NHMRC: IMPACT CASE STUDY

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Australian Government
National Health and Medical Research Council

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From bone biology to better treatments

NHMRC-funded research at St Vincent's Institute of Medical Research and the University of Melbourne transformed understanding of bone biology, enabling breakthroughs in osteoporosis treatment. Foundational discoveries led to the development of denosumab, a therapy that significantly improves bone density and reduces fractures. Now a first-line treatment in clinical guidelines, denosumab has improved outcomes for people at high fracture risk. This impact reflects decades of sustained investment in basic science translated into better patient care.

Origin

Osteoporosis, caused by an imbalance in bone renewal, affects 3.4% of Australians—especially older women—and often goes undiagnosed until fractures occur. These fractures, particularly hip fractures, increase mortality and reduce quality of life. Bone is a dynamic tissue regulated by osteoblasts (bone builders), osteoclasts (bone breakers), and osteocytes.

Until the 1980s, the molecular mechanisms controlling these cells were poorly understood.

Investment

NHMRC project and program grants supported this research from the early stages in 1984 through to 2009, enabling decades of sustained investigation. Long-term funding at the University of Melbourne and St Vincent's Institute of Medical Research led to key advances, including new models, cell lines, and collaborations.

Additional support came from the Cancer Council Victoria (formerly The Anti-Cancer Council of Victoria), contributing to the field's development and impact.

Research

By studying bone-producing tumours, NHMRC-funded researcher Jack Martin and team overcame barriers to isolating bone cells. They developed the UMR106 cell line, which mimicked osteoblasts and responded to parathyroid hormone (PTH), enabling insights into osteoblast–osteoclast communication. This led to the discovery of RANK Ligand (RANKL), a key regulator of bone breakdown.

Further research identified PTH-related protein (PTHrP) from lung cancer cells, linking cancer metastasis to bone degradation.

Translation

The UMR106 cell line, was widely shared and later distributed via the American Type Culture Collection, becoming central to global bone research. Its use helped uncover RANKL's role in bone breakdown, leading to the development of denosumab, a monoclonal antibody approved in Australia in 2010 to treat osteoporosis.

Understanding PTHrP's role in bone metastases also improved cancer care through the use of bone resorption inhibitors.

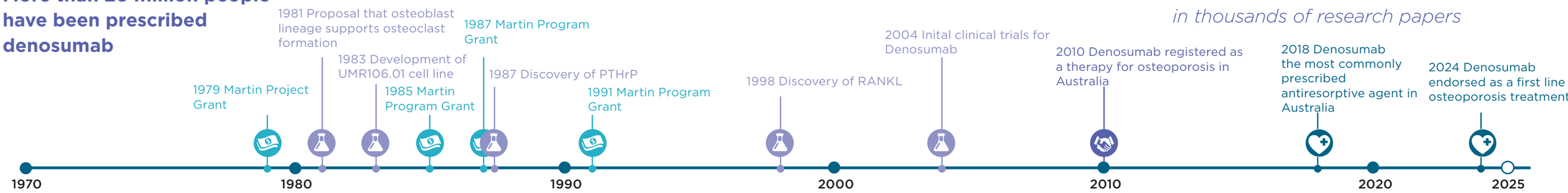
Impact

This research helped establish bone biology as a field of research, supporting development of denosumab—a breakthrough osteoporosis treatment. Denosumab significantly increases bone mineral density and reduces vertebral, non-vertebral, and hip fractures. In cancer patients with bone metastases, it delays skeletal complications and improves quality of life.

Denosumab's effectiveness has led to widespread adoption in national and international clinical guidelines.

More than 26 million people have been prescribed denosumab

The UMR106 cell line has been referred to in thousands of research papers



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