It Turns Out Adolescent Brain Science is Fake News: An Analysis of Dr. Frances E. Jensen's Claims About the Adolescent Brain

Don't trust my analysis? Here's some professionals that agree with me:

- Dr. Daniel Romer, Director of Adolescent Communication Studies at University of Pennsylvania.
    - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5626621/
    - "We do not question the reality that the adolescent period entails risk. What we challenge is the interpretation of the brain and behavioral underpinnings of this risk. Research suggests that the brain is structured to enhance development by encouraging movement toward independence and self-sufficiency, a process that supports exploration and learning. Support for this view has been observed in both humans and other animals following the onset of puberty."
    - Says that adolescents take risks not because of poor judgement or an underdeveloped brain but because of a drive for independence. The paper distinguishes risk resulting from poor judgement and risk resulting from lack of experience, saying that adolescents do not display broken judgement and that instead they take risk due to a lack of experience, which gives them experience therefore resolving itself.
- Dr. Robert Epstein, PhD in Psychology from Harvard, lectures at UCSD, founder and director emeritus of the Cambridge Center for Behavioral Studies in Concord, MA.
    - https://www.scientificamerican.com/article/the-myth-of-the-teen-brain-2007-06/
    - "As you will see, a careful look at relevant data shows that the teen brain we read about in the headlines--the immature brain that supposedly causes teen problems--is nothing more than a myth."
- Dr. Beatriz Luna, PhD in developmental psychology, Staunton Professor of Psychiatry and Pediatrics at the University of Pittsburgh School of Medicine.
    - http://www.post-gazette.com/news/health/2015/02/15/Don-t-blame-the-teenage-brain-for-risk-taking/stories/201502150090
    - "The traditional neurological explanation for why teens take more risks could be wrong, according to new research from a University of Pittsburgh neuroscientist. The adolescent tendency to engage in high-risk behaviors is often attributed to an underdeveloped prefrontal cortex, the part of the brain responsible for decision-making, planning and reasoning. That attribution, said Dr. Luna, is a myth that needs to be dispelled."
    - "Dr. Luna's team found that the architecture of different networks in the brain is completed before adolescence sets in."

And there's plenty more than that.

A Word on Adolescent Rat Studies

Adolescent rats are about six weeks old. Studies performed with adolescent rats are extremely popular when said studies are testing the effect of illegal drugs on the adolescent brain. Generally, these studies report that drugs such as THC or amphetamine have different effects on the brains of adolescent rats when compared to the brains of older adult rats. These studies are then extended to apply to human adolescents, generally considered to be from the ages of 13-18 years or even higher, by the media and by people like Dr. Jensen, who cites many adolescent rat studies in her book.

