

## **Time- and Zinc-Related Changes in Biomechanical Properties of Human Colorectal Cancer Cells Examined by Atomic Force Microscopy**

Jagoba Iturri<sup>1</sup>, Maria Maares<sup>2</sup>, Claudia Keil<sup>2</sup>, Hajo Haase<sup>2</sup> and José Luis Toca-Herrera<sup>1</sup>

<sup>1</sup>*Institute for Biophysics, Department of Nanobiotechnology, BOKU University for Natural Resources and Life Sciences, Muthgasse 11 (Simon Zeisel Haus), 1190 Vienna, Austria, and* <sup>2</sup>*Chair of Food Chemistry and Toxicology, Technische Universität Berlin, Straße des 17. Juni 135, 10623 Berlin, Germany*

Monitoring biomechanics of cells or tissue biopsies employing atomic force microscopy (AFM) offers great potential to identify diagnostic biomarkers for diseases, such as colorectal cancer (CRC). Data on the mechanical properties of CRC cells, however, are still scarce. There is strong evidence that the individual zinc status is related to CRC risk. Thus, this study investigates the impact of differing zinc supply on the mechanical response of the in vitro CRC cell lines HT-29 and HT-29-MTX during their early proliferation (24–96 h) by measuring elastic modulus, relaxation behavior, and adhesion factors using AFM. The differing zinc supply severely altered the proliferation of these cells and markedly affected their mechanical properties. Accordingly, zinc deficiency led to softer cells, quantitatively described by 20–30% lower Young's modulus, which was also reflected by relevant changes in adhesion and rupture event distribution compared to those measured for the respective zinc-adequate cultured cells. These results demonstrate that the nutritional zinc supply severely affects the nanomechanical response of CRC cell lines and highlights the relevance of monitoring the zinc content of cancerous cells or biopsies when studying their biomechanics with AFM in the future.