₆ requirement for the young adult male," Golden, Colorado, 8-9 May 1964.
3. Medical Laboratory Procedures Advanced Course, "The metric system" and "Preparation of laboratory solutions," Fitzsimons General Hospital, 24 February 1964.
4. SGO Advisory Committee on Environmental Medicine, "Future human studies," USAMRNL, 13-14 May 1964.
5. Lecture, "Nutrition review for the therapeutic and research dietitian," Walter Reed Army Hospital, Washington, D. C., 5-7 August 1964.
6. Reserve Officers' Training Program, "Vitamin C metabolism" and "Cellulose metabolism," USAMRNL, 12-24 July 1964.
7. Nutrition Seminar, "Studies of vitamin C metabolism in man" Colorado State University, Fort Collins, Colorado, 25 February 1965.
8. Meeting of the Advisory Committee on Nutrition to The Surgeon General, "Cellulose metabolism," "Chemistry of vitamin C and its nutritional requirements," "Recent or current vitamin B₆ studies," and "Vitamin C studies in humans," USAMRNL, 5-6 March 1965.
9. Postgraduate Course of Medical Technology, "Carbon ¹⁴ labeled vitamin C and B₆ studies in the human," USAMRNL in collaboration with University of Colorado School of Medicine, 18-19 March 1965.
10. 49th Annual Meeting, Federation of American Societies for Experimental Biology, "Xanthurenic acid excretion after loading with various forms of tryptophan in the evaluation of vitamin B₆ status," Atlantic City, New Jersey, 9-14 April 1965.

11. Workshop - The Influence of Altitude on Aspects of Nutrition, Metabolism and Endocrinology, "The influence of exposure to various altitudes upon utilization of vitamin C," USAMRNL, 12 January 1966.
12. Nutrition Seminar, "Studies of ^{14}C -labeled thiamine and pyridoxine in man," Colorado State University, Fort Collins, Colorado, 10 February 1966.
13. Biochemistry Seminar, "Vitamin C metabolism," USAMRNL, 1 April 1966.
14. Seminar, "Metabolism of ^{14}C -thiazole labeled thiamine in man," USAMRNL, 7 April 1966.
15. 50th Annual Meeting, Federation of American Societies for Experimental Biology, "Metabolism of 2- ^{14}C -thiazole labeled thiamine in man," Atlantic City, New Jersey, 11-16 April 1966.
16. 8th Annual Meeting of the American Society for Clinical Nutrition, "Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine and L-ascorbic acid," Atlantic City, New Jersey, 30 April 1966.

TRAINING AND EXPERIENCE

OF EACH INDIVIDUAL NAMED IN ITEM 4

(Use supplemental sheets if necessary)

B. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	U.S. Army Hosp. Wuerzburg & Ft. Sam Vanderbilt Univ. School of Med.	2 1/2 yrs 13 1/2 mo	YES NO <input checked="" type="radio"/> <input type="radio"/>	Yes No <input type="radio"/> <input type="radio"/>
b. Radioactivity measurement standardization and monitoring techniques and instruments	Vanderbilt University School of Medicine	4 1/2 mo 9 mo on job	YES NO <input checked="" type="radio"/> <input type="radio"/>	Yes No <input checked="" type="radio"/> <input type="radio"/>
c. Mathematics and calculations basic to the use and measurement of radioactivity	Same as b. above		Yes No <input type="radio"/> <input type="radio"/>	Yes No <input type="radio"/> <input type="radio"/>
d. Biological effects of radiation	Same as b. above		Yes No <input type="radio"/> <input type="radio"/>	Yes No <input type="radio"/> <input type="radio"/>

9. EXPERIENCE WITH RADIATION. (Actual use of radioisotopes or equivalent experience.)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Co ⁶⁰	0.5uc/patient or subject	Nutrition Clinic, Vanderbilt University.	9 months	Studies on Vitamin B ₁₂ requirements & half life
Co ⁶⁰		Dept. Biochemistry Vanderbilt University.	4 months	Relationship B ₁₂ to Calcium in B ₁₂ absorption
C-14, Cr-51, I-131		" " "	4 months	
P-32, H ₃ , K-42		" " "		

10. RADIATION DETECTION INSTRUMENTS. (Use supplemental sheets if necessary.)

Laboratory experience

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, measuring)

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. (For film badges, specify method of calibrating and processing, or name of supplier.)

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No
14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.
15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THE 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.

John E. Canham

Applicant named in item 1

Date _____

By: _____

Title of certifying official

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.

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

SUPPLEMENT A—HUMAN USE

This page may be completed by the physician's preceptor (if any) in the medical use of radioisotopes. When the information is not furnished by the preceptor, the name and present address of the preceptor (if any) should be shown in item 12 below.

9. (a) USING PHYSICIAN'S NAME

John E. Canham MC

(b) NAME AND ADDRESS OF APPLICANT (If different from 9(a))

Chief, Metabolic Division
U.S. ARMY Medical Research and Nutrition Laboratory
Fitzsimons General Hospital, Denver, Colorado 80240

10. CLINICAL TRAINING AND EXPERIENCE OF PHYSICIAN WHO WILL USE BYPRODUCT MATERIAL

(A) ISOTOPE	(B) CONDITION(S) DIAGNOSED OR TREATED	(C) NUMBER OF CASES	(D) TYPE OF PARTICIPATION FOR ALL CASES IN COLUMN B (circle applicable num- bers of items in accordance with key set forth below)
I-131	Diagnosis of thyroid function	20-25	① 2 3 4
	Treatment of hyperthyroidism		1 2 3 4
	Treatment of thyroid cancer		1 2 3 4
	Treatment of cardiac conditions		1 2 3 4
	Brain tumor localization		1 2 3 4
	Blood determinations		1 2 3 4
	Kidney function		1 2 3 4
	Others:		1 2 3 4
P-32 Soluble	Treatment of polycythemia and leukemia	2	① 2 3 4
	Brain tumor localization		1 2 3 4
	Treatment of bone metastases		1 2 3 4
	Others:		1 2 3 4
P-32 CrPO ₄	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites		1 2 3 4
	Others:		1 2 3 4
Au-198 Colloid	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites		1 2 3 4
	Others:		1 2 3 4
Cr-51	Blood determinations		1 2 3 4
	Others:		1 2 3 4
			1 2 3 4
Other Isotopes			1 2 3 4
	Co ⁶⁰ and Vitamin B ¹²		① ② 3 4

Key to above numbers (column D)

Active Participation and Discussion in the:

1. Examination of patients to determine suitability for radioisotope diagnosis and/or treatment and recommendations on dosage to be prescribed.
2. Collaboration in calibration and administration of dosages including related measurements and plotting of data.
3. Active period of training and experience of sufficient duration to permit followup of patients through treatment and posttreatment period including reevaluation as to effectiveness and complications.
4. Study and discussion of case histories to establish most efficacious diagnostic and/or therapeutic techniques for this radioisotope use.

TOTAL NUMBER OF HOURS OF PARTICIPATION IN CLINICAL TRAINING _____ hours

12. THE TRAINING AND EXPERIENCE INDICATED ABOVE WAS OBTAINED UNDER THE SUPERVISION OR GUIDANCE OF

Dr. John Coniglio PhD

Vanderbilt University

Dr. Richard Bozian

School of Medicine

(Name of physician or preceptor)

U.S.A. Med. Res. & Nut. Lab.

John E. Canham

(Signature)

Appendix I. References on General Health Physics

1. Recommendations of the International Commission on Radiological Protection, ICRP Publication 2, Report of Committee II on Permissible Dose for Internal Radiation, Pergamon Press, 1959.
2. Radiological Health Handbook, U. S. Department of Health, Education and Welfare, Sept. 1960.
3. Radioactive Isotopes in Medicine and Biology: Medicine, S. Silver; Lea and Febiger, Publishers, 1962.
4. Radioactive Isotopes in Medicine and Biology: Basic Physics and Instrumentation, E. Quimby and S. Feitelberg; Lea and Febiger, Publishers, 1963.
5. Use of Radioisotopes in Animal Biology and the Medical Sciences, Vol. 1 and 2, Academic Press, 1962.
6. Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water. Handbook 52, U. S. Dept. of Commerce.
7. Progress in Nuclear Energy: Series VI, Biological Sciences, J. G. Bugher, J. Coursaget and J. F. Loutit, Editors, Pergamon Press, 1959.
8. Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure. Handbook 69, U. S. Dept. of Commerce.
9. Progress in Nuclear Energy: Series VII, Medical Sciences, J. G. Bugher, J. Coursaget and J. F. Loutit, Editors, Pergamon Press, 1959.

