2017-723 An Osteoadsorptive Fluorogenic Substrate of Cathepsin K for Imaging Osteoclast Activity and Migration

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Technology description

SUMMARY
UCLA researchers in the Department of Dentistry have developed a novel fluorescent probe for studying the role of osteoclasts in bone diseases and for detecting the early onset of bone resorption by targeting an important protein Cathepsin K. This probe can also deliver drug molecules to bone resorption sites with high specificity.

BACKGROUND
Osteoporosis, rheumatoid arthritis, multiple myeloma and other bone ailments are debilitating diseases that involve abnormal breakdown of bones (bone resorption), leading to devastating skeletal defects and poor quality of life. Cathepsin K is produced by osteoclast cells to aid in breaking down collagen in bones, and its activity plays an important role in the development and progression of the aforementioned diseases. Molecular probes for cathepsin K have been developed to study the effects of this protein and osteoclast cells in many disease models. However, these probes do not specifically target bone tissues in animal models and have a short half-life for imaging.

INNOVATION
A molecular probe called OFS-1 has been developed to detect cathepsin K activity in vitro and in vivo. This novel probe is linked to a compound called bisphosphonate that binds strongly to bones, making the OFS-1 probe highly specific for targeting bones. OFS-1 contains a cleavable fluorophore-quencher pair, which is activated when cathepsin K cleaves OFS-1. Therefore OFS-1 can be used for sensitive and early detection of bone resorption in diseases. Activated OFS-1 remains bound to osteoclast cells after interaction with cathepsin K, making it easy to track florescent osteoclasts over time. Additionally, OFS-1 can be linked to a near infrared dye instead of a fluorescent dye to increase tissue penetration in live animal models. The probe can also be attached to drug molecules for targeted drug delivery at specific cathepsin K active sites for bone disease and cancer treatments.

Application area

Research studies on the effects of cathepsin K and osteoclasts for:

Osteoporosis
Osteoarthritis
Rheumatoid arthiritis
Multiple myeloma
Targeted drug delivery for:
Bone resorption abnormalities in the diseases mentioned above
Bone metastasis of cancer

Advantages

Highly specific for bone tissues
Flexible attachment of different types of fluorophores/probes
Can be used in vivo and in vitro
Can be used for drug delivery
Long half-life

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