**Neuroplasticity as a Non-stimulant Treatment of ADHD**

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As a parent, I noticed how my two oldest son's as preschoolers, were both extremely active, especially as they made cognitive gains. I pondered whether movement and brain growth had anything to do with each other. I had noticed that whenever there was a cognitive developmental leap, preceding it was that my two boys would become more intellectually and physically active. Could movement be stimulating their brain growth causing a leap in ability and learning?

This led me to the next question to ponder.

That is: Could it be that by giving stimulant medication, to children short-circuiting the brain into not producing the vital neurons for learning? Despite the improvement in behavior, there appeared to be no gains in ability and learning.

I became interested in neuroplasticity while looking for alternative treatment of ADHD. One of my own sons was diagnosed by a neuropsychologist and two psychiatrists being diagnosed with ADHD. My son received a neuropsychological evaluation and given every possible, conceivable test stating that my son had ADHD. After being taken off the medication, my son got straight an in conduct, made the honor roll, not taking any medication whatsoever.

At that point, I knew I was onto a possible alternative treatment to ADHD. I also knew that the medication that the children that I was working with would work in the beginning and then stop working. The doctors would prescribe higher and higher doses in order to attain the same result. Eventually many of these kids behavior became more and more "out of control". Instead of getting better, their behavior was getting worse. I was seeing children being hospitalized while taking a cocktail of medications and still ending up in a locked facility in order to control their behavior. The ambulance at the school has become a routine event. I was working in an inner city school, and many of the children I was working with were instead of graduating and going to college, they were dropping out of school and ending up in prison.

Having spoken to countless parents who have told me how their children were affected by that medication, how they couldn't sleep at night, how their children lost weight. One parent told me that her child looked like a concentration camp survivor.

Back then Adderall and Ritalin were being touted as miracle drugs and children were being prescribed this medication at a younger and younger age.

Knowing that both of these drugs were amphetamines and pondered the risk of taking the medication and its risk addiction factor. The question arose as to whether this drug could cause brain damage. I asked my son's pediatrician about the safety of this medication given that both of these drugs are known to cause weight loss and sleeplessness, he stated that the risk of my son

having ADHD and not being treated, had a very bad outcome. He described how kids with ADHD end up going to jail, and doing poorly in school, not having any friends, and that the drug actually improved not only the overall behavioral outcome of the child, but also cognitive performance.

Having researched where ADHD drugs were most prescribed and then looked at where drug addiction was most prevalent. The result was scary, as there was a nearly perfect match. Today, Manchester and Nashua NH have a severe drug addiction problem. This past year it is reported that there were 75,000 drug overdoses resulting in death and drug addiction is responsible for one out of every 4 deaths in adolescents.

In 2004, the child medication safety act was passed. Before that parents, could be charged and were being charged with medical neglect for not giving their child the ADHD medication. Parents who refused to medicate their child faced the wrath of the courts and the Department of Social Services banging down the door and yanking their kids away to a foster home in many cases a group home bunched together with children adjudicated as delinquent, where they were forcibly medicated.

He has pretty angry and said that what I was saying was true and that if my son lost weight that was the doctor's fault. Having spoken with another renowned physician who reiterated what my pediatrician said, about that the risk of an ADHD child ending up in prison outweighed the risk of the medication, even if it caused stunting of growth and diminished intellectual capacity because the risk of the child ending up in prison. This is a paradox because the United States has the world's highest incarceration rate, yet had the highest rate of prescribing by far than any other country in the world.

When I spoke with Shire Corporation about the medication problems my son was having, they said that Adderall doesn't cause any kind of side effect. It was all in my head, and that I should refer all these questions back to my pediatrician.