10. Peaceful Uses of Atomic Energy: Vol. 22, "Biological Effects of Radiation," 1958; United Nations Publication.
11. Peaceful Uses of Atomic Energy: Vol. 24, Part 1, "Isotopes in Biochemistry and Physiology," 1958; United Nations Publication.
12. Radioisotope Studies of Fatty Acid Metabolism, J. F. Mead and D. R. Howton, Pergamon Press, 1960.
13. Peaceful Uses of Atomic Energy: Vol. 10, "Radioactive Isotopes and Nuclear Radiations in Medicine," 1956; United Nations Publication.
14. Clinical Use of Radioisotopes. W. H. Beierwaltes, P. C. Johnson and A. J. Solari. W. B. Saunders Co., Publishers, 1957.
15. The Use of Isotopes in Nutrition Research with Special Reference to Tritium. J. Done and P. R. Payne. World Review of Nutrition and Dietetics: Vol. 1, p. 207, 1959, Hafner Publishing Co.

VOLUNTARY CONSENT STATEMENT

Military _____ Military Patient _____ Civilian _____ Civilian Patient _____

I, _____, having the capacity to consent, voluntarily and without force or duress consent to participate in research involving the use of tracer amounts of radioisotopes. I have been informed of, and understand, the nature, duration, and purpose of the experiment, the method and means by which it is to be conducted, the inconveniences and hazards to be expected, and the effects upon my health and person which may possibly come from participation in the experiment.

Specifically, I agree to receive (intravenously) _____ orally _____ a small quantity of _____ containing _____ microcuries of _____. I also agree to furnish urine and stool samples for the period following until no detectable radioactivity is present and submit to measurements of expired gases if Carbon-14 has been received.

I understand that I may at any time during the course of the experiment revoke my consent and withdraw from the experiment without prejudice.

I do not at this time have any physical diseases, except for the following _____, or mental disease, to the best of my knowledge.

DATE

SIGNATURE

SIGNATURE OF WITNESS

APPROVAL

I have personally ascertained that the quality of the foregoing consent is sufficient to permit the volunteer to participate in the experiment.

ATTENDING PHYSICIAN

PROJECT LEADER

Appendix III. Publications by Personnel of USAMRNL Since 1962 Involving
the Use of Tracer Studies in Human Volunteers

1. Baker, E. M., H. E. Sauberlich, S. J. Wolfskill, W. T. Wallace and E. E. Dean. Tracer studies of vitamin C utilization in man; metabolism of D-glucuronolactone-6-¹⁴C, D-glucuronic-6-¹⁴C acid and L-ascorbic-1-¹⁴C acid. Proc. Soc. Exp. Biol. Med., 109: 737, 1962.
2. Baker, E. M., N. G. Levandoski and H. E. Sauberlich. Respiratory catabolism in man of the degradative intermediates of L-ascorbic-1-¹⁴C acid. Proc. Soc. Exp. Biol. Med., 113: 379, 1963.
3. Respiratory catabolism of L-ascorbic acid. Reviewed in Nutrition Rev., 22: 7, 1964.
4. Bell, E. M., E. M. Baker and B. M. Tolbert. Synthesis of L-ascorbic-4-³H acid. J. Labeled Compounds, 11(2): 148, 1966.
5. Tolbert, B. M., E. M. Baker and J. C. Saari. Ascorbic acid metabolism in man. Fed. Proc., 25: 218, 1966 (Abstract).
6. Baker, E. M., H. E. Sauberlich, W. H. Amos and J. A. Tillotson. Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine and L-ascorbic acid. Am. J. Clin. Nutr., 18: 302, 1966 (Abstract).
7. Saari, J. C., E. M. Baker and H. E. Sauberlich. A simplified method for the isolation of urinary ascorbic acid as the 2,4-dinitrophenyl-osazone. Anal. Biochem., 15: 537, 1966.
8. Baker, E. M., M. Balaghi, R. S. Pardini and H. E. Sauberlich. Metabolism of 2-¹⁴C-thiazole labeled thiamine in man. Fed. Proc., 25(2): 245, 1966 (Abstract).

9. Amos, W. H., Jr., M. Balaghi, O. Ramirez and H. E. Sauberlich. Metabolism of ^{14}C -riboflavin in the rat. Fed. Proc., 25(2): 245, 1966 (Abstract).
10. Raica, N., Jr., Y. F. Herman, W. H. Amos, Jr. and H. E. Sauberlich. Riboflavin nutrition in the germ-free and pathogen-free rat. Fed. Proc., 25(2): 245, 1966 (Abstract).
11. Tillotson, J. A., H. E. Sauberlich, E. M. Baker and J. E. Canham. Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine. Proc. VIIth Inter. Congress of Nutrition, Hamburg, Germany (In press).
12. Sauberlich, H. E. Biochemical alterations in thiamine deficiency--their interpretation (In press).
13. Baker, E. M., J. C. Saari and B. M. Tolbert. Ascorbic acid metabolism in man. Am. J. Clin. Nutrition (In press).
14. Tolbert, B. M., A. W. Chen, E. M. Bell and E. M. Baker. Metabolism of L-ascorbic-4- ^3H acid in man. Am. J. Clin. Nutrition (In press).
15. Saari, J. C., E. M. Baker and H. E. Sauberlich. Thin-layer chromatographic separation of the oxidative degradation products of ascorbic acid. Anal. Biochem. (In press).

9. Amos, W. H., Jr., M. Balaghi, O. Ramirez and H. E. Sauberlich. Metabolism of ^{14}C -riboflavin in the rat. Fed. Proc., 25(2): 245, 1966 (Abstract).
10. Raica, N., Jr., Y. F. Herman, W. H. Amos, Jr. and H. E. Sauberlich. Riboflavin nutrition in the germ-free and pathogen-free rat. Fed. Proc., 25(2): 245, 1966 (Abstract).
11. Tillotson, J. A., H. E. Sauberlich, E. M. Baker and J. E. Canham. Use of carbon-14 labeled vitamins in human nutrition studies: pyridoxine. Proc. VIIth Inter. Congress of Nutrition, Hamburg, Germany (In press).
12. Sauberlich, H. E. Biochemical alterations in thiamine deficiency--their interpretation (In press).
13. Baker, E. M., J. C. Saari and B. M. Tolbert. Ascorbic acid metabolism in man. Am. J. Clin. Nutrition (In press).
14. Tolbert, B. M., A. W. Chen, E. M. Bell and E. M. Baker. Metabolism of L-ascorbic- $4\text{-}^3\text{H}$ acid in man. Am. J. Clin. Nutrition (In press).
15. Saari, J. C., E. M. Baker and H. E. Sauberlich. Thin-layer chromatographic separation of the oxidative degradation products of ascorbic acid. Anal. Biochem. (In press).

CURRICULUM VITAE

6 July 1966

CANHAM, John E. Lt. Colonel, MC

Position: Commanding Officer
U. S. Army Medical Research and Nutrition Laboratory
Fitzsimons General Hospital
Denver, Colorado 80240

Born: [REDACTED]

Married: [REDACTED]

Military Service:

May 1943 - Mar 1946 Enlisted Service

Jun 1949 - Jun 1950 Intern, Letterman General Hospital
San Francisco, California

Jul 1950 - Aug 1950 Medical Resident, Letterman General
Hospital, San Francisco, California

Aug 1950 - Feb 1951 TDY to FBCOM assigned to 8th Station
Hospital, Kobe, Japan. Duty involved
care and treatment of patients with
surgical and orthopedic conditions
and the running of the X-ray department.

Feb 1951 - Dec 1953 Letterman General Hospital, Resident
on the Medical Service

Jan 1954 - Jun 1956 Ward Officer, General Medical Service,
USAH, Ft. Belvoir, Va.

Jul 1956 - Dec 1956 Student, AMSS, BAMC, Ft. Sam Houston,
Texas (Advanced course)

Jan 1957 - Jul 1960 19th Field Hospital (USAH, Wurzburg,
Germany)

Duty: Jan 1957 - May 1957 - Asst. Ch.,
Medical Service

May 1957 - Jul 1960, Chief of
Medical Service

Additional Duties:

May 1957 - Jul 1960, Deputy
Hospital Commander

Oct 1957 - Jul 1960, Chief of
Outpatient and Health Services,
Wurzburg Medical Service Area

Oct 1957 - Jul 1960, Chief of
Preventive Medicine, Wurzburg
Medical Service Area

Sep 1960 - Jun 1961 Biochemistry Dept., Medical School of
Vanderbilt University, Nashville, Tenn.
for a course entitled, "Nutrition and
Metabolism".