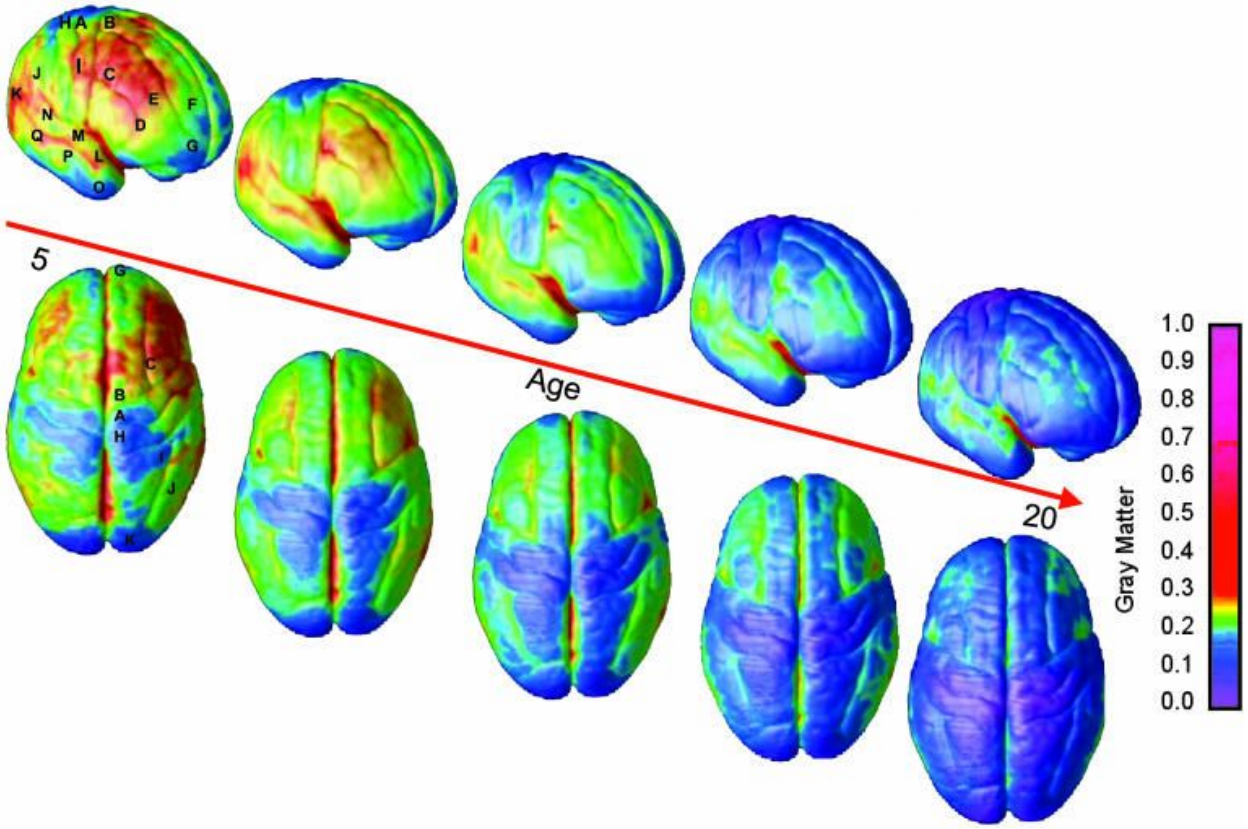
This extension, however, is not a valid one. Rats are not people. What rats *are* useful for is studying the effect something has on a rat. A scientist must use reason when extending the results to humans. For example, if a drug is found to cause cancer in rats, then it is likely reasonable to conclude that the drug would possibly cause cancer in humans. What is unreasonable is to use rats to study human development. Given how young rats are when they go through adolescence, it is fair to say that perhaps six weeks just isn't enough time for their brain to develop fully. Six week old humans surely do not have fully developed brains. However, a human will have been alive for over a decade by the time they reach adolescence. It is common sense to think that maybe in that decade the brain has become more developed than the brain of a six week old lab rat or six week old human. Therefore, while adolescent rats may have underdeveloped brains, the same may not be true for humans. In fact, reason would indicate that it is not true in humans. And the evidence shows that reason is right.

