

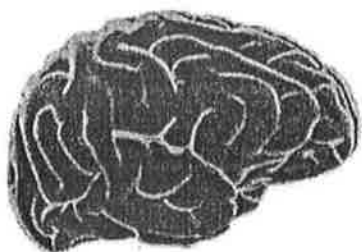
You Can Grow Your Intelligence

New Research Shows the Brain Can Be Developed Like a Muscle

Many people think of the brain as a mystery. They don't know much about intelligence and how it works. When they do think about what intelligence is, many people believe that a person is born either smart, average, or dumb—and stays that way for life.

But new research shows that the brain is more like a muscle—it changes and gets stronger when you use it. And scientists have been able to show just how the brain grows and gets stronger when you learn.

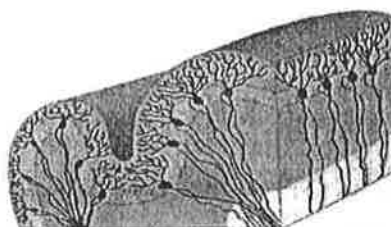
Everyone knows that when you lift weights, your muscles get bigger and you get stronger. A person who can't lift 20 pounds when they start exercising can get strong enough to lift 100 pounds after working out for a long time. That's because the muscles become larger and stronger with exercise. And when you stop exercising, the muscles shrink and you get weaker. That's why people say "Use it or lose it!"



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But most people don't know that when they practice and learn new things, parts of their brain change and get larger a lot like muscles do when they exercise.

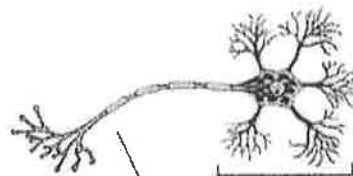
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A section of the cerebral cortex

Inside the cortex of the brain are billions of tiny nerve cells, called neurons. The nerve cells have branches connecting them to other cells in a complicated network. Communication between these brain cells is what allows us to think and solve problems.



Axon — Dendrites

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A typical nerve cell

When you learn new things, these tiny connections in the brain actually multiply and get stronger. The more that you challenge your mind to learn, the more your brain cells grow. Then, things that you once found very hard or even impossible to do—like speaking a foreign language or doing algebra—seem to become easy. The result is a stronger, smarter brain.

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How Do We Know the Brain Can Grow Stronger?

Scientists started thinking that the human brain could develop and change when they studied animals' brains. They found out that animals who lived in a challenging environment, with other animals and toys to play with, were different from animals who lived alone in bare cages.

While the animals who lived alone just ate and slept all the time, the ones who lived with different toys and other animals were always active. They spent a lot of time figuring out how to use the toys and how to get along with the other animals.

Effect of an Enriched Environment



Nerves in brain of animal living in bare cage



Brain of animal living with other animals and toys

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These animals had more connections between the nerve cells in their brains. The connections were bigger and stronger, too. In fact, their whole brains were about 10% heavier than the brains of the animals who lived alone without toys.

The animals who were exercising their brains by playing with toys and each other were also "smarter"—they were better at solving problems and learning new things.

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Even old animals got smarter and developed more connections in their brains when they got the chance to play with new toys and other animals. When scientists put very old animals in the cage with younger animals and new toys to explore, their brains also grew by about 10%!

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Children's Brain Growth

Another thing that got scientists thinking about the brain growing and changing was babies. Everyone knows that babies are born without being able to talk or understand language. But somehow, almost all babies learn to speak their parents' language in the first few years of life. How do they do this?

The Key to Growing the Brain: Practice!

From the first day they are born, babies are hearing people around them talk—all day, every day, to the baby and to each other. They have to try to make sense of these strange sounds and figure out what they mean. In a way, babies are exercising their brains by listening hard.

Later, when they need to tell their parents what they want, they start practicing talking themselves. At first, they just make goo-goo sounds. Then, words start coming. And by the time they are three years old, most can say whole sentences almost perfectly.

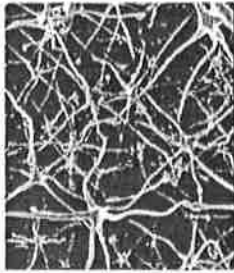
Once children learn a language, they don't forget it. The child's brain has changed—it has actually gotten smarter.

