EHU

CIC biomaGUNE
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Press release

XX/03/2026

Unravelling how some cartilage cells can turn into bone cells

A study by the EHU and CIC biomaGUNE has identified mechanisms that could guide future research into bone development and regenerative medicine

An international team led by Dr Ander Abarrategi at the EHU-University of the Basque Country and at CIC biomaGUNE has unravelled the molecular mechanisms causing some cartilage cells to be converted into bone cells.

Stem cells are to be found in virtually all body tissue and are capable of dividing and differentiating into various types of specialised cells, besides renewing themselves and producing more stem cells. Stem cells in the bone marrow and the growth plate (located at the tips of long bones) give rise to cells that form bone and cartilage tissue, respectively. Long bones form and become longer through a process in which chondrocytes (cartilage cells) are firstly formed in the growth plate before maturing and subsequently being replaced by osteoblasts (bone-forming cells).

"Rethinking the fundamentals of biology not only enables us to better understand these processes, but can also help us develop more effective treatments," pointed out Dr Ander Abarrategi. Along these lines, an international study, led by the researcher of the EHU and CIC biomaGUNE and published in the journal *Bone Research*, showed that "during development, some cartilage cells are converted into bone cells". This finding calls into question the belief that bone cells originate solely in bone marrow stem cells. In other words, "a newly-formed bone can originate in either bone marrow-derived stem cells or cartilage cells that have transitioned into bone cells", said the researcher.

***In vitro* and *in vivo* tools**

The research team developed *in vitro* and *in vivo* tools capable of modelling bone formation, which has enabled them to follow, chart, and study the transition from cartilage to bone. This has made it possible to acquire new insights into the mechanisms and signalling pathways involved in cartilage-derived bone formation. "This study shows that this transition does indeed take place, and we have also been able to uncover the mechanisms involved in this process of bone growth."

So, "we developed a series of modelling tools and methods that helped us to specify the molecular events that trigger the formation of osteoblasts (bone cells) derived from chondrocytes (cartilage cells) and to identify the key signalling pathways and transcription factors involved in this process", explained the researcher in the EHU's Department of Cell Biology and Histology.

This study provides new insights into the process of cartilage-to-bone transition, which could help guide future research into bone development and regenerative medicine. On the one hand, "we now have a better

understanding of the ossification process, so we have new targets for improving repair", said Abarrategi. On the other hand, he wondered whether "once this process has been specified, it might play a role in the development of bone tumours". And whether "defective transition could lead to the development of osteosarcomas or chondrosarcomas".

All of this highlights, once again, "the importance of fundamental research. Defining basic biological concepts relating to tissue formation has the potential to open up new avenues for research and lead to the development of new therapies", he concluded.

Additional information

Dr Ander Abarrategi is a lecturer and researcher in regenerative medicine in the EHU's Department of Cell Biology and Histology and former head of the Regenerative Medicine Laboratory at CIC biomaGUNE (Centre for Cooperative Research in Biomaterials). Using biomaterials and advanced 3D tissue models to study stem cell behaviour and skeletal development, his research focuses on understanding how bone and cartilage tissue form and regenerate. Dr Abarrategi's work aims to reveal mechanisms that could lead to improved treatments for bone repair and skeletal disorders.

Bibliographic reference

Raquel Ruiz-Hernández, Laurie Gay, Verónica Moncho-Amor, Pablo Martín, Jhonatan A. Vergara-Arce, Stefania Di Blasio, Thomas Snoeks, Unai Cossío, Ander Matheu, Maria M. Caffarel, Daniela Gerovska, Marcos J. Araúzo-Bravo, Amaia Vilas, Felipe Prosper, Sergio Moya, Daniel Alonso-Alconada, Ana Alonso-Varona, Gretel Nusspaumer, Javier Lopez-Rios, Karine Rizotti, Robin Lovell-Badge, Dominique Bonnet, Ilaria Malanchi & Ander Abarrategi

Modeling the chondrocyte-derived osteoblasts formation process reveals its molecular signature and regulation network

Bone Research

DOI: 10.1038/s41413-025-00500-6