WRONG
RIGHT

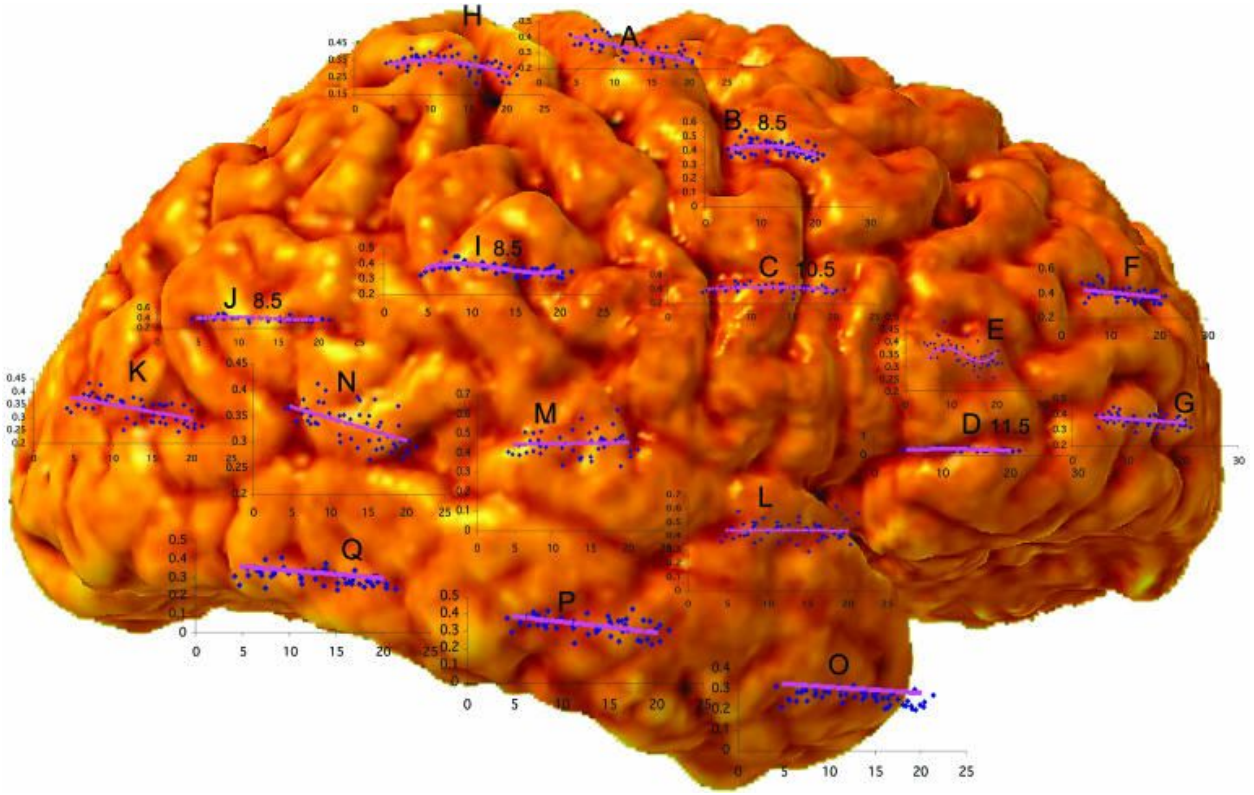
1. Teenagers react differently to hormones
    a. Evidence: Rat study on Adolescent Rats from 2007
2. 26 - The Teen Brain can be imprinted like a baby chicken's
    a. Evidence: 2 pages of humble bragging (pg 26)

3. Pg 26 - "Overabundance of grey matter (basic building blocks of the brain), undersupply of white matter (wiring)... [teens don't have] a brain ready for prime time: the adult world"
    a. No evidence, it's just her interpretation.
    b. EVEN IF HER FINDINGS ARE CORRECT, HOW DOES SHE KNOW THAT THIS IS A NOT SIMPLY A NONPATHOLOGICAL RESULT OF HAVING LESS LIFE EXPERIENCE?
    c. SHE IS LITERALLY ADMITTING IT IS READY TO FUNCTION LIKE AN ADULTS BRAIN, IT JUST HAS LESS MILES ON IT PG 26 - "IT'S PRIMED AND PUMPED, BUT IT HASN'T BEEN ROAD TESTED YET"

4. Pg 37 - "The teen brain is only 80% of the way to maturity"
    a. Evidence: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC419576/
    b. This study got curves like the 1st part of the U while measuring amount of Gray Matter in certain regions of the brain, saying that decreases in Gray Matter (GM) showed "maturation." Their own data shows that all of the curves flatten out by age 15, most by age 13. This means that their subjects were done developing by their own standards at some point when they were 14 years old. They took those curves and instead used linear regression, producing artificial lines that try to say GM changes until the 20's, which is where their graphs cut off. They used those statistically drawn lines to make the following chart:


5
Age
20
Gray Matter
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

Data:


H
A
B 8.5
I 8.5
C 10.5
F
J 8.5
E
K
N
M
D 11.5
G
L
Q
P
O

They even admit in the study G and F are done developing by adolescence, but they try to say E still develops. However, their own graph shows overall develop on average evened out by age 15. (Sometime when subjects were 14 years old). Furthermore, the pure amount of variation shows that some 20 year olds have an E the size of a person under 10! This data means nothing, but it's what Jensen bases her ridiculous "20% incomplete" claim on.

