

US DOE ARCHIVES  
326 U.S. ATOMIC ENERGY

720669

RG COMMISSION

Collection *Productive*

Box *26*

W. J. Satterfield, Jr., Chief, Insurance Section  
Division of Finance

AUG 22 1956

Folder *40*

H. N. Eakildson, Chief of Administration  
Division of Production

CLAIM SERVICE BY THE TRAVELERS INSURANCE COMPANY

SYMBOL: PL:LFM

Transmitted for your information is a copy of a memorandum, with enclosures, dated August 14, 1956, from J. E. Travis to E. J. Bloch, in regard to Hanford's follow-up action with Travelers Insurance Company, on the Riste - Swearingen v. General Electric Company claims.

Enclosure:  
As indicated above.

Distribution:  
1, 2 - Addressee  
3, 4 - PA & PL  
5, 6, 7 - PD Files

4006110 A

Signed and Dispatched

LIAISON ADMIN.

P:DIRECTOR

LFMurphy:jb

8/22/56

CONTROL COPY  
*8/22/56*

C O P Y

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES  
P. O. Box 117  
Oak Ridge, Tennessee

Medical Division

December 26, 1956

Dr. W. F. Libby  
United States Atomic Energy Commission  
Washington 25, D. C.

**BEST COPY AVAILABLE**

Dear Dr. Libby:

This is in answer to your letter of December 13 requesting an estimate of the factor by which the human body discriminates against strontium relative to calcium.

Attached is a survey of experimentally determined discrimination values. It is noted that the values for the three patients will be of the order of a discrimination against strontium of about two. This is in agreement with the value for rats on a milk diet. Recognizing that these are abnormal individuals although not particularly in relation to calcium metabolism, it would appear that a value of about two would be reasonable to use at this time. Other work should be forthcoming that will be more precise and perhaps gives some information in relation to children.

Dr. Blair, in Washington, handed me a letter to you from Bill Neuman expressing some doubts about the milk discrimination factors. Within the next day or so I shall write you a longer letter indicating some of our reasons for the factor of about seven as we now see it which apparently Neuman has overlooked. Also I am not entirely convinced of the correctness in applying a factor for correction of rib values to the whole skeleton. Such a factor would vary depending upon whether one is talking about single exposure or lifetime exposure. For single exposure it would be rather large as is shown in Kulp's data. For lifetime exposure I would expect the factor to be closer to one although this is a point upon which definite evidence can and should be obtained.

I am sorry that I was not aware of your letter until I returned from Washington and therefore could not answer you sooner.

Sincerely yours,

C. L. Comar  
Chief, Biomedical Research

CIC/jm  
Enclosure  
cc: Dr. C. L. Dunham  
Dr. M. H. Brucer  
Dr. J. L. Kulp

40061108

C O P Y

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES  
P. O. Box 117  
Oak Ridge, Tennessee

Medical Division

December 26, 1956

Dr. W. F. Libby  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Dr. Libby:

This is in answer to your letter of December 13 requesting an estimate of the factor by which the human body discriminates against strontium relative to calcium.

Attached is a survey of experimentally determined discrimination values. It is noted that the values for the three patients will be of the order of a discrimination against strontium of about two. This is in agreement with the value for rats on a milk diet. Recognizing that these are abnormal individuals although not particularly in relation to calcium metabolism, it would appear that a value of about two would be reasonable to use at this time. Other work should be forthcoming that will be more precise and perhaps gives some information in relation to children.

Dr. Blair, in Washington, handed me a letter to you from Bill Neuman expressing some doubts about the milk discrimination factors. Within the next day or so I shall write you a longer letter indicating some of our reasons for the factor of about seven as we now see it which apparently Neuman has overlooked. Also I am not entirely convinced of the correctness in applying a factor for correction of rib values to the whole skeleton. Such a factor would vary depending upon whether one is talking about single exposure or lifetime exposure. For single exposure it would be rather large as is shown in Kulp's data. For lifetime exposure I would expect the factor to be closer to one although this is a point upon which definite evidence can and should be obtained.

I am sorry that I was not aware of your letter until I returned from Washington and therefore could not answer you sooner.

Sincerely yours,

C. L. Comar  
Chief, Biomedical Research

CIC/jm  
Enclosure  
cc: Dr. C. L. Dunham  
Dr. M. H. Brucer  
Dr. J. L. Kulp

400110

**SURVEY OF STRONTIUM-CALCIUM DISCRIMINATION**  
(Steady state; normal diets and Sr levels)

C. L. Comar and R. H. Wasserman  
Medical Division, ORINS  
12-13-56

(This table contains some unpublished data and should  
not be quoted without permission of the authors.)

1. **Strontium-Calcium Observed Ratio (OR)** Reference 1

$$OR_{\text{sample-precursor}} = \frac{\text{Sr/Ca of sample}}{\text{Sr/Ca of precursor}}$$

2. **Strontium-Calcium Discrimination Factor (DF)** Reference 1

$$OR = (DF_1)(DF_2)(DF_3) \dots (DF_n)$$

3. **Rats - milk vs non-milk diets** Reference 1

	Milk	Non-Milk
$OR_{\text{bone-diet}}$	0.57	0.27
$OR_{\text{blood-diet}}$	0.46	0.21
$OR_{\text{urine-diet}}$	4.3	5.2
$OR_{\text{Blood-diet}}$		
$DF_{\text{urinary}}$	0.84	0.88
$DF_{\text{absorptive}}$	0.68	0.34

4. **Female, 72 years old, cervical carcinoma; Sr 85 and Ca 45 given in milk with each meal for 10 days.**

$OR_{\text{blood-diet}}$	0.60
$OR_{\text{retained-diet}}$	0.74
$OR_{\text{urine-diet}}$	2.8
$OR_{\text{blood-diet}}$	
$DF_{\text{urinary}}$	0.86
$DF_{\text{absorptive}}$	0.77
Sr 85 retained	43%
Ca 45 retained	57%

400111

5. Female, 37 years old, ovarian tumor; Sr 85 and Ca 45 given in milk with each meal for 15 days (data not complete).

OR<sub>blood-diet</sub> 0.50

6. Male, 25 years old, chronic granulocytic leukemia; Sr 85 and Ca 45 given in milk with each meal for 10 days.

OR<sub>blood-diet</sub> 0.52

7. Male, 9 years old, cerebellar medulloblastoma, Sr 85 and Ca 45 given in milk with each meal for 5 days.

OR<sub>blood-diet</sub> 0.52

8. Placental transfer, normal rats. Reference 2

OR<sub>body of dam-diet</sub> 0.28  
DF<sub>absorptive</sub> 0.42  
DF<sub>urinary</sub> 0.63  
DF<sub>placental-dam</sub> 1.22

OR<sub>fetus-diet</sub> 0.17  
DF<sub>absorptive</sub> 0.42  
DF<sub>urinary</sub> 0.63  
DF<sub>placental-fetus</sub> 0.65

9. Placental transfer, normal rabbits.

DF<sub>placental-fetus</sub> 0.49

10. Lactation

Dairy cows OR<sub>milk-diet</sub> 0.14 (different animals) Reference 3  
Goats\* OR<sub>milk-diet</sub> 0.16, 0.19  
OR<sub>blood-diet</sub> 0.21, 0.32

\* 2 animals on Sr 89 and Ca 45 for 12 days; data not completed or verified.

REFERENCES

1. Proc. Soc. Exper. Biol. and Med. 92, 859 (1956).
2. Amer. J. Physiol. (in press).
3. Progress in Nuclear Energy, Series VI, Biological Sciences, Volume I (1956); Pergamon Press.

4006112

Robert J. Wright, Chief, Washington Services  
Section, Division of Construction and Supply

April 9, 1957

C. L. Duzan, M. D., Director  
Division of Biology and Medicine

27384

REQUEST FOR INVITATIONAL TRAVEL ORDERS FOR DR. FRANKLIN G. McLEAN

CYSGOL: BMEP:MLB

Will you please issue invitational travel orders to Dr. Franklin G. McLean at the following address

Department of Physiology  
University of Chicago  
Chicago 37, Illinois

to cover travel from Chicago, Illinois to Washington, D. C. and return,  
for the purpose of attending an all-day meeting on April 23, 1957.

