



FALL 2007

# mental *NOTES*

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**The Brain That  
Changes Itself**

**Scattered Minds:  
Understanding  
ADHD**

**Can You  
Control  
Forgetting?**

**Work Affects  
Your  
Mental Health**

**How We Think  
is Related to  
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**The Capacity of  
Human Memory**

**Impact of Parent-Infant Interactions on the Brain**

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Fall 2007

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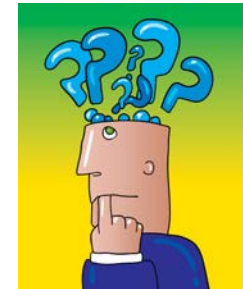
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### Cover Image: Neuron

The neuron is a basic nerve cell of the nervous system which sends and receives electrical signals to and from various parts of the body. These cells are the major actors in the brain as they are critical for the function of perception and thought. Communication between neurons provides the means by which the nervous system connects to and controls other systems within the body.

## A Time of Great Promise



Let me begin by saying how pleased I am to take part in the launch of *Mental Notes*. It is an important project that will make a significant contribution to informing Canadians about mental health and mental illness.

*Mental Notes* makes its appearance at a time of great promise for everyone concerned with mental health issues. The emergence of new initiatives of this type provide further evidence of a growing movement in Canada to improve the health and social outcomes of people living with mental health problems.

The strengthening of this movement is one of the reasons I am optimistic about the potential for the newly-created Mental Health Commission of Canada that the Government of Canada asked me to chair last March. Despite being just over four months old, I can tell you that there is already widespread and enthusiastic support for the realization of the Commission's mandate.

For example, when we advertised on our website for people to fill one of eleven non-governmental positions on the Board of the Commission, we received nearly 500 applications from across the country. At the end of August, Prime Minister Harper announced the names of the members of the Commission's inaugural Board of Directors. I believe the Board is truly representative of those who make up the diverse mental health community in our country.

For example, three members of the Board are people living with a mental illness. Other Board members are family caregivers, peer support workers, and service providers. There is also one First Nations and one Inuit member. As well, the Board includes people working in a variety of contexts: at the community level, in hospitals and in private clinical practice.

In addition, since the burden of caring for and treating people with mental health problems falls disproportionately on women, I am very pleased to note that there are seven women and four men among the non-governmental members of the Board.

The Commission's eight Advisory Committees are another key part of its structure. We are extremely fortunate that the people who have agreed to serve as Chairs of these Advisory Committees are truly outstanding leaders in their fields. Working with the members of each Advisory Committee, the Chairs will ensure that the Board of the Commission receives the best advice possible on critical topics such as children's mental health and mental health in the workplace, to name just two of the areas covered by Advisory Committees.

As we move forward, we can and must learn from each other – it is not necessary to reinvent the wheel. Although it will not deliver services, the Commission will encourage the sharing of best practices in service delivery through the pan-Canadian knowledge exchange centre it will build.

The Commission will also work to combat the stigma and discrimination that still confront Canadians living with mental health problems. Over a ten year period we will conduct a systematic campaign both to reduce stigma and eliminate discrimination.

Above all, we must never let mental health issues retreat back into the shadows. One way to ensure that this does not happen is to involve both government and the broader stakeholder community in a common effort to develop a national mental health strategy.

On all these fronts the Commission cannot succeed by trying to do everything on its own. It is only by working with the mental health community in all its diversity that the Commission can achieve its mandate.

No one has expressed this need for common understanding and combined effort better than Roy Muise. Roy is a certified peer counselor from Halifax, and this is what he said to the Senate Social Affairs Committee as it conducted hearings prior to recommending the creation of the Mental Health Commission:

To the people of Canada, I say welcome us into society as full partners. We are not to be feared or pitied. Remember, we are your mothers and fathers, sisters and brothers, your friends, co-workers and children. Join hands with us and travel together with us on our road to recovery.

I urge everyone across the country to heed this call.

The Honourable Michael Kirby  
Chair, Mental Health Commission of Canada

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## The Mental Health Commission of Canada: Making Mental Health a Canadian Priority



Mental illness affects one in five Canadians. It also strikes early, with the highest prevalence in young people aged 15 to 24. But we know it strikes people at all ages, in all walks of life. That is why Canada's New Government is committed to making mental health issues a national priority. We created the Mental Health Commission of

Canada in response to the May 2006 Standing Senate Committee report on mental health, mental illness and addiction in Canada. The Commission's board will comprise representatives of the federal, provincial and territorial governments along with mental health stakeholders and its chair will be former Senator Michael Kirby.

Canada's New Government announced in Budget 2007 our investment of \$55 million over five years for the Commission. Its mandate and structure will reflect recommendations contained in the Senate report.

In Canada today, we have many brilliant minds at work in the study and practice of mental health. From coast to coast to coast, the knowledge exists to improve the lives of the millions of Canadians affected by mental illness. The Commission will assemble the full weight of this expertise in leading the development of a much needed national mental health strategy for our country.

During the International Initiative on Mental Health Leadership in Ottawa in August, Prime Minister Stephen Harper reaffirmed the federal government's commitment to provide leadership in the response to mental illness and mental health and officially launched the Mental Health Commission.

Together with Mr. Kirby, Prime Minister Harper announced the founding Board of Directors, the Chairs of the eight Advisory Committees, and that the Commission would be located in Calgary, Alberta. Collectively, the Commission brings

together the knowledge of mental health experts; the provinces and territories, Canada's Aboriginal peoples and the federal government.

Many people living with a mental illness report that the stigmatization causes them more suffering than the disease itself. Consequently, the Commission will launch an anti-stigma campaign, and through such events as Mental Illness Awareness Week, National Mental Health Week and World Mental Health Day, Canadians will better understand the challenges those living with a mental illness face in their every day lives.

In addition to public education, the Commission will develop a national strategy for people living with mental health issues from coast to coast to coast. The Commission also plans to create an internet-based Pan-Canadian Knowledge Exchange Centre to provide governments, service providers, researchers, and the public easy access to evidence-based information.

Working together to end the stigma attached to mental illness is a positive step for all Canadians. Recognizing the need to increase dialogue, Canada's New Government is committed to providing leadership.

All Canadians have a role to play to help promote mental health and assist in the recovery of those with mental illness. For more information on mental health and mental illness, visit the Mental Health Commission of Canada website at [www.mentalhealthcommission.ca](http://www.mentalhealthcommission.ca).

Tony Clement  
Minister of Health Canada  
Government of Canada



Minister of Health

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## Editor's Message: Knowledge Leads to Change!



As Editor-in-Chief of *Mental Notes*, I am very excited to launch our premier issue with the understanding that information and education will allow Canadians to make mentally healthier choices leading to better health.

This is a time for change in Canada particularly with the establishment of the new Mental Health Commission of Canada chaired by The Honourable Michael Kirby. This month also commemorates Mental Illness Awareness Week in Canada as a reminder to us all of the often forgotten and misunderstood struggles associated with mental illness. Mental illness can affect Canadians of all ages, in all cultures and income groups, in both rural and urban communities. We hope that the knowledge provided in this magazine can make a difference that leads to change.

It is my pleasure to acknowledge and give credit to all those involved in making this publication possible. I would like to thank our sponsors, our team including the editorial advisory board, and the dedicated researchers and authors who translated their work into layman's terms providing relevant information about the brain, behaviour, mental disorders, research, treatments, and pharmacology. The magazine will address topics pertaining to the fetus, infant, child, adolescent, adult, and senior.

This is a pivotal time in neuroscience. The advancements in research and technology are leading to a greater comprehension of neuroanatomy (structure), neurobiology (life), and neurophysiology (function). The functioning of the brain and central nervous system can be described as remarkably efficient machines and the capacity of these systems are only now being more clearly understood.

We anticipate that the articles in *Mental Notes* will fascinate and amaze you only increasing your thirst for greater knowledge. Brain facts, brain health, risk factors, genetics: information that will assist you in making informed decisions about your mental health.

Each issue will include book and film reviews dealing with the brain and mental health issues. We, as individuals, choose our own personal medium for entertainment and education.

*Mental Notes* will have editorial content written by individuals living with mental illness illustrating their battles and triumphs. Their stories will remind us of the strength and adaptability of the human spirit.

The last page of each issue will have resources that may assist you or someone you know in locating a mental health agency or support group. Remember that identifying symptoms, early diagnosis, and treatment is critical to a positive recovery. Do not let stigma be a hurdle to your better mental health. Going to see a mental health professional is no different than seeing your dentist or doctor.

We look forward to your continued readership.

Warmest Regards,

Rose Marie Donovan  
Editor-in-Chief



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*Mental Notes* is published six times a year and is distributed to physicians and health care professionals as waiting room copies for the general public. Our goal is to promote the importance of Mental Health Care and reduce stigma and discrimination through information and education. Our mission is to encourage individuals to understand the benefits of seeking the expertise of health professionals.

Our editorial focus provides information on a wide variety of subjects principally written by researchers in a format that has not been previously available to Canadians.

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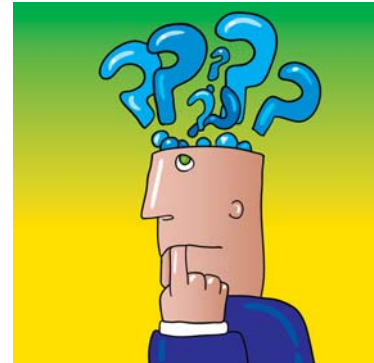
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## Can You Control Forgetting?

Kathleen L. Hourihan, MA, PhD (Candidate)<sup>1</sup> and Tracy L. Taylor, PhD<sup>2</sup>  
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In our busy, modern lives, there is so much information to remember that we often complain about our "bad memories" that cause us to forget important details like phone numbers, people's names, or where we left our keys. Yet forgetting information isn't necessarily a bad thing—numerous bits of information that were once important become quickly out-of-date, and forgetting them is essential to keeping our memory current.



We've all arrived at the grocery store only to realize that we've left our shopping list at home. We can often remember most of the items that were on that list, but imagine if we also remembered every item that had ever been on every grocery list we ever wrote—you'd have to bring home nearly every item in the store! Forgetting information that is no longer important is a key aspect of human memory that helps us think efficiently in our current situation. But how easily can we forget that information when we want to? We conducted a study (published in the December 2006 issue of the *Journal of Experimental Psychology: Human Perception & Performance*) to determine whether words can still be intentionally forgotten even when substantial time is spent trying to learn them.

