Study proves 'muscle memory' exists at a DNA level

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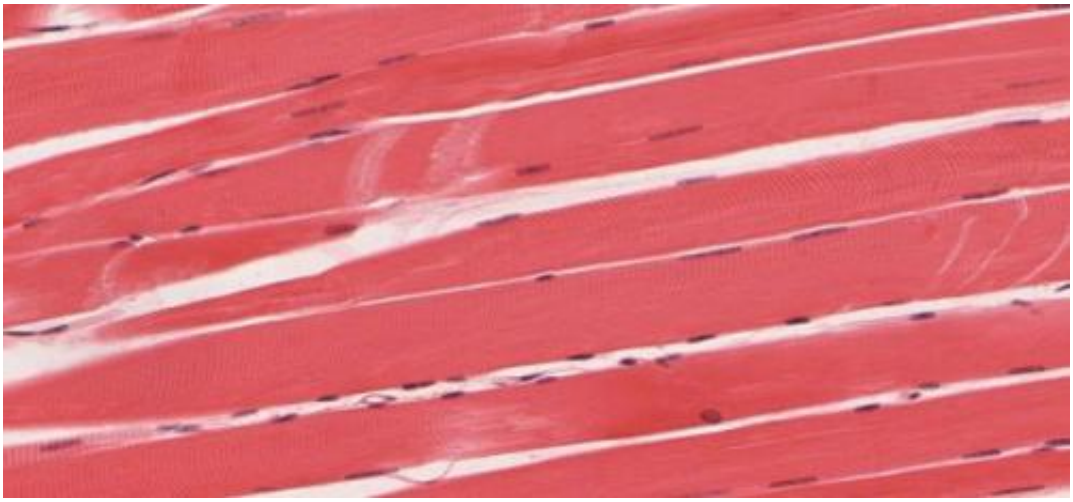

Skeletal muscle tissue. Credit: University of Michigan Medical School

A study led by researchers at Keele University has shown for the first time that human muscles possess a 'memory' of earlier growth—at the DNA level.

Periods of skeletal muscle growth are 'remembered' by the genes in the muscle, helping them to grow larger later in life.

The research, published in *Scientific Reports*, could have far-reaching implications for athletes caught using performance-enhancing muscle building drugs—as the drugs could be creating long-lasting changes,

making short-term bans inadequate.

Using the latest genome wide techniques, the researchers from Keele, along with the Universities of Liverpool John Moores, Northumbria and Manchester Metropolitan, studied over 850,000 sites on human DNA and discovered the genes 'marked' or 'unmarked' with special chemical 'tags' when muscle grows following exercise, then returns back to normal and then grows again following exercise in later life.

Known as epigenetic modifications, these 'markers' or 'tags' tell the gene whether it should be active or inactive, providing instructions to the gene to turn on or off without changing the DNA itself.

Dr. Adam Sharples, the senior and corresponding author of the study and Senior Lecturer in Cell and Molecular Muscle Physiology at Keele University and his Ph.D. student Mr Robert Seaborne explained:

"In this study, we've demonstrated the genes in muscle become more untagged with this epigenetic information when it grows following exercise in earlier life, importantly these genes remain untagged even when we lose muscle again, but this untagging helps 'switch' the gene on to a greater extent and is associated with greater muscle growth in response to exercise in later life—demonstrating an epigenetic memory of earlier life muscle growth."

The research has important implications in how athletes train, recover from injury, and also has potentially far-reaching consequences for athletes caught cheating.

Dr. Sharples explained:

"If an athlete's muscle grows, and then they get injured and lose some muscle, it may help their later recovery if we know the genes responsible

for muscle 'memory'. Further research will be important to understand how different exercise programmes can help activate these muscle memory genes."

Mr Seaborne continued:

"If an elite athlete takes performance-enhancing drugs to put on muscle bulk, their muscle may retain a memory of this prior muscle growth. If the athlete is caught and given a ban—it may be the case that short bans are not adequate, as they may continue to be at an advantage over their competitors because they have taken drugs earlier in life, despite not taking drugs anymore. More research using drugs to build muscle, rather than exercise used in the present study, is required to confirm this."

More information: Robert A. Seaborne et al. Human Skeletal Muscle Possesses an Epigenetic Memory of Hypertrophy, *Scientific Reports* (2018). DOI: 10.1038/s41598-018-20287-3

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