CC: Mr. Stanwood

US DOE ARCHIVES	
326 US ATOMIC ENERGY	
COMMISSION	
RG	
Collection	<i>Div. of Biology &amp; Medicine</i>
Box	<i>3202</i>
Folder	<i>Meeting - April 23, 1957 - Sr 90</i>

STATUS VERIFIED

BY Walter C. Krueser DATE 11/10/80

/nlb

BMEP  
Western

DIRECTOR  
Duzan

4/9/57

4/9/57

US DOE ARCHIVES

4006113

April 13, 1957

Dr. Franklin G. McLean  
Department of Physiology  
The University of Chicago  
951 East 58th Street  
Chicago 37, Illinois

Dear Dr. McLean:

In accord with the information contained in your letter of April 12, 1957, we are enclosing travel authorization and transportation requests covering your trip to Washington on the Baltimore and Ohio Railroad April 22 and return to Chicago by United Air Lines April 23.

Please return the third copy of each of the transportation requests to us in order that they may accompany the travel voucher when submitted for payment.

Sincerely yours,

Forrest Western  
Health Physicist  
Division of Biology and Medicine

Enclosures:

1. Travel authorization dtd 4/10/57
2. Transportation requests Nos.  
10,626,702 and 10,626,703

FWP  
Western/alk

4/18/57

US DOE ARCHIVES

4006114

THE UNIVERSITY OF CHICAGO  
CHICAGO 37 - ILLINOIS  
DEPARTMENT OF PHYSIOLOGY

Dr. Western

951 East 58th Street  
April 12, 1957

Dr. Charles L. Dunham, Director  
Division of Biology and Medicine  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Chuck,

Thank you for your letter of April 9, inviting me to attend a session on strontium 90 on Tuesday, April 23.

It will be a pleasure to be present on this occasion. As to travel arrangements, I plan to go by Baltimore and Ohio Railroad, Chicago to Washington, on April 22, and to return to Chicago by United Air Lines flight number 727 at 5:30 pm., April 23. I shall be glad to have the travel request made out accordingly.

Looking forward to seeing you,

Sincerely,



Franklin C. McLean, M. D.

FCMcL/kh

4006115

US DOE ARCHIVES

... ..  
... ..  
... ..

Normal diet, normal rabbits.

...	0.15
...	0.12
...	0.08
...	0.12
...	0.12
...	0.12
...	0.12
...	0.12

Normal diet, normal rabbits.

...	0.19
-----	------

...

Daily dose	0.14 (different animals)
...	0.16, 0.19
...	0.21, 0.32

2 animals on Sr 89 and Ca 45 for 12 days; data not completed or available.

REFERENCES

- Proc. Nat. Assoc. Biol. and Med. 48, 59 (1955).
- Acta. Physiol. (in press).
- Progress in Nuclear Energy, Series VI, Biological Sciences, Volume 1 (1955); Pergamon Press.

4006119

US DOE ARCHIVES

Robert J. Wright, Chief, Washington Services  
Section, Division of Construction and Supply

April 9, 1957

C. L. Dumas, M. D., Director  
Division of Biology and Medicine

27384

REQUEST FOR INVITATIONAL TRAVEL ORDERS FOR DR. FRANKLIN G. McLEAN

SIPOL: BMEP:MLE

Will you please issue invitational travel orders to Dr. Franklin G. McLean at the following address

Department of Physiology  
University of Chicago  
Chicago 37, Illinois

to cover travel from Chicago, Illinois to Washington, D. C. and return,  
for the purpose of attending an all-day meeting on April 23, 1957.

CC: Mr. Starwood

US DOE ARCHIVES	
326 US ATOMIC ENERGY	
RG	COMMISSION
Collection	<i>Div. of Biology &amp; Medicine</i>
Box	<i>3202</i>
Folder	<i>Meeting - April 23, 1957 - S-90</i>

STATUS VERIFIED  
BY *William R. [unclear]* DATE *11/10/80*

/mlh

BMEP  
Western

DIRECTOR  
Dumas

4/9/57

4/9/57

US DOE ARCHIVES

L110004

April 18, 1957

Dr. Franklin C. McLean  
Department of Physiology  
The University of Chicago  
951 East 58th Street  
Chicago 37, Illinois

Dear Dr. McLean:

In accord with the information contained in your letter of April 12, 1957, we are enclosing travel authorization and transportation requests covering your trip to Washington on the Baltimore and Ohio Railroad April 22 and return to Chicago by United Air Lines April 23.

Please return the third copy of each of the transportation requests to us in order that they may accompany the travel voucher when submitted for payment.

Sincerely yours,

Forrest Western  
Health Physicist  
Division of Biology and Medicine

Enclosures:

1. Travel authorization dtd 4/10/57
2. Transportation requests Nos.  
10,626,702 and 10,626,703

8110004

BMEP  
Western/mb

4/18/57

US DOE ARCHIVES

THE UNIVERSITY OF CHICAGO  
CHICAGO 37 - ILLINOIS  
DEPARTMENT OF PHYSIOLOGY

On Western

951 East 58th Street  
April 12, 1957

Dr. Charles L. Dunham, Director  
Division of Biology and Medicine  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Chuck,

Thank you for your letter of April 9, inviting me to attend a session on strontium 90 on Tuesday, April 23.

It will be a pleasure to be present on this occasion. As to travel arrangements, I plan to go by Baltimore and Ohio Railroad, Chicago to Washington, on April 22, and to return to Chicago by United Air Lines flight number 727 at 5:30 pm., April 23. I shall be glad to have the travel request made out accordingly.

Looking forward to seeing you,

Sincerely,



Franklin C. McLean, M. D.

FCMcL/kh

4000114

US DOE ARCHIVES

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES  
INCORPORATED  
P. O. BOX 117  
OAK RIDGE, TENNESSEE

MEDICAL DIVISION

April 13, 1957

Dr. Forrest Western  
Division of Biology and Medicine  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Dr. Western:

Thank you for your letter of April 9 in regard to the meeting scheduled for Tuesday, April 23. I appreciate being asked, of course, and will definitely be on hand.

Following our telephone conversation, I have discussed this matter with Bill Neuman and have come up with a suggested list of topics for presentation and discussion.

1. Definition of terms for expression of discrimination.
2. General methods and interpretations in determination of discrimination.
  - a. Single tracer lifetime feeding; stable Sr/Ca analysis; double tracer study
  - b. Analysis of single dose results
  - c. Minor discriminatory processes; blood to bone; biliary excretion; endogenous excretion
  - d. Major discriminatory processes; absorption, urinary excretion, placental transfer, lactation
  - e. Variables that may affect discrimination; mass of dietary calcium; nature of diet; age
3. Summary of discrimination results in experimental animals and man.
4. Interpretation of survey values in light of laboratory results on discrimination.
5. Specific discussion of Kulp's interpretations.
  - a. Discrimination factor in man
  - b. Weighting of results from analyses of specific bones
  - c. Problem of variation
6. Over-all estimates of discrimination.
7. Major areas in which more data are needed.

0710004

186012

US OCE ARCHIVES

10:58AM REECO HIGHLAND REPO 30 FEB 28 95

Dr. Forrest Western

-2-

April 13, 1957

Since there is much material to cover, my own thoughts were to present the pertinent experimental data as far as over-all results were concerned, and to discuss only as much theory as necessary to permit the needed generalizations. Neuman and I thought it would probably be better to have both of us carry on the discussion of each point as it comes up. We thought this might avoid some repetition and permit covering each particular aspect at one time. If you feel it better to have each of us make an individual presentation, I would appreciate the opportunity of speaking first since much of the data that we have obtained on these matters is directly applicable to the relevant questions, and this might avoid raising issues for which we have some fairly good answers already.

I will emphasize that the above thoughts are only suggestions and I would appreciate receiving any comments in regard to changing the approach or emphasis as you see fit.

Best regards.

Sincerely yours,



C. L. Comar  
Chief, Biomedical Research

CLC/jm

1710004

US DCE ARCHIVES

Dr. Calvin Fotts  
Special Assistant to Commissioner Libby

April 12, 1957

Forrest Western, Health Physicist  
Division of Biology and Medicine

DISCUSSIONS ON APRIL 23 RE DEPOSITION AND RETENTION OF INGESTED  
SERGIUM 90 IN THE SKELETON

SYMBOL: BMEP:FW

Enclosed is a list of persons to whom we have sent letters of invitation to attend the discussions on April 23. Of these we have not made personal contact with Dr. MacDonald. Contact with Dr. Lassle was made through Dr. J. L. Kulp.

Attached is a copy of a memorandum to members of the Division of Biology and Medicine, inviting interested persons to attend.

