Transforming bone cancer care for personalised treatment plans

An innovative technology for daily tumour monitoring during radiation therapy

Bone metastasis is a debilitating and incurable condition responsible for two to three million cancer deaths worldwide each year, and 5–10% of newly diagnosed bone cancer patients will develop this complex cancer type. Current care standards face significant challenges in monitoring tumour progression during treatment due to patients' severe pain, limited mobility, and the high radiation dose associated with standard X-ray CT imaging. As a result, doctors usually perform scans only at the time of diagnosis and again after treatment ends, which is typically three months later. This delay impedes timely adjustments for personalised tumour control and decreases secondary effects for patients.

But what if we could rewrite this narrative? What if doctors could observe bone cancer's response to therapy in real time without adding to a patient's suffering?

For the first time ever, the EU-funded BoneOscopy research and innovation project is turning this possibility into reality. Over the next five years, researchers across Europe will work together to develop the first technology for daily imaging during regular particle radiation therapy (PRT) to monitor calcium content and bone cancer regression of patients without any additional dose exposure. This scientific breakthrough is clinically fundamental to i) improve patient's quality of life and decrease suffering, ii) improve treatment outcomes and reduce long-term effects, and iii) enable informed medical decision-making based on quantitative data and adapt treatments to patient needs.

UNLOCKING THE FULL POTENTIAL OF SPECTROSCOPY ANALYSIS

Nuclear X-ray spectroscopy, also called prompt gamma spectroscopy (PGS) analysis, is a well-known method for analysing the elemental chemical composition of materials by irradiating them with particle beams. PGS analysis of tissues has not been previously achieved due to the complexity and the small size of the cellular volumes.

At the heart of BoneOscopy lies the ability to detect prompt gamma rays emitted from tumour volume during PRT, unlocking the full potential of spectroscopy analysis of cancer without any additional dose. The first in vivo analysis of calcium content in healthy bone tissues was performed in DKFZ Heidelberg, demonstrating the feasibility of the PGS technology to analyse particle-irradiated bone tissue. Building on this, BoneOscopy aims to perform spectroscopy analysis of complex patient environments with very fine resolution.

"BoneOscopy aims to develop a radically new technology to allow informed medical decisions by daily monitoring bone cancer during PRT"

Prof. Joao Seco,
BoneOscopy Project Coordinator
DKFZ Heidelberg, Germany

WORKING TOGETHER TO DEVELOP GROUND-BREAKING TECHNOLOGY

The success of BoneOscopy relies on the interdisciplinarity of its consortium, which comprises institutions with key expertise in multiple disciplines such as bioengineering, biology, physics, instrumentation, robotics and clinical PRT. The project brings together know-how in bioengineering, cancer biology and particle radiation therapy (DKFZ), engineering experience in designing and building instrumentation in molecular imaging and robotics expertise (CSIC), physics experience in simulation, detector development and fast electronics and instrumentation development for particle detectors at CERN (LIP) and clinical experience treating bone cancer patients with PRT and specific understanding of PRT beam structure and dose levels (THM). An industry partner in medical technologies with expertise in the development of novel medical subsystems and solutions that result in complex robotic prototypes covering software and hardware (Cosylab) and an SME with long-standing expertise in the management, communication and dissemination of European research and innovation projects (accelCH) complement the expertise to achieve the project goals.

QUICK FACTS: BONEOSCOPY AT A GLANCE

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Network: BoneOscopy is not just a technological breakthrough; it's a testament to what's possible when experts unite across disciplines and borders. Leading minds in bioengineering, cancer biology, robotics, and clinical care have come together to create hope:

- Deutsches Krebsforschungszentrum Heidelberg (DKFZ), Germany
- Instituto de Instrumentación para Imagen Molecular (i3M-CSIC), Spain
- Laboratório de Instrumentação e Física Experimental de Partículas (LIP), Portugal
- Technische Hochschule Mittelhessen (THM), Germany
- Cosylab, laboratorij za kontrolne sisteme, d. d. (Cosylab), Slovenia
- accelopment Schweiz AG (accelCH), Switzerland

LEADING RESEARCHERS

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For patients, families, and healthcare providers, BoneOscopy represents more than a project; it's a promise. A promise of hope, precision, and a future where cancer care is tailored to every individual.

Stay with us as we transform possibilities into reality. Follow BoneOscopy's journey at www.boneoscopy.eu and join us in creating a brighter tomorrow.

European Innovation Council

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