Participants in our study were given a list of words that they were asked to learn for a later memory test. Each word was presented on a computer screen for about 10 seconds. However, a random half of the presented words were also followed by an instruction to intentionally "forget" that word. The "forget" instructions occurred unpredictably, either one, five, or nine seconds after the word had been presented. After all of the words had been presented, the participants were asked to write down as many words as they could remember from the study, even words that they were told they could forget.

Forgetting information that is no longer important is a key aspect of human memory that helps us think efficiently in our current situation

There were two key findings. First, participants reported substantially fewer of the words that they had been told they could forget. This tells us that we can, in fact, intentionally forget information. The second key finding, however, was that forgetting became more and more difficult the longer the delay between receiving the word and its corresponding "forget" instruction. It was relatively easy for participants to forget the words that they had been holding in memory for one second, but much harder for participants to forget the words that they had been holding in memory for nine seconds.

The results of our study demonstrate an interesting aspect of human memory: We do have some control over our own remembering and forgetting. This, of course, does not mean that we have complete control over our memory. No one in the study remembered all of the words they studied, which means that we cannot always remember everything that we try to remember—human memory is limited by how much information we can learn in a short period of time. By the same token, no one in the study could forget all of the words that they were instructed to forget, and forgetting a word became more difficult the longer the time spent learning it. Intentional forgetting is not a perfectly controlled process either.

### Particularly strong memories may not be easily forgettable, even if we want to forget them

Relating the results of our study to everyday life, you can see that it is very easy to forget a piece of information if you do not spend a lot of time trying to learn it initially. One of the reasons we often forget someone's name only minutes after being introduced to them may be that we do not spend enough time or mental effort in learning that name—even spending a few extra seconds repeating their name silently might help to prevent forgetting. But we also know from our study that forgetting something is not just as easy as intending to forget it—well-learned information is harder to forget, and particularly strong memories may not be easily forgettable, even if we want to forget them. This has implications for people who may want to intentionally forget upsetting experiences. It seems likely that memories that we have "replayed" over and over may behave like well-learned words in our study and prove relatively difficult for us to intentionally forget. ○

# Work affects your mental health

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Depression is one of the leading causes of workplace disability and lost workdays world-wide

For many people, work is an important and health-promoting component of life. Working not only offers economic security, it also provides structure to the day, a sense of purpose and accomplishment, a place to meet and be with other people, and an identity that extends beyond the workplace. But despite these known benefits, mental health problems in the workplace are a growing concern.



The World Health Organization (WHO) reports that depression is one of the leading causes of workplace disability and lost workdays world-wide (1996). It has been estimated that in the average Canadian workplace 15-25% of employees will suffer from a mental illness (Coyle, 2004). Studies of the Ontario workforce reveal that monthly about 8% of the working population has a diagnosable mental disorder (Dewa et al., 2004). The loss of productivity resulting from mental illness costs the Canadian economy \$14.4 billion annually, according to figures from a study by Health Canada (Stephens & Joubert, 2001). It is predicted that by 2020 depression will be the leading cause of disability (WHO, 1996).

The toll that job stress takes on mental health is becoming clearer as increasing numbers of workers report psychological symptoms. Canadian research on work and mental health most commonly addresses disturbances in mood and anxiety, and there is evidence to support the relationship between work stress and major depressive disorders (Wang & Patten 2001). Furthermore, job stress may lead to increased alcohol intake, smoking, or other substance use, which in turn may exacerbate psychological, emotional, family or physical challenges that the

worker may be experiencing. Cognitive disturbances, such as trouble concentrating, forgetfulness, or difficulty with decision-making may also be experienced, raising concerns about safety and accuracy at work. Indeed, a common scenario is one in which a supervisor observes an employee's declining work performance, and accordingly, implements remedial measures or probationary terms, without ever becoming aware of the existence of a mental health problem. If there is disclosure of a mental health problem, more often than not, supervisors and co-workers have little information on how to deal with it.

Employers also suffer the effects of their employees' mental health problems as they bear the costs of absenteeism, staff turnover, and recruitment. Recently, the term "presenteeism" has been introduced to connote lost productivity when employees attend work when unwell. Presenteeism has been estimated to account for a large proportion of the economic cost of lost productivity from depression (Collins et al., 2005), as much as 86% in the U.S. (Stewart et al., 2003). Canadian research has found that depression and anxiety are more consistently associated with presenteeism than with absenteeism (Sanderson & Andrews, 2006).

What do we know about the factors that lead to these situations and how can we minimize or prevent mental health problems in the workplace? There are a number of contributors to stress and poor health that have much to do with the way jobs are structured, and the interactions between workers and their work environments. We know that stress results from a situation in which the demands placed on an individual exceed resources to meet the demand. A large body of literature supports this interaction. The Karasek model (Karasek, 1979) is perhaps the most widely known one to delineate this relationship. It addresses two main characteristics of work that influence job strain: job demands (the requirements of the job) and job latitude (the extent to which the worker can use skills or authority to address those demands). This model postulates that jobs that have the most negative effects on health are high strain jobs, that is, jobs which have high demands but the worker's skill or authority to meet those demands is low. It also suggests that social support (for example coworker or supervisor support) can modify these negative effects on strain. Indeed a large and well known study of British civil servants (the Whitehall II study) showed that high job demands were associated with increased risk of psychiatric disorder while high levels of social support were protective of mental health (Stansfeld, Fuhrer, Shipley, & Marmot, 1998). Subsequent research has shown that individuals in situations of high demands, low decision authority (control), low skill use, and low levels of social support are most likely to experience major depression, lower vitality, and poor emotional health at work (Amick et al., 1998; Niedhammer et al., 1998; Wang & Patten, 2001).

Another set of factors affecting mental health at work is the effort-reward relationship, which emphasizes reward systems

such as money/salary, esteem/respect, security, and career opportunities. The Effort Reward Imbalance Model (Siegrist, 1996) claims that a lack of reciprocity between costs and gains (for example, a job requiring high effort but offering low reward) may cause emotional distress and poor health. Studies have shown high efforts and low rewards to be particularly stressful and even stronger predictors of poor well-being than job control (de Jonge, Bosma, Peter, & Siegrist, 2000).

The good news is that these interactions are amenable to intervention and prevention at the workplace. Employers and employees must take responsibility for ensuring a fit between the demands of the workplace – including physical, cognitive, social and emotional demands and the skills/abilities of the employee, and must build opportunities for tailoring the fit. Managers and employers need to provide valued incentives (to the extent that they are possible), and explore reward structures that include not only money but also recognition, security, advancement and satisfaction. And all parties need to be made aware of the risks, signs, and symptoms of mental health problems that so often manifest themselves as declines in work performance. Education of employers and coworkers, and development of a corporate culture that is supportive towards persons with mental health problems are key factors.

## The loss of productivity resulting from mental illness costs the Canadian economy \$14.4 billion annually

Mental health problems affecting workers are under-identified and under-treated and result in prolonged impairment and disability (Bender & Kennedy, 2004). Currently, there are numerous players involved in the employee mental health system, including health care providers (eg family doctors), Employee Assistance programs, workplace personnel (eg Human Resource professionals), insurance providers and informal supports such as family. While this scenario is problematic in that it has led to a poorly integrated system, it also means that there are many sites and people that can be of assistance. Workers who question whether they may be experiencing a mental health problem can turn to these resources for assistance. Discussing symptoms with a health care professional enables appropriate treatment, and the earlier, the better. Working with an advocate - an EAP counsellor, or a rehabilitation professional, for example - can help determine effective ways of communicating with coworkers and informing employers of ongoing issues while maintaining desired levels of privacy. These supports can also be helpful in identifying and implementing accommodations in the workplace, such as a distraction-free work space, or flexible work hours. With increased awareness of the prevalence of mental health problems in the workplace, as well as contributors to these problems, there can be more coordinated efforts at accommodation, amelioration and prevention. ○

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# Teen gambling: Should we be concerned?

Jeffrey L. Derevensky, PhD  
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Upwards of 80% of adolescents report having engaged in some form of gambling

Gambling has shed many of its negative images and has been adopted as a socially acceptable form of entertainment. Provincial governments, often the largest recipients of gambling revenues, talk of how the profits are being used to enhance social, health and educational programs.



There are a wide variety of gambling activities from which to choose. Whether playing games of skill amongst their peers (i.e., getting the most points on a videogame or the most baskets in basketball), purchasing lottery tickets (most teens prefer the instant scratch tickets), sports wagering, electronic gambling machine games, shooting dice, sneaking into casinos or even Internet gambling, many adolescents report that gambling provides a sense of heightened excitement, fun, and relief from boredom. The fact that they have the potential to win money without working provides an added incentive.

Gambling and gambling advertisements appear everywhere. Going to the local corner store often provides an opportunity to purchase a wide variety of lottery tickets in spite of legal prohibitions. Television shows and movies often have the allure of gambling as a central focus. The debonair James Bond is a notorious high-stake gambler. It is often difficult to go to a jurisdiction in which a poker championship or

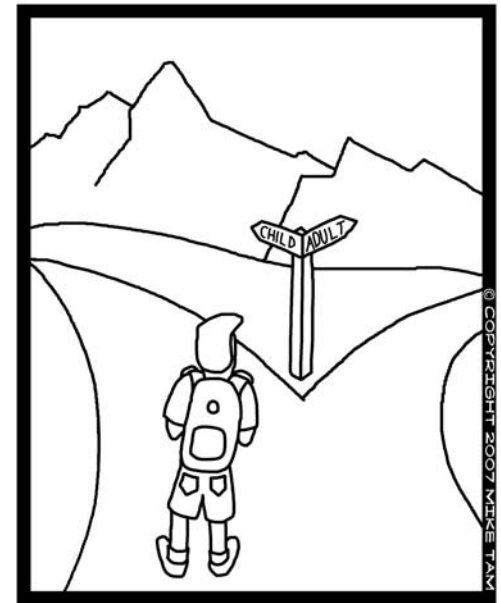
celebrity poker is not televised. Adolescents easily relate to their new heroes; the winners of these tournaments. Teens have added another attractive vocation to their potential list of future jobs....*professional gambler*. Pop-up ads on the Internet are pervasive, with many sites offering 'free' gambling-type games where individuals can win prizes. And, what starts off as a fun and enjoyable activity can lead to some devastating consequences. Adolescents with gambling problems typically show signs of depression, anxiety, antisocial behaviour, poor academic performance, delinquent behaviour, and with some contemplating suicide.