Enclosures:

1. List of persons invited to meeting
2. CC memo to members of DEM

7710004

BMEP  
Western/mlh

4/12/57

US BCE ARCHIVES

Office Memorandum • UNITED STATES GOVERNMENT

TO : *Forrest*

DATE: April 12, 1957

FROM : Forrest Western, Health Physicist  
Division of Biology and Medicine

*FW*

SUBJECT: DISCUSSIONS ON APRIL 23 RE DEPOSITION AND RETENTION OF INGESTED STRONTIUM 90 IN THE SKELETON

SYMBOL: BEBP:FW

At the request of Dr. Libby, the Division of Biology and Medicine is getting together a small group on April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. Interested members of the Division are invited to attend. The group will meet in Room 1062 at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. Cyril Comar, Dr. William Neuman, Dr. Franklin McLean, Dr. J. L. Kulp, Dr. Daniel Laszlo, Dr. Wright Langham, Dr. Hardin Jones, Dr. S. Allen Lough, Dr. Lyle T. Alexander, Dr. Robley Evans or alternate, and Lt. Ariel Schrodt.

Dr. Neuman and Dr. Comar and Dr. Laszlo have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion, extending into an afternoon session beginning at 2:00 o'clock.

Background for some of the discussion is given in the attached copies of correspondence between Dr. Libby, Dr. Neuman and Dr. Comar. Additional copies of this correspondence are available in my office.

Enclosures:  
As noted above

*Forrest →*

Addressees:

- Dr. C. W. Shilling
- Dr. G. Victor Beard
- Dr. H. D. Bruner
- Dr. Walter Claus
- Dr. Paul B. Pearson
- Dr. Robert F. Reitemeier
- Dr. John N. Wolfe

*Sory - out of town - CWB*

4000123

US DCE ARCHIVES

April 12, 1957

Dr. Iyle T. Alexander  
Principal Soil Scientist  
Plant Industry Station  
Beltsville, Maryland

Dear Dr. Alexander:

We are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We would like for you to attend if you are in position to do so. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Fotts, Dr. Cyril Comar, Dr. William Neuman, Dr. Franklin McLean, Dr. J. L. Kulp, Dr. Daniel Laszlo, Dr. Wright Langham, Dr. Hardin Jones, Dr. S. Allen Lough, and three or four others of whom we have not determined availability.

Dr. Neuman and Dr. Comar and Dr. Laszlo have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Neuman and Dr. Comar on the subject.

Sincerely yours,

Forrest Western  
Health Physicist  
Division of Biology and Medicine

Enclosures:  
As noted above

BMBP  
Western/mlb

4/12/57

US DCE ARCHIVES

4710004

April 12, 1957

Lt. Ariel Schrodt  
Walter Reed Army Institute of Research  
Washington, D. C.

Dear Lieutenant Schrodt:

We are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We would like for you to attend if you are in position to do so. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. Cyril Comar, Dr. William Neuman, Dr. Franklin McLean, Dr. J. L. Fulp, Dr. Daniel Lazzio, Dr. Wright Langham, Dr. Eardin Jones, Dr. S. Allen Lough, and three or four others of whom we have not determined availability.

Dr. Neuman and Dr. Comar and Dr. Lazzio have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Neuman and Dr. Comar on the subject.

Sincerely yours,

Forrest Westera  
Health Physicist  
Division of Biology and Medicine

Enclosures:  
As noted above

WCF  
Western/mlh

4/12/57

US DCE ARCHIVES

4000120

April 12, 1957

Dr. Thomas L. Shipman  
Health Division Leader  
University of California  
Los Alamos Scientific Laboratory  
P. O. Box 1663  
Los Alamos, New Mexico

Dear Dr. Shipman:

We are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We would like very much to have Dr. Wright Langham attend this meeting. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. Cyril Comar, Dr. William Newman, Dr. Franklin McLean, Dr. J. L. Kulp, Dr. Daniel Laszlo, Dr. Hardin Jones, Dr. S. Allen Lough, and three or four others of whom we have not determined availability.

Dr. Newman, Dr. Comar and Dr. Laszlo have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock.

The background of this meeting was discussed with Dr. Langham on the occasion of his recent visit here and at that time we gave him copies of correspondence between Dr. Libby, Dr. Comar and Dr. Newman on the subject.

Sincerely yours,

Charles L. Dunham, M. D.  
Director  
Division of Biology and Medicine

BMBP DIRECTOR  
Western/mlh

4/12/57

US DOE ARCHIVES

4006124

April 10, 1957

Dr. Daniel Laszlo  
Division of Neoplastic Diseases  
Montefiore Hospital  
100 E. Gum Hill Road  
New York 67, N. Y.

Dear Dr. Laszlo:

As you have been informed, we are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. Cyril Conar, Dr. William Keenan, Dr. Franklin McLean, Dr. J. L. Kulp, Dr. Hardin Jones, Dr. Wright Langham, and three or four others of whom we have not determined availability.

Dr. Keenan and Dr. Conar have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock. We hope you will be able to participate.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Keenan and Dr. Conar on the subject.

Sincerely yours,

Charles L. Dunham, M. D.  
Director  
Division of Biology and Medicine

Enclosures;  
As noted above

RLSP DIRECTOR  
Western/mlh Dunham

4/10/57

US DOE ARCHIVES

S. Allen Lough, Acting Director, Health and  
Safety Laboratory, New York Operations Office

April 10, 1957

Forrest Western, Health Physicist  
Division of Biology and Medicine, Washington

MEETING TUESDAY APRIL 23 RE DEPOSITION AND RETENTION OF INGESTED  
STRONTIUM 90 IN THE SKELETON

SYMBOL: BNEP:FW

As you have been informed, we are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. Cyril Conar, Dr. William Neuman, Dr. Franklin McLean, Dr. J. L. Kulp, Dr. Daniel Lassic, Dr. Hardin Jones, Dr. Wright Langham, and three or four others of whom we have not determined availability.

Dr. Neuman and Dr. Conar have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock. We hope you will be able to participate.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Neuman and Dr. Conar on the subject.

Enclosures:  
As noted above

BNEP  
Western/mlh

4/10/57

US DCE ARCHIVES

April 9, 1957

Dr. Franklin C. McLean  
Department of Physiology  
University of Chicago  
Chicago 37, Illinois

Dear Dr. McLean:

As you have been informed, we are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. Cyril Conar, Dr. William Feuman, Dr. J. L. Kulp, Dr. Daniel Lazzlo, Dr. Wright Langhan, Dr. Hardin Jones, Dr. S. Allen Lough, and three or four others of whom we have not determined availability.

Dr. Feuman and Dr. Conar have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock. We hope you will be able to participate.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Feuman and Dr. Conar on the subject.

An invitational travel order will be sent to you to cover this trip. If you will inform us of the airline or railroad on which you plan to travel, we will be glad to send you a Government travel request to relieve you of the necessity of advancing the cost of your ticket.

Sincerely yours,

Charles L. Dunham, M. D.  
Director  
Division of Biology and Medicine

Enclosures:  
as noted above

BNEP DIRECTOR  
Western/mlh Dunham

4/9/57

4006129

April 9, 1957

Mr. Robert J. Burtner  
Project Manager  
Atomic Energy Project  
University of California at Los Angeles  
P. O. Box 4164  
West Los Angeles 24, California

Dear Mr. Burtner:

We are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We would like to have Dr. Norman MacDonald attend if you are in a position to send him. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. P. Libby, Dr. Calvin Fotts, Dr. Cyril Comar, Dr. William Neuman, Dr. Franklin McLean, Dr. J. L. Kulp, Dr. Daniel Laszlo, Dr. Wright Langan, Dr. Hardin Jones, Dr. S. Allan Lough, and three or four others of whom we have not determined availability.

Dr. Neuman and Dr. Comar have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Neuman and Dr. Comar on the subject.

Sincerely yours,

Forrest Western  
Health Physicist  
Division of Biology and Medicine

BMBP  
Western/rjh

4/9/57

US DOE ARCHIVES

FEB 28 7 95 11:01AM REECO HIGHLAND REPO

151

April 9, 1957

Dr. Cyril L. Comar  
Medical Division  
Oak Ridge Institute of Nuclear Studies  
P. O. Box 117  
Oak Ridge, Tennessee

Dear Dr. Comar:

As you have been informed, we are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. William Newman, Dr. Franklin McLean, Dr. J. L. Hulp, Dr. Daniel Lazzlo, Dr. Wright Langham, Dr. Kardin Jones, Dr. S. Allen Lough, three or four others of whom we have not determined availability.

