

CRISS AND BRAIN RESEARCH—A PERFECT FIT!

By Lynn Havens

The decade of the 90's is still searching for its niche in history. If I had my way, it would be known as “the decade of the brain”. A tremendous amount has been learned in just the last few years about the way the brain processes information. Eric Jensen, in his book, Teaching with the Brain in Mind, says, “So what do we do about this brain knowledge? Is it useless theory? Not for the professional educator. As long as we are in the ‘business of learning’ the brain is relevant.” In this issue of *COMMENTS FROM CRISS*, we would like to share with you some of the recent discoveries and show you how CRISS fits with this new research.

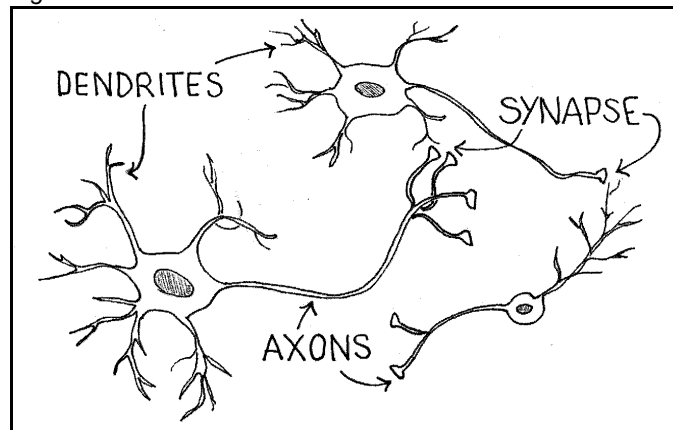
HOW DOES THE BRAIN LEARN?

First, we need to know *how* the brain learns, and, unfortunately, this will be tough since research is still being conducted. However, scientists do have some ideas on *what* happens. First, the brain receives some kind of stimulus through the five senses (seeing, hearing, smelling, tasting, or touching). The stimulus is divided, sorted, and processed, so that in the future it can be recalled. Research shows that, as a person repeats a past learning, the neural pathways become more efficient within the brain, and that means the person will remember the information more easily.

Discussing the anatomy of the brain is a little beyond the scope of this newsletter, but it plays an important part in helping you understand the brain. We direct you to the references listed on *page 7* for more detailed information.

For our purposes here, we will look only at the functioning of the brain cells called “neurons”.

Figure 1: Neurons



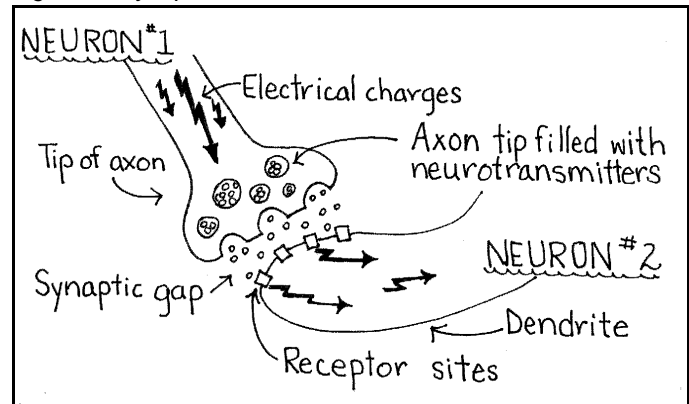
Although these brain cells comprise only 10% of all brain cells, they are the ones which are involved with learning and remembering. *Figure 1* shows you what neurons look like. Robert Sylwester (1995) compares the neuron to your arm: your hand represents the cell body, your fingers are the dendrites, and your arm would be the axon. Receptor sites cover the dendrites, or your finger tips.

When learning or doing something new, our brain experiences an increase in electrical energy. This energy is processed and sorted in various areas of the brain. Once this input is received by the brain cells they act like little batteries. The electrical energy travels to the tip of the axon where it stimulates the

release of chemicals into the synaptic gap (see Figure 2). The chemical reaction triggers an electrical impulse in the receptor sites of the dendrites. This impulse travels to the end of the axon where it continues to be passed on to other cells through this electrical to chemical to electrical process. As this process is repeated, the cells grow by dendritic branching. These branches strengthen the connection between the cells and help us more easily recall the newly learned information.