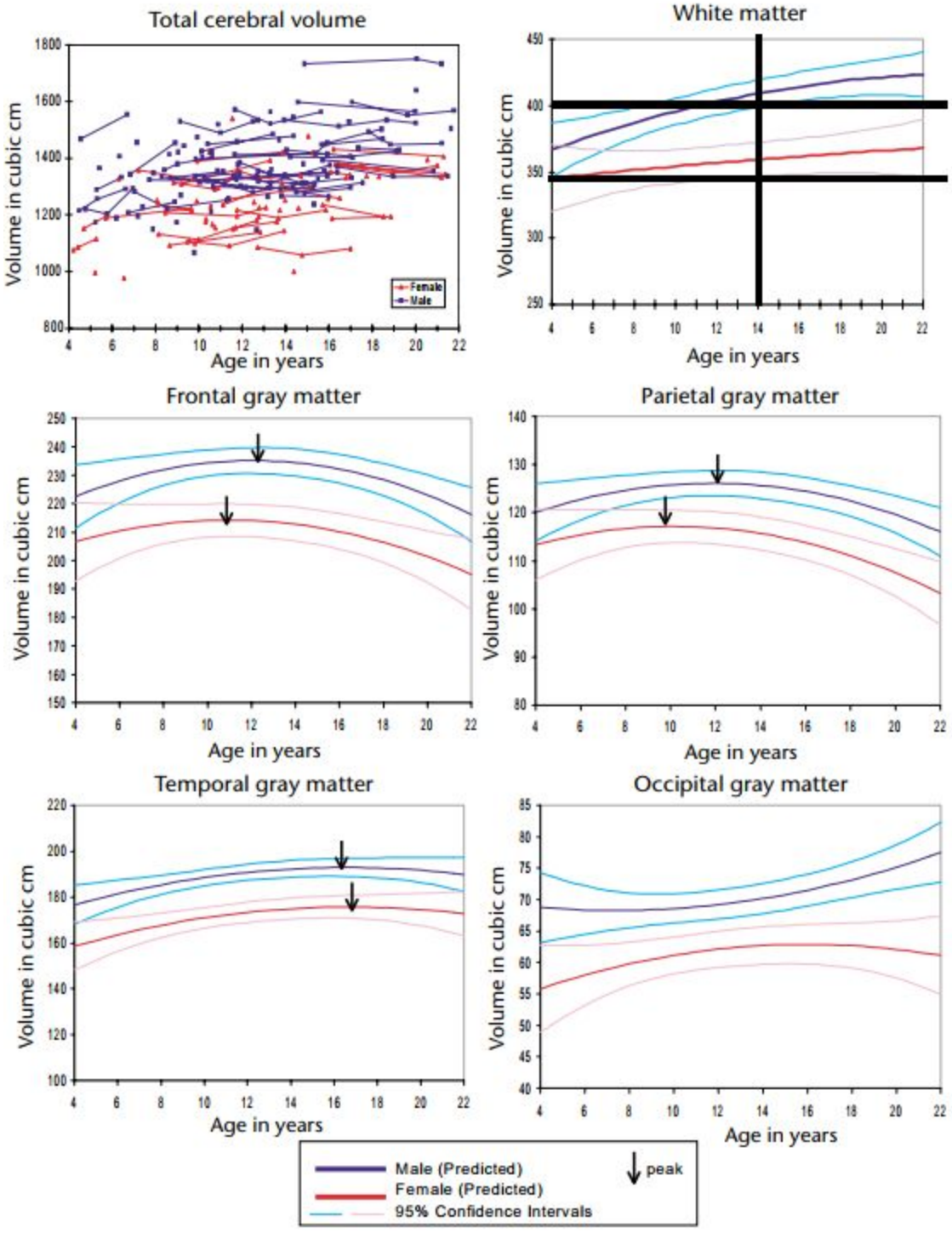
Furthermore, all this study does is (poorly) correlate age with GM change. Jensen uses it and tries to say age *causes* GM size change in the brain.
What actually causes it could be life experience, which is correlated with age which would be correlated with GM change.
But this study fails to correlate age past the age of 14 years old with change in GM so I don't even need to point all that out!

