



Knowledge in Motion
Lecture Series
Living Healthy
with Spinal Cord Injury

Spinal Cord Injury and the Importance of Exercise for Cardiovascular Health



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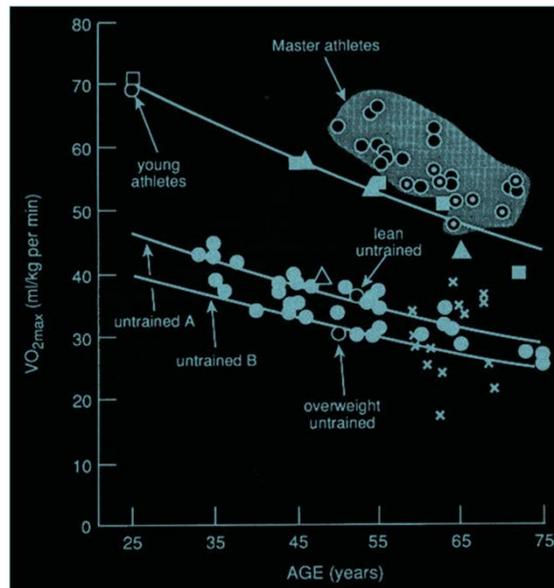
Spinal Cord Injury and the Importance of
Exercise for Cardiovascular Health

The condition of exercise is not a mere variant of the condition of rest, it is the essence of the machine.

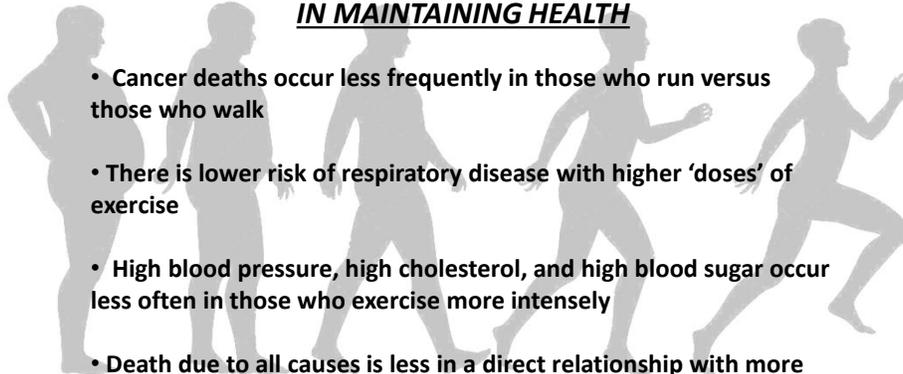
Sir Joseph Barcroft
Features in the Architecture of Physiological Function
1934

**THE LONG TERM EFFECTS OF SPINAL CORD
INJURY CAN RESEMBLE PREMATURE AGING**

- Changes in the heart and blood vessels, in metabolism, and in the muscles and bones lead to early aging and result in cardiovascular diseases at earlier ages



**THE ROLE OF EXERCISE INTENSITY
IN MAINTAINING HEALTH**



- Cancer deaths occur less frequently in those who run versus those who walk
- There is lower risk of respiratory disease with higher 'doses' of exercise
- High blood pressure, high cholesterol, and high blood sugar occur less often in those who exercise more intensely
- Death due to all causes is less in a direct relationship with more intense regular exercise

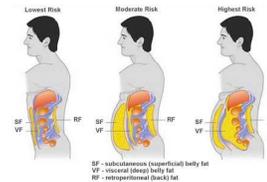
By 1 year after discharge, exercise capacity in those with an SCI is less than half that in the unfit general population
(Haisma. J Rehabil Med 2008)

“Physical rehabilitation after SCI needs to move beyond maximizing independence to focus on **maintenance of optimum health and fitness**”

(Spinal cord injury and physical activity: preservation of the body.
Galea. Spinal Cord, 2012)

