

## Re: Physical fitness and evolution

**Source:** <http://sci.tech-archive.net/Archive/sci.bio.evolution/2004-06/0223.html>

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**From:** Guy Hoelzer ([hoelzer\\_at\\_unr.edu](mailto:hoelzer_at_unr.edu))

**Date:** 06/24/04

Date: Thu, 24 Jun 2004 04:29:23 +0000 (UTC)

Dear Peter,

in article [cbc9qe\\$2713\\$1@darwin.ediacara.org](mailto:cbc9qe$2713$1@darwin.ediacara.org), Peter Webb at [webbfamily@DIESPAMDIEoptusnet.com.au](mailto:webbfamily@DIESPAMDIEoptusnet.com.au) wrote on 6/23/04 9:06 AM:

> "Guy Hoelzer" <[hoelzer@unr.edu](mailto:hoelzer@unr.edu)> wrote in message

> [news:cba431\\$1f6k\\$1@darwin.ediacara.org](mailto:news:cba431$1f6k$1@darwin.ediacara.org)...

>>

>> in article [cb7rtc\\$mic\\$1@darwin.ediacara.org](mailto:cb7rtc$mic$1@darwin.ediacara.org), Peter Webb at

>> [webbfamily@DIESPAMDIEoptusnet.com.au](mailto:webbfamily@DIESPAMDIEoptusnet.com.au) wrote on 6/21/04 4:44 PM:

>>

>>> *People who exercise at the gym primarily do so for one of two reasons – to*

>>> *build muscle mass or improve cardio fitness.*

>>>

>>> *Its easy to see why the body only puts on muscle in response to weight*

>>> *training. If there is excess food available, your body is better storing*

>>> *this as fat rather than as muscle, as fat provides 9 kCal of energy per Gram*

>>> *you carry around, whereas muscle (protein) provides only 4 KCal/gm. Carrying*

>>> *fat around is more energy efficient than carrying muscle, unless you have*

>>> *some other need for the muscle. Weight training simply tricks your body into*

>>> *thinking you need muscle for other purposes, so it alters the balance*

>>> *towards the less efficient storing of food as muscle.*

>>>

>>> *The adaptations that occur in response to cardio training are harder to*

>>> *explain. These include increased capillaries, more mitochondria, and*

>>> *numerous others. However, none of these seem to have a downside. Being*

>>> *fitter in a cardio sense always seems better than being unfit (unlike the*

>>> *situation with muscle vs fat).*

>>

>> *Actually, these adaptations generically result in a shorter lifespan. They*

>> *improve your performance in the meantime, but they also cause you to live*

>> *faster (metabolically) and senesce sooner.*

>

> *Really! My understanding was that all else being equal cardio fit people had*

> *a longer life expectancy than cardio unfit people.*

>

> *Nor have I heard that cardio fit people age faster.*

>

- > *Even in prehistoric times I would have expected cardio fit people to live*
- > *longer than unfit people, if only because they would be better at hunting*
- > *food and avoiding being eaten.*

They may indeed have gained a survival advantage in these ways, which would only compensate the physiological survival costs I was referring to. Also note that I referred to "these adaptations" which, following your statement meant "increased capillaries [and] more mitochondria", not cardio fitness in general.

You may be interested in the following observation (I would point you to the literature on the metabolic scaling theory of Brown, West and colleagues). Data spanning many orders of magnitude in animal size and metabolic rate reveal that vertebrates are generally allotted about 1 million heart beats per lifetime. There is plenty of variation around this rule, but the more data you include in the analysis, the more robust the rule appears. So, when you work out you use up your allotment of heart beats faster, but you reduce your resting heart rate at the same time. You don't get a larger allotment of heart beats by virtue of working out.

- >>> *So why does your body lose these adaptations to exercise when the exercise*
- >>> *stops? What is the environmental advantage of becoming unfit when we don't*
- >>> *exercise? Why doesn't your body just implement the adaptations to exercise*
- >>> *even if you aren't exercising?*

>>

- >> *You should be careful in your use of the word "unfit" in this context,*
- >> *because physical fitness and Darwinian fitness are very different things. I*
- >> *think I basically answered your questions above. Your Darwinian fitness is*
- >> *improved by reducing your metabolism to a slow idle when it is not being used*
- >> *to increase your Darwinian fitness through action.*

>>

>

- > *This would be a very attractive answer if being unfit increased your life*
- > *expectancy. However I do not believe this is true now, and would be even*
- > *less true of life before agriculture, cars and supermarkets.*

There is one result from the science of aging that shows up in virtually every study. The most effective way to maximize lifespan is to reduce metabolic rate. You can increase your expected lifespan by something like 30%, for example, if you lie down, get fed intravenously, and allow your muscles to atrophy for the rest of your life. It is not a life I would choose to live, but it is BY FAR the surest way to maximize your lifespan that we know. I would also argue that, whether or not there are other effective ways of maximizing lifespan that we have yet to discover, the existing data are clear with regard to the effect of metabolic rate.

Guy