

# Neuroscience: Environment and Violence

Paula M.S. Ingalls (USA)

**Abstract.** Today, the sciences are so overspecialized, it is difficult to remain current on what is being discovered in other corners of research. Ronald Kotulak, science reporter for *The Chicago Tribune*, has interviewed over 300 researchers in the various neurosciences. His findings have been published in his book: *Inside the Brain*. The new consensus is that the environment and experience are the architects of the brain. Biology is not the cause of violence; biology is shaped by external stimuli, which reshape the neural response mechanisms.

If those environmental influences are violent, aggression, impulsivity, and nihilism are wired into the structural network of neural connections in the brain and in the functional efficacy of the brain cells. Scientists have found that epilepsy and depression can be learned behaviors, implying that such diseases and other mental disorders can be corrected by relearning, especially when treated early in life. These latest psycho-neuro findings, suggest that we can no longer separate the mind from the brain or body from the soul whether one is a pre- or perinatal being or an adult. The development of the brain, thus the mind, begins upon conception when the zygote is already in a state of experience that will affect it for life -- either for better or for worse depending on the particular culture and environment the new organism is formed in.

## Introduction

There are two types of violence: malevolent violence and abuse couched in benevolence. We are all too familiar with the first in the U.S. The latest horror was committed by a six-year old boy in Michigan who mortally shot a classmate to settle a score. Although the adult crime rate has gone down considerably over the last decade, juvenile crime has gone up in spite of the total number of prescriptions of Ritalin written for preschoolers – as young as two years old – and older children: 11.4 million in 1998 versus 8.4 million in 1995.<sup>1, 2</sup> The recent terrorist attack on America is another prime example.

The other, malevolence under the aegis of good intentions and ignorance, is best explained by quotes. According to Vladimir Nabokov, a fetus is “The tiny madman in his padded cell.”<sup>3</sup> To Freud, the child is a “selfish savage” while to Melanie Klein a “murderous cannibal.”<sup>4</sup> Many practitioners of pre- and perinatal care still perceive a third trimester fetus as nothing more than a bundle of neurons and reflexes.<sup>5, 6, 7</sup> This materialistic view is being proven wrong by science. To be sure, the pre-nate is neurobiologically,

neurochemically, psychologically, and emotionally a receptive, responsive, and expressive human being at a much earlier stage in utero than ever imagined.<sup>8, 9, 10, 11, 12, 13, 14, 15, 16</sup> As a consequence, the perceptions, especially in neuroscience, concerning nature versus nurture, genes, and environment are shifting, placing greater emphasis on both nurture and the environment in the development of mammals, including humans.<sup>17,18,19</sup>

## Discussion

The incredible plasticity of the pre-, neonates, and children's brains is receiving greater attention. The consensus is that genes establish the framework while experience is the architect of the brain which uses the outside world to shape and reshape itself. The cultural and geographic environment customizes it. Experience from the moment of conception influences the organism physically, emotionally, psychological-ly, and mentally. From the outset, though, the physical effects on brain, neuro-development, neuro-chemistry, and electrical efficacy are of particular importance for both positive and negative stimuli which can alter genetic expressions significantly. The new perception is that it may be in the genes but is not necessarily predetermined by heredity such as eye color. For example, persistent stress during the embryonic and fetal stages may turn on or off genes, or combinations thereof, which otherwise would have not. Such genetic switching alters the course of development in utero in subtle and overt ways – possibly for life.<sup>16</sup> The distinction is important. Materialistic scientists would have us and the public believe that chemical imbalances and deficits in certain brain centers of, for example criminals, measured in studies with imaging scans, are due to heredity rather than caused by genes altered by the environment.

Too, awareness is growing concerning teratogenic effects of stress, toxins, drug therapies, and obstetrical harsh practices on the structural and functional development of cells, brain, and eventually the 'neuro-psycho' behavior of the individual. Such discoveries are objective and proof positive of the relationship between stress and violence inflicted pre- and perinatally and the violent behaviors of our youth in particular.<sup>9, 12, 16, 20, 21, 22, 23</sup> An obvious example, is the incurable Fetal Alcohol Syndrome.<sup>24</sup>

The implication is that adverse effects can take place on a cellular level the consequences of which are still not considered. In that light, I would like to digress and draw your attention to the latest advances in science:

1. Cloning with the necessary harsh manipulations of delicate embryonic cells.<sup>25</sup>
2. Preimplantation genetic diagnosis, or P.G.D. – an embryo screening test. Specific genes are isolated by puncturing the coating of fertilized eggs. With a glass needle, an embryo cell is sucked out, amplified, and checked for the presence or absence of genetic mutations such as the one for cystic fibrosis.<sup>26</sup>

3. Gender selection prior to conception. This newly developed method sorts the sperm by the amount of DNA by staining and piercing them with a laser before they are used for artificial insemination.