Jul 1961 - 31 Oct 1964 Chief of Metabolic Div., USAMPHL, FGH, Denver (Included in this period, was on loan to ICNHD to participate in a nutrition survey in Uruguay, S.A. Feb 1962 - May 1962.)

Dec 1962 - Jun 1963 Monitor, Utilization Group, Surgeon General's Intravenous Nutrient Group.

Jun 1963 - Present Monitor, Surgeon General's Intravenous Nutrient Program.

31 Oct 1964 - Present Commanding Officer, USAMPHL, FGH, Denver, Colorado

6 Jan 1966 - 13 May 66 TDY, Associate Course, Command & Gen. Staff College, Ft. Leavenworth, Kan.

Education:

Elementary and High School, Barker Central School, Barker, New York

1943 - 1944 The Military School of South Carolina (The Citadel) Charleston, So. Carolina Two semesters, ASTP

1944 The Johns Hopkins University, Baltimore, Maryland, A.B., 3 Semesters

Oct 1945 - Jun 1949 Columbia University's College of Physicians and Surgeons, New York, N.Y.

Sep 1960 - Jun 1961 Vanderbilt University's School of Medicine, Nashville, Tenn. (Post of Bishop, - Nutrition and Metabolism)

Jan 66 - May 66 Assoc Course Command & Gen. Staff College

Special Activities:

1. Associate Guest Editor, Symposium on I.V. Fats-- Am. J. of Clin. Nutrition - Jan 1966.
2. The Surgeon General's liaison representative to:
 - a. Nutrition Study Section, NIH (Sep 64 - present)
 - b. Food & Nutrition Board, NAS-NAS (Oct 64 to present)
 - c. Member, Sub-Committee on Vitamin A of the Committee on Dietary Allowances of the Food and Nutrition Board, NAS-NRC (1965 to present)
3. Member, C.S.U. Radiation Institute, Human Uses Radio-isotope Committee, Colo. State University, Fort Collins, Colorado (1964 to present)

Academic

Appointments: 1 Jul 1964

Affiliate Professor of Chemistry, Colorado State University, Fort Collins, Colorado

Membership in Societies:

Diplomate of the American Board of Medical Examiners; American Association for the Advancement of Science; American Medical Association; Am. Institute of Nutr. Am. Soc. for Clin. Nutrition

Special

Interests:

Nutrition and Nutritional Diseases
Intravenous Fat Emulsions
Liver Diseases.

Publications:

1. Consolazio, C. F., Matoush, L. O., Nelson, R. A., Harding, R. S., and Canham, J. E.: The Dermal Excretion of Minerals and Its Possible Relation to Mineral Balance and Requirements. U. S. Army Medical Research and Nutrition Laboratory Report No. 271, Oct 1962.
2. Consolazio, C. F., Nelson, R. A., Matoush, L. O., Harding, R. S. and Canham, J. E.: The Sweat Excretion of Nitrogen in Relation to Balance, Environment and Physical Activity. U. S. Army Medical Research and Nutrition Laboratory Report No. 270, Oct 1962.
3. Consolazio, C. F., Nelson, R. A., Matoush, L. O., Harding, R. S. and Canham, J. E. Nitrogen Excretion in Sweat and Its Relation to Nitrogen Balance Requirements. J. of Nutr., 79: 399, 1963.
4. Consolazio, C. F., Matoush, L. O., Nelson, R. A., Harding, R. S. and Canham, J. E.: Excretion of Sodium, Potassium, Magnesium and Iron in Human Sweat and the Relation of Each to Balance and Requirements. J. of Nutr., 79: 407, 1963.
5. Nunes, W. T. and Canham, J. E.: The Effect of Varied Periodicity of Eating on Serum Lipid and Carbohydrate Tolerance in Man. Am. J. Clin. Nutr., 12: 334, 1963 (Abstract)
6. Baker, E. H., Sauberlich, H. E. and Canham, J. E.: Vitamin B₆ Requirements of the Human, Fed. Proc., 22: 322, 1963 (Abstract)
7. Canham, J. E., Nunes, W. T. and Eberlin, E. W.: Central Nervous System Manifestations of B₆ Deficiency in Normal Human Adults, Fed. Proc., 22: 323, 1963 (Abstract)
8. Consolazio, C. F., Matoush, L. O., Nelson, R. A., Harding, R. S., and Canham, J. E.: The Excretion of Nitrogen and Minerals in Sweat and Their Relationship to Balance and Requirements. Fed. Proc., 22: 550, 1963 (Abstract)
9. Nunes, W. T. and Canham, J. E.: The Effect of Varied Periodicity of Eating ("Nibbling" vs "Gorging") on Glucose Tolerance in Man. (This manuscript has been prepared for publication in a scientific journal).
10. Nunes, W. T., Canham, J. E., Consolazio, C. F. and Nelson, R. A.: The Effect of Varied Periodicity of Eating on Respiratory Quotient and Oxygen Consumption in Man. (This manuscript has been prepared for publication in a scientific journal).
11. A report by the Interdepartmental Committee on Nutrition for National Defense: Nutrition Survey of the Republic of Uruguay, 1962. United States Government Printing Office, Washington, D. C.
12. Canham, J. E. and Sauberlich, H. E.: Chapter 15 entitled, "Vitamin B₆" for "Handbook of Nutrition" compiled by the Council on Foods and Nutrition of the AMA for publication in 1966.

13. Canham, J. E., Nunes, W. T. and Eberlin, E. W.: Electroencephalographic and Central Nervous System Manifestations of B₆ Deficiency and Induced B₆ Dependency in Normal Human Adults. Proceedings of the 6th International Congress of Nutrition, C. F. Mills & R. Passmore, Eds., Page 537 (Abstract), published by Messrs. E. & S. Livingstone, Ltd., Edinburgh, Scotland, 1964.
14. Sauberlich, H. E., Baker, E. M., Canham, J. E. and Raica, H. Jr.: Vitamin B₆ Requirement of the Human, Proceedings of 6th International Congress of Nutrition, C. F. Mills & R. Passmore, Eds., Page 538 (Abstract), published by Messrs. E. & S. Livingstone, Ltd., Teviot Pl., Edinburgh, Scotland, 1964.
15. Levandoski, M. G., Baker, E. M. and Canham, J. E.: Studies on the Auto-Oxidation of L-Ascorbic Acid. (Abstract). Sixth International Congress of Biochemistry, New York City, N. Y., July 1964., Pub. I.U.B., Vol. 32, Sect. V, G 176, p432, 1964.
16. Levandoski, M. G., Baker, E. M. and Canham, J. E.: A monodehydro Form of Ascorbic Acid in the Auto-Oxidation of Ascorbic Acid to Dihydroascorbic Acid. Biochemistry, 3: 1465-1469, Oct. 1964.
17. Baker, E. M., Canham, J. E., Nunes, W. T., Sauberlich, H. E. and McDowell, M. E.: Vitamin B₆ Requirement for Adult Men, Am. J. Clin. Nutr., 15: 39-66, 1964.
18. Jones, L. D., Castleberry, M. W., Canham, J. E., King, N. W.: Toxicity Testing of Fat Emulsions for Intravenous Administration Am. J. Clin. Nutrition, Jan, 1965, Vol 16: 68-74.
19. Levine, R. A., King, N. W. and Canham, J. E.: Hemodynamic Alterations Produced by Artificial Fat Emulsion Perfused Through the Isolated Rat Liver. Vol II, Fette in der Medizin, pp27-31, H. Henning, Ed., Pub. Pallas Verlag, Munich, 1965.
20. Canham, J. E., Jones, L. D., King, N. W. and Levine, R. A.: Metabolic and Toxicity Studies of Intravenously Administered Fat Emulsions, World Fat Congress, Hamburg, Germany, Oct 1964, Abstracts of Papers, pp 256-259, Published by Aschendorffsche, Buchdruckerei, Munster, Westf., Germany, 1964.
21. Baker, E. M., Canham, J. E. and Sauberlich, H. E.: Further Studies on the Vitamin B₆ Requirement for the Young Adult Male. (Abstract) Proc. 35th Ann. Meeting, Colorado-Wyoming Acad. Sci., 1964
22. Harding, R. S., Canham, J. E. and Sauberlich, H. E.: The Free Amino Acids in the Plasma and Urine of Human Subjects on a Vitamin B₆ Deficient Diet. (Ibid.)