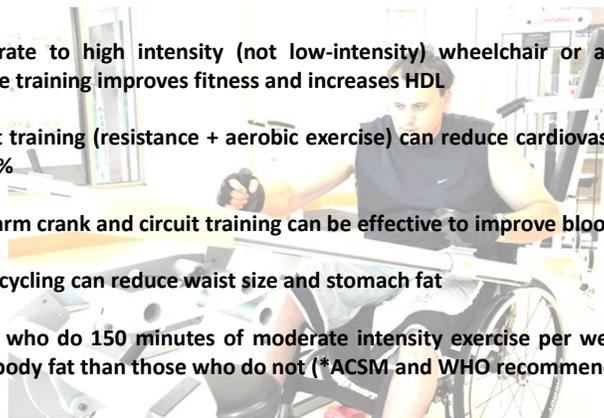
**CARDIOVASCULAR RISKS RELATED TO
INACTIVITY AFTER SPINAL CORD INJURY**

- Low levels of protective high-density cholesterol (HDL) and high levels of harmful low-density cholesterol (LDL)
- Loss of muscle mass
- Low resting metabolism and increased blood sugar
- Increased body fat (mainly stomach fat)



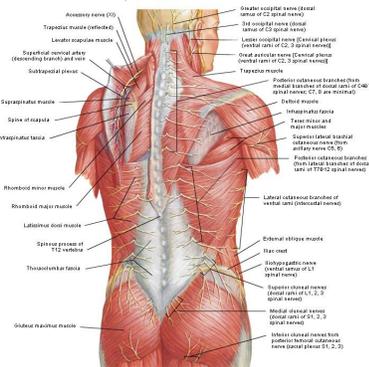
**EXERCISE REDUCES CARDIOVASCULAR RISK
AFTER SPINAL CORD INJURY**

- Moderate to high intensity (not low-intensity) wheelchair or arm crank exercise training improves fitness and increases HDL
- Circuit training (resistance + aerobic exercise) can reduce cardiovascular risk by ~25%
- Both arm crank and circuit training can be effective to improve blood sugar
- Hand-cycling can reduce waist size and stomach fat
- Those who do 150 minutes of moderate intensity exercise per week* have lower body fat than those who do not (*ACSM and WHO recommendation)

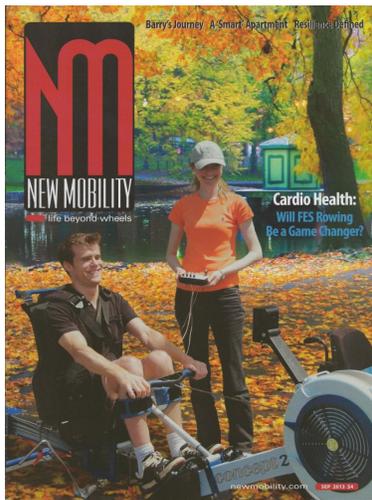


From: "Cardiometabolic Syndrome in SCI: The Role of Physical Deconditioning and Evidence-based Countermeasures" Maher, McMillan, Nash in [THE PHYSIOLOGY OF EXERCISE IN SPINAL CORD INJURY](#), J. Andrew Taylor, editor

KEY LIMITATION TO EXERCISE AFTER SCI: MUSCLE MASS



**OVERCOMING EXERCISE LIMITATIONS IN SCI
WITH FUNCTIONAL ELECTRICAL STIMULATION (FES)**



"E-Stim for Wellness," Richard Holicky
New Mobility, Sep 2013

'Taylor repeatedly emphasized that the program is exercise rather than therapy, and as an exercise physiologist, he believes meaningful exercise involves work, sweating and heavy breathing, a combination, he says, not often associated with the e-stim bike.'



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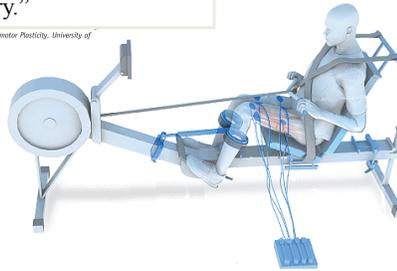
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From the ¹Spaulding Hospital Cambridge, Cambridge, MA; and ²France INSERM-U1093 Cognition, Action, and Sensorimotor Plasticity, University of Burgundy, Dijon, France.

“Our data suggest that the benefits of FES row training may lie in effectively circumventing the effect of SCI by engaging more muscle mass, independent of level of injury.”



**EXERCISE -- THE ESSENCE
OF THE MACHINE**

“My grandmother started walking five miles a day when she was sixty. She’s ninety-seven now, and we don’t know where the heck she is.”

— [Ellen DeGeneres](#)