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Experimental studies of the direct flexoelectric effect in bone materials JOHN FU, State University of New York at Buffalo — The piezoelectric effect in biological tissues has been attracting research interest due to the hypothesis that it may behave as a biological transducer, which can convert external stimuli into biologically-recognizable signals capable of controlling growth or resorptive processes. The piezoelectric effect in dried bone materials was first observed in 1957 [1]. A link between the effect and the adaptive response of bone cells was proposed in 1970 [2]. In this paper, we report our recent measurements on the direct flexoelectric effect in bone materials. Our specimens are both dried and wet bones. The origin of both piezoelectricity and flexoelectricity in bone may be ascribed to the crystalline alignment of the micelle of collagen molecules. The Curie group symmetries of the configuration of collagen fibres in the bone texture demonstrate the existence of both effects. However, our experimental results show that the piezoelectric responses in bone materials may be dominated by flexoelectricity at the micro and nano scales. Finally, we propose a link between the flexoelectric effect and bone spur (osteophyte). [1] E. Fukada and I. Yasuda, J. Phys. Soc. Jpn. 12, 1158 (1957). [2] A. Marino and R. Becker, Nature 228, 78 (1970).

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