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PROGRAM AND ABSTRACTS

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tion of gas bubbles in the body is thought to be theoretically impossible. A reexamination of nucleation theory reveals the overwhelming importance of two parameters: gas supersaturation and tissue surface tension (γ). For the (high) surface tension of pure water, nucleation requires more than 1000 ATA supersaturation. Lower values of γ allow nucleation with much smaller supersaturations. Application of nucleation theory can provide reasonable fits to both rat and human pressure reduction data with values of γ within the range reported for biological fluids (1 to 5 dyne/cm). These conclusions follow from homogeneous nucleation theory (assumes the presence of only a single liquid phase). The presence of heterogeneous sites, e.g. crevices and lipid surfaces, makes nucleation even more likely. (Supported by NMRDC Work Unit No. MF58524014.9040)

45 DIRECT NITROGEN EXCHANGE MEASUREMENTS IN MULTIPLE HUMAN TISSUES.
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Decompression tables are based on presumed--not measured--rates of inert gas exchange in specific body tissues. Previous measurements of N_2 kinetics used the whole body averaged signals in expired gas or mixed venous blood. We have used the positron emitting isotope N-13 with imaging equipment to obtain 3-dimensional local tissue information on N_2 exchange. Seven human subjects breathed radioactive N_2 in a synthetic air mixture at 1 ATA for 30 min with the N-13 emissions recorded during the inhalation and a subsequent 90 min washout. Measurements were made over regions of head, neck, shouder, and knee. The measurements confirm the existence of different nitrogen exchange rates in different tissues. Data from the knee joint in particular indicate that N-13 activity continued to accumulate even considerably after inspiration of the radioactive gas was discontinued. (Supported by NMRDC Work Unit No. M0099.PN.001.1155)

46 METHODS FOR PRODUCING MICROBUBBLES FOR MICROEMBOLISM STUDIES.
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Clinical complications of air embolism are sometimes observed in cases of decompression sickness, either in aerospace or underwater applications. In this report techniques are presented for producing calibrated microbubbles for air embolism studies. These techniques enable further research concerning the microembolism process as seen in air embolism or related problems. The utilization of differential absorption techniques in conjunction with gas injection methods enables calibrated microbubbles to be produced within the diameter range of capillary dimensions. To produce the microbubbles nitrogen is blended with carbon dioxide, the 'diluent' gas, while THAM (tris hydroxymethyl aminomethane hydrochloride) was used as an absorbent removing the 'diluent' gas from the initial bubbles. Hence, bubbles are initially produced from a gas mixture and the 'diluent' gas reabsorbed to reduce the diameter further. A Coulter counter was used for immediate size measurement of the bubbles. The absorbent medium in which the bubbles were produced was evaluated on 9 control dogs to test the physiological inertness. Plasma surface tension and arterial pH was measured in 5 animals receiving increasing doses while, in the remaining 4, arterial blood pressure, heart rate, breathing frequency and pulmonary artery pressure were measured before, during and after the injections. The resulting changes were within acceptable physiological limits.

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