Dr. Newman and Dr. Comar have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock. We hope you will be able to participate.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Newman and Dr. Comar on the subject.

Sincerely yours,

Forrest Western  
Health Physicist  
Division of Biology and Medicine

Enclosures:  
As noted above

BWGP  
Western/mlh

4/9/57

US DOE ARCHIVES

April 9, 1957

Dr. Robley D. Evans  
Physics Department  
Massachusetts Institute of Technology  
77 Massachusetts Avenue  
Cambridge 39, Massachusetts

Dear Robley:

We are getting together a small group on Tuesday, April 23, to discuss the deposition and retention of ingested strontium 90 in the skeleton. Do you think it might be appropriate for someone from your group, perhaps yourself, to participate? If Bob Dudley's plans to be in Washington the preceding week are not too firm, perhaps he could revise them to include this meeting on the same trip.

The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. Cyril Comar, Dr. William Neuman, Dr. Franklin McLean, Dr. J. L. Kulp, Dr. Daniel Lussale, Dr. Wright Langham, Dr. Ferdin Jones, Dr. S. Allen Lough, and three or four others of whom we have not determined availability.

Dr. Neuman and Dr. Comar have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Neuman and Dr. Comar on the subject.

Sincerely yours,

Charles L. Dunham, M. D.  
Director  
Division of Biology and Medicine

Enclosures:  
As noted above

BMEP DIRECTOR  
Western/mlh Dunham

4/9/57

US DOE ARCHIVES

April 9, 1957

Dr. Martin B. Jones  
Banner Laboratory  
University of California  
Berkeley 4, California

Dear Dr. Jones:

As you have been informed, we are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Fotts, Dr. Cyril Conner, Dr. William Neuman, Dr. Franklin McLean, Dr. J. L. Rupp, Dr. Daniel Luzzo, Dr. Knight Langham, Dr. S. Allen Lough, and three or four others of whom we have not determined availability.

Dr. Neuman and Dr. Conner have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock. We hope you will be able to participate.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Neuman and Dr. Conner on the subject.

Sincerely yours,

Furrest Western  
Health Physicist  
Division of Biology and Medicine

Enclosures;  
As noted above

BMEP  
Western/nlh

4/9/57

US DOE ARCHIVES

FEB 28 95 11:02AM RECO HIGHLAND REPO

April 9, 1957

Dr. J. Laurence Kulp  
Lamont Geological Observatory  
Torrey Cliff  
Palisades, New York

Dear Larry:

As you have been informed, we are getting together a small group on Tuesday April 23 to discuss the deposition and retention of ingested strontium 90 in the skeleton. We will meet in Room 1062, 1717 H Street, N. W., beginning at 10:00 a.m. The group is expected to include, in addition to personnel from this Division, Commissioner W. F. Libby, Dr. Calvin Potts, Dr. Cyril Conar, Dr. William Rowman, Dr. Franklin McLean, Dr. Daniel Lazzlo, Dr. Wright Langham, Dr. Hardin Jones, Dr. S. Allen Lough, and three or four others of whom we have not determined availability.

Dr. Rowman and Dr. Conar have been asked to make formal presentations of their views on the subject. These presentations will be followed by comments and informal discussion extending into an afternoon session beginning at 2:00 o'clock. We hope you will be able to participate.

As a background for some of the discussion, we enclose copies of correspondence between Dr. Libby, Dr. Rowman and Dr. Conar on the subject.

Sincerely yours,

Forrest Western  
Health Physicist  
Division of Biology and Medicine

Enclosures:  
As noted above

BMGP  
Western/mlh

4/9/57

4000134

NEED ARCHIVES

This is a fast message unless a dotted character is indicated by the proper symbol.

# WESTERN UNION TELEGRAM

W. P. MARSHALL, PRESIDENT

1957 MAR 20  
12 12

SYMBOLS	
DL	Day Letter
NL	Night Letter
LT	International Letter Telegram

The filing time shown in the date line on domestic telegrams is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination.

WTO18 PD=WUX ROCHESTER NY 29 1128AME=  
 DR C L DUNHAM, DIRECTOR OF BIOLOGY AND MEDICINE=  
 U S ATOMIC ENERGY COMMISS ION=

DEAR CHUCH I HAVE NO OBJECTIONS TO ANY OF MY  
 CORRESPONDENCE BEING CIRCULATED IT DOES NEED REVISION  
 HOWEVER AND I WILL TRY TO DRAW UP A NEW SUMMARY BEFORE  
 THE MEETING=

BILL NEUMAN=

CHUCH:

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

4000130

SEARCHED FOR SA

P. 20

FEB 28 11:02AM REECO HIGHLAND REPO

951

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES  
INCORPORATED  
P. O. BOX 117  
OAK RIDGE, TENNESSEE

MEDICAL DIVISION

February 25, 1957

27385

Dr. C. L. Dunham  
Director, Division of Biology and Medicine  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Chuck:

Dr. Potts recently called on me for a summary of Sr-Ca discrimination factors that Dr. Libby could use. There is attached for your information a copy of the material forwarded. This is essentially the same as presented before your meeting on internal emitters in December except that results on a 9 year old boy have been added.

Best regards.

Sincerely yours,

C. L. Conar  
Chief, Biomedical Research

CLC/jm  
Enclosure  
cc: Dr. M. Brucer  
Dr. H. Roth

US DOE ARCHIVES
326 US ATOMIC ENERGY
COMMISSION
RG _____
Collection <i>Div. of Biology &amp; Medicine</i>
Box <i>3202</i>
Folder <i>Meeting - April 23, 1957 - 298</i>

STATUS VERIFIED  
BY *William Stamer* DATE *11/10/80*

183965

US DOE ARCHIVES

4000156

157  
#59

February 23, 1957

Mr. J. E. Petts  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Mr. Petts:

Attached is a revised summary sheet on discrimination factors for  
your use. If there are any further questions please let us know.

Best regards,

Sincerely yours,

C. L. Conant  
Chief, Biological Division

CLC/3

Enclosure

4000137

US DOE ARCHIVES

151  
150

C. L. ...  
 Medical Director, ...  
 12-13-50

(This table contains data unpublished in the literature and is not to be quoted without permission of the author.)

1. Quantitative-Calcium Absorption Ratio (QAR) Reference 1

$$QAR = \frac{Ca^{45} \text{ in sample}}{Ca^{45} \text{ in precursor}}$$

2. Quantitative-Calcium Discrimination Factor (QDF) Reference 1

$$QDF = (DF_1)(DF_2)(DF_3) \dots (DF_n)$$

3. Fate - milk vs non-milk diets Reference 1

	Milk	Non-milk
Q <sub>absorbed</sub> -diet	0.57	0.27
Q <sub>retained</sub> -diet	0.46	0.21
<u>Q<sub>retained</sub>-diet</u>	1.3	1.2
DF <sub>retained</sub>	0.84	0.78
DF <sub>absorptive</sub>	0.98	0.71

4. Female, 72 years old, cervical carcinoma, Ca 35, and Ca 45 given in milk with each meal for 10 days.

Q <sub>absorbed</sub> -diet	0.60
Q <sub>retained</sub> -diet	0.74
<u>Q<sub>retained</sub>-diet</u>	2.5
DF <sub>retained</sub>	0.86
DF <sub>absorptive</sub>	0.77
Ca 35 retained	43%
Ca 45 retained	57%

400138

NSAID ARCHIVES

... ..  
 ... ..  
 ... ..  
 ... ..

0.50

Placental transfer, normal rats.

Parental-fetus	0.27
Placental-fetus	0.12
Placental-fetus	0.27
Placental-fetus	1.70
Placental-fetus	0.27

Placental transfer, normal rabbits.

Parental-fetus	0.69
----------------	------

Lactation

Dairy cows	CR Milk diet	0.14 (different animals)	Reference 1
	CR Milk diet	0.16, 0.19	
	CR Milk diet	0.21, 0.32	

2 animals on Sr 89 and Cs 137 for 12 days; data not completed on Sr 89.

REFERENCES

- Proc. Soc. Exper. Biol. and Med. 92, 559 (1956).
- Ann. N. Y. Acad. Sci. (in press).
- Progress in Nuclear Energy, Series VI, Biological Sciences, Volume 1 (1956), Pergamon Press.