According to the American Psychological Association:
"Stimulant drug abuse packs a triple-whammy to people's decision-making abilities, hampering their reasoning and increasing impulsive and compulsive behaviors, according to research presented at APA's 2011 Annual Convention by Trevor W. Robbins, a behavioral and clinical neuroscientist at the University of Cambridge in England."
https://www.apa.org/monitor/2011/10/stimulants.aspx

On my caseload was an eight-year-old student who was in the third grade and who was extremely disruptive, yet on the highest dose possible for ADHD medication. He was titrated off the ADHD medication after I spoke with the child's pediatrician at the request of his mother.

As it turned out, the child was being bullied and he was moved to another class and I developed a comprehensive behavior plan with the input of the boy's mother and his classroom teacher. The results were remarkable.

MRI studies of the brains of children and Adults diagnosed with ADHD have found that their brains are actually smaller and less developed. Stimulant medications were quickly scrubbed out as a causative factor, even though it was well known that the same result was occurring in the laboratory rats who had been fed ADHD meds, as neurotoxic means that brain cells are dying and therefore the brain is smaller.

The only apparent difference was that researchers had the opportunity to dissect the brains of the rats and make the discovery that Amphetamines are neurotoxic in the laboratory at the same titrated dosage given to children.

Today's schools have often cut out Physical Education especially in the poorly funded schools, as part of the draconian educational system based on "benchmarks". This was done despite that fact that children learn differently. Some children learn to read at a later age and even become very proficient in reading.

Teachers follow scripted prewritten lesson plans with little opportunity for any discrete changes. The kids are often fed on low-quality junk food that only meets the minimal standard of nutrition. It is now known that high carbohydrate junk food causes dementia and diabetics in adults, however, the political powers that be in place, feel that it is perfectly fine to feed kids a high carb diet and then prevent them from moving for eight hours a day.

When I was teaching at the Saudi Arabian International Schools in Jeddah, our test scores were off the charts, being in the 99th percentile for on the Standard Achievement Tests. Our K-9 students were admitted to Andover Academy and Choate on their way to the Ivy League Schools. Yet we always had recess and physical education every day. Our school year was 175 days and school got out around 2:00 PM. When I was in China, physical education was an integral part of the school program along with rest periods.

In college, as a biology major before studying psychology, I had learned that brain cells do not regenerate. It took a very long time to persuade psychologists and psychiatrists to give up their long-held belief that new neurons could not be formed in the brains of adults, but there is no longer any doubt about it.

It is now well-established that strenuous physical exercise stimulates the birth of new neurons in part of the brain that is critical for memory, the hippocampus.

It is now known that the molecular and cellular details explaining how exercise stimulates the birth of new brain cells have been worked out now in great detail. Immature non-neuronal cells in both the child and adult brain (glia) respond to protein growth factors that are generated in the body during robust physical activity. These growth factors stimulate the mother cells to spawn new neurons in the hippocampus. Amazingly, these nubile neurons then migrate through brain tissue to find their proper place in the neural circuitry.

Even more remarkable, new research proves that the new neurons are then able to wire themselves into the existing network of connections to boost performance in memory, just like adding RAM chips does for a laptop.

It is now known that animals forced to exercise also have a much slower cognitive decline in aging compared to sedentary Age-mates.
Neuroplasticity-based treatments have been proven to help adult stroke victims and people with schizophrenia," according to Dr. Wexler "Since the plasticity of a child's brain is much greater than an adult's, the potential for cognitive improvement is therefore also much greater."
Dr. Wexler worked in collaboration with Professor Jinxia Dong, a former Chinese national gymnast, and director of the Research Center for Sports Studies and Society at Peking University in China, to develop the physical exercise component. This has led to the first cognitive development program with the integration of physical and computer exercises to improve a child's ability to think, focus, learn, and socially interact.

The program developed by Dr. Wexler is for children ages 5-9. "A prototype evaluated in Beijing during the summer of 2010 produced cognitive gains similar in magnitude to a 10-point increase in cognition. An improved version of the program showed similarly promising results this past summer with children from New Haven Reads." https://www.c8sciences.com/c8-sciences-founder-bruce-wexler-awarded-4-million-nih-grant-for-adhd-research

**The Importance of Math and the Treatment of ADHD**

While I was working under the supervision of Dr. Matthew Israel, I witnessed a radical change in behavior of students who were being treated for ADHD without the use of psychotropic medication. One 11 year old boy who has been on a cocktail of many medications and one "out of control" had now been placed at the residential treatment center.

