



Center *for* Global **Nonkilling**

Neuroscience and Nonkilling

Exploratory Colloquium

2009



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Exploratory Colloquium on Neuroscience and Nonkilling
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Introduction and Purposes of the Colloquium

The mission of the Center for Global Nonkilling (CGNK) is to reduce the prevalence of killing in the world, and eventually eliminate killing altogether. To that end, it is essential to understand as much as possible about why people kill themselves or others, and what can be done to end killing.

One of CGNK's strategies is to explore the contributions various academic disciplines can make to discovering new approaches to end killing. More specifically, CGNK is conducting a series of exploratory colloquia to bring together experts in various fields to uncover new knowledge related to killing and nonkilling, and identify new directions for research, education and policy initiatives.

The first exploratory colloquium, Neuroscience and Nonkilling, was held July 27-28 in Philadelphia, Pennsylvania, USA. The purposes of the colloquium included:

- Exploring how neuroscience research might contribute to understanding the human capability to not kill and assessing whether a world without killing is possible
- Gaining greater insights into what we know about the brain and its relationship to killing and nonkilling
- Identifying new revelations from the rapidly expanding field of neuroscience to help eliminate the conditions that lead to killing and to foster the conditions that support nonkilling attitudes and behaviors.

The process of finding neuroscientists working specifically on stopping killing took some creativity, as the term 'nonkilling' only recently has been used with increasing frequency. Once an inquiry was sent out to an initial list of prospective participants, other researchers were identified who were doing research on the relationship between killing and the brain. Most researchers also hold academic appointments, so while inviting people did result in a high interest in attending, scheduling people when they could assemble at the same time was a significant challenge. Fortunately, each participant who attended had unique areas of interests and represented different specializations of neuroscience.

Since none of the participants had met prior to the Colloquium, the meeting began with each participant presenting a summary of her or his work. The research interests of participants covered neuroimaging, brain biochemistry and genetic links, evolutionary biology, psychosocial development and neurorealism, maternal nurturing, breastfeeding and the brains of humans and other primates, the science of cruelty and brainwashing, cognitive neuroscience and gerontology, and bioethics, among others. The participating scientists explored intersections, confluences and conflicts in their perspectives, worldviews and understandings. Many of the reports were, as might be expected, technically and scientifically complex. Some were novel, innovative and considered by some to be radical paradigms and perspectives.

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The goal of the colloquium was not consensus. CGNK sought new perspectives and insights about the relationships between neuroscience (and related fields) and what is known about the relationship between the brain, killing and nonkilling. One major outcome, however, is that all participants agreed more emphasis needs to be placed on efforts to encourage and promote maternal nurturing, as suggested by the life work of Dr. James Prescott. The absence of this nurturing is directly correlated with the increased likelihood of violence and killing later in life. The group seemed to agree in principle that CGNK needed to continue to promote such colloquia and other educational programs that focus on the challenges and opportunities associated with work to eliminate killing in the world.

This report is intended as a summary of discussions which occurred during the Colloquium, highlighting major themes and concepts taken from more than 50 pages of meeting notes. For readers interested in the particular research behind many of the concepts and ideas presented, we recommend reviewing the participants' websites, books, articles and past presentations for more detail. Full curriculum vitae for each participant can be found at www.nonkilling.org.

Participants and Their Backgrounds

To provide some background on the participants and their research interests, a brief biographical sketch of each follows.

Nelly Alia-Klein, PhD, Brookhaven National Laboratory

Nelly Alia Klein is a neuroscientist working for the Brookhaven Laboratory in New York. As an Israeli, she has grown up surrounded by violence. Her interest in understanding violence began with psychiatric interviews of people to see if they were fit to stand trial. She also researches drug addiction. From her work with neuroimaging and the gene MAOA monoamine oxidase A (breaks down serotonin and regulates neurotransmitters), it has been found that low serotonin in combination with childhood mistreatment show antisocial behavior and has a high correlation to violence.

Joshua Buckholtz, Vanderbilt University

Joshua Buckholtz is at Vanderbilt University, and is using neuroimaging to see how brain chemistry relates to violent behaviors. He has conducted research in prisons of Wisconsin, focusing particularly on people who are both dangerous and charismatic. He asserts that violence is a major health concern and that antisocial aggression has an economic cost of \$1.7 trillion. He has found that 10% of offenders commit 50% of crimes, often from the same families. This has led him to explore whether violence has genetic linkages.