23. Guest Editor "Symposium on Intravenous Fat Emulsions": Am. J. Clin. Nutrition, 16: 1-224, 1965.
24. Mueller, J. F. and Canham, J. E.: Editorial - Symposium on Intravenous Fat Emulsions. Am. J. Clin. Nutrition, 16: 1-3, 1965.
25. Canham, J. E., Harding, R. S., Consolazio, C. F. and Witt, H. F.: Gastrointestinal Degradations of Cellulose in the Human. Fed. Proc., 24: 314, 1965.
26. Harding, R. S., Canham, J. E. and Sauberlich, H. E.: The Free Amino Acids in the Plasma and Urine of Human Subjects on a Vitamin B₆ Deficient Diet. In "Automations in Analytical Chemistry", Ed. - Leonard T. Skeggs, Jr., Mediad, Inc. Publishers, 1966.
27. Consolazio, C. F., Matoush, L. O., Nelson, R. A. and Canham, J. E.: Comparisons of Nitrogen, Calcium and Iodine Excretion in Arm and Total Body Sweat. Fed. Proc., 25: 312, 1966 (Abstract).
28. Matoush, L. O., Nelson, R. A., Consolazio, C. F. and Canham, J. E.: Sweat Losses in Relation to Trace Mineral Balances. Fed. Proc., 25: 312, 1966 (Abstract).
29. Baker, E. M. and Canham, J. E.: Xanthurenic Acid Excretions after Loading with Various Forms of Tryptophan in the Evaluation of Vitamin B₆ Status. Fed. Proc., 24: 624, 1965 (Abstract).
30. Canham, J. E. and Consolazio, C. F.: Nutrition and Stress. Accepted for publication in NMA.
31. Surks, M. D. and Canham, J. E.: Albumin Metabolism in Man at High Altitude. Fed. Proc., 25: 349, 1966 (Abstract).
32. Consolazio, C. F., Matoush, L. O., Nelson, R. A., Harding, R. S. and Canham, J. E.: Nutrition Survey - Ranger Department, Fort Benning, Georgia, USAMRIID Report No. 231, January 1966, Denver, Colorado.
33. Canham, J. E., Baker, E. M. and Raica, M., Jr.: Vitamin B₆ Requirement of Adult Men. Proceedings of VII International Congress of Nutrition, Hamburg, Germany, August 1966. (Abstract).
34. Consolazio, C. F., Matoush, L. O., Nelson, R. A., Issac, G. J. and Canham, J. E.: Comparison of Nitrogen, Calcium, and Iodine Excretions in Arm and Total Body Sweat. Am. J. of Clin. Nutrition 18: 443-449, 1966.

Areas of Research: Areas of research activity has been in the following fields:

1. The effects of periodicity of eating upon normal intermediate metabolism in humans.
2. The degradation and possible utilization of cellulose in humans.
3. Have supervised the conduct and collaborated with other investigators in the performance of six studies on Vitamin B₆ metabolism in the normal adult male human including deficiency studies. These studies resulted in the original observation that vitamin B₆ deficiency in the adult can produce electroencephalographic abnormalities and convulsive seizures plus the original observation that excessive intake of vitamin B₆ can produce electroencephalographic abnormalities in the adult.
4. Have also participated in studies to determine the usability utilization and toxicity of various intravenous fat preparations.
5. Additional activities include participation with C. F. Consolazio in studies aimed at defining the extent of nutrient loss in perspiration of active adult males living in various environmental temperatures.
6. Have been responsible for the planning, coordination and supervision of Army nutrition surveys which involved various divisions of the Laboratory.
7. Additional areas of research activity have included the auto-oxidation of ascorbic acid in aqueous solutions and the relationship of these products to the normal metabolic function of ascorbic acid.

Training and Experience: Charles G. Liddle, Capt VC

Form AEC-313

Item 8	Type of Training:	Where Trained	Duration of Training	
a.	Principles and practices of radiation protection	Walter Reed Army Institute of Research	2 weeks	Formal
		Taft Sanitary Engineering Center	4 weeks	Formal
		University of Rochester	1 year	Formal
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	"	"	"

Item 9 Experience with radiation

Isotope	Maximum amount	Where experience gained	Duration	Type of Use
H ³	1 Mc	Four h U S Army Med Lab	1 yr	research
		Walter Reed Army Institute of Research	2 yrs	research
		USAMRNL	1 yr	research
Cl ¹⁴	"	"	"	"
P ³²	"	"	"	"
S ³⁵	"	"	"	"
Ca ⁴⁵	"	"	"	"
Cr ⁵¹	"	"	"	"
Fe ⁵⁹	"	"	"	"
Co ⁶⁰	"	"	"	"
Zn ⁶⁵	"	"	"	"
Sr ⁸⁵	"	"	"	"
Sr ⁹⁰	"	"	"	"
I ¹²⁵	"	"	"	"
I ¹³¹	"	"	"	"
Cs ¹³⁷	"	"	"	"
Ba-La ¹⁴⁰	"	"	"	"
Hg ¹⁹⁷	"	"	"	"
Hg ²⁰³	"	"	"	"

6 October 1966

LIDDLE, CHARLES G., Captain, VC, Radioisotope Section, Physiology Division,
U. S. Army Medical Research & Nutrition Laboratory

Date and Place
of Birth: [REDACTED]

Wife: [REDACTED]

Children: [REDACTED]

Education: DVM, Michigan State
University, 1960
MS, Radiation Biology,
University of Rochester,
1963

Experience: Veterinary Practice, June-
Dec 1960
Chief, Radioisotope Div,
Fourth US Army Medical
Lab, Ft. Sam Houston, Tex.,
Jan 61-May 62
Asst Ch, Dept of Food Radionuclides, Div Vet Med,
WRAIR, Washington, D.C., July 63-Dec 63
Ch, Small Animal Testing Section, Dept of Medicinal
Chemistry, WRAIR, Washington, D.C., Jan 64-June 64
Asst Ch, Dept of Food Radionuclides, Div Vet Med,
WRAIR, Washington, D.C., July 64-July 65
Ch, Radioisotope Sec, Physiology Div, USAMRNL,
Aug 65 to present

Publications: None

Hobbies: Bowling, antique autos, camping, hiking, music, reading

Member of American Veterinary Medical Association; Health Physics Society

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4

(Use supplemental sheets if necessary)

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	University of Illinois	1 yr	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input type="radio"/> Yes <input checked="" type="radio"/> No
b. Radioactivity measurement standardization and monitoring techniques and instruments	"	4 mos	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
c. Mathematics and calculations basic to the use and measurement of radioactivity	"	4 mos	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
d. Biological effects of radiation	"	4 mos	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No

9. EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
C ¹⁴	100 μ c	University of Illinois	1 1/2 yrs	metabolic studies
H ³	100 μ c	University of Illinois	3 mos	Lab Course in Radi Isotope Techniques

10. RADIATION DETECTION INSTRUMENTS (Use supplemental sheets if necessary)

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, measuring)

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE

12. FILM BADGES, DOSIMETERS, AND BIO ASSAY PROCEDURES USED (For film badges, specify method of calibrating and processing, or name of supplier)

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

13. FACILITIES AND EQUIPMENT Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No

14. RADIATION PROTECTION PROGRAM Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.

15. WASTE DISPOSAL If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, 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

Ronald S. Pardini, 1st Lt MSC

Applicant named in item 1

Date _____

By: _____

Title of certifying official

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.

6 September 1966

PARDINI, RONALD S., 1/Lt, MEC, Biochemist, Chemistry Division, U. S. Army
Medical Research and Nutrition Laboratory

Date and Place
of Birth: [REDACTED]

Wife: [REDACTED]

Children: [REDACTED]

Education: BS, California State Poly.
College, 1961

Ph.D., Univ. of Illinois,
1963

Experience: USAMRNL, Sept 65 to present

Publications: 1

Hobbies: Skiing, bowling, handball

Member of: American Oil Chemists Society; Gamma Sigma Delta-Honor
Society; Fitzsimons Ski Club

20 September 1966

SYNER, JAMES C., Lt. Colonel, MC, Commanding Officer and Chief, Computer Division, U. S. Army Medical Research & Nutrition Laboratory

Date and Place
of Birth:

Wife:

Children:

Education: BS, Springfield College,
(Mass.), 1937-41
MD, Boston Univ., 1946-50
Rotating Internship,
Walter Reed Army Hosp,
1950-51
Residency, Internal Med,
Walter Reed, 1951-54
Residency, Pulmonary Disease, Fitzsimons General
Hospital, 1955-57

Teaching

Appointments: Colorado Univ. School of Medicine, Denver, Colo.
Colorado General Hospital, Pulmonary Disease Clinic,
Denver, Colo.