Adolescents experiencing severe gambling problems report beginning gambling at 9 or 10 years of age. Because of its relative social acceptability gambling behaviour is established relatively early, considerably earlier than other potentially addictive behaviours including tobacco, alcohol, and drug use. Given that there are few observable signs of gambling dependence among children, these problems have not been as readily noticed compared to other addictions.

Problem gambling or pathological gambling is viewed as a continuous disorder; starting off innocently enough and progressing into a problem. There is ample evidence to suggest that the early onset of gambling and a big win (the size of the win is dependent upon the individual such that a teen winning \$100 may view that as a large win) can be predictive of a future problem. For some teens, gambling problems will lead to devastating consequences. To make matters worse, while our children are educated in our schools about the possible negative effects of cigarette smoking, alcohol and drug use, and unprotected sex, little is being done to help educate them about the risks or consequences of excessive gambling.

While there is a constellation of risk signs associated with excessive problematic gambling, it is important to note that most teens don't experience all of the following problems. Here's a short quiz to help identify whether or not a problem may exist:

- Do you often find yourself thinking about gambling activities at odd times of the day and/or planning the next time you will play?
- Do you lie to your family or friends or hide how much you gamble?
- After spending money on gambling activities do you play again another day to try to win your money back (more than half the time)?
- In the past year, have you spent your school lunch money, or money for bus fares, on gambling activities?
- In the past year, have you taken money from someone with whom you live without their knowing to gamble?
- Do you ever gamble as a way of escaping problems?
- Do you find you need to spend more and more money on gambling activities?
- In the past year, have you stolen money from someone outside the family or shoplifted to gamble?
- Do you become restless, tense, fed up, or bad tempered when trying to cut down or stop gambling?
- In the past year, have you gone to someone for help with a serious money worry caused by participation in gambling?
- Have you fallen out with members of your family, or close friends, because of your gambling behaviour?
- In the past year, have you missed school to participate in gambling experiences (5 times or more)?



Teens have added another attractive vocation to their potential list of future jobs....*professional gambler*

If someone answered yes to four or more of these questions they may be experiencing a gambling problem. All provinces have a hotline number where people can seek help.

There remains little doubt that adolescents constitute a particularly high-risk group for acquiring a gambling problem given their high rates of risk-taking behaviours, their perceived invulnerability, their lack of recognition that gambling can lead to serious problems, and the social acceptability and glamorization of gambling. More information on youth gambling can be found at [www.youthgambling.com](http://www.youthgambling.com).

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# “OUCH” Children’s memory for pain: Implications for clinical care

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Memories of pain can have a significant impact on how a child copes with future procedures.



The painful event is likely to be misremembered as more severe and unmanageable than it actually was



Children have remarkable memories for everything from a visit to Disneyland to their first hospital experience. However, good memory for distressful aspects of pain experiences can lead to poor coping of subsequent painful procedures. We know that some children avoid necessary medical care because of fear induced by memories of earlier painful procedures. For example, individuals with ‘needle phobia’ trace their phobia back to childhood memories with needle experiences. So what does research tell us about how memories of, say, a needle at a doctor’s office influence a child’s behaviour the next time she goes back to the doctor?

Research has compared the reaction to immunization injections at age four to six months in three groups of baby boys. The group who, as newborns, had been circumcised without local or regional anesthesia cried significantly more in response to the needle poke than the boys who had been circumcised with anesthesia and the boys who had not been circumcised. These findings suggest that an early procedure carried out without analgesia sensitizes infants to pain for months.

Another telling study showed that children do not benefit as much from analgesic medication given prior to a painful procedure if they had that procedure without analgesic in the past. Their memory of the first experience with unrelieved pain made it difficult for them to experience the relief provided by the analgesic. These studies show that a remembered early painful experience can cause negative reactions to later painful events – in other words, memory for pain may have consequences separate from the effects of the pain itself.

Of course, children’s reactions to painful procedures vary. It is important to note that children experiencing repeated painful procedures may experience *sensitization* (an increased reaction to pain over time), *habituation* (getting used to the stimulus and showing a lessened reaction over time), *no change* in their reactions over time, or even a lack of any predictable pattern in their reaction to pain. Certainly, we cannot assume that children will just get used to a repeated painful procedure. In fact, for moderate or severe pain, most will not. For some children, the pain gets worse with each repetition. Younger children are most at risk for sensitizing

reactions for several reasons. They often experience the initial pain as severe, the pain is less well understood, and their resources to cope with the pain are less developed. In such cases the painful event is likely to be misremembered as more severe and unmanageable than it actually was. Over time, some children’s memories of painful events change. For example, children with recurrent or chronic pain have been found to evaluate their painful experiences more negatively when asked to remember them long after they happened, when compared to what they said about the pain at the time it was experienced. It appears likely that these memories of pain can, under some circumstances, have a significant impact on how a child copes with future procedures.

It is important to help children remember distressful medical procedures in a way that helps them cope better with future procedures. Several studies show that when children are prepared for surgery in advance by providing information and exposure via educational videos and practice hospital visits, the result is decreased fear and distress going into surgery. Researchers have also found that an intervention (a movie) that distracted or directed attention away from painful sensations helped the children have more accurate pain memories. Though more research is needed, it now appears



## Remembered early painful experiences can cause negative reactions to later painful events

that helping children *reframe* their memories by focusing on positive coping appears to help reduce their distress levels and may make future procedures less painful.

The research on children’s memory for pain has several practical implications for clinicians and parents. First, it is important to assess pain memories (by asking parents for example) so as to identify children who have had exceptionally negative experiences. These children can then receive effective intervention for pain and fear. Second, children can be prepared for painful experiences by giving them accurate, credible information at their own level of understanding (e.g., supplement discussion with visual information for young children), which will enhance their sense of control over the situation. Third, it is important to *emphasize the positive* aspects of previous distressing experiences with children and to remind them of how well they coped, which may reduce future fear and pain.

In sum, when treating children consider what they remember about the experience. A procedure may seem minor to an adult but a child may remember it as terrible. Investing in proper preparation and pain management today is likely to pay off tomorrow — for the child in reduced fear and avoidance of future care, and for the health professional in reduced time required to complete procedures. ○

### References and details are provided in the following article:

von Baeyer, C.L., Marche, T., Rocha, E. & Salmón, K. Children’s memory for pain: Overview and implications for practice. *Journal of Pain*, 2004;5(5):241-249.  
Extensive web resources on pain in childhood (acute, recurrent, and chronic) are available at [www.childpain.org](http://www.childpain.org) and at [www.aboutkiddhealth.ca/Pain/](http://www.aboutkiddhealth.ca/Pain/).



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# Scattered Minds: A look at what shapes the minds of those with ADHD/ADD

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ADD is situational: in the same individual its expression may vary greatly from one circumstance to another



Gabor Maté

At age 52 I was diagnosed with attention deficit disorder, known by the acronyms ADHD or ADD. I was, at that time, a busy family physician and weekly medical columnist for the *Globe and Mail*, as well as Medical Coordinator of the Palliative Care Unit at Vancouver Hospital. For all my apparent success, my life was quite disorganized and I was beset by the many unresolved emotional and psychological dilemmas that burden the adult with ADD, including addictive tendencies, poor self-esteem and by relationship issues in my, by then, twenty-seven year-old marriage. Although the pharmacological

treatment I received did not miraculously resolve all my problems, the diagnosis helped to provide me with a map to my own brain and to my behaviours. It was tremendously helpful in my growth and maturation as a person. In the eleven years since then I can report that I've left many of my problems behind. Not least, I've been able to fulfill my lifelong passion to be an author; having written three bestselling books, translated into many languages internationally, I'm now looking forward to the

ADD is an increasingly recognized problem in our society, but one that remains poorly understood and, often, badly mishandled. A few years ago many people were shocked at news that a teacher in Port Hardy, on Vancouver Island, taped a seven-year-old hyperactive boy's head to his desk in order to control his behaviour. This report ought to have rung alarm bells about the ill-preparedness of our educational system to cope with the growing number of children struggling with attention deficit/hyperactivity disorder (ADHD or ADD) and other neuropsychological problems. A recent study in the United States indicates that nearly nine per cent of school age children in the U.S. meet the diagnostic criteria for ADHD. Health Canada statistics indicate that the amount of Ritalin consumed in Canada in 1997 represented more than a five-fold increase since 1990, including a 21-per-cent jump in the last year of that time period.

There are voices who argue that the diagnosis is just another medical cop-out devised for the peace of mind of incompetent parents and lazy teachers—and of self-pitying adults too immature to face the demands of existence. ADD has been called “the flavour of the decade.”

Thus the Port Hardy teacher's response did not reflect personal cruelty but a general lack of recognition and understanding of the challenges faced by a child troubled by ADD or by any number of the mental health problems burgeoning among today's youth.

Adults with ADD fare no better. I hear from many adults across North America who have struggled for decades without

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publication of my recently-completed fourth early next year.

Before I was diagnosed, I did not know why I was consistently late for everything—work, appointments, family events; why I'd rather have scaled Mount Everest walking on my hands than organize the mess on my desk; why my impulse control left me often when I most needed it; why I had such difficulty staying on task unless I was extremely highly motivated; why my memory cut out with inconvenient frequency; why my mind was always in overdrive, why I was forever juggling several projects at the same time.

It's similar with the ADD child. A doctor in Toronto gave the father of a nine-year old girl with attention deficit disorder a dramatically apt analogy. Imagine, he said, you're standing in the middle of a really crowded room. Everyone around you is talking. Suddenly someone asks you: “What did so-and-so just say?” That's what it's like inside the ADD brain, that's how it is for your child.



knowing that there is a rational explanation for some of their life-debilitating patterns and that help is potentially available. My current medical work is with drug addicts, many with HIV, in Vancouver's Downtown Eastside. I have been struck by how often addicted patients of mine with self-evident ADHD traits have eluded diagnosis throughout childhood and well into their adult years. Some others were diagnosed as children but never seem to have received consistent treatment. In very few cases have any of them been treated for the condition as adults. Studies have clearly shown that ADHD predisposes one to addictions of all sorts, whether to drugs, alcohol, or to behaviours like gambling and shopping compulsions.

