

From *Mind Performance Hacks* (ISBN 0596101538) by Ron Hale-Evans.

# Overclock Your Brain

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*In some situations the brain is performance limited by the available fuel. Increase the fuel and you can temporarily get a performance boost.*

The brain is one of the most energy hungry of the human organs. Despite making up only about 2% of the average body weight, it uses almost 20% of the normal intake of energy. Although the brain is mostly made up of fat, this is mainly used to protect and insulate brain cells and is not available as an energy store. It therefore relies on the rest of the body to provide it with a supply of energy, which consists almost entirely of glucose. The brain uses up its own glucose supplies in about 5 – 10 minutes if they are not replenished, meaning it is particularly sensitive to changes in blood glucose levels.

As part of this process, oxygen is also needed, and is another essential component of the brain's fuel supply. Oxygen is used as part of glucose metabolism to provide brain cells with a number of important chemicals that allow them to support themselves and communicate with other neurons.

Unsurprisingly, mental performance relies on the functioning of the brain, and like with any other organ, this performance is linked to how many resources are available. Research has shown that in some instances, mental performance is rate-limited by the available glucose and oxygen. In other words, you can increase the rate of mental processing by increasing the available fuel.

It turns out that this effect is not global, and it typically effects some mental abilities more than others. To get the best performance increase, you need to know how quickly glucose and oxygen are metabolised in the body to perfect your timing, and which mental processes are most affected to select your task.

## In Action

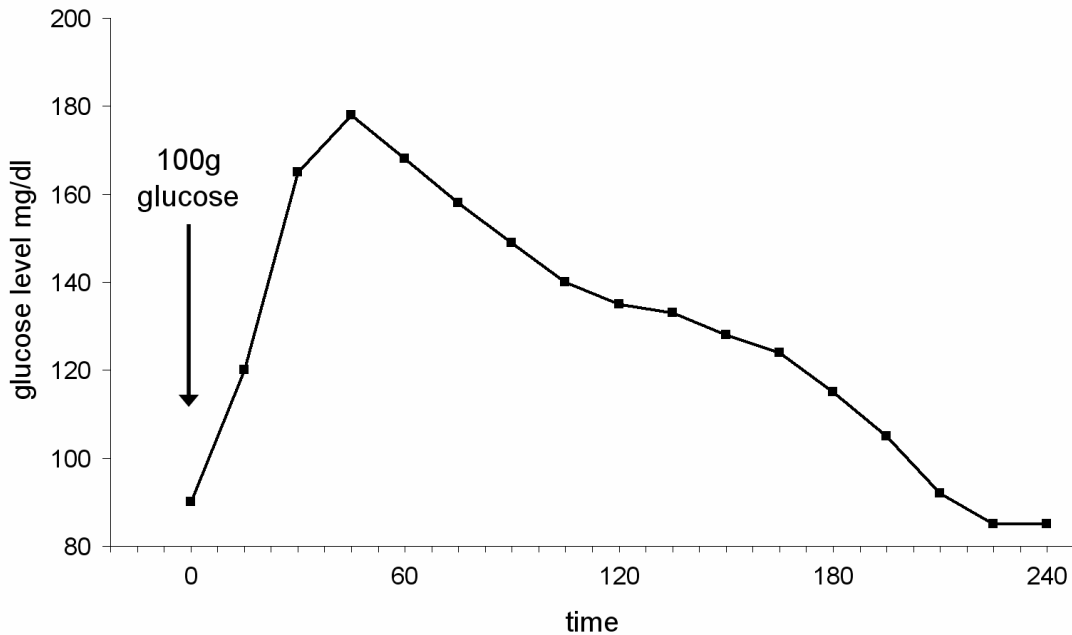
One of the most reliably findings is that increasing available glucose and oxygen seems to have a beneficial effect on memory. Importantly, the effect is usually found for memory encoding but not memory recall. If you are not familiar with this distinction, think of it in terms of the mental activities involved in memory. Encoding is when you encounter the information and try to commit it to memory, recall is when you want to retrieve previously committed information.

Increasing glucose and oxygen supplies to the brain seems to allow information to be more accurately and fully committed to memory – in other words, you learn better. This means when you come to recall it at a later stage, you will undoubtedly do better, because the information there is clearer and more comprehensive. The reverse does not seem to be true however. If you first encoded something without the aid of extra oxygen and glucose, suddenly making more oxygen and glucose available when you try and recall it will not improve your overall memory performance.

The improvement in oxygen levels on memory [1] typically lasts for a few minutes only (five is about the limit), so you need to time your learning to happen shortly after an increase in oxygen, or ensure that you maintain a slightly increased level for the duration of the learning period. Oxygen canisters are available in some shops, although they are often expensive and unwieldy. More

usefully, light exercise or even deliberately increasing breathing rate by a small amount will increase blood oxygen levels. For example, going for a walk while listening to something you want to remember on a walkman or mp3 player while should do the trick.

Glucose has a much longer term effect, as can be seen from [figure whatever]. Here the maximum available glucose peaks at about an hour, although it rapidly becomes available after it has been ingested. All energy giving foods are broken down into glucose at some stage, although at different rates. The graph charts the rate of pure glucose absorption, so best matches the effect of sugary drinks.



Glucose is important as a simple fuel, but is also used in the creation of the neurotransmitter acetylcholine. This chemical is particularly linked to memory, and its no accident that, like oxygen, extra glucose is linked to an increase in memory and learning ability [2]. Again, timing is crucial but not so much effort is needed to constantly maintain glucose levels. A well-timed sugary drink, thirty minutes to an hour before you have to remember or take notice of something particularly well should improve how well you remember it.

## End Notes

1. Scholey AB, Moss MC, Wesnes K (1998) Oxygen and cognitive performance: the temporal relationship between hyperoxia and enhanced memory. *Psychopharmacology*, 140, 123-126.
2. Meikle A, Riby LM, Stollery B (2004) The impact of glucose ingestion and gluco-regulatory control on cognitive performance: a comparison of younger and middle aged adults. *Human psychopharmacology*, 19 (8), 523-35.

## See Also

- Fuel for thought by Andrew Scholey:  
[http://www.bps.org.uk/\\_publicationfiles/thepsychologist%5CScholey.pdf](http://www.bps.org.uk/_publicationfiles/thepsychologist%5CScholey.pdf)