**This case study examines the potential legacy of the games for the health and wellbeing, including happiness, of the whole population as well, specifically, for older people.**

## *How Sport Makes You Happy*

Any keen exerciser will quickly endorse the positive mental effects that result from a good gym session or some time spent pounding the pavement. It might, then, come as little surprise to know that exercise is now used as a treatment for depression, as it actually causes us to become happier!

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We all know that sport can lead to better physical health, but did you know that sport and physical exercise can cause significant benefits to occur in your mental health?

The academic and medical community have become increasingly interested in the positive mood enhancing benefits of physical exercise. In fact, exercise is now a medical intervention in the treatment of depression!

## *Exercise and Emotions: The Role of Neurotransmitters*

*Exercise makes you happy by chemically altering the level of NEUROTRANSMITTERS in your brain; namely,* ***dopamine, beta-endorphin, serotonin and*** **dopamine.** These are the chemicals that govern our emotional state and determine how happy we are, how optimistic we are, and how well we can cope with stress and anxiety. They are responsible for communicating information throughout our brain and our body. They relay signals between nerve cells, called "neurons."

The brain uses neurotransmitters to tell your body to do everything that it needs to do to physically function. For example, it they tell your heart to beat, your lungs to breathe, and your stomach to digest.

Neurotransmitters also control our mood, our ability to sleep, our concentration, and our weight. Factors such as lack of exercise, stress, a poor diet, drug use (prescription and recreational), alcohol and caffeine can detrimentally affect our neurotransmitter levels, but the good news is that this can be fixed. This case study presents a basic overview of the neurotransmitters present in your body, and what they do, and then goes on to discuss how exercise and a healthy diet can positively affect your neurotransmitter levels.

There are two types of neurotransmitter: Excitatory (which stimulate the brain) and inhibitory (that calm the brain). Inhibitory neurotransmitters balance mood and are easily depleted when the excitatory neurotransmitters are overactive.

### *Inhibitory Neurotransmitters*

**SEROTONIN** is an inhibitory neurotransmitter. Adequate amounts of serotonin are necessary for a stable mood and to balance any excessive excitatory (stimulating) neurotransmitter firing in the brain. If you use stimulant medications or caffeine in your daily regimen – it can cause a depletion of serotonin over time.

Serotonin regulates lots of physiological functions, such as carbohydrate cravings, sleeping, feelings of pain, digestion and immune function.

Serotonin is a 'happy' chemical that is responsible for significant and positive adaptations in our emotional state. For the brain to maintain a stable and uplifted emotional state, it must exhibit high levels of serotonin. Interestingly, the most common cause of manic depression is either a lack of serotonin in the brain or inefficiency of serotonin receptors. The great news is that exercise greatly enhances the amount of serotonin that is released within your brain, increasing feelings of happiness, contentment and wellness.

### *Excitatory Neurotransmitters*

**DOPAMINE** is considered to be both excitatory and inhibitory. Dopamine can alleviate depression and also improve our ability to focus. However, when dopamine is either elevated or low, we lose our ability to focus and concentrate, and it also really affects our drive and motivation.

Stimulants (medications for ADHD, amphetamines and caffeine) can cause dopamine to be pushed into the synapse so that focus is improved. However this is only a quick fix solution as, unfortunately, consistent stimulation of the dopamine neurotransmitter can lead to the long-term depletion of dopamine levels in the body. So lots of caffeine and use of amphetamines is a very bad idea and can easily lead to depression. Don't risk it!

**NOREPINEPHRINE,** an excitatory neurotransmitter, is responsible for stimulatory processes in the body, and also helps to make epinephrine. This neurotransmitter can cause anxiety if levels are too high. However, levels that are too low can be responsible for low energy, decreased focus and insomnia.

**EPINEPHRINE** is an excitatory neurotransmitter that is reflective of stress. This neurotransmitter will often be elevated when ADHD like symptoms are present. Long term stress or insomnia can deplete epinephrine levels, which is particularly worrying as epinephrine also regulates heart rate and blood pressure.

Beta-endorphins are another one of our mood regulating chemicals, and they assist in the reduction of pain in the body. Large amounts can cause euphoria - which is great news for sports fans, as prolonged exercise has been proven to greatly increase the amount of endorphins present in the body! This feeling is referred to colloquially as a 'runners high'.

### *How Exercise Improves Synaptic Transmission of Neurotransmitters*

So we have seen how exercise significantly enhances emotional state (happiness and contentment) via elevated levels of the neurotransmitters beta-endorphin and serotonin.

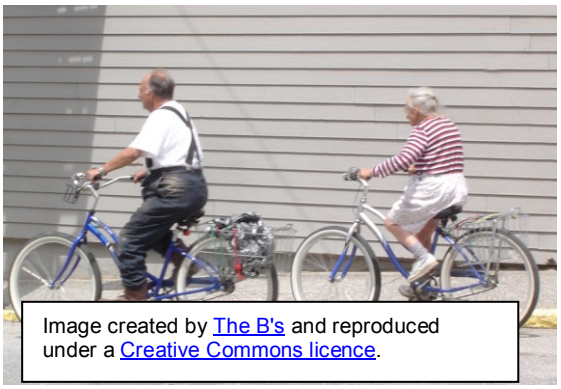
But exercise does something else very efficient, too. It also affects the brains' aminergic *synaptic transmission*. What does this mean? Basically, that the transmission rate of neurotransmitters are improved when exercise occurs, so that any existing chemicals in the body are effectively used more efficiently, and thus exert a greater impact on our mood. This explains why new exercisers might struggle through the first few sessions, but after exercise becomes more regular, their *synaptic transmission* and *beta-endorphin, serotonin* and *dopamine* levels improve and increase, and their mood is elevated as an immediate response to exercise. They start to experience the 'runner's high' and exercise starts to become a whole lot more rewarding!