It is all the more important that children be diagnosed and treated properly at an early age and that both the medical profession and the public become more aware of the features of this common disorder so that both children and adults can

For parents it is heartbreaking to witness their child's exclusion from school ground games, birthday parties, sleepovers, Valentine card exchanges

receive the proper support. Some parents resist the idea of ADD for fear of seeing their children labelled and categorized. They do not like the idea of pinning a medical diagnosis on a child who, except in certain areas of functioning, seems quite well. Such fears are not baseless. Too often ADD seems no more than a judgement which characterizes which a problem student, incapable of normal activity.

Recognizing a child's ADD should simply be a way of understanding that helping him calls for some particular, knowledgeable, and creative approaches, not that there is anything fundamentally or irremediably wrong with him. This recognition should enable us to support the child in fulfilling his potentials, not to further limit them. The same is true for adults. The stigma of being labelled as “abnormal” needs to be removed from people with ADD. I personally would have benefited had I known a few decades earlier what internal obstacles I was up against.

What, then, is ADD? Attention deficit disorder is defined by three major features, any two of which suffice for the diagnosis: poor attention skills, deficient impulse control, and hyperactivity. The hallmark of ADD is an automatic, unwilld “tuning out,” a frustrating non-presence of mind. People suddenly find that they have heard nothing of what they have been listening to, saw nothing of what they were looking at, and recall nothing of what they were trying to concentrate on. One misses information and directions, misplaces things, and struggles to stay abreast of conversations. Tuning out creates practical hardships, and it also interferes with one's enjoyment of life. There is a sense of being cut off from reality, an almost disembodied separation from the physical present. “I feel like I am a human giraffe,” is how one man described it, “as if my head is floating in a different world, way above my body.”

This absence of mind is one cause of the distractibility and short attention spans which bedevil the adult or child with ADD, except around activities of high interest and motivation. There is an almost active not noticing, as if a person purposefully went out of his way to be oblivious of what is around him. I



compliment my wife for a new decoration in our living room, only to be told that the very same item has been in that very same place for months or even years.

Completely lacking in the ADD mind is a template for order, a mental model of how order comes about. You never feel you can master the confused mess of books, papers, magazines, pieces of clothing, compact discs, letters to be answered, and sundry other objects—you only shift portions of the chaos from one corner to the next. Should you nevertheless succeed now and then, you know full well that the order is temporary. Soon you will be throwing things about again, seeking some needed item you are sure you saw recently in some obscure nook or cranny.

Coordination difficulties affect many, but not all, people with ADD, particularly in the area of fine motor control. Things are dropped, feet are stepped on, and balls fly in the wrong direction. Objects piled on top of each other during clean-up are fated to come crashing down. By opening the closet door one precipitates an avalanche of books, clothes, and other items which had been gathered and arranged pell-mell, or simply thrown on top of each other in the hope that they would sort themselves out. Telephone numbers are scribbled with the digits misplaced: even if one can read what one has written, one will still get the number wrong.

The distractibility in ADD is not consistent. Many parents and teachers are misled: to some activities a child may be able to devote, if anything, a compulsive, hyperconcentrated attention. Hyperfocusing which excludes awareness of one's environment is also a result of poor attention regulation. Too, often hyperfocusing involves what may be described as passive attention, as in watching television or playing video games. *Passive attention* permits the mind to cruise on automatic without requiring the brain to expend effortful energy. *Active attention*, in which the mind is fully engaged and the brain has to perform work, is mustered only in special circumstances of high motivation. Active attention is a capacity the ADD brain lacks whenever organized work must be done, or when attention needs to be directed towards something of low interest.

A facility for focusing when one is interested in something does not rule out ADD, but to be able to focus the person with ADD requires a much higher level of motivation than do other people. Ignorance of this fact has led many doctors to miss the diagnosis.

ADD is situational: in the same individual its expression may vary greatly from one circumstance to another. There are certain



### These children are not purposively inattentive or disobedient

classes, for example, in which the ADD child may perform remarkably well, while in others they are scattered, unproductive, and perhaps disruptive. Teachers may conclude that the child is willfully deciding when, or when not, to buckle down and work diligently. As in the Port Hardy example, many children with ADD are subjected to overt disapproval and public shaming in the classroom for behaviours they do not consciously choose. These children are not purposively inattentive or disobedient. There are emotional and neurophysiological forces at play that do the actual deciding for them.

The second nearly ubiquitous characteristic of ADD is impulsiveness of word or deed, with poorly-controlled emotional reactivity. The adult or child with ADD can barely restrain himself from interrupting others, finds it a torture awaiting his turn in all manner of activities, and will often act or speak impulsively as if *à*forethought had never been invented. The consequences are predictably negative. One is forever trying to shut the barn door after the horse has bolted. "I want to control myself," a 33-year old man said at his first visit to my office, "but my mind won't let me." The impulsiveness may express itself as impulse buying, the purchase of unneeded items on a sudden whim without regard for cost or consequence. "Impulse buying?" another man exclaimed during our first interview. "If I had the money I would have the impulse to buy the whole world."

Hyperactivity is the third salient characteristic of ADD. Classically it is expressed by trouble keeping physically still, but it may also be present in forms not readily obvious to the observer. Some fidgetiness will likely be apparent—toes or fingers tapping, thighs pumping, nails being chewed, teeth biting the inside of the mouth. The hyperactivity may also take the form of excessive talking. In a minority of cases, especially in girls, hyperactivity may be absent altogether; they may go through school inattentive and absent minded but, as they cause no trouble, they are "passed through" from grade to grade. While the finding of hyperactivity is not required for the diagnosis of ADD, it can be quite dramatic for some patients. "The only thing that ever slowed me down was the police siren when I was caught speeding" said a twenty-seven year old woman.

The loquacious hyperverbality of many children with ADD is

notorious. One Grade Two little boy was called "talk bird" by his classmates because his chatter was so incessant. Some adults with ADD have told me that they speak so quickly in part because so many words and phrases tumble into their minds that they fear forgetting the most important ones unless they release them at a fast rate.

The individual with ADD experiences the mind as a perpetual motion machine. "I have a mind like a butterfly," a fifty-seven year old woman said. An intense aversion to boredom, an abhorrence of it, seizes hold as soon as there is no ready focus of activity, distraction, or attention. I, for one, rarely had a moment's relaxation without the immediate and troubling feeling that I ought to be doing something else instead. The oldest person to whom I have prescribed a stimulant was an eighty-five year old woman who, on taking Ritalin, was able to sit still more than fifteen minutes for what was literally the very first time in her life.

The restlessness coexists with long periods of procrastination. The threat of failure or the promise of reward has to be immediate for the motivation apparatus to be turned on. Without the rousing adrenalin rush of racing against time, inertia prevails. On the other hand, when there is something one wants, neither patience nor procrastination exist. One has to do it, get it, have it, experience it, immediately.

An adult with ADD looks back on his life to see plans never fully realized and intentions unfulfilled strewn about the landscape like abandoned casualties on a long march. "I am a person of permanent potential," one patient said. Surges of initial enthusiasm quickly ebb. People report unfinished retainers walls begun over a decade ago, semi-constructed boats taking up garage space year after year, courses entered and quit in languages, in woodworking, in music, in art and in sundry other subjects, books half-read, business ventures forsaken, stories or poetry not written—many, many roads not travelled.

Social skills are also an issue. Something about ADD hinders one's capacity to recognize interpersonal boundaries. Although some ADD children shrink away from being touched, in early childhood most of them literally climb all over adults and generally exhibit an almost insatiable desire for physical and emotional contact. They approach other children with a naive and unrequited openness, to which rebuffs are often the response. Impaired in their abilities to read social cues, they may be ostracized by their peers. For parents it is heartbreaking to witness their child's exclusion from school ground games, birthday parties, sleepovers, Valentine card exchanges.

It is clear that the earlier people are diagnosed and treated—and by treatment I don't necessarily mean medication—the better the chances are that they will avoid dysfunctional life patterns that may persist for a long time, or self-medication with addictive substances and behaviours.

In the concluding part of this two-part series, I will discuss why the ADD brain functions the way it does. I will also give my views on how to approach the treatment of the child and the adult with ADD/ADHD. As I will show, medications have their place—I continue to take one myself—but they need not and should not be the mainstay of therapy.

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## Early Parent-Infant Interactions and Brain Developments

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The long-term health risk and resiliency of infants depends on parent-infant interactions, together with the infants' own genetic heritage<sup>1-5</sup>. Many of these parent-infant interactions appear to cross mammalian species<sup>6</sup>, from the licking and grooming behaviors and ultrasonic vocalizations of rodents<sup>7,8</sup> to the feeding, cleaning, caressing, checking-on-safety routines, and cry-care loops<sup>9,10</sup> found cross-culturally in humans<sup>11</sup>. Human parental thoughts include a heightened sense of empathy and worry, as well as a longing for proximity and idealization<sup>12</sup>. Brain imaging research shows that human parenting thoughts and behaviours are supported by key emotion-regulation brain centers<sup>13</sup>. Over time, infant responses quickly become more sophisticated, allowing for more complex reciprocal interactions, such that baby-brain development cannot be separated from psychological development. The mechanisms by which parent-infant interactions affect baby brain development are profound, manifold and a keen area of current research.

In humans, the measurement of parent-infant synchrony provides a window into how parent-infant behaviours affect baby brain development. Synchrony between parent and

### Early-life stresses are associated with increased risk for other medical problems, such as obesity and cardiovascular diseases

infant, as evidenced by co-occurring social behaviours and appropriately matching sequences of play, is decreased with certain conditions in either mother or child. Unfavourable infant-risk conditions include prematurity, multiple births, intrauterine growth retardation, feeding disorders and a variety of psychiatric conditions such as being withdrawn, having autistic siblings, or exhibiting posttraumatic distress. Parent-infant synchrony is also disturbed by parental depression and anxiety disorders<sup>14, 15</sup>, which are associated with stress-system dysregulation and an array of poor outcomes for the child<sup>16, 17</sup>.