RECEIVED  
 FEB 28 1956  
 RADIOLOGICAL  
 DIVISION

44006139

EWGP:MLH

January 3, 1957

27388

Dr. C. L. Comar, Chief  
Biomedical Research  
Oak Ridge Institute of Nuclear Studies  
P. O. Box 117  
Oak Ridge, Tennessee

Dear Dr. Comar:

Thank you for your letter of December 28, 1956, in which you enclosed reprints and other material on Sr-Ca discrimination. I am very glad to have it.

We appreciated your participating in our recent conference in Washington.

Yours very truly,

Forrest Western  
Health Physicist  
Division of Biology and Medicine

US DOE ARCHIVES	
326 US ATOMIC ENERGY	
RG	COMMISSION
Collection	<i>Div. of Biology &amp; Medicine</i>
Box	3202
Folder	<i>Meeting - 23 April 1957 - 590</i>

/mlh

EWGP  
Western

1/3/56

STATUS VERIFIED

BY *William H. ...* DATE *11/10/80*

US DOE ARCHIVES

4006140

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES  
INCORPORATED  
P. O. BOX 117  
OAK RIDGE, TENNESSEE

December 28, 1956

MEDICAL DIVISION

Dr. Forrest Western  
Division of Biology and Medicine  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Dr. Western:

Just a note to let you know how much I enjoyed the conference in Washington. This was certainly very helpful to me and brought out a good many points to which we shall try to get some answers; these are the smaller points, of course.

I am not sure whether you remember it or not but my first experiments on the strontium-calcium discrimination came about because of the discussions with you and Walter at the Rand Conference in Santa Monica. There is attached some of our recent work in case you have not already received this material.

Best regards.

Sincerely yours,

*Cecil Comar*

C. L. Comar  
Chief, Biomedical Research

CLC/jm

Enclosure

Reprints enclosed with this letter and retained by FW:

"Radioactive Calcium Studies in Pregnancy" by C.L. Comar - reprinted in Annals of The New York Academy of Sciences, V.64, Art. 3, Pages 281-298, Aug. 17, 1956.

"Strontium-Calcium Discrimination Factors in the Rat." (22636) by C.L. Comar, R.H. Wasserman, and H.N. Hold - reprinted in Proceedings of the Society for Experimental Biology and Medicine 1956, v.92, 359-363.

"The influence of amino acids and other organic compounds on the gastrointestinal absorption of calcium<sup>45</sup> and strontium<sup>89</sup> in the rat." J. Nutrition, v.59, No. 3, July, 1956.

181621

141004

18  
19  
20

C. L. Comar  
12/3/56

Some Recent References on Metabolism of Fission Products

1. "Radioisotopes in the Study of Mineral Metabolism", Progress in Nuclear Energy, Series VI Biological Sciences, Vol. 1, 153 (1956). Review of metabolism of calcium, strontium, and iodine from standpoint of physiology, nutrition, and health hazards of fission products.
2. "Comparative Utilization of Dietary Sr 90 and Calcium by Developing Rat Fetus and Growing Rat", Proc. Soc. Exp. Biol. and Med. 88, 232 (1955). Ratio of Sr to Ca utilization from diet was 0.28 for the rat and 0.20 for the fetus.
3. "Strontium-Calcium Discrimination Factors in the Rat", Proc. Soc. Exp. Biol. and Med. 92, 859 (1956). Definition of terms, description of double tracer experiments. Ratio of Sr to Ca utilization from non-milk diet was 0.27, from milk diet, 0.51; this was related to absorptive process. Absorptive and urinary discrimination were most important.
4. "The Influence of Amino Acids and Other Organic Compounds on the Gastrointestinal Absorption of Calcium 45 and Strontium 89 in the Rat", J. Nutrition 59, 371 (1956). Lactose, lysine and arginine almost doubled Ca and Sr absorption in the rat. Sr absorption was increased by these substances more than was Ca absorption.
5. "Absorption of Calcium and Strontium From Milk and Nonmilk Diets", accepted for J. Nutrition. Milk increased markedly the absorption and retention of Ca and/or Sr in man, rats, and cattle. No effect on rabbits or chicks.
6. "Species Differences in the Gastrointestinal Absorption of Ca 45", submitted to Arch. Biochem. Lysine, arginine and skim milk increased Ca absorption in rats but not in chicks. The effects of these substances and Vit. D were generally additive.
7. "Endogenous and Biliary Excretion of Calcium-45 and Strontium-89", Arch. Biochem., in press. In the dog, twice as much Sr was excreted in the bile as Ca, and 20% more Sr through the intestinal mucosa. The contribution to the over-all discrimination by these routes was small.
8. "The Comparative Metabolism of Sr 89 and Ca 45 by Bone Growth in Vitro", accepted for Proc. Soc. Exp. Biol. and Med. Using chick embryo bone in tissue culture, Sr entered bone 1.08 times faster than Ca but was released 1.2 times faster than Ca.
9. "Differential Removal of Sr 85 and Ca 45 From the Skeleton of Rats as Determined by Peritoneal Lavage", in preparation. By use of peritoneal lavage in nephrectomized rats it was shown that Sr was preferentially released from bone by a factor of 1.3 over Ca.

referred  
12/3/56

Comar  
12/3/56

7410004

187  
103  
11

Medical Division, ORINS  
 C. L. Conar and R. H. Wasserman  
 12/13/56

SURVEY OF STRONTIUM-CALCIUM DISCRIMINATION  
 (Steady state; normal diets and Sr levels)

1. Strontium-Calcium Observed Ratio (OR)

$$OR_{\text{sample-precursor}} = \frac{\text{Sr/Ca of sample}}{\text{Sr/Ca of precursor}}$$

2. Strontium-Calcium Discrimination Factor (DF)

$$OR = (DF_1)(DF_2)(DF_3)\dots(DF_n)$$

3. Rats - milk vs non-milk diets

	Milk	Non-Milk
$OR_{\text{bone-diet}}$	0.57	0.27
$OR_{\text{bone-diet}}$	0.46	0.21
$OR_{\text{urine-diet}}$	4.3	5.2
$OR_{\text{blood-diet}}$		
$DF_{\text{urinary}}$	0.84	0.88
$DF_{\text{absorptive}}$	0.68	0.34

4. Female, 72 years old, cervical carcinoma; Sr 85 and Ca 45 given in milk with each meal for 10 days.

$OR_{\text{blood-diet}}$	0.60
$OR_{\text{retained-diet}}$	0.74
$OR_{\text{urine-diet}}$	2.8
$OR_{\text{blood-diet}}$	
$DF_{\text{urinary}}$	0.86
$DF_{\text{absorptive}}$	0.77
Sr 85 retained	42.7%
Ca 45 retained	57.6

5. Female, 37 years old, ovarian tumor; Sr 85 and Ca 45 given in milk with each meal for 15 days (data not complete).

$OR_{\text{blood diet}}$	0.46
--------------------------	------

6. Placental transfer, normal rats.

$OR_{\text{body of dam-diet}}$	0.28
$DF_{\text{absorptive}}$	0.42
$DF_{\text{urinary}}$	0.63
$DF_{\text{placental-dam}}$	1.22
$OR_{\text{fetus-diet}}$	0.17
$DF_{\text{absorptive}}$	0.42
$DF_{\text{urinary}}$	0.63
$DF_{\text{placental-fetus}}$	0.65

7. Placental transfer, normal rabbits.

$DF_{\text{placental-fetus}}$	0.49
-------------------------------	------

8. Lactation

<u>Dairy cows</u>	$OR_{\text{milk-diet}}$	0.14 (different animals)
<u>Goats*</u>	$OR_{\text{milk-diet}}$	0.16, 0.19
	$OR_{\text{blood-diet}}$	0.21, 0.32

\* 2 animals on Sr 89 and Ca 45 for 12 days; data not completed or verified.

ca. male, 20 years old, Leukemia  
 US DOE ARCHIVES  
 OR 11/11/56 - 0.75

4100143

Medical Division, ORINS  
 C. L. Comar and R. H. Wasserman  
 12/13/56

SURVEY OF STRONTIUM-CALCIUM DISCRIMINATION  
 (Steady state; normal diets and Sr levels)

1. Strontium-Calcium Observed Ratio (OR)

$$OR_{\text{sample-precursor}} = \frac{\text{Sr/Ca of sample}}{\text{Sr/Ca of precursor}}$$