To continue, as nature dictates, it is not in the number of neural connections; the question is which particular synaptic couplings are made and at which particular time. Content – initially derived from sensory and reflexive experiential in- and output – develops and expands over time into a perceptual and conceptual one. The emphasis is not on experience per se, but on the type of quality of environmental influences on the embryo, fetus, and newborn. In spite of its plasticity, the brain can get damaged from environmental threats and stresses, from alcohol and drugs, from maternal neurosis and psychosis, from stroke and head trauma, such as possibly caused by forceps and caesarian section during delivery.<sup>16</sup> For example, Dr. Saul Schanberg of Duke University and Tiffany Field of the Univ. of Miami discovered one of the most important biological buttons of all: touch. When newborn rats were separated from their mothers they stopped growing regardless how well they were fed and medically attended to. The pups went in survival mode: the body's need for food was subdued by stress hormones which actually turned off genetic activity so that cells could not divide. Working with 'preemies', the researchers found the same chemical changes as in the rats: the stress hormone cortisol was up and DNA synthesis was down. Similarly, 'preemies' that were held and had their backs rubbed regularly started to get stronger and grow by as much as thirty grams per day versus the anemic rate of twelve to seventeen grams a day before such touching therapy was used.<sup>16</sup> In a recent study, reported in The New York Times, of 150 teenagers who weighed 2 pounds or less at birth (called 'micropreemies'), nearly one-third had significant physical disorders, including cerebral palsy, blindness, and deafness with academic and behavioral problems often surfacing in the school years.<sup>19</sup> As a cause, prematurity is exacerbated by invasive modern medical techniques, immediate separation and isolation from the mother for a long period of time, and lack of social and emotional interactions beyond changes of tubes and electrodes. As Dr. Patricia M. Rodier, professor and anatomist at the Univ. of Virginia phrased it, "Many systematic brain insults during brain development do result in lasting behavioral and emotional alterations, while in many instances leaving the affected being normal in appearance"<sup>9, 10</sup>

Systematic environmental stress upon prenatals and young infants leave landmark imprints due to reduced or increased levels of neurotransmitters such as serotonin, noradrenaline, cortisol, and others. In the developing brain, the main neurochemical function is to adapt to the specific environment – to find out how to best survive in that world. The researchers can now tell us with increasing certainty how the brain adapts physically to a threatening environment – how abuse, poverty, neglect, or sensory deprivation – as is the

case with ‘micropreemies’ – can reset the brain’s chemistry in ways that make genetically vulnerable children more prone to violence. These brain changes can become permanent, encoding into genes a propensity for aggression and violence. These genes are not passed on to the next generation because the genetic changes occur in the brain cells and not in the sperm cells.<sup>16</sup> However, parents who have suffered the genetic alterations in their brain cells can still pass on their proclivity to violence by means of their own behaviors, thoughts, and attitudes towards their children. Parents teach overtly and covertly by example.

Dr. Markus J. Kruesi, Chief of Child and Adolescent Psychiatry at the Medical School at the University of Illinois, said: “What we are all beginning to conclude is that the bad environments children are more and more exposed to are, indeed, creating an epidemic of violence. Environmental events are really causing molecular changes in the brain that make people more impulsive.”<sup>16</sup> Adaptation by the brain to a stressful environment expresses itself in behaviors, such as hyper vigilance, reactivity, impulsivity, and a mentality of always anticipating the worst. Thus, a constant preparedness in the name of self-protection and survival is neurochemically triggered and becomes the norm – a part of a person’s personality. The effect of early pervasive stress is that the neonate is taught by its own neurochemistry that facilitates the flight, fight, or freeze mechanism. The hyper vigilant infant is constantly in readiness to be on the defensive as survival has become its singular goal. According to Eichhorn and Verny, quoting Megan R. Gunnar of the University of Minnesota, children who have chronically high levels of cortisol due to persistent stress have been shown to experience more developmental delays – cognitive, motor, and social – than other children.<sup>26</sup> Dr. Bruce Berry of the Baylor College of Medicine, and an expert in severely abused children, said: “those kids have high resting heart rates, increased startle response; they will eat but not gain weight. They have the physiology of permanent fear. Reminders of the early trauma(s) can keep flipping the switch of the evolutionarily perfected stress-response mechanism, overstimulating stress hormones, causing the heart to race, the body to cool, the mind to focus narrowly on survival.”<sup>27, 10</sup>

Especially young infants respond with their first learned behaviors and use strategies ‘that worked before.’ It is as if their emotional and sensory brain goes through its Rolodex of chronologically and cross-indexed organized response cards. Each response behavior, whether reflexive or learned, creates or reinforces synaptic connections and neural pathways for life. For infants who learn to respond with rage – rage due to a low serotonin, or high noradrenaline and cortisol productions, or combinations thereof – develop behaviors that are not represented in the neocortex by formulated thoughts. Yet, they retain the emotional memories, neural pathways, and affected gene cells. As these children grow up, they will continue to respond with curses, fists, and kicks

precisely because those were the behaviors they learned first out of necessity. Raw survival continues to matter foremost. Furthermore, the affected brain anatomy and chemistry can inhibit learning, concentration, attachment, and even empathy. “This is significantly more damaging than traditional infectious diseases ...,” said Dr. Perry “If you influence the way the brain functions in ways that become chronic and permanent, that’s fixed. Impulsive violence is only a piece of what we’re finding. The big picture is the lost potential of kids,”<sup>27</sup> because these children – these silent victims – are not living: they are struggling through each day while locked into their infantile primary goal of survival and related patterns of behavior. The next phase in their development toward chronic violence is the period between roughly ages 6 and 10 when their intellectual development begins to take shape.