5. Pg 39 - "The parietal lobes … mature late in the adolescent brain"
    a. She doesn't really have a source so I assume it's the previous NIH study which features data on "maturation" of parts of the parietal lobe (J, I, H, A). The data simply shows her claim is not true.
6. Pg. 39 - Prospective Memory develops during the 20s
    a. No evidence, she states that researchers found it
    b. I CANNOT FIND ANYTHING SAYING IT DEVELOPS AGAIN IN THE 20's
    c. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3065819/ - This shows that college kids (a group age 18 - 22) perform much better on PM tasks than the a group age 61+. If Jensen's claim were correct, this group of young adults would be undeveloped or *developing*. Instead, they greatly outperform older adults
    d. https://www.frontiersin.org/articles/10.3389/fnhum.2015.00362/full - a one-way ANOVA revealed no significant difference between the four age groups on PM percentage correct. (12/13, 14/15, 16/17, 18/19). It doesn't even change from 12 to 19!!!! HAHAHA
7. Pg. 41 - Ability to multitask is still developing through the teen years
    a. Evidence: https://www.sciencedaily.com/releases/2005/05/050518104401.htm
    b. The researchers had adolescents between ages 9 and 20 complete several behavioral tests. One task involved recognizing previously presented faces while a second involved looking at the location of a dot on a computer screen, then, after a delay, indicating where the dot had been. These two tasks assessed "working memory," the ability to use recognition or recall to guide future actions. A third task required that the youth remember multiple pieces of information in the correct sequence, and sometimes re-order the information in their memory before responding to a question. **Finally, the researchers included a task in**

which participants had to search for hidden items in a manner requiring a high level of multi-tasking and strategic thinking. The researchers found that the ability to use recall-guided action to remember single pieces of spatial information developed until ages 11 to 12, while the ability to remember multiple units of information developed until ages 13 to 15. **At age 14, these things are admitted by the researchers to be fully developed in *everyone*.** "However, strategic self-organized thinking (which was measured by having participants search for hidden items), the type that demands a high level of multi-tasking skill, continues to develop until ages 16 to 17." WRONG - what they actually found is that older teens did better when searching for hidden items. This could easily be explained by, I dunno, **life experience**, random chance, not controlling for IQ among groups, or personal engagement in the study.

c. Instead, they went to the media and wrote this: https://www.livescience.com/270-teens-lousy-chores.html - "Finally researchers have come up with a reason other than pure laziness for why teenagers can't shower *and* brush their teeth or unload the dishwasher *and* wipe down the counter. Blame it on "cognitive limitations." Their brains can't multitask as well as those of the taskmasters.Trust, however, that they'll grow out of it. The part of the brain responsible for multitasking continues to develop until late adolescence, with cells making connections even after some children are old enough to drive, according to a new study" - Wow, that went from an isolated finding being explainable by any number of things to the media implying the findings show that teen drivers are dangerous and lack "cell connections."
d. How did they conclude that the skill is *developing* in teens just because their oldest participants excelled at it the most? They have no data on how this skill changes throughout adulthood, meaning they can't conclude it is *developing*.Developing implies that before it finishes changing, it is dysfunctional. However, this study simply shows younger teens are mildly slower at finding the hidden items. It's at most *changing,* but again, that doesn't mean much and their data hardly proves that.
e. This skill is way too complex to measure ability to multitask. It's way too open to being influenced by other variables, as outlined above. So their results don't actually show ability to multitask correlated to age, it shows ability to find hidden items correlated to age.

