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<u>Research in Graubünden</u> Understanding and improving bone healing

The application of new methods is expected to shed light on the subject



Bone healing in mice. Tissue section of a femur (left), spatial transcriptomics (right). Image credit: https://www.ors.org/transactions/2023/2175.pdf

Her experience at a small animal clinic in England sparked veterinarian Esther Wehrle's interest in bone healing research: "We were referred severe cases from other practices. These animals often had problems with bone healing. I was interested in why some developed healing problems and others did not." After spending a year in England, earning a doctorate in molecular biology and a master's degree in medical engineering, Wehrle sought new ways to deepen her understanding of bone healing. At the University of Ulm and ETH Zurich, Wehrle investigated how bone healing can be improved using mechanics. Since April 2022, she has been head of bone biology at the AO Research Institute (ARI) in Davos, which offers an optimal environment for this interdisciplinary and translational research.

Wehrle uses animal models to research bone healing in animals and humans, with a particular focus on mechanics and molecular and immune biology. Mechanics refers to the way in which the bone fracture was fixed, how much stress is placed on the bone, or how much movement is present in the bone gap. Wehrle explains how regular bone healing works: "There are different phases of healing. First, there is a necessary inflammation phase. Then comes the repair phase, in which new bone tissue forms. Finally, there is the remodeling phase, in which the new tissue is remodeled so that it takes on the same structure as the original bone. Despite great advances in the treatment of bone fractures, certain pre-existing conditions, such as diabetes or advanced age, can cause problems. This affects about ten percent of patients."

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Wehrle wants to take a closer look at the various factors that can cause problems during healing: "We are investigating how the inflammation phase can be regulated with the administration of antibodies if it is too severe or lasts too long. I am also interested in how the mechanics and molecular processes that take place during bone healing influence each other. To investigate these interactions, we use established techniques (cell culture, CT) as well as two newer methods: proteomics and spatial transcriptomics. Proteomics can be used to determine the total amount of proteins in a blood sample. To do this, blood is drawn at various points during the healing process. This allows us to study how protein profiles in the blood differ in normal and impaired healing. Spatial transcriptomics allows us to measure all the gene activity in a tissue sample and map where that activity occurs. We can use this method to look at where genes critical to healing are formed in the fracture area. The new knowledge about the presence or absence of certain proteins and genes during the healing process should help to detect healing disorders early, improve treatment methods and be able to specifically tailor them to individual patients."

Esther Wehrle and Daniela Heinen



Esther Wehrle. Image: AO Foundation

More information

The AO Research Institute Davos (ARI) occupies a leading position worldwide in the field of preclinical research for trauma surgery and orthopedics. The research work conducted at the headquarters in Davos contributes significantly to Davos' recognition as a research location. www.aofoundation.org

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