The importance of parent-infant synchrony is congruent with compelling evidence that environmental circumstances must be considered together with genetic predispositions in assessing behavioural traits and vulnerabilities for psychopathologies<sup>18</sup>. For example, it has been shown that children and adults who are exposed to early-life stress are more likely to develop depression if they are homozygous for the short allele of the serotonin transporter as compared to individuals with the more "protective" long allele of the serotonin transporter<sup>19-21</sup>. However, despite genetic protective factors, extensive human clinical data show that child abuse or neglect is associated with

Child abuse or neglect is associated with increased risk for a large number of psychopathologies that may persist throughout life



increased risk for a large number of psychopathologies that may persist throughout life, including anxiety and mood disorders, poor impulse control, cognitive deficits, and psychosis<sup>22-27</sup>. Moreover, even poor parental bonding without frank abuse or neglect is associated with increased risk for several psychological vulnerabilities<sup>28</sup>. The worrisome burdens of early-life stress are also associated with increased risk for other medical problems, such as obesity and cardiovascular diseases<sup>29</sup>.

Similarly, prolonged maternal separation has adverse effects on both rodent<sup>30</sup>, and primates<sup>31-33</sup>. In fact, the behavioural profiles of these monkeys is remarkably similar to the classic descriptions of secure versus anxious attachment in human infants<sup>34</sup>. This also fits with studies of human populations showing that children exposed to abuse manifest higher levels of cortisol and catecholamine stress hormones, and the lack of infant attachment security correlates with cortisol reactivity to environmental stress<sup>35</sup>.

Thus, resilience or risk profiles are affected across generations by how parenting modulates the development of infants' stress-response system<sup>32, 33, 36-40</sup>. In adulthood, rodent pups

that received higher levels of parental care by way of licking and grooming and arched-back nursing during the first 10 days of life show reduced levels of stress hormones in response to restraint stress<sup>41</sup>. Later in life, high-maternal care rodents exhibit decreased startle response and increased open field exploration. This may be due to increased formation of new synaptic connections within the hippocampus<sup>43</sup>, and reduced cell loss<sup>44</sup>. Studies<sup>40, 43, 45</sup> have convincingly demonstrated maternal behaviours – even prenatal signals from mothers to their fetuses – are important influences on the infant's stress-response system. Along the same lines, mother rats which increased levels of licking and grooming during the first week postpartum, display increases of their own maternal behaviours compared with those adult rats which experienced low licking and grooming. These early life experiences appear to influence later maternal behaviour by shaping central oxytocin and estrogen receptor expression<sup>46-49</sup>. Indeed, an increased level of licking and grooming in rats is associated with enhanced oxytocin receptor expression in brain areas functionally related later to maternal behaviour<sup>39</sup>. Also, naturally occurring variations in maternal behaviour are associated with similar differences in oxytocin receptor levels in the female offspring<sup>46</sup>. With oxytocin known to be important in the initiation of maternal behaviour as well as social cognitions and trust in humans<sup>50-52</sup>, these studies strongly suggest a link between rearing experience, oxytocin receptor expression, and subsequent complex behaviours including parenting<sup>47</sup>.

Animal studies of receptor expression and improved stress regulation by parenting suggest that human infants may also



### Prenatal signals from mothers to their fetuses – are important

benefit from optimized parenting behaviours. This may be especially important when parental brain circuits are impaired by depression or anxiety<sup>13</sup>. Some randomized control interventions, delivered by professionals and aimed at improving parental care, such as nurse home visiting programs for pregnant women and

parents of young children, produce replicable long-term benefits for children's behavioural and cognitive health and development for a variety of different communities<sup>53-56</sup>. ○

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# The Magnitude of Human Memory

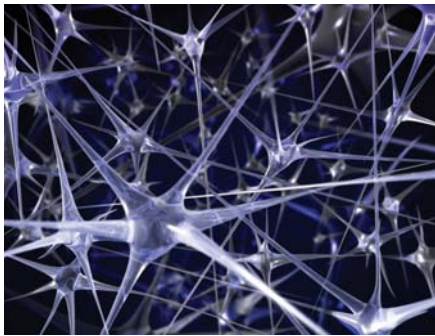
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The memory capacity of the human brain is in the order of  $10^{8.432}$  bits

## How Large is the Maximum Capacity of Human Memory?

Despite the fact that the number of neurons in the brain have been identified in psychology and neuroscience, human memory capacity is still unknown [Kotulak, 1997; Leahey, 1997; Gabrieli, 1998; Mattlin, 1998; Payne and Wenger, 1998; Harnish, 2002]. A recent discovery in *Cognitive Informatics* (CI - how information and knowledge are represented and processed in the brain) revealed that the memory capacity of the human brain is in the order of  $10^{8.432}$  bits [Wang et al., 2003]. The determination of the magnitude of human memory capacity is not only theoretically significant in cognitive science, but also practically useful to unveil the human potential, as well as the gap between natural and machine intelligences.



The number of neurons in an adult brain is in the order of 100 billion ( $10^{11}$ )

It is identified that the number of neurons in an adult brain is in the order of 100 billion ( $10^{11}$ ), and each neuron is connected to a large number of other neurons via several hundred to a few thousand synapses [Marieb, 1992; Smith, 1993; Pintel, 1997; Sternberg, 1998; Rosenzweig et al., 1999]. However, the magnitude of memory capacity of human brains is still a mystery. In cognitive informatics, it is recognized that the capacity of human memory is not only dependent on the number of neurons in the brain, but also the connections among them. This also explains why neurons in an adult brain

seem stable; however, huge amounts of information can be remembered throughout the entire life of a person. The finding on the magnitude of the human memory capacity is in the order as high as  $10^{8.432}$  bits reveals an interesting mechanism of the brain. That is, the brain does not create new neurons to represent new information; instead it generates new synapses between the existing neurons in order to represent new information. This theory is now supported by observations in neurophysiology [Marieb, 1992; Pintel, 1997; Rosenzweig et al., 1999].

## The Brain and Information Processing

The basic characteristic of the human brain is information processing. Unlike a computer, the brain works in two approaches: the internal *willingness-driven* processes and the external *event- and time-driven* processes. External information and events are the major sources that stimulate the brain, particularly for higher cognitive life functions. In this case, the brain may be perceived as a passive system, at least when it is conscious, that is controlled and driven by external information and events. Even the internal willingness, such as goals, motivations, and emotions, may be considered as derived information based on originally external information with long-term feedbacks in the memory.

It is commonly understood that memory is the foundation of any form of intelligence. Cognitive informatics explores how information and knowledge are represented in the brain, particularly in long-term memory. Conventionally, Long-Term Memory (LTM) has been perceived as static and fixed in adult brains [James, 1890; Baddeley, 1990; Smith, 1993; Sternberg, 1998; Rosenzweig et al., 1999]. This was based on the observation that the capacity of adult brains has already reached a stable state and would not grow continuously. However, recent discoveries in neuroscience and cognitive informatics indicate that LTM is dynamically reconfiguring, particularly at the lower levels of the neural clusters [Squire et al., 1993; Rosenzweig et al., 1999; Wang and Wang, 2006]. Otherwise, the mechanisms of memory establishment, enhancement, and learning, which are functioning everyday in the brain, cannot be explained.

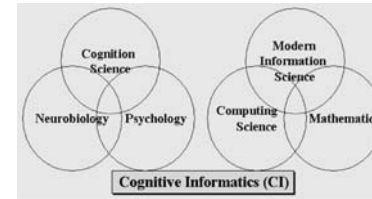
Investigation into the cognitive models of information and knowledge representation in the brain is perceived to be one of the fundamental research areas that help to unveil the mechanisms of the brain. All physiological observations and neuroscience evidences about LTM can be logically modeled as a set of *Hierarchical Neural Clusters* [Wang, 2007a, 2007b; Wang and Wang, 2006]. A physiological connection between a pair of neurons via a synapse represents a logical *relation* between two abstract objects or concepts. The hierarchical and partially connected neural clusters are the foundation for information and knowledge representation in LTM. It is

The brain does not create new neurons to represent new information, instead it generates new synapses between the existing neurons in order to represent new information

perceived that memory and knowledge are represented by the connections between neurons in the brain, rather than the neurons themselves as information containers.

## What is Cognitive Informatics?

Cognitive informatics (CI) investigates the internal information processing mechanisms and processes of natural intelligence — human brains and minds. CI is a cutting-edge research area that tackles the fundamental problems of modern informatics, computation, software engineering, artificial intelligence, cognitive science, neuropsychology, and life sciences. Almost all of the hard problems yet to be solved in the above areas share a common root in the understanding of mechanisms of natural intelligence and cognitive processes of the brain.



Relationship between cognitive informatics and natural sciences

CI focuses on the nature of information processing in the brain, such as information acquisition, representation, memory, retrieval, generation, and communication. Information plays a vital role in connecting the physical world and the abstract world.

## Quantitative and Qualitative Advantages of the Human Brain

The *quantitative advantage* of the human brain in cognitive informatics states that the magnitude of the memory capacity of the brain is tremendously larger than those of the closest species; the *qualitative advantage* of the human brain states that the possession of the abstract layer of memory and abstract reasoning capacity make the human brain profoundly powerful on the basis of the quantitative advantage.

Brains are dynamically different from each other both logically and physiologically [Wang, 2002, 2007c; Wang and Wang, 2006]. Therefore, there is no identical physiological structure and allocation for the acquired and conscious life functions such as behaviour and skills. Human beings may never exhaust the potential of their memory because the capacity of memory is extremely tremendous, which is far greater than the total memories of all computers existing and existed in the world. The difference between the memory of human beings and computers demonstrates the efficiency of

information representation, retention, and processing in human brains. Computers store data in a direct and unconscious manner; while the brain stores information by relational neural clusters. Computer data can be accessed directly by explicit addresses and can be sorted; while the human brain may retrieve a content-sensitive search and match among neuron clusters where relational connections and configurations themselves represent information.