8. Pg 54 - “It takes longer for teenagers (vs. children & adults) to learn not to do something”
    a. Says there are several studies but doesn’t actually refer to one. If the study actually exists the result could easily be explained by the teenagers being less engaged in the study than the children.
    b. https://www.sciencedirect.com/science/article/pii/S0278262611002405 - This study reveals that teens and adults react within 40 miliseconds as fast as eachother when learning not to do something - not statistically significant difference. This directly refutes the claim.
9. Pg. 57 - “Myelination of the frontal lobes take much, much longer and are not finished until a person is well into his or her twenties.”
    a. Evidence: https://www.researchgate.net/publication/12807832_Brain_Development_during_Childhood_and_Adolescence_A_Longitudinal_MRI_Study - Specifically about this study published in 1999 she says Myelin in adolescence has “only one trajectory: up” That’s funny, because the actual data (which are sketchy processed lines, they don’t reveal the data scatters in this study) actually reveals that that white matter, or myelin, is pretty much done developing by 14 or 15 in men, and earlier in women.



On the myelin graph, I drew a line at 14 and a line intersecting both that line and the bottom 95% confidence interval for both genders. This bottom 95% confidence line, by the way, means the researchers are not equipped to say this line is not reality. As you can see, for both genders the bottom line comes down to meet the horizontal black line

again, indicating that, in the case of the male, a 22 year old would have the same amount of white matter as a 14 year old. This means that the amount of myelin actually goes down in late adolescence. But does that retard 20 something's judgement? No! Furthermore, on other possible patterns of myelin development put forth by this study, myelin production would never stop as the lines keep going. If this were the case, then it would mean that changes in myelin occur over the course of a lifetime and they do not indicate the maturity of the brain itself, as Jensen and some other "scientists" have been claiming in the media. Again, it's unclear if myelin production even occurs at all in the teen years, according to the very study this book is citing.

b. Evidence #2:
https://cloudfront.escholarship.org/dist/prd/content/qt1d34r7w2/qt1d34r7w2.pdf

She uses this 1999 study to claim that "myelin continues to be produced past adolescence, even into a person's 30s."

This study is extremely flawed. What they did is that they took a group of adolescents with a mean age of 13.8 and compared the average size of certain brain region's gray matter in that group to the average size of certain brain region's gray matter in the adult group, with a mean age of 25.6.

They did not show brain development in individuals, and the size of each group was 10 people! If you look at variation between brain sizes in individuals from the 2nd picture of this document, it's revealed that brain size can vary hugely between two people of the same age. Furthermore, they measured "gray matter" or more simply put, the overall size of some macrostructures and tried to say that a reduction in gray matter means an increase in white matter. Therefore, this study may not even show any activity related to white matter, even if its results were taken at face value, which they shouldn't be, considering the study fails to track actual brain development, instead opting to compare different people's brain sizes. One look at the individual variation in the brain size data all throughout this packet will show you why that's a bad idea. Guess what data wasn't reported? Average group skull sizes!

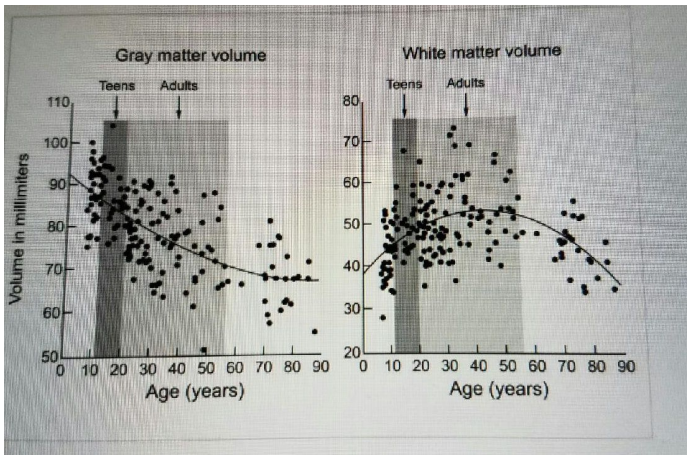
It also doesn't track development throughout adulthood or compare adult brains, even though Jensen claimed this study shows that a person develops myelin into their 30's. In fact, this study uses 23 year olds in the adult group, who are said by Jenson to have immature brains. Those 23 year old's brain sizes were averaged together with the other people in the adult group to be compared to the average from the adolescent group. So how can Jenson cite this study to support her claim??