Joshua Duntley, PhD, The Richard Stockton College of New Jersey

Joshua Duntley is a neuroscientist and professor at Stockton State University. His area of expertise is human evolutionary history, and he seeks to answer the question, "How did human evolution shape modern cognitive adaptations?" He has studied the fascination Americans have with violence in the media and the link between violence, sex and killing. His research suggests that a majority of Americans have homicidal fantasies, thus the popularity of these kinds of shows. From the evolutionary history perspective, killing was a result of the elimination of competition for mates, protecting resources, and elimination of costly children, with most killing committed by young males competing for mates.

Bruce Eldine Morton, MD, PhD University of Hawai'i

Bruce Morton is a retired neuroscientist from the University of Hawaii, having previously served at Harvard and other universities. His lifelong research goals include clarification of the functional and hierarchical relationships of the brain neurotransmitter and anatomical systems producing consciousness, emotions, and psychosocial development. This encompasses topics ranging from the mode of action of psychoactive drugs to the molecular bases of the emotional illnesses. Overarching this is an interest in the critical stages of brain psychosocial development, developmental arrests and trauma repair

Kathleen Taylor, PhD, Oxford University

Kathleen Taylor studied philosophy, psychology and physiology at Oxford. As a neuroscientist, she worked on eye movements and, later, the biological basis of dyslexia. After leaving the academy, she became a science writer and has recently finished two books, entitled *Brainwashing* (Oxford University Press) and *Cruelty* (Oxford University Press). In her view, killing is largely related to the misuse of power, so to reduce killing the attitudes and behaviors of those in power need to be further explored and altered. Her work on cruelty demonstrates links between the human psyche and social factors which lead to violence and killing.

James W. Prescott, PhD, Institute of Humanistic Science

James Prescott is a developmental neuropsychologist and cross-cultural psychologist who has conducted extensive research on issues of maternal-infant/child bonding, affectional bonding, cerebellar development, and violence in both primates and humans. He began by addressing the question: "How do you raise a primate infant to display adult peaceful, affectionate behaviors or its opposite of violent behaviors?" This led to research on how to promote empathy, compassion, caring and affection rather than violence, aggression and killing. He documented abnormalities in primate brains due to infant separation, which led to his seminal work on the important role of maternal nurturing in developing peaceful and non-violent cultures.

Peter J. Whitehouse, MD, PhD, Case Western Reserve University

Peter Whitehouse received an MD-PhD from Johns Hopkins University, with an interdisciplinary PhD focused on cognitive neuroscience and behavioral linguistics. He is a geriatric neurologist, a cognitive neuroscientist, and an environmental ethicist. He has appointments in seven different departments at Case Western Reserve University, including Nursing, Ethics, and Organizational Behavior. Peter is working in geriatrics and focuses on Alzheimer's, as well as the environmental attributes of violence (e.g., low levels of lead). He questions whether neuroscience has direct linkages to nonkilling and challenges treating violence/killing as a preventable disease because he views the medicalization of the issue as problematic.

Meeting notes were taken by Utpal Sandesara, University of Pennsylvania Medical School, and the meeting was facilitated by CGNK Leadership Team members Katherine Li and Thomas Fee.

Agenda & Major Themes

The agenda was designed to address several fundamental questions related to killing and nonkilling. Many of these questions were discussed in depth and many new questions were generated. The group spent considerable time clarifying basic understandings, agreements and disagreements about scientific, political and personal views, which enriched the deliberations. Ultimately, discussions highlighted the need for more research on how the brain influences behaviors related to violence, aggression, killing and not killing.

The questions below, some of which were elicited from participant presentations, provided a framework for deliberations. The major themes and outcomes of the Colloquium were drawn from the discussions.

1. To deal with aggression/violent behavior, would you intervene at the level of the gene, or the society?

James Prescott began by asserting that the vestibular-cerebellar system is the key to brain development. He focuses his attention on early childhood development and claims that during fetal development the sensory systems are only active on a rudimentary level. Movement stimulation, however, is continually activated through movement of the mother. This is the primary mechanism of maternal bonding during the fetal phase of development. What happens in most modern human cultures is that this continuous movement stimulation ends with birth. Since it takes a while for the other sensory systems to develop to establish post-natal bonds with the mother (see the Rock a Bye Baby video at www.violence.de), movement stimulation (vestibular-cerebellar system-- prenatal and postnatal) is the most important sensory system for emotional development – linking the importance of post-natal breastfeeding.