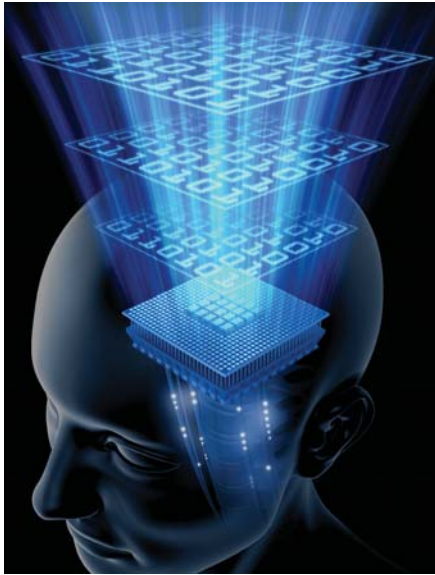
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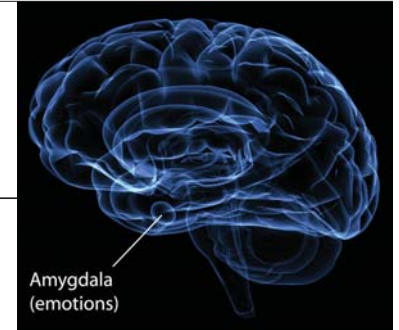
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## Feeling emotional: What's your amygdala got to do with it?

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The amygdala may be associated with emotional experience but not necessary for it



If all the world's a stage, then the amygdala may be the emotional spotlight

Although as individuals we are intimately familiar with what emotions are, their scientific account presents an elusive underlying complexity. Most commonly, the term "emotion" suggests a specific qualitative experience, such as the solemn gravitas associated with sadness or the lightness of being associated with joy. When these unique experiences that give color and meaning to our lives are transformed from short-lived into chronic conditions they can have devastating consequences for mental and bodily health. To better understand human emotions and their dysregulation in affective disorders, human neuroscience has begun to pin down the elusive neuroanatomy of these most prominent of mental experiences.



One of the brain regions associated with emotional functioning is the limbic system, and in particular its most central component—the amygdala—an evolutionarily older structure buried in the depths of the brain's temporal lobes. Neuroimaging studies that allow us to peer inside the human

brain as emotions are produced, have shown the amygdala fluctuates with emotional experience in both healthy and affect disordered populations, pointing to its central role in emotional experience. One difficulty with this apparent association is that emotions reflect a constellation of diverse but correlated neural and bodily events. For example, witnessing a gruesome automobile accident may involve: 1) specific emotions related to fear or sadness, 2) bodily activation or arousal (e.g., increased heart rate, sweaty palms), 3) salient cognitive changes, such as grabbing one's attention and thereby demanding to be the central focus of awareness and 4) altering later memory, being associated with vivid reminiscences in the following months and years. In the safer confines of the lab or the bore of an MRI scanner, the amygdala has been associated to some extent with all of these facets of emotional response. As such, amygdala activity may represent the generation of emotional experience itself, or it may reflect many of the facets correlated with emotional experience. Thus the relation between amygdala activity and emotional experience is correlational but not causal. That is, the amygdala may be associated with emotional experience but not necessary for it. To examine whether the amygdala is indeed necessary for emotional experience one can examine individuals who have suffered injury to or developmental malformation of this part of the brain.

In a series of studies we have closely examined whether emotional experience is altered in patients with amygdala injury. In one study, amygdala damaged patients and healthy controls were asked to keep an emotional diary, providing daily reports of various emotional experiences over a 1-month period. Analysis of these daily reports revealed that amygdala damage did not alter the magnitude (how strongly) or frequency (how often) various emotional states are experienced compared with healthy participants. More fine-grained analyses further showed that how emotional states tend to co-occur (e.g., sadness but not joy tends to accompany anxiety) was similarly intact. In other studies we

have shown that when these same patients are asked to relive emotions, conjuring them up from memory, these individuals display visibly evident emotional expressions on their faces, including the emotion fear; with which the amygdala is often associated. Thus, although the amygdala may be associated with emotional experience, it is not necessarily critical for its occurrence.

Why would injury to the amygdala, a brain area thought to be so central to emotions, not alter emotional experience? The results of our studies regard introspective emotional experiences that are associated with complex abstract factors not directly tied to momentary environmental events. Indeed, many emotional experiences involve ruminations upon the past or concerns about the future, thereby involving thoughts about threats and rewards in the absence of their presence. Such forms of emotional re-play and forecasting may depend upon the more recently evolved frontal cortices rather than the amygdala alone. Much of human emotion depends on how we psychologically frame our experience; that is, how we think is related to how we feel. With the thinking frontal cortices left intact, individuals without an amygdala may still be able to think about their feelings, which is sufficient to support rich emotional experiences.

What then does the human amygdala do? The amygdala is neuroanatomically positioned to alter the workings of the parts of the brain involved in perception and memory, enhancing processing of events of potential self-importance. We know that events associated with intense emotional experiences receive greater attention and are later better remembered. These emotional influences on attention and memory are now known to depend on the integrity of the amygdala. Amygdala damage eliminates the biasing of perceptions and memories toward the emotionally significant relative to the mundane, rendering the peaks and valleys of our experiential landscape flat. If all the world's a stage, then the amygdala may be the emotional spotlight, shedding light on the most dramatic players of our life story. ○

Much of human emotion depends on how we psychologically frame our experience

# An Editor's Journey with Alcoholism

Paul Sullivan

There was a deep, dark pool of frigid water, a drowning pool of fear, self-loathing and insecurity

I think I realized I was an alcoholic as I was trying to convince myself I wasn't one.



Paul Sullivan

I was a young man and quite fancied myself as a smart man. I had showed some promise through school, a promise never quite realized, but it was enough to convince me of my own genius.

Beneath the thin ice of my self-confidence, there was a deep, dark pool of frigid water, and a drowning pool of fear, self-loathing and insecurity, and like all plumbing problems, the longer I ignored it, the more flooded my basement became.

So I did everything I could to avoid the truth. I didn't "drink" I was a "party animal". I drank like the young Hemingway, romantic, resolute, and, if doomed, it was an attractive, deferred kind of doom.

But who was I kidding? I was drunk before I got to the party, and by the end of the party, a babbling, drooling lunatic. The next morning was a frenzy of forensic archeology, piecing together the shards of a blackout, a broken mind, frantically hoping I didn't really say that do that or act like that.

My life revolved around drinking. I would line up the weekend based on drinking events: Friday night: go out for dinner, get bombed; Saturday: pub crawl, get bombed; Sunday: start with brunch, get bombed. And that was just the weekend. I could easily consume a bottle of wine at lunch, sometimes

two, if I was feeling expansive. Every meal required alcohol—food was optional.

Yet, those were the 70s and wretched excess was cool. So I told myself. It was no more cool than it is today, but I could drink like a rock star even if I couldn't sing or play the guitar. Thirty years later, I break out in a cold sweat just thinking about the way I was.

One day, I remember, the illusory music died. I was reading Time magazine, which I disdained because it wasn't Rolling Stone, didn't speak with the voice of a generation, and if it did, that generation wore plaid. The article in question was about alcoholism, which didn't apply to me, and the article featured a sidebar quiz: Are You an Alcoholic? No, I snorted, and filled in the quiz. As it turned out, I was right. Of the 36 signs of alcoholism, I only exhibited 34 of them. See, I told you, I said to the long-suffering woman who eventually became my wife (and who continues to be my wife today, thank the Lord), I'm not alcoholic.

Meanwhile, I literally could not drink coffee in public. I was unable to raise the cup to my mouth without shaking so violently, I would spill the scalding coffee all over the table and myself. On those rare nights I was sober, I would lie in bed, afraid to close my eyes in case I died. I would often drive home from the pub after consuming 24 glasses of draft beer. But I was not an alcoholic.

Every person's addiction is woven into a unique tapestry of genetics, environment and upbringing

These days, I believe the only test you need is that you want to keep drinking. Back then, I was elaborately parsing and spinning every manifestation of my addiction to alcohol. But that test stayed with me, and like the writing on the wall, it refused to go away. I found myself referring to it almost daily, as I continued to knock them back, arguing and muttering to myself. I would weave my way to the men's room, banging against walls, staggering over the urinal, reassuring myself that I wasn't an alcoholic because I failed to qualify on two out of 36 points: I didn't drink alone or because drinking did not affect my work. It got to the point where even those self-justifications were out of date, but no matter—when I took the test, that was the case, and the test became my rock, my reference.

How could I be so stupid and blind? Well, it was pretty easy. I was a slave to alcohol and alcohol was calling the shots. It was a very near thing. Finally, I think, a tiny shred of that IQ I worshipped so vainly saved my life. My intellectual pride forced me to read the writing on the wall, and the message could

not have been plainer: "You may have dodged two of the 36 signs," it said, "but, you idiot, you've admitted to 34! You're at least 90 per cent an alcoholic! What's more important," the writing on the wall continued in a more compassionate vein: "you're suffering so much...why do you want to suffer so much?"

It was not an epiphany, I was not suffused in white light. In fact, I was more than a little bit in love with my own suffering. Finally, however, the prospect of further humiliation won the day. I didn't want to stop, or the alcohol I craved didn't want me to stop, but I had become fat and uncomfortable and a distinctly old 27. My hair had gone grey at the temples. I was becoming a social pariah. Even then, I quit three times (to lose weight, I told myself) before I took my last drink: New Year's Eve, 1982. I was 32 years old. I was lucky to see my 30th birthday.

I'm a big one for ceremony. I actually quit for real one morning during the previous November, after downing more than a dozen jumbo martinis with a "friend", being rolled by a cab driver, left drooling in the snow, and crawling home. But I allowed myself one more night on the town, then said goodbye to alcohol. At that point, I finally knew that drinking was going to kill me, and all things considered, I was more afraid of dying than not drinking.

Therapists and I have sifted through the clues, and slowly, self-knowledge is accumulating



I've been sober ever since. Like the rest of my fellow non-drinking alcoholics, I take it one day at a time. I realize that every person's addiction is woven into a unique tapestry of genetics, environment and upbringing. No two snowflakes are alike. It has become a lifelong quest to read the tapestry, to pore over it like a medieval manuscript, looking for illumination: Why me? Therapists and I have sifted through the clues, and slowly, self-knowledge is accumulating. But self-knowledge is not a cure. It helps, but the pool is still dark and deep. And if I don't watch myself, I know I'll drink it dry.