He was gradually titrated off all of the medications. We noticed that as his ability to attend and focus improved so did his math skills and abilities.

This was very exciting news, as math is inherently an executive functioning task, by its very nature. Math requires the ability to store information on a short term basis to be analyzing and to synthesizing this information. Poor Executive functioning is one of the most important factors in the diagnosis of ADHD. This would support that if you improve math skills and abilities, you also are treating ADHD at the same time.

Among extremely bright American, Indian and Chinese students who excel in math, there is a very low incidence of ADHD.

**The Importance of Exercise in the Treatment of ADHD**

In China Aerobic exercise, before school begins, is part of the school curriculum. Shanghai China, has among the highest test scores in math in the world.

It is now knows that aerobic exercise, increases neural growth and brain development, probably the most important facet of the application of the use of Neuroplasticity to increasing attention

and focus, behavior and learning. This finding is contrary to what is purported to be high quality education- That is the mantra of charter schools- The more class hours and time spent on learning, the greater gains in overall learning capacity.

According to **Science Daily**:
"Aerobic exercise, such as running, has positive effects on brain structure and function, for example, the generation of neurons (neurogenesis) in the hippocampus, a brain structure important in learning. It has been unclear whether high-intensity interval training (HIT), referring to alternating short bouts of very intense anaerobic exercise with recovery periods, or anaerobic resistance training has similar effects on hippocampal neurogenesis in adulthood. In addition, individual genetic variation in the overall response to physical exercise likely plays a part in the effects of exercise on adult neurogenesis but is less studied.

Researchers from the Department of Psychology and from the Department of Biology of Physical Activity at the University of Jyväskylä studied the effects of sustained running exercise, HIT and resistance training on adult hippocampal neurogenesis in adult male rats. In addition to the commonly used Sprague-Dawley rats, rat lines developed by collaborators at the University of Michigan were also used: Rats with a genetically high response to aerobic training (HRT) and those with a low response to aerobic training (LRT). The exercise training period was 6 to 8 weeks (running, HIT or resistance training) during which control animals of the same rat line/strain remained in sedentary conditions in the home cage.

The results indicate that the highest number of new hippocampal neurons was observed in rats that ran long distances and that also had a genetic predisposition to benefit from aerobic exercise: Compared to sedentary animals, HRT rats that ran voluntarily on a running wheel had 2-3 times more new hippocampal neurons at the end of the experiment. Resistance training had no such effect. Also the effects of HIT were minor. To conclude, only sustained aerobic exercise improved hippocampal neurogenesis in adult animals."

https://www.sciencedaily.com/releases/2016/02/160208083606.htm

If fact without new neuron development, learning is delayed.

## The Importance of a Healthy Diet in the Treatment of ADHD

It is now too well known that a high carbohydrate diet leads to obesity and Insulin resistance, with some children developing diabetics in their early teens. What is not talked about is that these foods, can present with fatigue which means the child can become easily distracted as they are unable to focus due to fatigue.

A solution, which has already proven to be very effective in both public and private school is to maintain a healthy diet.

While working as a school psychologist, I have noticed many students, who were middle class, their families were still struggling to buy food, as a result of the family mortgage and student

loans. Under the current food stamp program regulations, these families are ineligible for student loans.

Therefore I consider a healthy diet as a treatment for ADHD. In addition, Concerta, Adderall is an appetite suppressant would be expected to influence nutrition in children.