Observation of the brain during the learning process supports what we have been saying for many years -- you need to practice or study new information in order to learn it. It is interesting to note that every time a teacher asks a question and a student recalls the information, the student's neural pathway to that information is strengthened. This provides some mighty powerful justification for "wait" time. By not allowing other students the time to recall the information, we are not allowing them the opportunity to strengthen their pathway to that information! Think-Pair-Share (page 56, Chapter 4 of the CRISS manual) is a great strategy to assure this wait time.

Figure 2: Synapse



BRAIN RESEARCH - IMPLICATIONS FOR TEACHING AND LEARNING

As we look at the information being published about brain research, certain topics seem to stand out. We will take a look at several of these areas and see how they fit with our roles of teacher and learner and with Project CRISS.

EMOTION (*joy, fear, surprise, disgust, anger, and sadness*).

Research shows that these six emotions have their own brain pathways and chemicals and, as you know from experience, they can get in the way of learning.

Research says...

- ▶ *Emotion drives attention*--- We cannot separate how we feel, act, and think. We pay attention to those things which "hook" us emotionally.
- ▶ *Emotion creates meaning*--- We remember information which is attached to our emotions.
- ▶ *Emotion affects behavior*--- Our experiences create emotions which drive our thoughts, decisions, and responses. Responses like anticipation, cynicism, and/or frustration have a big impact on our motivation and behavior.

What can teachers do?

- ▶ *Be a positive role model*--- Show your love of learning, share a book, music, and/or community work.
- ▶ *Celebrate*--- Show off student work, use acknowledgments, high fives, treats, music.
- ▶ *Encourage controversy*--- Use RAFT assignments where the **R**oles have opposing viewpoints and the **F**ormats are debates, dialogs, arguments, editorials, or a tug of war!
- ▶ *Use energizing rituals*--- While learning new information or practicing prior learnings, use clapping, cheers, chants, and movements. This is a great way to change pace in lectures or the longer block scheduled classes.

- ▶ *Provide time for introspection---* Learning logs and journals create opportunities for reflection and for making (emotional) connections. Instructional conversations where students share their own stories and experiences and relate information to local and current events can assist in this way, too.

ATTENTION.

We pay attention to those things which promote our survival and which extend pleasurable states. For a lot of our students, school is not a place where they find those things!

Research says...

- ▶ *Attention is based on brain chemistry---* Norepinephrine is the chemical with the most impact. Students low in norepinephrine appear “out of it” while students whose norepinephrine levels are high behave hyperactively.
- ▶ *Attention requires a balance between novelty and ritual---* Novelty grabs our attention, while ritual reduces our stress.
- ▶ *Attention is cyclical---* Research shows that our ability to attend to spacial and verbal information varies throughout the day in cycles of 90 to 110 minutes. When our spacial attending is high our verbal attending is low.
- ▶ *Constant attention is **not** productive---* Much of what we learn cannot be processed consciously because the input is too fast. We need internal time to process - time for learning to “imprint”.

What can teachers do?

- ▶ *Take breaks---* Both students and teachers need time for processing. Fill the breaks with soft music, journaling, and/or low volume instructional conversations.
- ▶ *Use alternative methods of assessment---* Student attention cycles may not coordinate with your usual method of assessment. Assessments collected over time will eliminate this problem. Try portfolios or performance-based assessments.
- ▶ *Allow some choice---* both in learning methods (student-owned strategies!) and in assessment. This enables students to balance both novelty and ritual. Encourage student input and choice with RAFT assignments.
- ▶ *Facilitate changes---* Change the location for learning, go outside, move to the back of the room, use the hallway or empty lunchroom. Use music to change the classroom sounds.
- ▶ *Do energizing rituals---* These can lower stress and, at the same time, provide time for students to process information.