This can happen because learning causes permanent changes in the brain. The babies' brain cells get larger and grow new connections between them. These new, stronger connections make the child's brain stronger and smarter, just like a weightlifter's big muscles make them strong.

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Growth of neuron connections in a child from birth to 6 years old

At birth



At age 6

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The Real Truth About "Smart" and "Dumb"

No one thinks babies are stupid because they can't talk. They just haven't learned how to yet. But some people will call a person dumb if they can't solve math problems, or spell a word right, or read fast—even though all these things are learned with practice.

At first, no one can read or solve equations. But with practice, they can learn to do it. And the more a person learns, the easier it gets to learn new things—because their brain "muscles" have gotten stronger!

The students everyone thinks as the "smartest" may not have been born any different from anyone else. But before they started school, they may have started to practice reading. They had already started to build up their "reading muscles." Then, in the classroom, everyone said, "That's the smartest student in the class."

They don't realize that any of the other students could learn to do as well if they exercised and practiced reading as much. Remember, all of those other students learned to speak at least one whole language already—something that grownups find very hard to do. They just need to build up their "reading muscles" too.

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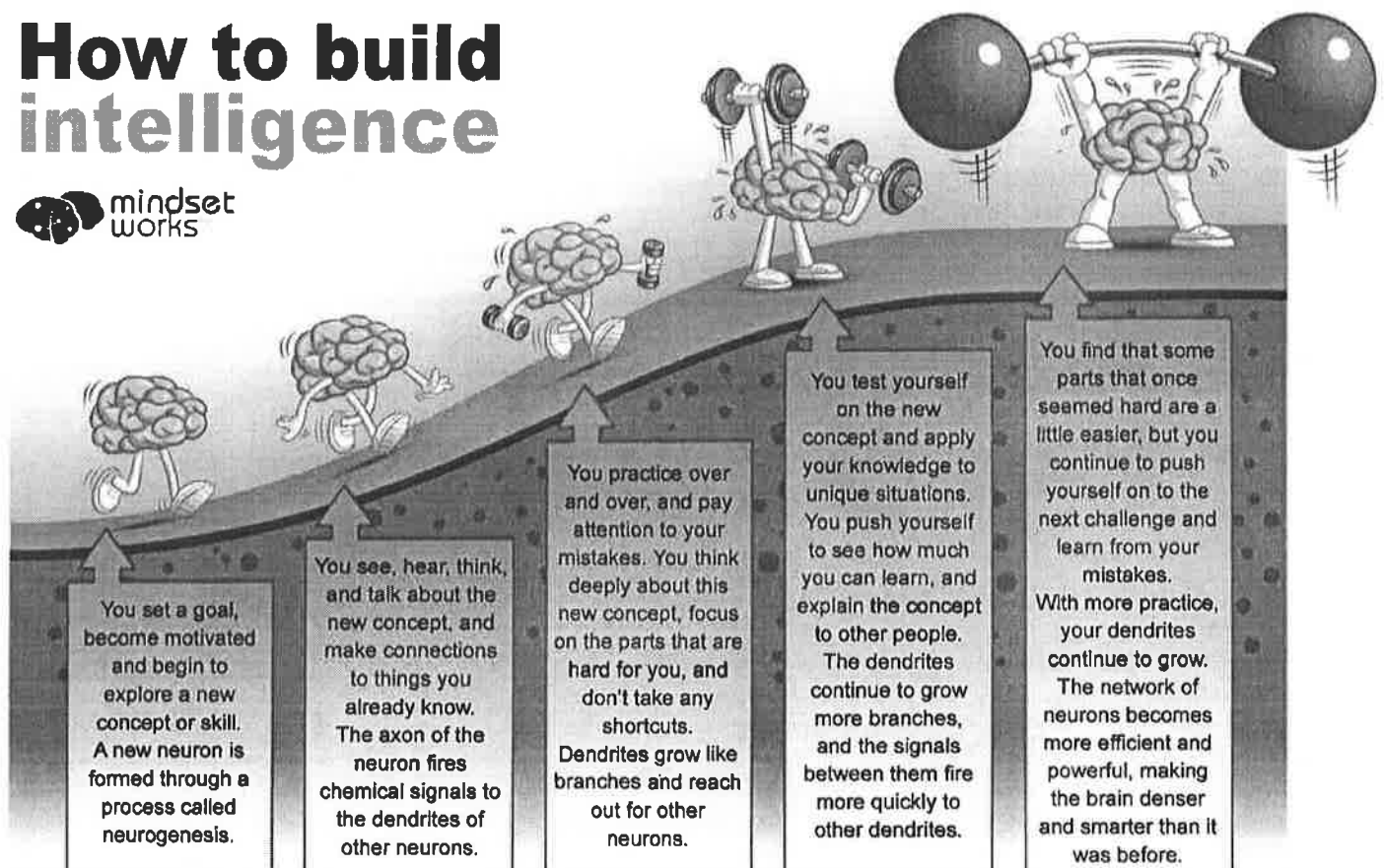
What Can You Do to Get Smarter?

