

## Brain-Science and Natural History

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My personal quest for bio-science understanding started in earnest related to my family history with stroke. New research available on brain-science offered promising knowledge I wanted to learn. At the same time I have been acquiring skills and knowledge in natural history and sharing that with others. As I pursued my interest in brain science I was convinced being outdoors and following my passion for all things natural history relates very well to promoting brain health. That's what this essay is about.

I learned about new techniques for treating strokes that have positive effects months and even years after the brain attack. There are technologies for helping people overcome speech, motor movement control and balance problems from stroke, as well as MS and other debilitating neuro-diseases. Pain control methods are reaching into cognitive functioning for control. I found developing therapies ranging from learning disorders, Parkinson's disease, chronic migraines, brain trauma and autism to name a few. Cognitive function and memory are amenable to training and stimulation in ways few people even guessed a couple decades ago. I found brain science is promising to people of all ages who have a brain and want to keep using it into their old age.

At the basic research level, brain-science has discovered and explored plasticity in brains of every living organism (with a brain) regardless of age. Researchers found cancer patients were forming new brain cells the day they died, and these were seriously diseased brains! Brains learn to transfer control to undamaged areas after serious injuries. Globally damaged brains learn to re-organize and control massive confusion after brain trauma from explosions, brain disease, stroke and even significant removal of brain tissue due to accident or surgery.

The effects of aging on human brains has a tragic effect on far too many seniors. It's an old story I first glimpsed in developmental psychology class fifty years ago. It hasn't gotten prettier for those who do the same things people did fifty years ago as they aged: More sitting with less exercise, less social stimulation, and little new learning as they grew older. The human brain starts life with little organization and understanding and over the years, the brain slides back into that same noisy situation unable to control the brain, differentiate the world and loses control of body machinery to reach a level close to infants. Fortunately most people expire before such an extreme. We all know of glowing exceptions where the ancient among us live full and glowing lives.

Brain-science has studied the problem of the aging brain in addition to the impact of disease and trauma and has discovered what it takes to slow, stop or even reverse the aging process. Even more fortunately, I found many of the outdoor natural history activities fit the recommendations for keeping your brain in top condition or restoring it if it has been injured. Here's the short list:

1. Learn something new. Most of us avoided learning anything new since we went to school, or when we started our first couple of jobs. After that we relied on the same skills and extended our knowledge incrementally trying to keep from doing anything requiring too much effort or pain in learning.
  - a. With Natural history, unless ecological biology, geology, botany, ornithology etc. were part of your career, you step up to learning a new knowledge base and skills. If you want incentive for increasing your knowledge of local birds, here it is. If the phenological cycle of local plants interests you, start your own study in your backyard. If phenology is a new concept, research it and then dive in.
  - b. The more difficult it might seem, the more you benefit from learning. If Latin wasn't part of your formative years, learning Latin names could refresh brain cells that haven't fired in awhile. Rousting those brain cells for new learning makes all learning easier and creates a better functioning brain.
2. Make your brain focus on more things. Older eyes tend to scan less and less of what's in front of our faces. As we age we slow that process and every other cognitive function. Being outside stimulates your brain to focus on a wider range of subjects with greater depth of field. Getting off the highway with continuous life and death decisions means you can change from drilling your focus on oncoming traffic and the undulations of the road to looking at what is happening around you.
  - a. Take birding as an example: It requires scanning with rapid eye movement **everywhere** to see where there might be birds. In addition, birders get interested in identification. How does that work with vision? It means learning to match shape, color, behavior, and size with the possible target. Trying to predict where a bird might be involves imagination, prediction and planning.
  - b. Birds move with great rapidity and through a distracting environment creating fleeting glimpses. This is great motivation for teasing the brain to push faster and pull together phenomenally small bits of data to create a pattern out of data that has small resolution. Great work when you can get it!
  - c. Can you find the bird with your binoculars and get your camera on it with your other hand and then focus and change settings for lighting and depth of field? Can you catch it flit out of range as you move your technology into place? Can you look up the bird in the smart phone app while watching it? Predict where it might show up next through the brush? All these very sophisticated skills of tracking, predicting, using eye-hand coordination are well worth practicing to stretch your brain cognition.

