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Mechanical properties of growing melanocytic nevi and the progression to melanoma ALESSANDRO TALONI, CNR-IENI, Via R. Cozzi 53, 20125 Milano, Italy, ALEXANDER ALEMI, LASSP, Department of Physics, Clark Hall, Cornell University, EMILIO CIUSANI, Istituto Neurologico Carlo Besta, Milano, Italy, JAMES P. SETHNA, LASSP, Department of Physics, Clark Hall, Cornell University, STEFANO ZAPPERI, CNR-IENI, Via R. Cozzi 53, 20125 Milano, Italy, CATERINA A. M. LA PORTA, Department of Biosciences, University of Milano, NATIONAL RESEARCH COUNCIL OF ITALY TEAM, LASSP, DEPARTMENT OF PHYSICS, CORNELL UNIVERSITY TEAM, ISTITUTO NEUROLOGICO CARLO BESTA COLLABORATION, DEPARTMENT OF BIOSCIENCES, UNIVERSITY OF MILANO TEAM — Melanocytic nevi are benign proliferations that sometimes turn into malignant melanoma in a way that is still unclear from the biochemical and genetic point of view. Diagnostic and prognostic tools are then mostly based on dermoscopic examination and morphological analysis of histological tissues. To investigate the role of mechanics and geometry in the morpholgical dynamics of melanocytic nevi, we present a computational model for cell proliferation in a layered non-linear elastic tissue. Our simulations show that the morphology of the nevus is correlated to the initial location of the proliferating cell starting the growth process and to the mechanical properties of the tissue. We also demonstrate that melanocytes are subject to compressive stresses that fluctuate widely in the nevus and depend on the growth stage. Numerical simulations of cells in the epidermis releasing matrix metalloproteinases display an accelerated invasion of the dermis by destroying the basal membrane. Moreover, we show experimentally that osmotic stress and collagen inhibit growth in primary melanoma cells while the effect is much weaker in metastatic cells.

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