Paul Sullivan has worked in media for more than two decades. He was former Western Editor for the Globe and Mail, Managing Editor of the Vancouver Sun, Host of the Early Edition on CBC Radio Vancouver, and has been an editor, editorial vice president, producer or columnist for West Magazine, The Journal (CBC TV), Telemedia Inc., The Winnipeg Sun, the Winnipeg Free Press, and Globe Investor Gold. He is currently President and Chief Strategist of Sullivan Media, his Vancouver-based communications consultancy. ☺

# Social and Physical Activity Reduce Depression in Later Years

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Older adults are healthier and they live longer when they are socially engaged

Years ago social scientists suggested that the natural transition to be expected of older adults would be from social engagement to disengagement. It was understood that Society and the elderly would mutually agree to "disengage" from one another in late life. The older person would not only accept but actually welcome society's decreased involvement. The elder would become increasingly preoccupied with the self and decrease emotional investment in persons and objects in the environment

Other scientists disagreed. Activity, not disengagement, was the secret to successful aging. A physically and socially active life-style was the most adaptable means for achieving life satisfaction in the later years. The latter view appears to be the correct one. Older adults are healthier and they live longer when they are socially engaged. Social isolation and impaired social support have been found, for example to be associated with both moderate and severe depressive symptoms in the elderly.

Now the challenge to social engagement/social support as contributing to mental health in older adults comes indirectly from a different source. Biological psychiatry (branch of psychiatry dealing with the biological basis of mental illness) is in the ascendance, especially in North America, and therefore, interest in social factors has faded to the background. Even so, some of the more effective talking therapies assist older adults in managing their relationships with their social environment.

We cannot ignore the findings from biological psychiatry. Many older adults are biologically vulnerable to the onset of



depression though the overall frequency of depression in late life is no higher than earlier in life. It would appear that older adults are more biologically vulnerable to depression yet psychological and social factors are more protective in late life compared to mid-life. This assumes that the older adult's mental functioning and medical condition is reasonably good.

## Talking therapies assist older adults in managing their relationships with their social environment



We have made dramatic gains in our ability to treat depression in older adults with medications as well as psychotherapies. These gains, paradoxically, have led to a focus upon the individual in isolation rather than the individual living in a social environment when considering prevention and intervention for late life depression. Psychosocial interventions that address the environment as well as the individual, interventions which attempt to prevent depression onset as well as identify and treat depression early, have been dramatically absent.

Social support is the most important factor in preventing both the onset and progression of depression in later life. Recent advances in our understanding of the biological underpinnings of these depressive states must not blind us to the importance of social factors. Effective social interventions can be initiated by social and health care workers as well as family and friends. ○

# The Negative Impact of Child Sexual Abuse

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The negative impact of sexual abuse varies considerably among child victims

Many survivors of childhood sexual abuse experience short and long-term negative outcomes associated with abuse including depression, anxiety, post-traumatic stress disorder, diminished academic performance, social skill deficit, sexual dysfunction, and somatic complaints. (For reviews see Beitchman, Zucker, Hood, DaCosta, & Akman, 1991; Beitchman, Zucker, Hood, DaCosta, Akman, & Cassavia, 1992).

Despite these negative outcomes, the developmental trajectory of sexual abuse victims cannot be consistently predicted. Several research studies have shown that the negative impact of sexual abuse varies considerably among child victims (Caffaro-Rouget, Lang, & van Santen, 1989; Conte & Schuerman, 1987; Wolfe & Birt, 1995). In fact, many survivors do not exhibit any behavioural indication of abuse related distress. Considerable variability exists in published reports of victim outcome. For example, reports indicate that as many as 30% of survivors do not manifest symptoms directly associated with the experience of child sexual abuse (Kendall-Tackett, Williams, & Finkelhor, 1993). As a result of the varied response patterns, a distinct "child sexual abuse syndrome" has not been identified in the research or clinical literature (Alexander, 1992). Rather, a constellation of possible risk factors have been compiled and varied post-disclosure responses recorded.

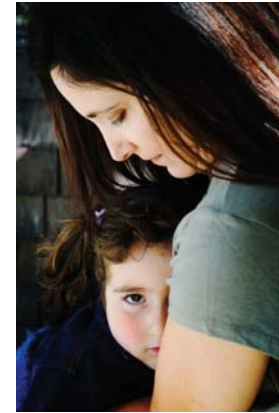
A number of factors have already been identified as having an impact on child adjustment and well-being in the aftermath of child sexual abuse. Frequency and severity of abuse (Fergusson, Horwood, & Lynskey, 1996; Friedrich, Urquiza, & Beilke, 1986), relationship to the perpetrator (Sedney & Brooks, 1984; Spaccarelli & Fuchs, 1997) and, more recently, presence and quality of the non-perpetrating mothers' response to the child's disclosure of sexual abuse (Bolen & Lamb, 2002; Elliott & Cames, 2001).

The outcomes of child sexual abuse are manifold and distress to the child may worsen if the child does not receive the necessary support from his or her non-abusive parent. Prevention education and professional help are important for offering assistance to victims and reducing the risk of revictimization. For information on where to go for help, contact your local distress centre, sexual assault centre, social service agency or mental health organization that provides counselling to children and families.

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## Survivors of childhood sexual abuse experience short and long-term negative outcomes

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## Book Review: The Brain that changes itself

Dr. Norman Doidge, MD

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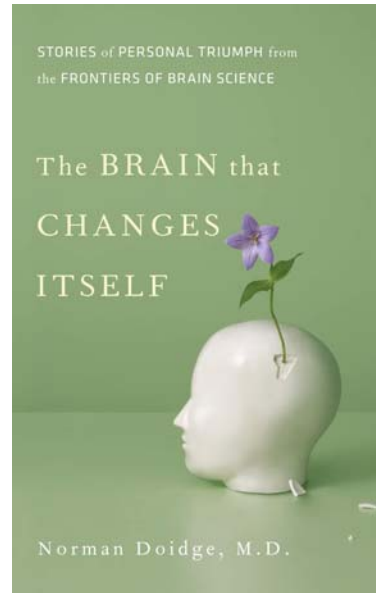
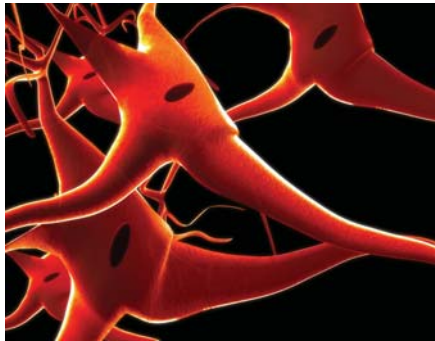
The brain can change its own structure and function through thought and activity

### From the book jacket:

**The brain can change itself.** It is a plastic, living organ that can actually change its own structure and function, even into old age. Arguably the most important breakthrough in neuroscience since scientists first sketched out the brain's basic anatomy, this revolutionary discovery, called neuroplasticity, promises to overthrow the centuries-old notion that the brain is fixed and unchanging. The brain is not, as was thought, like a machine, or "hardwired" like a computer: Neuroplasticity not only gives hope to those with mental limitations, or what was thought to be incurable brain damage, but expands our understanding of the healthy brain and the resilience of human nature. Norman Doidge, M.D., a psychiatrist and researcher, set out to investigate neuroplasticity and met both the brilliant scientists championing it and the people whose lives they've transformed.

### Thinking, learning, and acting can turn our genes on or off, thus shaping our brain anatomy and our behaviour

The result is this book, a riveting collection of case histories detailing the astonishing progress of people whose conditions had long been dismissed as hopeless. We see a woman born with half a brain that rewired itself to work as a whole, a woman labelled retarded who cured her deficits with brain exercises and now cures those of others, blind people learning to see, learning disorders cured, IQs raised, aging brains rejuvenated, painful phantom limbs erased, stroke patients recovering their faculties, children with cerebral palsy



learning to move more gracefully, entrenched depression and anxiety disappearing, and lifelong character traits altered.

Doidge takes us into terrain that might seem fantastic. We learn that our thoughts can switch our genes on and off, altering our brain anatomy. Scientists have developed machines that can follow these physical changes in order to read people's thoughts, allowing the paralyzed to control computers and electronics just by thinking. We learn how people of average intelligence can, with brain exercises, improve their cognition and perception in order to become savant calculators, develop muscle strength, or learn to play a musical instrument, simply by imagining doing so.

Using personal stories from the heart of this neuroplasticity revolution, Dr. Doidge explores the profound implications of the changing brain for understanding the mysteries of love, sexual attraction, taste, culture, and education in an immensely moving, inspiring book that will permanently alter the way we look at human possibility and human nature.

This book is about the revolutionary discovery that the human brain can change itself, as told through the stories of the scientists, doctors, and patients who have together brought about these astonishing transformations. Without operations or medications, they have made use of the brain's hitherto unknown ability to change. Some were patients who had what were thought to be incurable brain problems; others were people without specific problems who simply wanted to improve the functioning of their brains or preserve them as they aged. For four hundred years this venture would have been inconceivable because mainstream medicine and science believed that brain anatomy was fixed. The common wisdom was that after childhood the brain changed only when it began the long process of decline; that when brain cells failed to

### When one part of the brain fails, another can often substitute

develop properly, or were injured, or died, they could not be replaced. Nor could the brain ever alter its structure and find a new way to function if part of it was damaged. The theory of the unchanging brain decreed that people who were born with brain or mental limitations, or who sustained brain damage, would be limited or damaged for life. Scientists who wondered if the healthy brain might be improved or preserved through activity or mental exercise were told not to waste their time. A neurological nihilism—a sense that treatment for many brain problems was ineffective or even unwarranted—had taken hold, and it spread through our culture, even stunting our overall view of human nature. Since the brain could not change, human nature, which emerges from it, seemed necessarily fixed and unalterable as well.

The belief that the brain could not change had three major sources: the fact that brain-damaged patients could so rarely make full recoveries; our inability to observe the living brain's microscopic activities; and the idea dating back to the beginnings of modern science—that the brain is like a glorious machine. And while machines do many extraordinary things, they don't change and grow.

I became interested in the idea of a changing brain because of my work as a research psychiatrist and psychoanalyst. When patients did not progress psychologically as much as hoped, often the conventional medical wisdom was that their problems were deeply "hardwired" into an unchangeable brain. "Hardwiring" was another machine metaphor coming from the idea of the brain as computer hardware, with permanently connected circuits, each designed to perform a specific, unchangeable function.

When I first heard news that the human brain might not be hardwired, I had to investigate and weigh the evidence for myself. These investigations took me far from my consulting room. I began a series of travels, and in the process I met a band of brilliant scientists, at the frontiers of brain science, who had, in the late 1960s or early 1970s, made a series of unexpected discoveries. They showed that the brain changed its very structure with each different activity it performed, perfecting its circuits so it was better suited to the task at hand. If certain "parts" failed, then other parts could sometimes take over. The machine metaphor, of the brain as



an organ with specialized parts, could not fully account for changes the scientists were seeing. They began to call this fundamental brain property "neuroplasticity."