2. Strontium-Calcium Discrimination Factor (DF)

$$OR = (DF_1)(DF_2)(DF_3)\dots(DF_n)$$

3. Rats - milk vs non-milk diets

	Milk	Non-Milk
$OR_{\text{bone-diet}}$	0.57	0.27
$OR_{\text{precursor-diet}}$	0.46	0.21
$\frac{OR_{\text{urine-diet}}}{OR_{\text{blood-diet}}}$	4.3	5.2
$DF_{\text{urinary}}$	0.84	0.88
$DF_{\text{absorptive}}$	0.68	0.34

4. Female, 72 years old, cervical carcinoma; Sr 85 and Ca 45 given in milk with each meal for 10 days.

$OR_{\text{blood-diet}}$	0.60
$OR_{\text{retained-diet}}$	0.74
$\frac{OR_{\text{urine-diet}}}{OR_{\text{blood-diet}}}$	2.8
$DF_{\text{urinary}}$	0.86
$DF_{\text{absorptive}}$	0.77
Sr 85 retained	42.7%
Ca 45 retained	57.6

5. Female, 37 years old, ovarian tumor; Sr 85 and Ca 45 given in milk with each meal for 15 days (data not complete).

$OR_{\text{blood diet}}$	0.46
--------------------------	------

6. Placental transfer, normal rats.

$OR_{\text{body of dam-diet}}$	0.28
$DF_{\text{absorptive}}$	0.42
$DF_{\text{urinary}}$	0.63
$DF_{\text{placental-dam}}$	1.22
$OR_{\text{fetus-diet}}$	0.17
$DF_{\text{absorptive}}$	0.42
$DF_{\text{urinary}}$	0.63
$DF_{\text{placental-fetus}}$	0.65

7. Placental transfer, normal rabbits.

$DF_{\text{placental-fetus}}$	0.49
-------------------------------	------

8. Lactation

<u>Dairy cows</u> $OR_{\text{milk-diet}}$	0.14 (different animals)
<u>Goats*</u> $OR_{\text{milk-diet}}$	0.16, 0.19
$OR_{\text{blood-diet}}$	0.21, 0.32

\* 2 animals on Sr 89 and Ca 45 for 12 days; data not completed or verified.

441004

US DOE ARCHIVES

191  
7/25

27390 -

December 21, 1956

Dr. William F. Neuman  
Chief, Biochemistry Section  
Atomic Energy Project  
School of Medicine and Dentistry  
The University of Rochester  
P. O. Box 287, Station 3  
Rochester 20, New York

US DOE ARCHIVES	
326 US ATOMIC ENERGY	
COMMISSION	
RG	
Collection	<i>Div. of Biology &amp; Medicine</i>
Box	<i>3202</i>
Folder	<i>Meeting - 23 April 1959 - Sr 90</i>

Dear Dr. Neuman:

I appreciate your extremely helpful letter of December 18. May I have your permission to circulate all but the first and last paragraphs which are unrelated to the main technical content?

With reference to your final paragraph, I certainly agree that whatever our general political or sociological attitudes be, all of us must and should contribute to the scientific study. I was very interested in your comments about the significance of the data obtained on ribs and other operative materials. I agree with you that only the average can be derived from these data at the present. Plans are being made to do further work on their significance for the distribution curve. I am now in discussions with one of the Sunshine researchers on this point. He gets a very large spread from his rib data which is entirely out of line with the spread observed for natural Sr and for whole body Sr<sup>90</sup> burdens from stillborn babies.

I think your overall factor of 7-12 looks a little bit lower than the Sunshine data themselves indicate, although certainly not out of the range of possibility at the present time. Things are sharpening up rather rapidly though, and I hope before long we will know better from Sunshine data themselves. We certainly must repeat Comar's work on the plant-to-milk factor.

Sincerely yours,

W. F. Libby

cc: Dr. C. L. Dunham, AEC, Washington

CH10004

STATUS VERIFIED

BY *Wilbur A. Strauss* DATE *11/10/56*

181463

194  
~~205~~

December 13, 1956

Dr. Cyril L. Conner  
Chief, Biomedical Research  
Oak Ridge Institute of Nuclear Studies  
P. O. Box 117  
Oak Ridge, Tennessee

Dear Cyril:

I wonder whether you would be so kind as to give us your considered estimate of the average factor by which the human body discriminates against Sr relative to Ca in its assimilation processes. I am oscillating between factors of 2 and 10 at the present time and I wish we could settle more firmly on a value. Sunshine data themselves would perhaps indicate a factor of 3 if you take the body burden of two or three-year old children and compare it with milk in the same area. In this connection, my October 12 speech data for humans are high because they were operative material in general, and they should be corrected downward by the ratio of the pickup for the material used, such as ribs, as compared to the whole skeleton. Dr. Kulp has these factors in hand and when he applies them to the data we obtain 0.35 S.U. for children and 0.13 S.U. for adults at the end of 1955.

Sincerely yours,

W. F. Libby

cc: Dr. C. L. Dunham  
Dr. J. L. Kulp

9479004

US DOE ARCHIVES

195  
221

UNITED STATES  
ATOMIC ENERGY COMMISSION  
WASHINGTON 25, D. C.

December 13, 1956

Dr. William F. Neuman  
Chief, Biochemistry Section  
Atomic Energy Project  
School of Medicine and Dentistry  
The University of Rochester  
P. O. Box 237, Station 3  
Rochester 20, New York

Dear Dr. Neuman:

I wonder whether you would be so kind as to give me your considered estimate of the average factor by which the human body discriminates against Sr relative to Ca in its assimilation processes. I am oscillating between factors of 2 and 10 at the present time and I wish we could settle more firmly on a value. Sunshine data themselves would perhaps indicate a factor of 3 if you take the body burden of two or three-year old children and compare it with milk in the same area. In this connection, my October 12 speech data for humans are high because they were operative material in general, and they should be corrected downward by the ratio of the pickup for the material used, such as ribs, as compared to the whole skeleton. Dr. Kulp has these factors in hand and when he applies them to the data we obtain 0.35 S.U. for children and 0.13 S.U. for adults at the end of 1955.

Sincerely yours,

W. F. Libby

cc: Dr. C. L. Dunham  
Dr. J. L. Kulp

Lh1000h

May 15, 1957

27973

Dr. C. L. Conar  
Chief, Biomedical Research  
Oak Ridge Institute of Nuclear Studies  
P.O. Box 117  
Oak Ridge, Tennessee

Dear Cyril:

Thanks for the draft of the strontium report. To put all the material together so promptly must have been somewhat of a chore. Alexander (Geo. V.) and Ralph Kusbaum have given me the latest spectrographic data on stable Sr and Ca analyses of human ribs and diet. Our present value for the observed ratio of (Sr/Ca) bone + (Sr/Ca) diet is  $0.14 + 0.03$ . This applies to the whole population, using 0.72 as the fraction of dietary Ca which comes from milk products, and 0.28 as the fraction coming from vegetables, fruits and cereals. I would appreciate it if the enclosed sheets from Ralph and Alex could be included in Attachment A of your draft.

Best regards to you and Mrs. Conar.

Cordially,

N. S. MacDonald

NSM:vs  
Encl.  
cc: Dr. C. L. Dunham  
Dr. F. Western ✓

4  
10004

US DOE ARCHIVES	
326 US ATOMIC ENERGY	
COMMISSION	
RG	
Collection	DBM
Box	3201
Folder	Sunshine General 2

STATUS VERIFIED UNCL  
BY Joe Diaz DATE 9/3/80

187245

Department of Energy  
Historian's Office  
ARCHIVES

K23  
~~150~~  
970

File: Sunshine

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES

INCORPORATED

P. O. BOX 117

OAK RIDGE, TENNESSEE

June 5, 1957

31924

MEDICAL DIVISION

Dr. Willard F. Libby  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Dr. Libby:

I appreciate very much your sending me copies of correspondence and other material in connection with the strontium problem. This is very helpful in keeping me abreast of developments in other laboratories.

I was especially happy to receive the copy of Hardin Jones' letter to you in which he registers agreement with some of our discrimination data. I have no objection, as a matter of fact I rather welcome the healthy skepticism of colleagues like Hardin Jones and Bill Neuman. As you will note, when they really sit down and look over the data carefully they usually come up in good agreement with our results and interpretations.

Some very recent work on patients receiving double tracers of strontium and calcium on a nonmilk diet is still giving us a discrimination against strontium not much greater than 2. We are, however, exerting every effort to see if it is possible that a discrimination as high as 8 may occur; at the present time, however, we have no real indication of this.

