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Henning von Gierke's continuing contribution: Underwater whole-body vibration

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Henning von Gierke was a leader in the characterization of human response to sound and vibration and in the development of international standards in this area. One focus of his research was using a multidisciplinary approach to create biodynamic models for whole-body vibration with the aim of predicting and preventing injury in vehicles. The focus of this presentation is whole-body vibration underwater with the aim of predicting discomfort or possibly injury to divers from low-frequency sonar. The frequency range of interest is 40-80 Hz, which encompasses the resonance of human lung. For this purpose, a biodynamic model developed by von Gierke to simulate thoracic, abdominal, and spinal responses to different vibrational excitations in air [H. E. von Gierke, J. Acoust. Soc. Am. 50, 1397 (1971)] is adapted for underwater conditions. It is assumed that the diver is neutrally buoyant and will therefore experience whole-body acceleration equal to the particle acceleration produced by the sound field in the absence of the diver. Emphasis is placed on determining the appropriate source distribution on the body as well as adjusting von Gierke's model to accommodate the decrease in lung compressibility with diver depth and mass loading on the chest. [Work supported by ONR.]