**Toxins in the Environment**

According to Attitude Magazine- a Magazine Dedicated to the treatment of ADHD:

'Scientific research suggests that exposure to toxic chemicals — everyday toxins found in foods, carpeting and flooring, cleaning and lawn products, and personal-care products, like toothpastes — may contribute substantially to disorders such as ADHD, autism, and learning disabilities. Infants and children are especially vulnerable to toxic chemical exposure because their biological systems are still developing. During fetal development, exposure to even minuscule amounts of toxins at critical junctures can have a lifelong impact on the child's brain and physical health. When toxins disrupt brain development, disabilities like ADHD can occur.'

Therefore, in the treatment of ADHD, it would be logical to assume that taking care to remove as many environmental toxins, from the child's environment.

The treatment of ADHD using the approach as expressed here also includes 504 accommodations, specialized instruction and evaluation.

If a child is not making effective school progress, even after the schools evaluation, then an independent evaluation may be warranted. Often schools will try to get away with just providing a 504 accommodation on the doctor's orders. Traditionally, this has meant the child going to the nurse to be given his/her ADHD pill and a front row seat in the classroom. The work may also be broken down and directions modified.

An independent evaluation, often uncovers an undiagnosed learning disability or event giftedness. A gifted child, may be bored in school and make mischief to entertain himself and the class. This can lead to a power struggle between the child and the teacher. The best solutions, often involve the parent and have the parent work with the child to ameliorate the behaviors.

Often a parent will jump to get a neuropsychological evaluation. The problem with this is that the brain in neuro-plastic to begin with and today's diagnosis may not be relevant in a couple of months or years. A psychoeducational evaluation, even can have more weight in the regular classroom.

Parental Supervision, is probably the most influential effect in terms of school success because it has been shown conclusively that the more time that a parent spends with their child, the better the outcome. Yet public school education often rants that the time spent in school and on

homework are most important, however the research does not prove this out. I mention this because children diagnosed with ADHD, often have poor school outcomes.

This leads to ask the question: What is the best treatment for ADHD using a neuroplasticity approach?

What I am stating here is that what some parents are doing with their child who are achieving school success without their child having been diagnosed with ADHD may be the best approach combined with what I stated above.

First and foremost, this is an educational approach to the management and treatment of ADHD , with School Psychologists, Special Education teachers and Parents taking the lead in conjunction with the consult of the pediatrician or a neuropsychologist, if available and affordable.

**The Regimen:**

1. Schools implement an aerobic exercise program in the morning for at least 30 minutes, with maximum benefit of an hour. If this is not possible, at home have the child complete 15-30 minutes before going to school.

2. Do not spend an excessive amount of time on homework. Especially avoid power struggles. If the math homework assignment is too difficult for you to complete, it is probably too difficult for your child to complete. A good example is a student that I was helping with parent to complete a math assignment, had no textbook and no information except the child's notes, in which the child not the very best note taker. As we completed the problems, the last two were impossible to complete unless you used calculus. The writer of the work sheet apparently did not have a good understanding of advanced math, which can happen.

3. Focus on math and math problems solving using a like Singapore approach. This means having similar math problems already worked out completely, an answer key and a focus on the concepts of math and especially numeration.

4. A daily routine, with exercise built into each day both morning and evening during school days. Karate, Judo and just about any sport involving an aerobic activity is beneficial, so before foregoing sports as a punishment for bad grades, you should consider that.

5. Maintain a healthy diet for the entire family. Cocoa is a natural stimulant and is a natural vasodilator. Flavanol-rich cocoa induces nitric-oxide-dependent vasodilation in healthy humans, which would naturally have similar benefits as Guanfacine a standard non-stimulant ADHD Medicine. It also a mild stimulant, as well has having protein and

nutrients. Limit bread, high fructose corn syrup, potatoes, potato chips, candy and artificial ingredients. A lot of Artificial Ingredients are banned in Europe, China, and Russia. Consider there is a reason for this.

6. At home, maintain a routine, and stick to it. Allow for an enough time for homework, sleep, meals, exercise and entertainment.