### *Other Ways that Exercise Improves Mood*

Experts believe that there are additional reasons that explain why exercise can lower depression and generally enhance our feelings of happiness. Exercise provides a positive environment that transports the individual away from the stressors of daily life. Participation in exercise, or a positive sports environment can also raise the self-esteem, confidence and feelings of mastery in an individual.

### *Which specific types of exercise make you happiest?*

Scientists have found that there is no one type of exercise that is more effective than another However, there seems to be a consensus that exercises ought to be done continuously for the best effects to take place.





### *Flexing Octogenarian Muscle*

**Are our Oldest and Wisest considered in Olympic Legacy Plans?**

Recent academic studies indicate that exercising well into our twilight years is of vital importance in maintaining health and fitness. This is particularly due to the rehabilitative properties of exercise, and the role that exercise plays in pressing the 'pause' and 'rewind' button on many degenerative conditions such as osteopaenia and osteoporosis.

According to recent estimates, it is possible that the number of people over 60 could rise by as much as 40% in the next 30 years. This would lead the ratio of working citizens to over 65's from 3.7:1 to 2.1:1 by 2040. Such a situation carries significant implications for the economy, firstly because there are fewer people working and producing a taxable income, and secondly because increasing age is positively correlated with the onset of degenerative disease that places huge financial strain on the National Health Service.

An ageing time bomb has been acknowledged by the World Health Organisation (WHO) who warns that the health impact of an ageing population could be enormous. They have predicted significant increases in cancer, heart attacks, diabetes, dementia and other illnesses, and have

now launched a campaign to promote good health in old age.

Given that our grannies have been proven to need exercises now more than ever, how does this reflect in London 2010 legacy targets? Is LOCOG truly flexing octogenarian muscle or is its health legacy for seniors on the stair master to failure?

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### *Why OAP's need Exercise*

As people age, their level of musculature diminishes, increasing their potential for degenerative illness, increasing their risk of injury, and lowering their overall quality of life. Recent academic studies identified that the elderly found all manner of household tasks (climbing up the stairs, housework, carrying groceries, etc) much easier if they engaged in exercise 2-3 times a week (provided that the exercise in question consisted of both cardiovascular activity, such as walking, and also some light weight training, using small hand weights or elasticated exercise bands).

### *Free Swimming Programme for Seniors Disappears*

Unfortunately, the legacy goals for young people and OAP's have been injured by recent cuts in the popular 'free swimming' programme that was only rolled out in 2008 as a much vaunted and publicised Olympic legacy. The cuts have been introduced as a cost saving measure, but this raises the question of whose costs are actually being saved. After all, if senior citizens are being dissuaded from exercising, it may be the NHS and the public purse that pays the price.

The Sports and Olympics Minister, Hugh Robertson, commented that the scheme was "a luxury" that could no longer be afforded and has been axed as part of £73m savings made by the Department for Culture, Media and Sport. Of course, critics might comment that free swimming for pensioners hardly deserves the title of luxury, and instead might point to the 5 star hotel budgets for Olympic delegates, or league topping Olympic quango salaries as more appropriate uses of that particular term.

Commented Robinson: "This is not a decision that gives me any pleasure... however, the research shows that the great majority of free swimmers were swimming already, and would have paid to swim anyway. With a crippling deficit to tackle and tough decisions to take, this has become a luxury we can no longer afford." Robertson went on to comment that the scheme has not delivered value for money nor significantly increased physical activity.

### *Legacy Value?*

In terms of overall legacy value, will London 20102 deliver? Professor Mike Weed, of Canterbury Christ Church University, Kent, doesn't think so.

Professor Weed indicated that the London 2012 Olympic and Paralympic Games will cost over £9 billion - £150 for every man, woman and child in the UK: "For this investment, we have been

promised legacy outcomes for sport and physical activity, regeneration, culture, sustainability, the economy and disability. Each of these areas has implications for health or relates to socioeconomic determinants of health."

Prof Weed said the findings suggest £150 a head towards staging London 2012 "is a poor investment made by the treasury on our behalf."

It remains to be seen whether such predictions and analyses are correct, but one thing is for sure: senior citizens should never be forgotten in the legacy plans of the Olympics.

### *Find out More*

Physical Exercise and Psychological Well-Being: A Population Study in Finland

**Hassmen P, Koivula N, Uutela A, *Prev Med* 2000 Jan;30(1): pp.17-25**

Alterations in Selected Measures of Mood With a Single Bout of Dynamic Taekwondo Exercise in College-Age Students

**Toskovic, NN, *Percept Mot Skills* 2001 Jun;92(3 Pt 2):1031-8**

**Senior Citizens Live Longer, Healthier Lives if they Exercise**

http://seniorjournal.com/NEWS/Fitness/2009/20090914-SenCitLiveLongerHealthier.htm

**London 2012 Olympics & Paralympic Games quarterly Report**

http://www.culture.gov.uk/images/publications/DCMS_GOE_QR_July_2010.pdf

**DCMS Free Swimming Statistics**

http://www.culture.gov.uk/publications/7072.aspx

Leveille, S. G., LaCroix A. Z., Moore G. E., Fiatarone M. A. (1994) **Exercise Training for Very Elderly People.** Engl J Med; 331: p. 1237-1238.

### *CREDITS*



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