



Brain Workouts: What Helps Cognitive Fitness?

by

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Part I – Back from Break

Doors slammed, music blared, excited voices echoed through the hallways, and laughter was everywhere. Winter vacation was over and students were back in their college dorm, getting ready for the new semester and talking about what they did over the break. Darrell and Anthony, friends and roommates, had already unpacked their bags and were rearranging their room to accommodate Darrell's new, huge, flat-screen TV.

Anthony: Dude, this is so cool! But, if my grades go down, it's your fault. How are we going to get any work done with all the movies and gaming we'll have on this flat-screen?

Darrell: I know, right? Best gift ever from my parents. But, I couldn't use it much over break because my dad insisted that he needed to play a bunch of "brain games" on it. You know, those visual, attention, quickness, and memory games? He said those computer games are the best exercise for his aging brain and that they'll keep his memory from declining. Actually, when he said that, I laughed out loud, because it sounds bogus. But, he said there's research on it.

Anthony: Seriously, he said there's research on it? My dad claims the exact same thing about working out! He says scientific studies show that physical exercise helps slow down memory loss and other brain decline. That's why he's into running. Hah, we should get them together and have them debate.

Darrell: Yeah, they could debate it as they play brain games while running. Hey, wait. This is reminding me of stuff we learned in biopsychology last semester. Didn't we learn that new neurons are created, even in adulthood, but also that neurons are genetically programmed to die?

Anthony: Uh, I sort of remember that. It tied in with brain plasticity stuff, right? But wasn't it just about people with Alzheimer's disease?

Darrell: Hmm, I don't think so, but I can't totally remember.

Anthony: Hah, that's so ironic that we can't remember if it's about Alzheimer's.

Questions

1. What is brain plasticity?
2. What is the term that refers to the formation of new neurons?
3. What term refers to the genetically programmed death of neurons in the brain? Is this genetically programmed neuronal death only found in the brains of people with Alzheimer's disease?

Part II – Last Semester’s Notes

Anthony: Hey, what are you looking for?

Darrell: I’m trying to find my biopsych notes from last semester. It’s driving me crazy that I can’t remember that stuff about brain plasticity. Plus, I want to show my dad that he’s wrong about those brain games being good for his memory. He said it’s the idea of “use it or lose it,” but I think that’s just a slogan written on a T-shirt.

Anthony: Yeah, I seriously doubt my dad’s claim that running is both a physical workout and a brain workout. It sounds like some crazy thing he read in a fitness magazine. Ok, I’ll get my notes, too. Unfortunately, I sold my textbook, so I don’t have that.

Darrell: Yeah, me too. I needed the money. Ah, I found them! Ok, right here it talks about the development of synapses between neurons. It’s under the heading of “Synapse Formation and Maintenance.” Oh, yeah, I remember this. Synapses are where information is exchanged between neurons. Oh, and remember those things called dendritic spines and how we joked that it sounds like the name of a heavy metal rock band?

Anthony: Yeah, dude, that was hysterical. Looking at these notes I’m kind of starting to remember that lecture now. There were also a bunch of terms that sounded as though we were in a forestry class, remember that? There was sprouting. And branching. And arborization. Those totally cracked me up.

Darrell: Oh, yeah, that was so funny! I felt like a lumberjack in that class for a while. Hey, I found some other stuff here. Oh, neurogenesis: That’s the term for the creation of new neurons.

Anthony: Neurogenesis. Yep, that’s it. I’ve got that, too. My notes say that there are chemicals in the brain that help neurons grow and that help neurons survive instead of dying. Oh, and there are ones that help neurogenesis, too. But, I didn’t write down what those chemicals are. Do you have that in your notes?

Darrell: No, I think I was absent that day. But, all this stuff is exactly what we need to know in order to find out if our dads are right. Shoot, now I’m starting to think that my dad might actually be right about brain games and the whole “use it or lose it” idea.

Anthony: Yeah, maybe. But, I don’t really see anything in our notes that supports my dad’s idea that exercise helps the brain and memory.

Darrell: We can keep searching for answers later. In the meantime, our brains need games right now, so let’s test out the new flat-screen!

Questions

1. Explain what dendritic spines, sprouting, branching, and arborization are and how these concepts relate to synapses. Then, draw a picture that you could share with Anthony and Darrell that demonstrates these concepts and that will help them understand. Be sure to label the neurons’ other relevant structures, as well.
2. Anthony is correct that there are chemicals in the brain that help neurons survive, help promote neural growth, and are involved in neurogenesis. What are these chemicals called? What are two main ones that you’ve learned about? Do all neurons receive these chemicals? Why or why not?
3. Darrell’s father used the phrase, “use it or lose it.” What neuronal activities are related to this idea?
4. Darrell’s dad insists that there are scientific research findings supporting his claim that playing brain games helps one’s brain and keeps memory from declining, whereas Anthony’s dad insists that there are scientific research results supporting his claim that physical exercise helps one’s brain and slows memory decline. Based on what you’ve learned about synapses and about the chemicals that promote neural survival and growth, is one of the dads correct? Is neither correct? Are both correct? Give evidence to support your answer.
5. Which of these two “brain workouts” do you believe would be the most beneficial for you as you experience adulthood and aging? Why? Which of these brain workouts do you believe would be the most beneficial for you in terms of learning material in your current college classes? Why?

Resources

Brain Plasticity

BrainFacts.org. Accessed April 2016 from <<http://www.brainfacts.org>>.

DANA Foundation. Accessed April 2016 from <<http://www.dana.org>>.

Neuroscience Online: An Electronic Textbook for the Neurosciences. Accessed April 2016 from <<http://neuroscience.uth.tmc.edu/s1/index.htm>>.

"Brain Games" and the Brain

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Papp, K.V., Walsh, S.J., & Snyder, P.J. 2009. Immediate and delayed effects of cognitive interventions in healthy elderly: A review of current literature and future directions. *Alzheimer's & Dementia* 5(1): 50–60. doi: 10.1016/j.jalz.2008.10.008 Accessed April 2016 from <https://www.researchgate.net/publication/23715998_Immediate_and_Delayed_Effects_of_Cognitive_Interventions_in_Healthy_Elderly_A_Review_of_Current_Literature_and_Future_Directions>.

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Exercise and the Brain

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