7. Don't let a teacher give your child assignments that are politically correct but are useless in Education. High stakes testing does not work in the long run, because it is too restrictive for learning disabled children.

8. Avoid Toxins in the environment. Artificial coloring, mercury, lead, cadmium, and other toxic substances, can cause damage. Lead and Mercury are known neurotoxins and can cause brain damage.

9. Do not be over reliant on a behavior plan, as first and foremost the behavior plan should be a dynamic one as behavioral expectations take place over time.

I spent some time in China and what I saw and heard from both teachers and parents that behavior issues were few and far between. Children are in classes of as many as 60 children and continue to do well both academically and behaviorally. One plausible reason for this that the approach is to child behavior is distinctly different from the western approach. Children with behavior issues are not considered a mental health issue, but on a more basic and natural approach. One teacher put it simply to me. Children are like animals and need to be trained. Putting that into a more western language approach: Children are human and need to be educated.

All children at one point or another tend to misbehave.

Recommendations for the treatment of ADHD within the school setting:

**Recommendations to build Processing**

Overall, the child's processing speed scores are an area of relative weakness, indicating that this is a potential area for intervention. Children with relatively low processing speed may work more slowly than same-age peers, which can make it difficult for them to keep up with classroom activities. It is important to identify the factors contributing to the child's performance in this area; while some children simply work at a slow pace, others are slowed down by perfectionism, problems with visual processing, inattention, or fine-motor coordination difficulties. In addition to interventions aimed at these underlying areas, processing speed skills may be improved through practice. Interventions can focus on building the child's speed on simple timed tasks. For example, he can play card-sorting games in which he quickly sorts cards according to increasingly complex rules. Fluency in academic skills can also be increased through similar practice. Speeded flash card drills, such as those that ask the student to quickly solve simple math problems, may help develop automaticity that can free up cognitive resources in the service

of more complex academic tasks. Digital interventions may also be helpful in building his speed on simple tasks. During the initial stages of these interventions, the child can be rewarded for working quickly rather than accurately, as perfectionism can sometimes interfere with speed. As his performance improves, both accuracy and speed can be rewarded.

**Recommendations for School Difficulties**

When possible, the child should be presented with new material in a small-group setting. This will allow for fewer distractions and will allow the teacher to monitor the child's learning more closely.

Teachers are encouraged to provide frequent, immediate, and specific feedback on the child's task performance. This is particularly important as the child is learning new skills. For example, rather than using a vague statement such as "Try again," a more effective phrase could be, "You added these two numbers, but you should have added these two instead." Immediate feedback regarding incorrect practice or response patterns should reduce the need for retraining.

Teachers are encouraged to make tasks concrete whenever possible by providing manipulatives, pictures, models, diagrams, and graphs.

Teachers are encouraged to repeat new concepts in a variety of ways to provide the child ample opportunity to generalize and internalize the new material.

Teachers are encouraged to provide maintenance activities for newly mastered skills and concepts to ensure that the child's retains novel learning.

It is recommended that assigned tasks and activities be appropriately challenging for the child's ability level. Positive reinforcement can be given at home and school before, during, and after the child successfully completes a task. Giving the child appropriately challenging work can help build his self-esteem and sense of accomplishment.

The child's activities could be shortened and then gradually lengthened. For example, if the child's is required to complete ten arithmetic problems, the teacher might first give him two problems and then gradually increase the number presented.

In order to ensure the child's understanding of a task, it may be helpful if directions are presented one at a time and he is asked to rephrase the directions prior to proceeding with the task.

The child could bring his homework home and review materials covered in class. The teacher may wish to assist him in developing a homework log in which assignments are noted. At the end of each school day, the child can review which assignments are due and which materials he needs to bring home.

The child's family, teachers, therapists, school counselor, and/or school psychologist are encouraged to maintain regular communication to ensure that they use consistent approaches throughout the child's day. Homework should reflect concepts learned in class and should include information to parents that indicate how tasks should be completed.