Best regards.

Very truly yours,

C. L. Comar  
Chief, Biomedical Research

CIC/jm

cc: Dr. Charles Dunham

400619004

STATUS VERIFIED UNCL  
BY Jose Diaz DATE 8/27/80

Department of Energy  
Historian's Office  
ARCHIVES

US DOE ARCHIVES	
326 US ATOMIC ENERGY COMMISSION	
RG	
Collection <u>Former Commission - LIBBY File</u>	
Box	<u>2242</u>
Folder <u>SUNSHINE CORP. - COMAR et al</u>	

C O P Y

United States  
ATOMIC ENERGY COMMISSION  
Washington 25, D. C.

December 13, 1956

Dr. Cyril L. Comar  
Chief, Biomedical Research  
Oak Ridge Institute of Nuclear Studies  
P. O. Box 117  
Oak Ridge, Tennessee

Dear Cyril:

I wonder whether you would be so kind as to give me your considered estimate of the average factor by which the human body discriminates against Sr relative to Ca in its assimilation processes. I am oscillating between factors of 2 and 10 at the present time and I wish we could settle more firmly on a value. Sunshine data themselves would perhaps indicate a factor of 3 if you take the body burden of two or three-year old children and compare it with milk in the same area. In this connection, my October 12 speech data for humans are high because they were operative material in general, and they should be corrected downward by the ratio of the pickup for the material used, such as ribs, as compared to the whole skeleton. Dr. Kulp has these factors in hand and when he applies them to the data we obtain 0.35 S.U. for children and 0.13 S.U. for adults at the end of 1955.

Sincerely yours,

W. F. Libby

cc: Dr. C. L. Dunham  
Dr. J. L. Kulp

Identical letter to:

Dr. Austin M. Brues, Director  
Div. of Biological & Medical Research  
Argonne National Laboratory  
P. O. Box 299

Lemont, Illinois  
4008760

C O P Y

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES  
P. O. Box 117  
Oak Ridge, Tennessee

Medical Division

December 26, 1956

Dr. W. F. Libby  
United States Atomic Energy Commission  
Washington 25, D. C.

Dear Dr. Libby:

This is in answer to your letter of December 13 requesting an estimate of the factor by which the human body discriminates against strontium relative to calcium.

Attached is a survey of experimentally determined discrimination values. It is noted that the values for the three patients will be of the order of a discrimination against strontium of about two. This is in agreement with the value for rats on a milk diet. Recognizing that these are abnormal individuals although not particularly in relation to calcium metabolism, it would appear that a value of about two would be reasonable to use at this time. Other work should be forthcoming that will be more precise and perhaps gives some information in relation to children.

Dr. Blair, in Washington, handed me a letter to you from Bill Neuman expressing some doubts about the milk discrimination factors. Within the next day or so I shall write you a longer letter indicating some of our reasons for the factor of about seven as we now see it which apparently Neuman has overlooked. Also I am not entirely convinced of the correctness in applying a factor for correction of rib values to the whole skeleton. Such a factor would vary depending upon whether one is talking about single exposure or lifetime exposure. For single exposure it would be rather large as is shown in Kulp's data. For lifetime exposure I would expect the factor to be closer to one although this is a point upon which definite evidence can and should be obtained.

I am sorry that I was not aware of your letter until I returned from Washington and therefore could not answer you sooner.

Sincerely yours,

C. L. Comar  
Chief, Biomedical Research

CIC/jm  
Enclosure

cc: Dr. C. L. Dunham  
Dr. M. H. Brucer  
Dr. J. L. Kulp

1919004

SURVEY OF STRONTIUM-CALCIUM DISCRIMINATION  
(Steady state; normal diets and Sr levels)

C. L. Comar and R. H. Wasserman  
Medical Division, ORINS  
12-13-56

(This table contains some unpublished data and should  
not be quoted without permission of the authors.)

1. Strontium-Calcium Observed Ratio (OR) Reference 1

$$OR_{\text{sample-precursor}} = \frac{\text{Sr/Ca of sample}}{\text{Sr/Ca of precursor}}$$

2. Strontium-Calcium Discrimination Factor (DF) Reference 1

$$OR = (DF_1)(DF_2)(DF_3)\dots(DF_n)$$

3. Rats - milk vs non-milk diets Reference 1

	Milk	Non-Milk
$OR_{\text{bone-diet}}$	0.57	0.27
$OR_{\text{blood-diet}}$	0.46	0.21
$\frac{OR_{\text{urine-diet}}}{OR_{\text{Blood-diet}}}$	4.3	5.2
$DF_{\text{urinary}}$	0.84	0.88
$DF_{\text{absorptive}}$	0.68	0.34

4. Female, 72 years old, cervical carcinoma; Sr 85 and Ca 45 given in milk with each meal for 10 days.

$OR_{\text{blood-diet}}$	0.60
$OR_{\text{retained-diet}}$	0.74
$\frac{OR_{\text{urine-diet}}}{OR_{\text{blood-diet}}}$	2.8
$DF_{\text{urinary}}$	0.86
$DF_{\text{absorptive}}$	0.77
Sr 85 retained	43%
Ca 45 retained	57%

4006162

5. Female, 37 years old, ovarian tumor; Sr 85 and Ca 45 given in milk with each meal for 15 days (data not complete).

OR<sub>blood-diet</sub> 0.50

6. Male, 25 years old, chronic granulocytic leukemia; Sr 85 and Ca 45 given in milk with each meal for 10 days.

OR<sub>blood-diet</sub> 0.52

7. Male, 9 years old, cerebellar medulloblastoma, Sr 85 and Ca 45 given in milk with each meal for 5 days.

OR<sub>blood-diet</sub> 0.52

8. Placental transfer, normal rats. Reference 2

OR<sub>body of dam-diet</sub> 0.28  
DF<sub>absorptive</sub> 0.42  
DF<sub>urinary</sub> 0.63  
DF<sub>placental-dam</sub> 1.22

OR<sub>fetus-diet</sub> 0.17  
DF<sub>absorptive</sub> 0.42  
DF<sub>urinary</sub> 0.63  
DF<sub>placental-fetus</sub> 0.65

9. Placental transfer, normal rabbits.

DF<sub>placental-fetus</sub> 0.49

10. Lactation

Dairy cows OR<sub>milk-diet</sub> 0.14 (different animals) Reference 3  
Goats\* OR<sub>milk-diet</sub> 0.16, 0.19  
OR<sub>blood-diet</sub> 0.21, 0.32

\* 2 animals on Sr 89 and Ca 45 for 12 days; data not completed or verified.

#### REFERENCES

1. Proc. Soc. Exper. Biol. and Med. 92, 859 (1956).
2. Amer. J. Physiol. (in press).
3. Progress in Nuclear Energy, Series VI, Biological Sciences, Volume I (1956); Pergamon Press.

4000163

C O P Y

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES  
 P. O. Box 117  
 Oak Ridge, Tennessee

Medical Division

January 9, 1957

Dr. W. F. Libby  
 United States Atomic Energy Commission  
 Washington 25, D. C.

Dear Dr. Libby:

This is an additional answer to your letter of December 13 in regard to the Sr-Ca discrimination problem. I am especially interested in discussing Dr. Kulp's ideas about correcting rib values to whole skeletons and Dr. Neuman's letter to you of December 18 particularly in regard to the milk discrimination factor. Rather than detail the theoretical aspects (which would take at least 30 minutes in front of a blackboard) I should like to stress the experimental data.

1. The Milk Discrimination Factor

Previous results with rats have shown that one gets the same discrimination results by either lifetime feeding of Sr\*/stable Ca in constant ratio or short-time feeding of Sr\*/Ca\* in constant ratio. Since lifetime feeding with livestock is impractical one has to rely on the validity of double tracer experiments at present. Eventually these should be checked by stable Sr analyses on feed, bone, and milk.

Table 1 presents a double tracer study with goats in which steady state conditions were attained. It is noted that the discrimination against strontium was 0.18 or a factor of about 5.5. Experiments with dairy cows were done before the double tracer technique was used and are summarized in "Progress in Nuclear Energy - Biological Sciences," volume 1, page 183, Pergamon Press (1956). These studies were done partly as single dose and partly as daily dose (steady state) experiments with Sr\* and Ca\*. The average discrimination against strontium was 0.14 or a factor of about 7.

In a recent summary of survey results the following table appears (A.E.R.E. HP/R 2056, Harwell, Berks).