Specialty
Board

Certification: American Board of Internal Medicine, 1953

Experience: Lab Tech, Ft. Devens, Mass., 1941-42
Air Corps, OCS, Miami, Fla., 1942
Meteorology School, Univ. Utah, 1942-43
29th Bomb Gp., Boise, Ida., 1943-44
Prisoner of War Camp, Mo., 1944-45
Walter Reed General Hospital, 1950-55
Fitzsimons General Hospital, 1955-61
Ch, Computer Div, USAMRIID, Fitzsimons General Hospital,
Denver, Colo., 1961-65
Chief, Professional Svcs & Deputy Surgeon, 8th US Army,
Korea, 1964-65
Commanding Officer, USAMRIID, Fitzsimons General Hospital,
August 1966 to present

SYNER, JAMES C., Lt Col, MC

Publications: Approximately 17

Member of: Associate of the American College of Physicians

8. TYPE OF TRAINING		WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle one)	128MAG CDS (Circle one)
a. Principles and practices of radiation protection		Walter Reed Army Institute of Research	1 yr	(Yes) No	(Yes) No
b. Radioactivity measurement standardization and monitoring techniques and instruments		Walter Reed Army Institute of Research	1 yr	(Yes) No	(Yes) No
c. Mathematics and calculations basic to the use and measurement of radioactivity		Ill. Instit. of Technology	3 yrs	Yes (No)	(Yes) No
d. Biological effects of radiation		Walter Reed Army Institute of Research & Walter Reed Gen Hosp	5 yrs	(Yes) No	(Yes) No

9. EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)				
ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
¹²⁵ Co		WRAIR	9 mon	Lab. res.
⁵⁹ Fe		WRAIR	1 month	Lab. res.
⁵¹ Cr		Walter Reed Genl Hosp.	3 years	Blood vol. deter. in patients
(See attached)				

10. RADIATION DETECTION INSTRUMENTS (Use supplemental sheets if necessary)					
TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBERS AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mR/hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, etc.)
Scintillation counter	3	¹⁴ C			Measuring
Gas-flow B-counter	3	¹⁴ C			Measuring
Gamma counter	2	⁵⁹ Fe			Measuring
Pi-Paper scanner	2	¹⁴ C			Measuring
Thin-layer chromatogram scanner	1	¹⁴ C			Measuring

11. AID CD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE:

Done by personnel at U.S. Army Institute of Research and Univ. of Pennsylvania.

12. FILM BADGES, DOSEMETERS, AND ASSAY PROCEDURES USED (For film badges, specify method of calibrating and processing, or name of supplier)

Film badges provided by radiation safety office at WRAIR and the Univ. of Penn.

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility if attached. (Circle answer) Yes No

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, receipt, training, and experience of person to perform leak test, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, 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.

Date 22 July 1965

By: [Signature]
Applicant named in item 1

Title of certifying official: _____

WARNING.—18 U. S. C., Section 1001, Act of July 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 or to any officer within its jurisdiction.

U. S. GOVERNMENT PRINTING OFFICE: 1961 OF-613865

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
SUPPLEMENT A—HUMAN USE

Form approved
Budget Bureau No. 38-8080

This page may be completed by the physician's preceptor (if any) in the medical use of radioisotopes. When the information is not furnished by the preceptor, the name and present address of the preceptor (if any) should be shown in item 12 below.

9. (a) USING PHYSICIAN'S NAME Robert H. Herman Major, MC USAMRIID, FCHI, Denver, Colo.	(b) NAME AND ADDRESS OF APPLICANT (if different from 9(a))
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10. CLINICAL TRAINING AND EXPERIENCE OF PHYSICIAN WHO WILL USE BYPRODUCT MATERIAL

(A) ISOTOPE	(B) CONDITION(S) DIAGNOSED OR TREATED	(C) NUMBER OF CASES	(D) TYPE OF PARTICIPATION FOR ALL CASES IN COLUMN B (circle applicable num- bers of items in accordance with key in left margin)
I-131	Diagnosis of thyroid function	Approx 50	(1) 2 (3) (4)
	Treatment of hyperthyroidism	Approx 50	(1) 2 (3) (4)
	Treatment of thyroid cancer		1 2 3 4
	Treatment of cardiac conditions		1 2 3 4
	Brain tumor localization		1 2 3 4
	Blood determinations		1 2 3 4
	Kidney function		1 2 3 4
	Others:		1 2 3 4
P-32 Soluble	Treatment of polycythemia and leukemias	Approx 4	(1) 2 (3) (4)
	Brain tumor localization		1 2 3 4
	Treatment of bone metastases		1 2 3 4
	Others: Treatment of thrombocytopenia	Approx 1	(1) 2 (3) (4)
P-32 CrO ₄	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites		1 2 3 4
	Others:		1 2 3 4
Au-198 Colloid	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites	Approx 1	(1) 2 (3) (4)
	Others:		1 2 3 4
Cr-51	Blood determinations	Approx 20	(1) 2 (3) (4)
	Others:		1 2 3 4
Other Isotopes			1 2 3 4
			1 2 3 4
			1 2 3 4

Key to above numbers (column D)

Active Participation and Discussion in the:

1. Examination of patients to determine suitability for radioisotope diagnosis and/or treatment and recommendations on dosage to be prescribed.
2. Collaboration in calibration and administration of dosages including related measurements and plotting of data.
3. Active period of training and experience of sufficient duration to permit followup of patients through treatment and posttreatment period including reevaluation as to effectiveness and complications.
4. Study and discussion of case histories to establish most efficacious diagnostic and/or therapeutic techniques for this radioisotope use.

11. TOTAL NUMBER OF HOURS OF PARTICIPATION IN CLINICAL TRAINING: At least 100 hrs over a 3 year resi-
dency in internal medicine and 1 1/2 yrs doing cl. invest. in metabolic & endocrine
12. THE TRAINING AND EXPERIENCE INDICATED ABOVE WAS OBTAINED UNDER THE SUPERVISION OR GUIDANCE OF Appropriate staff
members at Walter Reed General Hospital.

27 July 1966

HERMAN, ROBERT H., Lt. Colonel, MC
Chief, Metabolic Division, USAMRNL

Date and Place
of Birth:

Wife:

Children:

Education:

BS, Illinois Institute
of Technology, 1950
BS, Univ. of Illinois
Medical School, 1951
MD, Univ. of Illinois
Medical School, 1953

Experience:

Internship, Walter Reed
General Hospital,
1953-1954
Resident, Internal Medicine,
Walter Reed General Hospital, 1955-1958
Medical Field Service School, 1954-1955
Chief of Medicine and CO, 43rd Surgical Hospital,
Korea, 1958-1959
Military & Allied Sciences Course, 1959-1960
Hoff Gold Medal, 1960
Dept. of Metabolism, Walter Reed Army Institute
of Research, 1960-1962
Graduate Student, Dept. Biochemistry, University
of Pennsylvania Medical School, 1962-1965
Chief, Metabolic Division, USAMRNL, July 1965
to present

Publications: Approximately 25 scientific publications

Hobbies: Photography

Membership in: AAAS, Soc. Ill. Bacteriologists, Am. Fed. Clin. Res.,
Am. College of Physicians, AMA, Am. Inst. Nutrition,
Am. Soc. Clin. Nutrition, Diplomate Am. Board of
Internal Medicine, Fellow Am. College of Physicians,
Liaison Representative, Metabolic Study Group, NIH.

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	S.U.N.Y. Brooklyn, N.Y.	1 yr	Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments	"	"	Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity	"	"	Yes No	Yes No
d. Biological effects of radiation	"	"	Yes No	Yes No

9. EXPERIENCE WITH RADIATION (Actual use of radiisotopes or equivalent experience)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
C ¹⁴	1 Mc	The New York Hospital N.Y.C.	2 yrs	Metabolic Experiments in animals
Cl ³⁶	5 Mc	S.U.N.Y. Brooklyn, N.Y.	1 yr	"
Na ²⁴	5 Mc	"	"	"

10. RADIATION DETECTION INSTRUMENTS (Use supplemental sheets if necessary)

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mv, hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, measuring)

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE

12. FILM BADGES, DOSIMETERS, AND BIO ASSAY PROCEDURES USED (For film badges, specify method of calibrating and processing, or name of supplier)

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

13. FACILITIES AND EQUIPMENT Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hood, etc. Explanatory sketch of facility is attached (Circle answer) Yes No
14. RADIATION PROTECTION PROGRAM Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedure: name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.
15. WASTE DISPOSAL If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, 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

David Zakim, Capt. MC

Applicant named in item 1

Date _____

By: _____

Title of certifying official

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.

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
SUPPLEMENT A—HUMAN USE

This page may be completed by the physician's preceptor (if any) in the medical use of radioisotopes. When the information is not furnished by the preceptor, the name and present address of the preceptor (if any) should be shown in item 12 below.