ENVIRONMENT.

We often hear people debate the heredity vs. environment issue. Which has more impact on our character and intelligence? Well, research shows that heredity has a 30 - 60% impact and environment has a 40 - 70% impact! In our schools, we cannot change heredity, but we can improve the learning environment

Research says...

- ▶ *Environment can be enriched through feedback---* Students need to get feedback on their learning experiences immediately and often. The best feedback is interactive between student and teacher, student and student, student and technology, and/or student and himself and the feedback needs to be specific. Students need some choice in when and where they get the feedback, and it should be provided through all the modalities.

- ▶ *Environment can be enriched through challenge---* Try to challenge your students by exposing them to new experiences and information, to new methodologies and technology. Challenge them with a variety of choices on projects and create new learning experiences by using field trips and/or speakers.

What can teachers do?

- ▶ *Provide an environment filled with reading and writing opportunities---* in school as well as at home.
- ▶ *Enrich your classroom with movement---* Motor activity in young children stimulates neural growth, and it is valuable for high school students as well.
- ▶ *Provide lots of opportunities for thinking and problem solving---* Remember, to solve problems students can use paper, models, analogies, discussion, statistics, artwork, and you name it! This variety of methods will create many new neural pathways. Organize problem solving through CRISS problem-solution guides.
- ▶ *Play music---* In several studies, background music played while students were reading actually improved their reading comprehension and their spatial temporal reasoning.
- ▶ *Encourage the use of art---* By using and practicing art, the brain actually rewires itself to make it stronger. Students usually enjoy free-form mapping and adding illustrations or icons to other forms of note-taking.
- ▶ *Give lots of options---* Create challenge by teaching your students a variety of CRISS strategies - don't rely on just one or two. Then, let students select the strategies which work best for them for learning, projects, and assessment.
- ▶ *Redecorate!---* Change the appearance of your room. The use of posters (student free-form maps), color, mobiles (3-D Power notes), etc. creates a comfortable and affirming atmosphere.

MOTIVATION.

Research shows that behaviorism does not work, i.e., “bribes” fail to motivate and to change habits. Although some studies showed that these “rewards” temporarily motivated simple responses, more complicated behaviors (like learning) were usually impaired by the use of such rewards.

Research says...

- ▶ *The brain creates its own motivation---* The brain has its own internal reward system which consists of chemical opiates used to regulate pain and stress. They produce a natural “high” within our bodies when we have a positive experience. Although external rewards are received differently by all students, when a learning experience is positive, nearly all students will respond favorably.
- ▶ *Past experiences impact motivation---* If students link a new learning experience with past successes, they will be motivated, however, if they relate the new experience to past failures, they will be unmotivated. Students who have lots of past failures will be very difficult to motivate.
- ▶ *Present conditions can impact motivation---* Students will lack motivation if the learning style does not match theirs, if there is a lack of resources, a language barrier, poor nutrition, fear of failure, uncomfortable temperature, irrelevant content, and a host of other factors often beyond our control.
- ▶ *Goals and beliefs impact motivation---* Students who have a positive outlook toward the future (including clear, focused goals) tend to be more positive and, therefore, more motivated. Students who believe that they have the ability to learn and also the interest and resources to succeed are sure to do just that.

What can teachers do?

- ▶ *Eliminate stress*--- Do a problem-solution guide with “stress in the classroom” as your problem. Follow through with the students’ suggested solutions.
- ▶ *Set goals*--- Establish clear learning goals which involve some student choice (KWL is great for this).
- ▶ *Create a positive learning environment*--- “Publish” student work, use affirmations, acknowledgments, and positive non-verbals.
- ▶ *Activate positive emotions*--- Through modeling and role-playing, teach students how to manage their emotions. Use rituals and celebrations as a way to release emotions in a positive way.
- ▶ *Provide lots of feedback*--- Feedback is one of the greatest sources of intrinsic motivation. Just make sure the feedback is quick and that you provide opportunities for students to act on the feedback. (*Metacognition is self-managed feedback.*)

RETENTION.