Relative Sr 90/Ca Ratios Normalized to Vegetation = 100

	Vegetation	Animal Bone	Milk
U. S. 1953	100	30	16
U. S. 1955	100	28	15
U. K. 1955	100	40	9

4919004

January 9, 1957

It is noted that the discrimination between vegetation and milk is in reasonable agreement with experimentally determined values. The high U. K. discrimination is rather unexpected.

In regard to Dr. Neuman's letter I am certainly in agreement that mechanisms are frightfully complex and am enclosing a recent reprint that represents a great deal of effort on this problem. However, these considerations have little if any bearing on the experimentally determined discrimination values. I hope that Dr. Neuman will visit us and go over all of the data. I would especially like to point out Table 1 of the attached reprint that demonstrates no differential mammary secretion of calcium isotopes 40 through 48 as determined by the mass spectrograph.

We are still somewhat uncertain about absorptive discrimination in ruminants; our first thoughts were that there was none, but some recent evidence indicates that the endogenous losses may complicate the picture.

## 2. The Relationship of Rib to Skeleton Values.

If Sr\* is ingested by individuals whose bones are already formed there will be a definite and well-known pattern of distribution with some areas of bone showing much higher levels than others. This is amply documented in the literature and is in agreement with Table 1 in Kulp's forthcoming Science paper.

If an individual's bones are formed from a diet with a constant Sr/Ca ratio I would theoretically expect a constant Sr/Ca ratio (related to the dietary ratio) in all bones of the individual. Experimental support for this is found in Figure 3 of (A.E.R.E. MRC/R 2030, Harwell, 1956 "Trace Elements in Human Tissue"). These workers found essentially the same Sr/gm of ash in different bones of single individuals. Of course, if the Sr 90 level of the dietary were increasing one might expect to find higher levels in more recently formed areas of bone.

My personal feeling would be to report the rib values as obtained. If tumor induction or other change is related to the local concentration, as well it might be, then such values even if higher than other bones might be more representative of potential damage.

## 3. Over-all Human Discrimination

As indicated in a previous letter, Sr\*/Ca\* given to 3 patients in milk with every meal for 10 to 15 days showed a discrimination against strontium by a factor of about 2. I do not understand the reasoning from single dose data in Kulp's Science paper by means of which a discrimination

4006165

of 9 is proposed. Based on above evidence and some of our rat data, I rather think that there would be little change of Sr\*/Ca\* ratio in bone with time under conditions of constant intake of Sr\*/Ca\*. But this must await face to face discussion.

#### 4. Summary of Discrimination Data

As a matter of interest there is a listing of physiological processes that may contribute to discrimination and for which there are experimental data (major processes probably contribute a factor of 1.5 or more).

<u>Physiological Process</u>	<u>Data on</u>
Absorption from gut (major)	rat, man (ruminant data is in question)
Urinary excretion (major)	rat, man, dog
Movement from blood to bone (minor)	chick embryo bone grown in tissue culture
Movement from bone to blood (minor)	chick embryo bone, rat
Biliary excretion (minor)	rat, dog
Endogenous excretion (minor)	dog
Fetal transfer (major)	rat, rabbit
Secretion in milk (major)	goat, cow

#### 5. Plant to Human Discrimination

Assuming that 80 per cent of the dietary calcium is of milk origin, I would conservatively estimate over-all discrimination as follows:

fract.	discr.	discr.	fract.	discr.
of Ca	from	from	of Ca	from
from	plant	milk to	from	plant
milk	to milk	human	non-milk	to human
		bone	source	bone

$$(0.8) \times (1/5.5 \text{ to } 1/7) \times (1/2) \quad / \quad (0.2) \quad \times \quad (1/2 \text{ to } 1/3.6) = 0.17 \text{ to } 0.11$$

or an over-all discrimination against strontium of 6 to 9. Total fetal discrimination would then range from 12 to 18.

Data that are badly needed to firm up the above estimates are:

- 1) Discrimination in children
- 2) Discrimination in human beings of non-milk calcium as normally consumed
- 3) Fetal discrimination in human beings

Dr. W. F. Libby

-4-

January 9, 1957

6. Data That Are very Badly Needed

1. Physiological response of large mammals to levels of Sr 90 (Cs 137) in the diet from time of development in utero until death.

I will be glad to expand on any of the above points if and when desired.

Best regards.

Sincerely yours,

C. L. Comar  
Chief, Biomedical Research

CIC/jm  
Enclosure

cc: Dr. M. Brucer  
Dr. C. S. Shoup  
Dr. J. E. Kulp  
Dr. W. Neuman  
Dr. C. L. Dunham

L919004

C O P Y

Table 1

Strontium-Calcium Discrimination in Lactating Goats  
(Sr 89 and Ca 45 fed twice daily from  
August 23 through September 4)

	<u>GOAT B</u>				<u>GOAT W</u>			
	% of daily dose per liter milk			<u>OR<sub>blood diet</sub></u>	% of daily dose per liter milk			<u>OR<sub>blood diet</sub></u>
	<u>Ca 45</u>	<u>Sr 89</u>	<u>OR<sub>milk diet</sub></u>		<u>Ca 45</u>	<u>Sr 89</u>	<u>OR<sub>milk diet</sub></u>	
Aug.								
24 am	.18	.033	.13		.075	.039	.52	
pm	.31	.046	.15		.16	.034	.21	
25 am	1.5	.28	.19		.70	.12	.17	
pm	2.8	.54	.19		.77	.22	.29	
26 am	5.9	.86	.15		2.4	.22	.092	
pm	--	1.1			2.9	.52	.18	
27 am	5.6	1.1	.20		3.2	.51	.16	
pm	5.9	1.2	.20		3.2	.59	.18	
28 am	5.3	1.2	.21		3.4	.57	.14	
pm	6.6	1.3	.20		3.7	.64	.17	
29 am	6.7	1.5	.22	.46	3.6	.71	.20	.22
pm	7.2	1.5	.21		3.8	.77	.20	
30 am	6.3	1.3	.21	.44	3.8	.62	.16	.26
pm	6.3	1.4	.22		3.5	.67	.19	
31 am	6.6	1.4	.21	.32	3.7	.68	.18	.20
pm	6.7	1.4	.21		3.8	.68	.18	
Sept.								
1 am	6.5	1.3	.20	.34	3.4	.61	.18	.23
pm	6.8	1.5	.22		3.8	.64	.17	
2 am	6.8	1.2	.18	.24	3.7	.54	.15	.21
pm	6.2	1.2	.19		3.8	.57	.15	
3 am	6.2	1.1	.18	.24	3.6	.48	.13	.18
pm	5.8	1.1	.19		3.5	.49	.14	
4 am	6.1	1.1	.18	.27	3.5	.49	.14	.19
pm	6.0	1.1	.18		3.7	.51	.14	
5 am	6.1	1.1	.18	.24	3.4	.49	.14	.21
			<u>Avg.</u>	<u>.19</u>		<u>Avg.</u>	<u>.17</u>	<u>.21</u>

\*  $OR_{milk diet} = \frac{Sr^*/Ca^* \text{ in milk}}{Sr^*/Ca^* \text{ in diet}}$

4006168

US DOE ARCHIVE  
326 U.S. ATOMIC ENERGY  
COMMISSION

*Quinn T. ...*

Collection F.C. LIBBY-Files... Re-REVIEW

Box 2234

Folder Reading File - W.F. LIBBY  
December 1, 1956 - June 1, 1957

January 15, 1957

107846

Dr. C. L. Condr  
Chief, Biomedical Research  
Oak Ridge Institute of Nuclear Studies  
P. O. Box 117  
Oak Ridge, Tennessee

Dear Cyril:

Thank you for your most informative letter of January 9 on the Sr-Ca discrimination problem. It is excellent in its clarity and detail. I hope the recipients of copies will write about any further points which occur to them, with copies to all concerned. Perhaps in this way we can press on to an agreed conclusion. This, needless to say, is a very important objective.

You calculate Plant/Man as 6 to 9 conservatively. If we take Munsel's latest Soil/Plant of 1.4, we get 8 to 13. These agree well with natural strontium data.

Sincerely yours,

W. F. Libby

- cc: Dr. M. Bruwer
- Dr. C. S. Shoup
- Dr. J. L. Kulp
- Dr. V. Neuman
- Dr. C. L. Dunham

**BEST AVAILABLE COPY**

BEST COPY AVAILABLE

4006169