P. (a) USING PHYSICIAN'S NAME
David Zakim, Capt MC
USAMRNL
Denver, Colo.

(b) NAME AND ADDRESS OF APPLICANT (if different from P(a))

10. CLINICAL TRAINING AND EXPERIENCE OF PHYSICIAN WHO WILL USE BYPRODUCT MATERIAL

(A) ISOTOPE	(B) CONDITION(S) DIAGNOSED OR TREATED	(C) NUMBER OF CASES	(D) TYPE OF PARTICIPATION FOR ALL CASES IN COLUMN B (circle applicable num- bers of items in accordance with key forth below)
I-131	Diagnosis of thyroid function	50	(1) 2 (3) (4)
	Treatment of hyperthyroidism	50	(1) 2 (3) (4)
	Treatment of thyroid cancer		1 2 3 4
	Treatment of cardiac conditions		1 2 3 4
	Brain tumor localization		1 2 3 4
	Blood determinations	50	(1) 2 (3) (4)
	Kidney function		1 2 3 4
	Others:		1 2 3 4
P-32 Soluble	Treatment of polycythemia and leukemia	10	1 2 3 4
	Brain tumor localization		1 2 3 4
	Treatment of bone metastases		1 2 3 4
	Others:		1 2 3 4
P-32 CrPO ₄	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites	5	(1) 2 (3) (4)
	Others:		1 2 3 4
Au-198 Colloid	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites	5	(1) 2 (3) (4)
	Others:		1 2 3 4
Cr-51	Blood determinations		1 2 3 4
	Others:		1 2 3 4
			1 2 3 4
Other Isotopes	Co ⁶⁰ Schilling test	100	(1) (2) (3) (4)
			1 2 3 4
			1 2 3 4

Key to above numbers (column D)

Active Participation and Discussion in the

1. Examination of patients to determine suitability for radioisotope diagnosis and/or treatment and recommendations on dosage to be prescribed.
2. Collaboration in calibration and administration of dosages including related measurements and plotting of data.
3. Active period of training and experience of sufficient duration to permit followup of patients through treatment and posttreatment period including reevaluation as to effectiveness and complications.
4. Study and discussion of case histories to establish most efficacious diagnostic and/or therapeutic techniques for this radioisotope use.

11. TOTAL NUMBER OF HOURS OF PARTICIPATION IN CLINICAL TRAINING 200 hours

12. THE TRAINING AND EXPERIENCE INDICATED ABOVE WAS OBTAINED UNDER THE SUPERVISION OR GUIDANCE OF

Dept of Medicine, Cornell Univ, New York Hospital Medical Center
during 4 years of internship and residency training

(Name of physician (preceptor))

(Institution)

(Signature)

29 August 1966

ZAKIM, DAVID S., Captain, MC, Asst. Chief, Metabolic Division, U. S. Army
Medical Research and Nutrition Laboratory

Date and Place
of Birth: [REDACTED]

Wife: [REDACTED]

Children: [REDACTED]

Education: BA, Cornell University,
1956
MD, State Univ. of NY,
Brooklyn, NY, 1961

Experience: Intern and Assistant
Resident, Medicine,
Cornell Medical Center
Research Fellow, Dept. Medicine, Cornell Medical Center

Publications: 7

Hobbies: Photography, golf

Member of: Alpha Omega Alpha

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)

B. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	Nuclear Medicine Dept Univ. Hospital, Ann Arbor, Mich.	1 mo.	<input checked="" type="radio"/> Yes No	<input checked="" type="radio"/> Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments	"	1 mo.	<input checked="" type="radio"/> Yes No	<input checked="" type="radio"/> Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity	"	1 mo.	<input checked="" type="radio"/> Yes No	<input checked="" type="radio"/> Yes No
d. Biological effects of radiation	"	1 mo.	<input checked="" type="radio"/> Yes No	<input checked="" type="radio"/> Yes No

9. EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)				
ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
I^{131}	10 Mc	Univ. of Mich. Med. Center	1 Month	Diagnostic and Therapeutic
e^{133}	1 Curie	Univ. of Mich. Med. Center	1 Year	Research

10. RADIATION DETECTION INSTRUMENTS (Use supplemental sheets if necessary)					
TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr. hr.)	WINDOW THICKNESS (mg. cm.)	USE (Monitoring, surveying, measuring)

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE

12. FILM BADGES, DOSIMETERS, AND BIO ASSAY PROCEDURES USED (For film badges, specify method of calibrating and processing, or name of supplier)

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No
14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.
15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, 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.

Richard P. Carson, Capt., M.C.

Applicant named in item 1

Date: _____

By: _____

Title of certifying official

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.

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
SUPPLEMENT A—HUMAN USE

This page may be completed by the physician's preceptor (if any) in the medical use of radioisotopes. When the information is not furnished by the preceptor, the name and present address of the preceptor (if any) should be shown in item 12 below.

9. (a) USING PHYSICIAN'S NAME
Richard P. Carson, Capt MC
USAMRNL
Denver, Colo.

(b) NAME AND ADDRESS OF APPLICANT (If different from 9(a))

10. CLINICAL TRAINING AND EXPERIENCE OF PHYSICIAN WHO WILL USE BYPRODUCT MATERIAL

(A) ISOTOPE	(B) CONDITION(S) DIAGNOSED OR TREATED	(C) NUMBER OF CASES	(D) TYPE OF PARTICIPATION FOR ALL CASES IN COLUMN B (circle applicable numbers of items in accordance with key 1 forth below)
I-131	Diagnosis of thyroid function	24	① ② 3 ④
	Treatment of hyperthyroidism	6	① ② ③ ④
	Treatment of thyroid cancer	3	① ② ③ ④
	Treatment of cardiac conditions	1	1 2 3 ④
	Brain tumor localization		1 2 3 4
	Blood determinations	3	① ② 3 ④
	Kidney function		1 2 3 4
	Others:		1 2 3 4
P-32 Soluble	Treatment of polycythemia and leukemia	3	① ② ③ ④
	Brain tumor localization		1 2 3 4
	Treatment of bone metastases		1 2 3 4
	Others:		1 2 3 4
P-32 CrPO ₄	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites		1 2 3 4
	Others:		1 2 3 4
Au-198 Colloid	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites		1 2 3 4
	Others:		1 2 3 4
Cr-51	Blood determinations	3	① ② 3 ④
	Others:		1 2 3 4
	Others:		1 2 3 4
Other Isotopes	Hg ¹⁹⁷ Brain and Renal scanning	15	① ② 3 ④
	Na ²⁴ Dilution study	1	① ② 3 ④

Key to above numbers (column D)

Active Participation and Discussion in the:

1. Examination of patients to determine suitability for radioisotope diagnosis and/or treatment and recommendations on dosage to be prescribed.
2. Collaboration in calibration and administration of dosages including related measurements and plotting of data.
3. Active period of training and experience of sufficient duration to permit follow up of patients through treatment and posttreatment period including reevaluation as to effectiveness and complications.
4. Study and discussion of case histories to establish most efficacious diagnostic and/or therapeutic techniques for this radioisotope use.

11. TOTAL NUMBER OF HOURS OF PARTICIPATION IN CLINICAL TRAINING 160 hours

12. THE TRAINING AND EXPERIENCE INDICATED ABOVE WAS OBTAINED UNDER THE SUPERVISION OR GUIDANCE OF

Wm. H. Beirwaltes, MD, AT Univ. of Mich Med Center
(Name of physician (preceptor)) Ann Arbor, Mich

(Signature)

1 September 1966

CARSON, RICHARD P., Captain, MC, Physiology Division, U. S. Army Medical
Research and Nutrition Laboratory

Date and Place
of Birth:

Wife:

Children:

Education:

MD, University of Michigan,
Ann Arbor, Mich., 1962
MA, (Pharmacology), Univ. of
Michigan, 1966

Experience:

Medical Internship, Duke Univ.
Medical Center
Two-year residency, internal
medicine, Univ. of Michigan Medical Center
One-year Fellowship, Clinical (investigative)
Pharmacology, Univ. of Michigan Medical Center
Medical student Summer Research Fellowship

Publications: Two

Hobbies: Golf, bowling

Member of: Phi Delta Epsilon Medical Fraternity

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application. If application is for renewal of a license, complete only Items 1 through 7 and indicate new information or changes in the program as requested in Items 8 through 15. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail three copies to: U. S. Atomic Energy Commission, Washington 25, D. C. Attention: Isotopes Branch, Division of Licensing and Regulation. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30 and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20.

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc.) Alfonso H. Janoski, Capt MC USAMRNL	(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1 (a).)
2. DEPARTMENT TO USE BYPRODUCT MATERIAL	3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)
4. INDIVIDUAL USER(S). (Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.)	5. RADIATION PROTECTION OFFICER (Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.)

