Title: Tissue gas exchange models and decompression computations: a review

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Abstract: Mathematical models for inert gas transport and decompression are summarized. Both semi-infinite and finite media are treated, and resulting analytic expressions are obtained and compared against each other. One-dimensional plane and cylindrical geometries are considered, and limiting forms are explicitly detailed. Models are placed into three categories for discussion--bounded, bulk, and perfusion-diffusion. The intent is to collect treatments and techniques into one source for reference. Staging criteria, where appropriate to a model, are also included in the development. Bounded, bulk, and perfusion-diffusion models are described in supersaturation, statistical, and thermodynamic frameworks. Some strengths and weaknesses of deterministic and statistical models are noted. Today, models can be nested in hi-tech decomputers utilizing precision depth sensors and elapsed timers. The ability to solve equations and check criteria in an essentially continuous time mode imparts new dimensionality, enhancing capability and optimizing performance. However, there are limits on all computational models, both in theory and application, and herein we review range, physical correctness, and history of the algorithm.

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