- d. Birds make calls and noises that aid your ability to find and identify species. Memory for songs matching specific birds is another challenge to aid in practicing crucial new skills.
  3. So that brings us to speed. We....slow...down. We slow eye movements and limit the range we scan. Television is great training for the slowing process. We speak slower and even hear slower and take longer identifying visual targets unless we practice things that are faster. If you listen to children you'll find their speech is rapid and sometimes a blur. Trying to hear them is highly motivating experience so you can catch their nature story and be ready to stimulate the next step or take their question and push it along the path of discovery. The more quickly the human brain works the better the connections for making meaning of life and all the sources of information we encounter. Otherwise our own slowing brain becomes a noisy environment competing with external stimulation. We need practice to keep up.
    - a. That flitting bird, that skimming dragonfly, the chance encounter with a gopher above ground or a flirt of yellowish light that might have been a mountain lion are stimulation we can use to stay sharp and take life to the fullest. Being right doesn't matter, being ready and catching enough to wonder does! Sharing that with each other and students and adults is the passion of natural history students and docents regardless of age.
    - b. Hearing fits here as well. Is that sound a squirrel or is it a bird? Would that be a robin or am I hearing a scrub jay? Can I differentiate that bird sound from the traffic noise in my neighborhood?
    - c. What does it remind you of? That memory trace needs a massage and a kick in the starter once in a while to make sense of the world. The more memories you have the more opportunities for developing unique patterns, push them to the limit!
4. Skills for the brain have been broken into a series to help design skill building based on research by Michael Merzenich and others:
  - a. Attention which has to do with tracking, avoiding being distracted, and parsing out target from background.
  - b. Brain Speed involves rapidly engaging your brain in visual sweeps of the environment, listening to a range of sounds for specific matches and being able to select a pattern rapidly from fast moving targets. Faster is important to brain function, while "taking it easy" is the old key to retirement but it is credited with developing overwhelming brain noise. More green time, less screen time for adults!
  - c. Memory loss is the senior-adult fear of our age. The key to developing resilience to memory requires cleaning up the information flow to your brain, not practicing remembering! Differentiating among tasks, being able to hear and see with acuity and being able to organize incoming data so it's possible to recall are the skills required for memory optimization.

- d. People Skills and recognition help connect our social fabric and perform well handling social situations. Working with people making decisions together and listening carefully for instructions and for questions improves this skill. In learning and teaching natural history, we make multiple decisions in this realm while challenging ourselves and any audience and delivering relevant information on a level fit to age and experience.
- e. Intelligence means cognitive functioning that connects patterns with memory and interpretation of clues and solving problems or mysteries. Certainly the process of understanding the complexity of nature is the very essence of what is needed for posing the best questions, implementing naturalists' observations in a scientific manner.
- f. Navigation and way-finding are essential and prone to confusion. What better place to keep in practice than on the trail? We locate and hike an area. We share directions and find things we want to share and navigate our way back or recall for later use.

While it is true that repetitive practice, like crossword puzzles, could increase your puzzling ability it these simple pleasures have not been found to help with other learning or memory tasks. Activities that improve the speed of your brain or learning new content and skills are effective with other cognitive tasks, because of their novelty, forcing your brain to fire in new ways and maintaining the data input stream from your senses to the cognitive machinery and memory banks.

Here is an example of research that makes this case for birders:

<http://palomaraudubon.org/vanderbilt-university-birding-expertise-project-looking-for-birders-of-all-levels-to-help-with-their-study/>

Another factor in jolting your aging brain back into the high-speed lane is to look for meaning in learning. Merzenich, says "...adult plasticity – which actually begins in early childhood -- only occurs when the brain is excited in particular, specific behavioral contexts. Rather marvelously, the older brain only permits change when it judges that change to be important, rewarding or good for it." So being involved with subjects related to your passions exactly fit the criteria of being important, rewarding and worth learning. Tune into nature and develop your skills and knowledge and even better, share your learning with others. You tune up your brain and most likely, exercise your limbs, heart and lungs.

I also ran across a surprising finding about how we walk. In America we tend to smooth everything out to make it safer and easier to get about. Good idea, right? Probably, but only to a point. Researchers found when people regularly encounter uneven cobbles or trails, their balance improves. Later in life they are better able to avoid falling. If your brain doesn't practice looking for and adjusting to uneven terrain,

you lose the ability to constantly practice the balance between foot bottom, body position and visual input. To compensate for failing balance, one might start looking at the walking surface. That interferes with walking erect with eyes looking to the distance and has the counterproductive effect of disturbing your balance. This is another argument for getting off the sidewalk and out on the trail! Over and over, findings in neuro-science suggest we need to go back to natural environments to make our equipment; our brains and bodies, work better.

On a search through the literature, aerobic exercise came up repeatedly as the best self-controlled method for keeping cognitive functions in top condition. There is no drug, chemical or supplement that can compare. Climbing a hill to search for mushrooms, might be a great way to keep balance and heart in shape. Taking kids for a hike in the woods is a motivating and moving experience with positive outcome for brain and body.

Barry Lopez suggested decades ago, it shouldn't be a surprise we crave natural environment as our personalities were forged in the wild. After all, he points out, the wild is where our personalities were forged. E. O. Wilson coined the word biophilia: a natural attraction to nature. We benefit from experience with wild environments. When researchers found recovery much faster for patients with a view of nature, it was not such a surprising outcome. We simply function better with nature in our lives.

Learning to learn like a child in the wilderness again will wake up your brain and preserve your memory. Connect with the earth, go out to find and learn new things, enjoy your encounter and love it enough to make a place for it in your brain and your heart. Finally, share it with another kid so you lock it in tight where you can find it to use again and again. The idea that the brain is like a muscle that grows with exercise is not just a metaphor, its a fact of life well focused on nature.

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