6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.) H ³ C ¹⁴ C ¹⁴	(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.) Steroids 2 Mc Steroids 300µc Acetic Anhydride 10 Mc
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7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. (If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)

Research in laboratory animals and in vitro experimentation

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 1 (Use supplemental sheets if necessary)

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	Columbia Univ College of Physicians & Surgeons	2 yrs	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
b. Radioactivity measurement standardization and monitoring techniques and instruments	Mt Sinai Hosp (Radiophysics Dept)	1 yr	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
c. Mathematics and calculations basic to the use and measurement of radioactivity	"		<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
d. Biological effects of radiation	"		Yes <input checked="" type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No

9. EXPERIENCE WITH RADIATION. (Actual use of radioisotopes or equivalent experience.)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
H ³	5 Mc	Columbia Univ College of Physicians & Surgeons	2 yrs	Purification, Human metabolism, Isolation & Synthesis
C ¹⁴	10 Mc	"	"	"

10. RADIATION DETECTION INSTRUMENTS. (Use supplemental sheets if necessary.)

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, measuring)

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE.

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. (For film badges, specify method of calibrating and processing, or name of supplier.)

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, 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.

Alfonso H. Janoski Capt MC

Applicant named in item 1

Date _____

By: _____

Title of certifying official

WARNING.—18 U. S. C., Section 1001, Act 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.

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
SUPPLEMENT A—HUMAN USE

This page may be completed by the physician's preceptor (if any) in the medical use of radioisotopes. When the information is not furnished by the preceptor, the name and present address of the preceptor (if any) should be shown in item 12 below.

9. (a) USING PHYSICIAN'S NAME

Alfonso H. Janoski Capt MC
USAMRNL
Denver, Colo. 80240

(b) NAME AND ADDRESS OF APPLICANT (If different from 9(a))

10. CLINICAL TRAINING AND EXPERIENCE OF PHYSICIAN WHO WILL USE BYPRODUCT MATERIAL

(A) ISOTOPE	(B) CONDITION(S) DIAGNOSED OR TREATED	(C) NUMBER OF CASES	(D) PERCENT OF PARTICIPATION FOR ALL CASES IN COLUMN B (circle applicable num- bers of items in accordance with key set forth below)
I-131	Diagnosis of thyroid function	50	① 2 ③ ④
	Treatment of hyperthyroidism	15	① 2 ③ ④
	Treatment of thyroid cancer	4	① 2 ③ ④
	Treatment of cardiac conditions		1 2 3 4
	Brain tumor localization	5	1 2 3 ④
	Blood determinations		1 2 3 4
	Kidney function		1 2 3 4
	Others:		1 2 3 4
P-32 Soluble	Treatment of polycythemia and leukemia	10	① 2 3 ④
	Brain tumor localization		1 2 3 4
	Treatment of bone metastases	2	1 2 3 ④
	Others:		1 2 3 4
P-32 CrPO ₄	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites		1 2 3 4
	Others:		1 2 3 4
Au-198 Colloid	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites	2	1 2 3 ④
	Others:		1 2 3 4
Cr-51	Blood determinations	25	① 2 ③ ④
	Others:		1 2 3 4
			1 2 3 4
Other Isotopes	Tritium labelled & Carbon-14 labelled	6	① ② 3 ④
	Steroids - Research		1 2 3 4
			1 2 3 4

Key to above numbers (column D)

Active Participation and Discussion in the:

1. Examination of patients to determine suitability for radioisotope diagnosis and/or treatment and recommendations on dosage to be prescribed.
2. Collaboration in calibration and administration of dosages including related measurements and plotting of data.
3. Active period of training and experience of sufficient duration to permit followup of patients through treatment and posttreatment period including reevaluation as to effectiveness and complications.
4. Study and discussion of case histories to establish most efficacious diagnostic and/or therapeutic techniques for this radioisotope use.

11. TOTAL NUMBER OF HOURS OF PARTICIPATION IN CLINICAL TRAINING 240 hours

12. THE TRAINING AND EXPERIENCE INDICATED ABOVE WAS OBTAINED UNDER THE SUPERVISION OR GUIDANCE OF

Dr. Sergei Feitelberg - Mt Sinai Hosp New York; Dr. Sidney Werner -
Columbia-Presbyterian Med Center N.Y.; Dr. Nicholas P. Christy -
Roosevelt Hospital, NY, AT _____
(Name of physician (preceptor)) (Institution) (Signature)

29 August 1966

JANOSKI, Alfonso H., Captain, Medical Corps, Physiology Division,
U. S. Army Medical Research & Nutrition Laboratory

Date and Place
of Birth: [REDACTED]

Wife: [REDACTED]

Children: [REDACTED]

Education: BA, Seton Hall University
South Orange, N.J., 1957
MD, Columbia University, NY,
1961

Experience: Internship, Bellevue Hos-
pital, Columbia (First)
Medical Division
1st & 2nd year Medical
Residencies, Bellevue
Hospital
Visiting Fellow in Medicine (endocrinology),
Columbia Presbyterian Medical Center, New York,
1964-66

Publications: Two

Hobbies: Photography, hunting, fishing

Member of: Harvey Society of New York
American Association for Advancement of Science
New York County Medical Society

APPLICATION FOR BYPRODUCT MATERIAL LICENSE

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application. If application is for renewal of a license, complete only Items 1 through 7 and indicate new information or changes in the program as requested in Items 8 through 15. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail three copies to: U.S. Atomic Energy Commission, Washington, D.C., 20545. Attention: Isotopes Branch, Division of Licensing and Regulation. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30 and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20.

1. (a) NAME AND STREET ADDRESS OF APPLICANT (Institution, firm, hospital, person, etc.) James W. Anderson, Captain, M.C. U S Army Medical Research and Nutrition Laboratory Fitzsimmons General Hospital Denver, Colorado 80240		(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED (If different from 1 (a).) Same
2. DEPARTMENT TO USE BYPRODUCT MATERIAL Metabolic Division		3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)
4. INDIVIDUAL USER(S). (Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.)		5. RADIATION PROTECTION OFFICER (Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.)
6. (a) BYPRODUCT MATERIAL (Elements and mass number of each) I ¹²⁵ I ¹³¹	(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.) 0.5 mc 0.5 mc	
7. DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. (If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.) 1) In vitro determinations of plasma insulin values and plasma values of other hormones. 2) Thyroid function studies in rats		

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	Mayo Graduate School Rochester, Minnesota	1 yr	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
b. Radioactivity measurement standardization and monitoring techniques and instruments	Mayo Graduate School Radioisotope Clinic, FGH	1 yr 1 yr	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
c. Mathematics and calculations basic to the use and measurement of radioactivity	Mayo Graduate School	1 yr	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No
d. Biological effects of radiation	Mayo Graduate School	1 yr	<input checked="" type="radio"/> Yes <input type="radio"/> No	<input checked="" type="radio"/> Yes <input type="radio"/> No

9. EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
I ¹³¹	0.5mc	Mayo Graduate School	1 yr	Animal investigation
I ¹²⁵	200 mc	Radioisotope Clinic, Fitzsimmons Gen Hosp	1 yr	Therapy of thyroid disorders

10. RADIATION DETECTION INSTRUMENTS (Use supplemental sheets if necessary)

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, measuring)

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED (For film badges, specify method of calibrating and processing, or name of supplier)

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No
14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source.
15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved.

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, 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.

James W. Anderson, Captain, M.C.

Applicant named in item 1

Date _____

By: _____ 90501

Title of certifying official

90501

UNITED STATES ATOMIC ENERGY COMMISSION
APPLICATION FOR BYPRODUCT MATERIAL LICENSE
SUPPLEMENT A—HUMAN USE

Form approved
Budget Bureau No. 38-R080-1

This page may be completed by the physician's preceptor (if any) in the medical use of radioisotopes. When the information is not furnished by the preceptor, the name and present address of the preceptor (if any) should be shown in item 12 below.

9. (a) USING PHYSICIAN'S NAME

(b) NAME AND ADDRESS OF APPLICANT (if different from 9(a))

James W Anderson, M.D.
(Captain, M.C.)

