

Naval Medical Research Institute
 Hyperbaric Medicine Program Center
 National Naval Medical Center
 Bethesda, Maryland 20014
 2 May 1980

Mr. Paul Meyer
 L-180
 Lawrence Livermore Laboratory
 P. O. Box 808
 Livermore, California 94550

Dear Paul:

I have enclosed a short description of the background and expected protocols for our experiments for your use. I trust they will fulfill the need you described on the phone this week. Also enclosed is a sample calculation of the results we expect to see. The count rates expected over the regions we want are quite low. I assumed a N-13 specific activity of 0.3 mCi/liter at the beginning of the 30 minute inhalation level and a camera geometric efficiency of 1%. An increase in either of these parameters would be very useful. Even with the low rates calculated, I believe the experiments are worth doing because the statistical methods we use can accept low numbers and because the data is so necessary. Is it possible to have the camera record the clock time of the arrival of each photon pair instead of accumulating counts over sec-min size intervals? Such a record would allow even more powerful statistical analysis to be performed on the data.

The next two weeks is the time for us to renew our research proposals here which include approval for human experimentation. The dose calculations you said would be available are necessary for this approval. I will call you next week about specific questions, and send you a copy of my local proposal when it is ready.

This letter and enclosures are products of our computer being subverted to word-processing use. We are short of secretarial help and they are consumed with the proposal renewals. I am looking forward eagerly to getting to Livermore for these experiments.

Sincerely,



Paul K. Weathersby, PhD
 LCDR, HSC, USN

REPOSITORY LLNL
 COLLECTION PAUL MEYER'S PAPERS
 HUMAN RESEARCH NAVY/DECOMP.
 BOX No. SICKNESS EXPER. STUDY FILES
 FOLDER N/A

1157451

Proposal for Joint Naval Medical / Lawrence Livermore Experiments

Background

Decompression sickness, an occupational hazard of U. S. Navy deep sea divers, is thought to result from an excessive accumulation of inert gas (normally nitrogen) in the diver's body. Empirical procedures have evolved for the diver to slowly return to normal pressure after breathing gases at many atmospheres ambient pressure. Some of these decompression procedures appear to be unsafe; others seem to be so slow (but safe) as to be inefficient. Optimum procedures cannot be estimated until specific data is obtained on the actual rates of N_2 uptake kinetics in man.

Approach

1) First experiments proposed:

To obtain nitrogen kinetic information, a group of 6-10 human volunteers (each studied twice), provided by Naval Medical will breathe a mixture of 20% O_2 , 80% $^{13}N_2$ for up to 30 minutes. During the uptake time and for as long as possible thereafter (ca. 1.5 hr), the location of the ^{13}N in the person will be monitored with the positron camera. Anatomic areas of special interest during this period -- shoulder, elbow, skull -- will remain within view of the camera. From the experimental record of activity vs. time vs. location, the data will be analyzed to produce estimates of total N_2 capacity, mean, and variance of N_2 residence times in the organs of interest.

2) Further experiments proposed:

To obtain information on which inert breathing gas(es) would produce the fastest allowable safe decompression, i. e. have the shortest mean residence times in the critical tissues, dual simultaneous isotope studies will be performed. Humans or dogs (decision to be made after Exp. 1 is concluded) will breathe a mixture of 20% O_2 and two radioactive gases (e.g. ^{13}N plus ^{133}Xe or ^{85}Kr) and be studied as in Exp. 1. Camera will operate in scintillation mode since only a single positron emitting isotope can be used while maintaining discrimination. Data will be analyzed as in the other experiment, except that the simultaneous kinetics of the two tagged gases will allow interpretation in terms of the gas physico-chemical properties (solubility, diffusion coefficient).

1157452

5/15/80

Personnel:

Principal investigators:

P. K. Weathersby and L. D. Homer, Department of Hyperbaric Medicine and Physiology, Naval Medical Research Institute, Bethesda, MA.

Responsible party at Livermore:

P. Meyer, E-Division

1157453