This study took a very small group of what were quite possibly most prepubescents who would still grow 8 - 10 inches in height alone, compared the size of their brain to a group of people in their late 20s, and Jensen used this as proof of myelination in teens, which was supposed to be proof of her overall frontal lobe claim, for which she only provided these two hardly relevant studies. Not only are these

studies barely relevant to her overall claim, these studies don't even support her smaller claims which were supposed to function as evidence for her larger claim!

10. Pg 60 - "When teen's amygdalae signaled danger, their frontal lobes don't respond"
    a. Evidence: Not studies, but instead a few anecdotes about wasted teens making poor decisions.
        1. Her son didn't take a drunk freshman to the hospital. It says in the book he didn't do it because she was under the drinking age.
        2. A 16 year old got wasted, and then lost during a blizzard outside. He avoided authorities who were looking for him in the storm because he was afraid of getting in trouble for drinking. Says it in the book.

11. Pg 77 - "Gray matter reduction is different for teens than adults, making teens better learners"
    a. Evidence: An adolescent rat study. The problem with this is that those are 2 weeks old, they're not reflective of human teens. They are at best reflective of human toddlers.



This is the data from her own book. Look how the curve on the white matter graph is inappropriate - it could be a straight line from teens to 50 somethings.
Notice how gray matter degenerates throughout the entirety of your life. It clearly cannot be used as evidence that the teen brain is "20% undeveloped." The only thing leading "scientists" to believe that grey matter loss, which is seen throughout your entire life, is different in teens is a rat study.

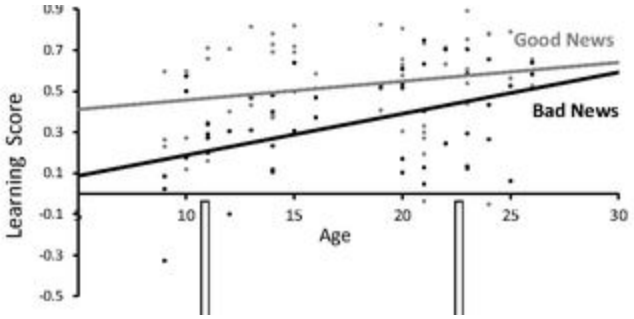
12. Pg 80 - "Set limits for your teenager because their over exuberant brains can't do it for themselves. Take away their phones if they don't comply. Insist on knowing their passwords"
    a. Evidence: None - She just asserts it! This is the most academically dishonest P.O.S. publication I've ever seen!

13. Pg 81 - "Teenagers have the capacity for modifying their own behavior."

14. Pg 83 - Adolescents have less ability to process negative information than adults do, so they are less likely to not do something risky, and less likely to learn from the mistake than adults are."

a. In regards to teens being "less likely to learn from their mistake", this is directly contradicting her previous claims about teens being better learners.
b. Her evidence: http://www.pnas.org/content/110/41/16396.full
c. This study uses 9 to 26 year olds. There is a lack of 17-19 year olds as evident in their processed data below, which skewed the age correlation. Finally, all they do is weakly correlate age and "learning score" for bad news. Even if their finding are repeatable, which I doubt they are (and they have never been repeated), this study does not show that age and therefore the age of the brain causes this deficit as Jensen would have you believe. The study is purely psychological - it doesn't ever get near the brain.

A



This is their data. What you can actually make out by looking at the actual points is a mild increase up to the age of about 13, and then it basically just stays the same/ even drops into adulthood. Instead what they did is use linear regression to draw a line, using the low scores from the prepubescent children and the high scores from the people in their mid twenties to make the case that this develops through your teen years. It doesn't even look like they had any participants age 17 and 18, and they only had a few 16 and 19 year olds, all of who scored higher than "average."
Finally, this study has absolutely nothing to do with the claim that teens are less likely to learn from their mistakes. And the study design PLUS the data gathered from the study do not actually support Jensen's assertion that teens have "less ability to process negative information."