10. CLINICAL TRAINING AND EXPERIENCE OF PHYSICIAN WHO WILL USE BYPRODUCT MATERIAL

(A) ISOTOPE	(B) CONDITION(S) DIAGNOSED OR TREATED	(C) NUMBER OF CASES	(D) TYPE OF PARTICIPATION FOR ALL CASES IN COLUMN B (circle applicable num- bers of items in accordance with key set forth below)
I-131	Diagnosis of thyroid function	200	① ② ③ 4
	Treatment of hyperthyroidism	25	① ② ③ 4
	Treatment of thyroid cancer	10	① ② ③ 4
	Treatment of cardiac conditions		1 2 3 4
	Brain tumor localization		1 2 3 4
	Blood determinations		1 2 3 4
	Kidney function		1 2 3 4
	Others:		1 2 3 4
P-32 Soluble	Treatment of polycythemia and leukemia		1 2 3 4
	Brain tumor localization		1 2 3 4
	Treatment of bone metastases		1 2 3 4
	Others:		1 2 3 4
P-32 CrPO ₄	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites		1 2 3 4
	Others:		1 2 3 4
Au-198 Colloid	Treatment of prostatic cancer		1 2 3 4
	Treatment of cervical cancer		1 2 3 4
	Treatment of pleural effusions and/or ascites		1 2 3 4
	Others:		1 2 3 4
Cr-51	Blood determinations		1 2 3 4
	Others:		1 2 3 4
			1 2 3 4
Other Isotopes			1 2 3 4
			1 2 3 4
			1 2 3 4

Key to above numbers (column D)

Active Participation and Discussion in the:

1. Examination of patients to determine suitability for radioisotope diagnosis and/or treatment and recommendations on dosage to be prescribed.
2. Collaboration in calibration and administration of dosages including related measurements and plotting of data.
3. Active period of training and experience of sufficient duration to permit followup of patients through treatment and posttreatment period including reevaluation as to effectiveness and complications.
4. Study and discussion of case histories to establish most efficacious diagnostic and/or therapeutic techniques for this radioisotope use.

11. TOTAL NUMBER OF HOURS OF PARTICIPATION IN CLINICAL TRAINING 150 hours

12. THE TRAINING AND EXPERIENCE INDICATED ABOVE WAS OBTAINED UNDER THE SUPERVISION OR GUIDANCE OF

David Preston
Major, M.C.

(Name of physician (preceptor))

Radioisotope Clinic
AT Fitzsimmons General Hosp.

(Institution)

(Signature)

25 July 1966

ANDERSON, JAMES W., Capt., MC
Metabolic Division, U. S. Army Medical Research & Nutr. Lab.

Date and Place
of Birth:

Wife:

Children:

Education:

BA, West Virginia University,
1958
MD, Northwestern University
Medical School, 1961
Internship, Presbyterian
Hospital, Denver, Colorado
1962
Residency, Internal Medi-
cine, 3 years, Mayo
Graduate School, 1965

Experience:

Research, Dept. of Physiology, Mayo Graduate School,
1 year Thyroid Autoimmunity, 1963-1964
Chief of Metabolic-Renal Section, Fitzsimons
Army Hospital, 1965-1966
U.S. Army Medical Research & Nutrition Laboratory,
Metabolic Division, July 1966 to present

Publications:

Co-author of three scientific publications

Hobbies:

Golf and reading

Member:

Denver Medical Society, Colorado Medical Society,
AMA, American Diabetics Association

Licensed to
practice:

Minnesota

Curriculum Vitae

BERT MILLS TOLBERT

I. Born: [REDACTED]

Married: [REDACTED]

Business Address: Chemistry Department, University of Colorado, Boulder, Colorado.

Education:

- 1) Twin Falls High School, 1934-1938, Class Valedictorian.
- 2) Idaho State College, Pocatello, Idaho. 1938-1940.
Major: Chem. Engr.
- 3) University of California, Berkeley, California. 1940-1942.
Major: Chemistry. 1942, B.S. Cum Laude.
- 4) University of California, Berkeley, California. 1942-1945.
Major: Chemistry. 1945, Ph.D. Research Prof., G. E. K.
Branch. Research Area: Physical-Organic Chemistry.
- 5) Eidgenossche Technische Hochschule, Chemistry Department, Zurich, Switzerland. 1945-1946, Ph.D. Research Prof., G. E. K. Branch. Research Area: Physical-Organic Chemistry.

III. Employment History:

- 1) 1942 Summer. California Research Corporation, Standard Oil of California. Research Chemistry.
- 2) 1942-1944. Chemistry Department, University of California, Berkeley. Teaching assistant in chemistry.
- 3) 1944-1946. Radiation Laboratory, University of California, Berkeley. Research chemist in uranium chemistry.
- 4) 1946-1957. Radiation Laboratory, University of California, Berkeley. Research chemist; Associate Director Bio-Organic Chemistry group.
- 5) 1958 Summer. Radiation Laboratory, University of California, Berkeley.

- 6) 1957-present. Chemistry Department, University of Colorado, Boulder. Associate Professor, 1957-1960; 1961 - Professor.
- 7) 1962-1963. Visiting Professor for the International Atomic Energy Agency at University of Buenos Aires, Argentina.

IV. Societies and Honors:

Honor Societies: Sigma Xi, Phi Beta Kappa, Phi Lambda Upsilon

Professional Societies: American Chemical Society, American Association of Biochemical Chemists, Society for Experimental Biology and Medicine, Radiation Research Society, The American Academy of Sciences (Fellow), National Academy of Sciences (Fellow), American Association for the Advancement of Sciences (Fellow)

Special Fellow, U. S. Public Health Service, 1952-1953.

Visiting Professor, International Atomic Energy Agency, 1962-1963.

V. Fields of Research Interest and Specialization:

- 1) Biochemistry. Protein structure and conformation. Kinetics of intermediary metabolism and oxidation of labeled compounds to CO_2 . Biological function and metabolic fate of ascorbic acid. Tracers in intermediary metabolism.
- 2) Radiation chemistry. Radiation effects in enzyme structure and function. Radiation chemistry of amino acids and peptides. Radiation chemistry of carbohydrates.
- 3) Radiochemistry. Synthesis and use of labeled organic compounds. Ionization chamber assay of beta emitters. Liquid scintillation counting. Uranium chemistry.
- 4) Physical-organic chemistry. Spectra of dyes. Mechanism of reactions.

VI. Consultant for:

- 1) Cutter Laboratories, Emeryville, California, 1956-1957.
- 2) Lawrence Radiation Laboratory, Berkeley, California, 1957-1959.
- 3) Medical and Nutritional Research Laboratory, Fitzsimmons Army Hospital, (U.S. Surgeon General's Office), Denver, Colorado, 1957-present.

- 4) Cary Instruments, Varian Associates (Applied Physics Corporation)
Monrovia, California, 1956-present.
- 5) Marathon Oil Company, Denver Research Center, Littleton, Colorado,
1959-1962, 1965-present.

VII. Teaching:

General Biochemistry, Intermediate Biochemistry, Protein Structure,
Nuclear and Cellular Chemistry, Physical Chemistry, Introductory
Organic Chemistry

Item 8 and 9 Attachment # 4

Training and Experience of Individuals Named in Item 4

For Prof. Bert M. Tolbert
Chairman, Isotopes Committee

<u>Type of Training</u>	<u>Where Trained</u>	<u>Duration</u>	<u>On The Job</u>	<u>Formal Course</u>
a. Principles and Practices of Radiation Protection	Lawrence Radiation Lab., University of California Berkeley, California.	12 yrs.	Yes	Yes
b. Radioactivity Measurement Standardization and Monitoring Techniques and Instruments	Lawrence Radiation Lab., University of California Berkeley, California.	12 yrs.	Yes	Yes
c. Mathematics and Calculations Basic to the Use and Measurement of Radioactivity	Chemistry Department and Lawrence Radiation Lab., University of California Berkeley, California.	11 yrs.	Yes	Yes
d. Biological Effects of Radiation	Donner Lab. and Lawrence Radiation Lab., Uni. of Calif., Berkeley, Calif.	11 yrs.	Yes	Yes

In addition to this experience Prof. Tolbert has had 9½ years of teaching the four above mentioned subjects at the University of Colorado, Chemistry Department, Boulder, Colorado.

9. Experience with Radiation:

<u>Isotope</u>	<u>Maximum Amount</u>	<u>Where Experience Was Gained</u>	<u>Duration</u>	<u>Type of Use</u>
Cobalt-60	2000 curies	Radiation Lab., Uni. of California	9 yrs.	Irradiation Source
Carbon-14	1000 mc	Radiation Lab., Uni. of California	13 yrs.	Chemical, Medical and Biological Research
Tritium	200 curies	Radiation Lab., University of California	10 yrs.	Chemical, Medical and Biological Research
Cesium-137	1000 curies	University of Colorado	7 yrs.	Irradiation Source
Other alpha, beta and gamma emitters	Up To 1000 mc.	University of Colorado	7 yrs.	Chemical and Biological Research