

UNDER STRICT EMBARGO UNTIL 00.01 BST Monday 28 October 2013

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Brief exposure to performance-enhancing drugs may be permanently 'remembered' by muscles

Brief exposure to anabolic steroids may have long lasting, possibly permanent, performance-enhancing effects, shows a study published today [28 October] in *The Journal of Physiology*.

Previously, re-acquisition of muscle mass – with or without steroid use – after periods of inactivity has been attributed to motor learning. However, this new data from the University of Oslo suggests that there is a cellular 'memory mechanism' within muscle of brief steroid users.

The team investigated the effects of steroids on muscle re-acquisition in mice and discovered greater muscle mass and more myonuclei – which are essential components for muscle fibre function – were apparent after returning to exercise.

Professor Kristian Gundersen explains how they carried out the study and the results found:

"Mice were briefly exposed to steroids which resulted in increased muscle mass and number of cell nuclei in the muscle fibres. Three months after withdrawal of the drug (approximately 15% of a mouse's life span) their muscles grew by 30% over six days following load exercise. The untreated mice grew insignificantly."

The findings might have consequences for the exclusion time of doping offenders as brief exposure to anabolic steroids might have long lasting performance-enhancing effects.

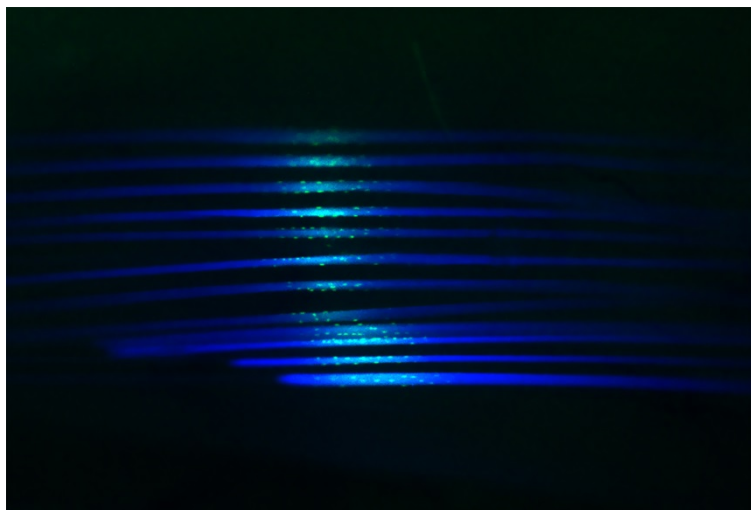
Prof Gundersen says:

"The results in our mice may correspond to the effects of steroids lasting for decades in humans given the same cellular 'muscle memory' mechanism. The new results might spur a debate on the current World Anti-Doping Agency (WADA) code in which the maximum exclusion time is currently two years."

Additionally, the data suggests that strength training when young might be beneficial later in life since the ability to generate new myonuclei is impaired in the elderly.

Future studies should include human muscles and further investigation into the cellular and molecular mechanism for muscle memory

Muscle fibres with cell nuclei. Credit: Jo C Bruusgaard



ENDS

Notes to Editors

1. Full paper:
Ingrid M. Egner, Jo C Bruusgaard, Einar Eftestøl & Kristian Gundersen (2013) A cellular memory mechanism aids overload hypertrophy in muscle long after an episodic exposure to anabolic steroids. *Journal of Physiology*

Please contact Lucy Holmes (details below) for the manuscript ahead of publication on 28 October.

2. Media resources, including photos and quotes, are available freely at the following site:
<http://www.mn.uio.no/ibv/english/research/groups/physiology/labgrupper/gundersen/for-media/>
3. *The Journal of Physiology* publishes advances in physiology which increase our understanding of how our bodies function in health and disease. <http://.jp.physoc.org>

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The Journal of Physiology

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