Neuro is for "neuron," the nerve cells in our brains and nervous systems. Plastic is for "changeable, malleable, modifiable." At first many of the scientists didn't dare use the word "neuroplasticity" in their publications, and their peers belittled them for promoting a fanciful notion. Yet they persisted, slowly overturning the doctrine of the unchanging brain. They showed that children are not always stuck with the mental abilities they are born with; that the damaged brain can often reorganize itself so that when one part fails, another can often substitute; that if brain cells die, they can at times be replaced; that many "circuits" and even basic reflexes that we think are hardwired are not. One of these scientists even showed that thinking, learning, and acting can turn our genes on or off, thus shaping our brain anatomy and our behaviour—surely one of the most extraordinary discoveries of the twentieth century.

### Half a brain that rewired itself to work as a whole

In the course of my travels I met a scientist who enabled people who had been blind since birth to begin to see, another who enabled the deaf to hear; I spoke with people who had had strokes decades before and had been declared incurable, who were helped to recover with neuroplastic treatments; I met people whose learning disorders were cured and whose IQs were raised; I saw evidence that it is possible for eighty-year-olds to sharpen their memories to function the way they did when they were fifty-five. I saw people rewire their brains with their thoughts, to cure previously incurable obsessions and traumas. I spoke with Nobel laureates who were hotly debating how we must rethink our model of the brain now that we know it is ever changing. The idea that the brain can change its own structure and function through thought and activity is, I believe, the most important alteration in our view of the brain since we first sketched out its basic anatomy and the workings of

## It is possible for 88-year-olds to sharpen their memories to function the way they did when they were 55

its basic component, the neuron. Like all revolutions, this one will have profound effects, and this book, I hope, will begin to show some of them. The neuroplastic revolution has implications for, among other things, our understanding of how love, sex, grief, relationships, learning, addictions, culture, technology, and psychotherapies change our brains. All of the humanities, social sciences, and physical sciences, insofar as they deal with human nature, are affected, as are all forms of training. All of these disciplines will have to come to terms with the fact of the self-changing brain and with the realization that the architecture of the brain differs from one person to the next and that it changes in the course of our individual lives.

While the human brain has apparently underestimated itself, neuroplasticity isn't all good news; it renders our brains not only more resourceful but also more vulnerable to outside

influences. Neuroplasticity has the power to produce more flexible but also more rigid behaviours—a phenomenon I call "the plastic paradox." Ironically, some of our most stubborn habits and disorders are products of our plasticity. Once a particular plastic change occurs in the brain and becomes well established, it can prevent other changes from occurring. It is by understanding both the positive and negative effects of plasticity that we can truly understand the extent of human possibilities.

Because a new word is useful for those who do a new thing, I call the practitioners of this new science of changing brains "neuroplasticians."

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## Film Review: Elling

Topic: Anxiety Disorders and Social Phobia

Subtitled Norwegian film directed by Petter Naess  
Casting: Per Christian Ellefsen, Sven Nordin

**Plot:** Elling is an excellent, funny, and heart-warming film about two Norwegian men who are both socially inept. Together they move from a state-run institution and are challenged to live on their own in an apartment in Oslo. They are supervised by a social worker who is attempting to integrate them back into society.

Elling transcends the popular stereotypes in film by portraying these two characters living with mental illness exhibiting emotional and intellectual motivations and the drive to become mentally healthier as they rejoin society.

Elling (Per Christian Ellefsen) is a short, logical, recluse who had lived life alone with his mother prior to his institutionalization, and now he is roommate to Kjell Bjarne (Sven Nordin), a gentle giant who has never slept with a woman. Elling is terribly frightened by all the activity on the streets, "I have always had two enemies, dizziness and anxiety," he says. Both characters are phobic completing routine activities such as using the telephone or going grocery shopping.

Elling was a 2001 Academy Award nominee for Best Foreign Language Film. These two delightful characters cleverly draw the audience into sharing their struggles with mental illness and their recovery.

*Mental Notes* highly recommends this film. The story is told with clever dialogue illustrating the struggles of living with mental illness in society. ○

## Film Review: Snow Cake

Topic: Autism & Unanticipated Grief

Sigourney Weaver, Alan Rickman and Canadian Carrie-Anne Moss

**Plot:** An Englishman with a haunted past meets a vibrant young teenager who is hitchhiking to Wawa, Ontario with gifts for her mother. Tragedy strikes as his vehicle is accidentally struck by a transport truck killing this vivacious, energetic teen.

Snow Cake is an exquisitely acted drama about a tormented English stranger who arrives in Wawa and who unexpectedly develops a friendship with a remarkably functional autistic woman.

This tragedy unites two people living outside the mainstream of society's norms, and binds them in a unique and rewarding friendship.

Weaver is extraordinary in her role as an adult living with autism, who functions rather well living in her own home, working in a supermarket stacking shelves.

The viewer will appreciate Weaver's way of maintaining order in the chaos of her everyday life and the Englishman's moody yet brilliant and introspective character.

The audience will be endeared to the plot, characters, and illustration of the human condition.

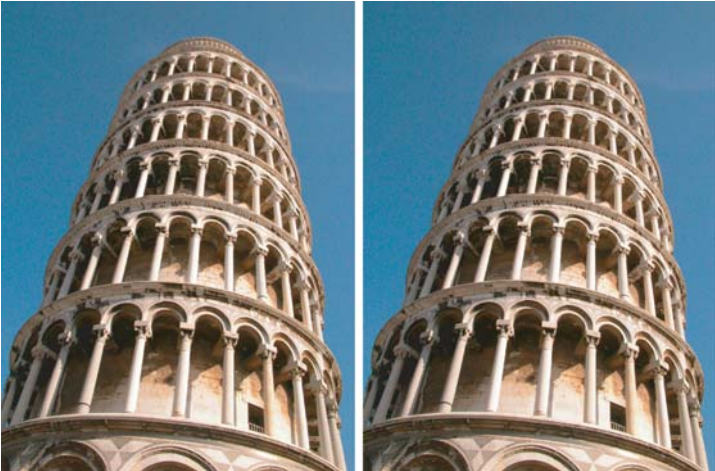
*Mental Notes* highly recommends this film as an entertaining and educating medium for understanding the struggles of autism, internal pain, and unanticipated grief. ○

## Resources

Mental Health Crisis Line .....	www.crisisline.ca
Suicide Prevention .....	www.suicideinfo.ca
Domestic Violence and Abuse .....	http://hotpeachpages.net/canada/index.html
Parent Helpline .....	www.parenthelpline.ca
Kids Helpline .....	www.kidshelpphone.ca
Canadian Association of Sexual Assault Centres .....	www.casac.ca
Telecare Distress Centres of Canada Inc. ....	www.members.tripod.com/telecarecanada
Canadian Network for the Prevention of Elder Abuse .....	www.cnpea.ca
Shelternet .....	www.shelternet.ca
Canadian Association of Foodbanks .....	www.cafb-acba.ca
ADHD Canada .....	www.adhdcanada.com
CH.A.D.D. Canada (ADD) .....	www.chaddcanada.org
Canadian Centre on Addiction Abuse .....	www.ccsa.ca
Centre for Addiction and Mental Health .....	www.camh.net
Alzheimer Society of Canada .....	www.alzheimer.ca
Canadian Coalition for Seniors' Mental Health .....	www.ccsmh.ca
Ami Québec: Alliance for the Mentally Ill Inc. ....	www.amiquebec.org
Anorexia Nervosa and Bulimia Association .....	www.phe.queensu.ca/anab
National Eating Disorder Information Centre .....	www.nedic.ca
Anxiety Disorders Association of Canada .....	www.anxietycanada.ca
Aspergers Society of Canada .....	www.aspergers.ca
Online Asperger Syndrome Information .....	www.udel.edu/bkirby/asperger/suppCAN.html
Autism Society Canada .....	www.autismsocietycanada.ca
Mood Disorders Society of Canada .....	www.mooddisorderscanada.ca
Schizophrenia Society of Canada .....	www.schizophrenia.ca
S.A.F.E. Self Abuse Finally Ends Canada .....	www.safeincanada.ca
The Learning Disabilities Association of Canada .....	www.ldac-taac.ca
Responsible Gambling Council .....	www.responsiblegambling.org
Canadian Sleep Society .....	www.css.to
Mental Health Commission of Canada .....	www.mentalhealthcommission.ca
Mental Health Canada/Santé Mentale Canada Inc. ....	www.mentalhealthcanada.com
Canadian Mental Health Association .....	www.cmha.ca
Canadian Medical Association .....	www.cma.ca
The College of Family Physicians of Canada .....	www.cfpc.ca
Canadian Psychiatric Association .....	www.cpa-apc.org
Canadian Psychological Association .....	www.cpa.ca
Canadian Psychoanalytic Association .....	www.psychoanalysis.ca
Canadian Association of Social Workers .....	www.casw-acts.ca
Canadian Counselling Association .....	www.ccacc.ca
Canadian Group Psychotherapy Association .....	www.cgpa.ca
Canadian Psychiatric Research Foundation .....	www.cprf.ca

## The “Leaning Tower Illusion”

These two pictures of the Leaning Tower of Pisa look as if they have been photographed from a different angle, but in fact they are identical. This is an example of a visual rather than optical illusion, because the trick is in the mind, not in the light. Why does it happen? Normally, when two identical towers rise up, their images converge due to perspective. Our brains have learnt to compensate for the perspective distortion with the result that we see the towers correctly as identical. However when the image contains towers that do not converge but are instead parallel, as in the Pisa towers, the visual system, because it applies the same perspective correction, sees them as diverging.



The “Leaning Tower Illusion” won the 2007 Best Vision Illusion Contest organized by the Neural Correlate Society, in an award ceremony held in Sarasota, Florida. The illusion was discovered by Professor Frederick Kingdom in collaboration with Dr. Elena Gheorghiu and Ali Yoonessi at the McGill Vision Research Unit in the Department of Ophthalmology, McGill University. They discovered the illusion quite by accident while carrying out research into human vision funded by the Canadian Institute of Health Research.