We don’t want our students to just memorize information to pass a test. We want them to learn and retain that information, so it will be useful for future living and learning.

Research says...

- ▶ *Retention requires “sense”*--- We have to know “what is it?” before we can remember something.
- ▶ *Retention requires “meaning”*--- We also need to know, “Why do I need to know this?” if we hope to retain the information.
- ▶ *Retention reacts to the “primacy-recency” effect*--- We remember best those things we encounter at the beginning of a learning cycle and those at the end.

What can teachers do?

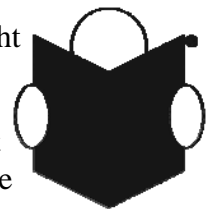
- ▶ *Engage emotions*--- Use role playing and cooperative learning to emphasize the social and interactive nature of learning. Check out the CRISS manual, Chapter 4, for lots of cooperative discussion strategies. Leave a “dumping box” by your classroom door. Students who are upset can write out the problem (problem-solution guide) and leave it in the box.
- ▶ *Provide opportunities to discover relevance*--- Give students time to relate information to prior learnings. Help students make connections to current events, family histories, stories, myths, and metaphors to make learning relevant. Strategies like KWL, think-pair-share, Venn diagram, and pre-/post-learning maps work well for this.
- ▶ *Encourage connections and patterns*--- The brain creates meaningful context through patterns. Try pattern puzzles with pictures, words, phrases, and/or sentences.
- ▶ *Emphasize rehearsal*--- To retain information, students must practice it. Factual recall requires rote rehearsal through memorizing and repeating. Deeper level comprehension requires elaborate rehearsal through paraphrasing, predicting, questioning, summarizing, etc. Two-column notes allow for easy practice, and creating QAR’s over material can lead to deeper understanding.
- ▶ *Teach in 20-minute learning episodes*--- A 20-minute period fosters the greatest retention in students because of the primacy-recency effect. Each 20 minutes you need to change strategies and modalities. Remember, the most important information should come first - not role call and announcements!

THE CRISS CONNECTION:

The above summary of brain research is just the tip of the iceberg. We have tried to give you some of the more practical aspects, so you will have something tangible to use in the classroom. The good news is that CRISS fits well with what has been published to date. If you do CRISS, you are teaching in a brain-compatible way. The student-owned CRISS strategies presented to you through our workshop and training manual will foster positive *emotions* in your students, will help students *attend* to what is most important, will create a positive *environment* for learning, will *motivate* students, and will help students *retain* what they learn.

**BRAIN FACTOIDS
AND OTHER STUFF TO KEEP IN MIND!**

1. Since we remember best what we learn first, if you are teaching two things which might be confused by students, such as *mitosis* and *meiosis*, teach the differences first.
2. The “working memory” is where information goes before it is either tossed away or put into long-term storage. The following chart shows the brain’s processing time before fatigue and boredom.



Age	Time
5 - 14	5 - 10 minutes
14+	10 - 20 minutes

If the brain can’t connect sense and meaning in that time, the information is lost!

3. The number of items a person can hold in their working memory changes with age as shown in the chart below.

Age (in years)	NUMBER		ITEMS
	Minimum	OF Maximum	Average
<5	1	3	2
5-14	3	7	5
>14	5	9	7

Memory can be expanded by clustering or grouping information together - ORGANIZATION!

4. Early assumptions that people are either left-brained or right-brained are outdated. We are all both-brained, with many people having *slight* dominance of one side over the other. The best learning engages BOTH hemispheres. Remember to deal with concepts both verbally (L) and visually (R). Discuss concepts both logically (L) and intuitively (R).
5. 95% of all learning input is through sight, hearing, and touch. Most people have a preference for one modality over the others. Make sure to teach using ALL modalities and model for students ways to practice and rehearse using ALL modalities.

6. The brain processes information in the following order:
1st: Data affecting survival
2nd: Data generating emotions
3rd: Data for new learning

Please be aware that what we are trying to input is not of the highest priority to the human brain.

BRAIN REFERENCES & RESOURCES

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