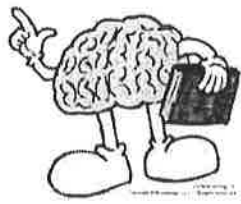
Just like a weightlifter or a basketball player, to be a brain athlete, you have to exercise and practice. By practicing, you make your brain stronger. You also learn skills that let you use your brain in a smarter way—just like a basketball player learns new moves.

But many people miss out on the chance to grow a stronger brain because they think they can't do it, or that it's too hard. It does take work, just like becoming stronger physically or becoming a better ball player does. Sometimes it even hurts! But when you feel yourself get better and stronger, all the work is worth it!

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How to build intelligence





Your strategy for
ANY big problem!

B.reak it down

R.epeat

A.ction

I.nformation search

N.ever give up!



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Effective Effort Rubric

This rubric assesses the learning process and the effective effort that a learner applies.

	Fixed	Mixed	Growth
Taking on Challenges	You don't really take on challenges on your own. You feel that challenges are to be avoided.	You might take on challenges when you have some previous experience with success in a related challenge.	You look forward to the next challenge and have long range plans for new challenges.
Learning from Mistakes	You see mistakes as failures, as proof that the task is beyond your reach. You may hide mistakes or lie about them.	You may accept mistakes as temporary setbacks, but lack strategies to apply what you learned from the mistakes in order to succeed.	You see mistakes as temporary setbacks, something to be overcome. You reflect about what you learned and apply that learning when revisiting the task.
Accepting Feedback and criticism	You feel threatened by feedback and may avoid it all together. Criticism and constructive feedback are seen as a reason to quit.	You may be motivated by feedback if it is not overly critical or threatening. Who is giving the feedback, the level of difficulty of the task, or their personal feelings might all be factors in your motivation.	You invite and are motivated by feedback and criticism. You apply new strategies as a result of feedback. You think of feedback as being a supportive element in the learning process.
Practice and Applying Strategies	You do not practice and avoid practicing when you can. You do not have any strategies for accomplishing the learning goals or tasks, or you apply ineffective strategies.	You practice, but a big setback can make you want to quit. You are willing to practice things you are already considered "good at." You are open to being given a strategy to meet a challenge, but you rarely apply your own new strategies.	You enjoy the process of practicing and see it as part of the process of getting good at something. You may create your own practice or study plans. You fluidly use many strategies, think of some of your own strategies, and ask others about their strategies.
Perseverance (focus on task)	You have little persistence on learning goals and tasks. You give up at the first sign of struggle.	You may persevere with prompting and support. Unless you are provided strategies for overcoming obstacles, you will stop or give up.	You "stick to it" and have stamina for the task(s). You keep working confidently until the task is complete.
Asking Questions	You do not ask questions or do not know which questions to ask, but you can usually say you don't "get it" if asked.	You might ask questions about a portion of the task that you feel you can do. If you perceive it to be out of your ability, you probably won't ask questions.	You ask specific questions, ask questions about your own thinking, and challenge the text, the task, and the teacher.
Taking Risks	You do not take risks, and if something is too hard you turn in blank work or copied work, if anything at all. You are not engaged in the process/task.	You will take risks if the task is already fairly familiar to you. If not, you will resort to copying or turning in partially completed work.	You begin tasks confidently risk making errors, and openly share the work you produce.