Title: Simulation of the dynamics of decompression sickness bubbles and the generation of new bubbles

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Abstract: This communication introduces a system of equations for simulating the dynamics of growth and decay of decompression bubbles. The equations are solved by a numerical method and account for gas diffusion, the action of surface tension, tissue N2 washout by blood, and the rate of ascent from depth. The simulations demonstrate how inward diffusion of N2 can generate a persistent gas bubble from a nucleation process or a nucleus (these are provisionally defined as entities that can give rise to a small bubble of a certain size); an explosive positive-feedback loop is set off as the enlarging radius decreases the pressure due to surface tension. Generation of persistent bubbles is most likely during ascent from depth when PN2 inside any gas phase is decreasing rapidly and PN2 outside is still high before appreciable tissue washout has occurred. The "susceptibility" for the generation of a persistent bubble at any time can be defined as the reciprocal of the difference, at that time, between partial pressure of the nitrogen in tissue and in a spherical bubble of the size that is characteristic of the nucleation process or nucleus; susceptibility is less when ascent is slow because PN2 in bubbles stays high while washout removes N2 from the tissue.

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