Unfortunately, there is very little literature concerning what goes actually on in the mind of those young children who are predisposed towards violence and/or who have an unresolved traumatic history. What are their actual thoughts? How do they evaluate new experiences?<sup>10</sup>

Susan J. Sara of the Institut des Neuroscience in Paris, has concluded from her research that “... it is inconceivable that a new memory can be acquired independently of retrieval of past experience, in that it is memory of the past that organizes and provides meaning to the present perceptual experience.”<sup>28</sup> Past experiences provide a bifocal lens through which each new experience is perceived and initially evaluated. But, when a child begins to think independently, whether consciously or subconsciously, s/he differs from adults in several major respects: 1. children’s thought patterns are linear; they take things literally. 2. Their thoughts are subjective and I-centered. Their ego is still the core of their emotional and mental universe. Their rationale can be illogical by adult standards but flawlessly logical by their own measurements. 3. According to Peter Shepherd, the meanings of words during the middle phase of language development are represented in the mind as an aggregate of subjective responses. Meanings are defined in terms of their position on a continuum between polar adjectives, such as ‘Good-Bad’, or ‘Kind-Unkind’, or as kids would phrase it: ‘It’s cool-It’s a bummer’, and so on. So they are felt meanings, defined not by other words but in terms of the subjective experience of these qualities.<sup>29</sup> In other words, a new experience to say an eight-year old goes initially through sensory and emotional filters already stored in the limbic system which holds the emotional and sensory memories of the past.<sup>10</sup> According to Dr. Joseph LaDoux, Neuroscientist of the Center for Neural Science in New York, the emotional, or limbic system, can act independently of the neocortex. From the amygdala, which also acts as the storehouse of emotional memories, projections extend to every part of the brain among them the locus ceruleus in the brain stem which manufactures noradrenaline: a stress hormone that suffuses the cortex, brain stem, and limbic system itself. This

hormone makes the sensory circuits more sensitive; it also increases blood pressure, speeds up heart rate, affects breathing, such as its suspension when in fright or behaviorally paralyzed.<sup>30</sup> Thus, a neonate repeatedly subjected to severe fright will have a lot of reinforced connections from the various centers to the Amygdala and from there to other parts of the middle and lower brain sections, as well as overproduction of noradrenaline and other hormones. As a result, behaviors in response to fear are firmly encoded in the brain's neural networks, especially as the amygdala stores the emotional aspects of traumatic experiences and behaviors in response to them. The overall effect may be a hyper-active emotional brain. Thus, when intellectual development is in progress, thoughts are formed that are based on an emotional traumatic past. As a consequence, the neocortex will have strong connections to the limbic, or emotional brain.

### **Conclusion**

Today, kids with traumatic pasts buried inside or unresolved conflicts are at greater risk than ever before because of our culture. Violence is everywhere. Forty years ago there were virtually no drugs, guns, run-aways, rampage rage at schools, violent television and video games, acid rock, and nihilistic lyrics as they are today. A traumatic past does not have to be pre- and perinatal: early poverty, illiteracy, lack of education, an environment engaged in war, fundamentalist and extremist religious indoctrination can cause the same psycho-social problems. Intellectually vulnerable by about age 6 or 7, their young minds are ready to absorb interpretations and develop ideologies that can turn them into hoodlums, gangsters, drug dealers, and terrorists of the ultra right or other causes. In time, attitudes change from being victims to turning into emotionless and cold victimizers during puberty when the high noradrenaline is converted to low noradrenaline production.<sup>16</sup> Psychologically, these adolescents change from defensive survivors to aggressive challengers or victimizers. Some of them turn against themselves and resort to self-mutilation, or cutting, anorexia, or bulimia. As adults, they can't tolerate being wrong for the unconscious associations carry life threatening charges. As a consequence, they will carry to extremes their belief in being right regardless of the issue in question, particularly when their beliefs are validated by religion or political activism. Too, they cannot be dissuaded from their mandates and fanatic behaviors for they cannot be wrong which underscores their tunnel vision and intolerance. Their philosophy of 'Might is Right' and their self-righteousness is often maintained by brutal force which serves simultaneously as a means to act out their own repressed traumatic pre- and perinatal memories and their unresolved rage. City gang members, skinheads, terrorists are typical examples.

Last but not least, teenagers with a violent ideology with its roots in violence done onto them, in many cases pre- and perinatally, are extremely difficult to help that might change their minds. They are inflexible. Those early experiences have become part and parcel of their neural networks and neurochemistry which is maintained by the very emotionally underpinned ideologies – primal philosophies embraced by what to their unconscious is nothing less than survival. Emotionally, they are infants or young children wrapped in adult bodies, yet no less lethal because of it.