Prescott challenged participants to examine the cross-cultural implications of these findings. "We are rearing our infants and children without physical affectionate bonds (breastfeeding and baby carrying). The brain areas that lead to pleasure are damaged; they are dysfunctional and cannot inhibit the violent circuits of the brain. This produces depression and uncontrolled violent behavior including alcohol and drug abuse violence. He asserts that animals raised in social isolation (somatosensory deprivation) develop impaired sexual affectional bonding that leads to violence. This is particularly true for primates, including human primates. The lack of physical affection during infancy/childhood (pleasure) is often associated with violence (pain) as a form of "discipline." Many modern human cultures are somatosensory deprived, which can lead to depression and a path of sexual violence rather than sexual love. (See footnotes i and ii.)

Pertinent to the issue of killing and not killing, Prescott (1975) maintains that children in modern human cultures are subjected to a functional somatosensory deafferentation (the functional reduction of somatosensory stimulation--Love). This has led to the "epidemics" of depression, hyperactivity, hyper-reactivity, impulsivity, homicide and suicide seen in modern human cultures and provides a neuropsychological foundation for why 77% (20/26) of tribal cultures, which have weaning age of two years or greater, have absent or low rates of suicide--the six cultures inflicted pain-harsh treatments- upon the infant. The peaceful or violent nature of 49 tribal cultures could be predicted with 100% accuracy based upon measures of affectional bonding in two stages of development (1) maternal-infant/child bonding (baby carrying during the first year of life) and (2) youth sexual affectional bonding (www.violence.de/prescott/bulletin/article.html).

In essence, sensory stimulation produces the neurointegrative brain and sensory deprivation produces the neurodissociative brain. These two sensory processes of pain and pleasure form our two cultural brains: 1) the subcortical emotional/social/sexual brain-- first in evolution and ontogeny; and 2) the neocortical, thinking, rational brain--second in evolution and ontogeny. How these two cultural brains are encoded with pain and pleasure determine the life paths of peace or violence that will be followed by the individual where culture (environment) shapes life experiences of pain and pleasure and the cultural brain that supports the behaviors of peace or violence. Pain produces the neurodissociative brain and pleasure produces the neurointegrative brain.

Adding to James Prescott's comments, Joshua Buckholz's notes, in any given society, 10 percent of criminal offenders are responsible for up to 50 percent of crime. And in any given community, there is a clustering of criminals into a small number of families, with perhaps 10 percent of families committing 50 percent of the crimes. It has long been known that some families produce a disproportionate number of the family members with delinquent behaviors. Genetic variance accounts for about 50 percent of the population variation in violent behavior. When asked which genes are responsible for the inheritance of antisocial behavior, the critical answer is MAOA – monoamine oxidase A. This enzyme

breaks down serotonin, and other monoamine neurotransmitters regulate serotonin levels.

Similar to Buckholtz's work, Nelly Alia-Klein also has conducted research focused on the importance of genes in predicting phenotypes, such as aggression. She believes more work in this area might result in progress in the future.

This discussion suggests that in the near term social interventions might be more successful in reducing violence and killing. Holding and breastfeeding children from birth, especially during the first three years of life, have a profound effect on preventing the types of brain dysfunction noted that often lead to violence and killing. In the longer term, more exploration of genetic dispositions to violence might also bear fruit in helping to reduce violence and prevent killing.

2. Why do we care about antisocial aggression at all?

Joshua Buckholtz, whose research focuses on the intergenerational transmission of antisocial behavior, its relation to our understanding of who is at risk for violent behavior, genetic markers for violent behavior, and prospects for the future, suggests we should be concerned about violence and killing if for no other reason that it results in astronomically deleterious economic impacts. He cites research estimating the costs of violence and killing to be 1.7 trillion dollars per year. So apart from the moral and social aspects, which are sufficient grounds on their own, the cost alone should give rise to caring about and investing in reducing violence and killing.

3. Since changes in serotonin metabolism have been observed in violent individuals, what are the implications for efforts to develop a society with less violence and killing?

Participants noted that low levels of the serotonin metabolite have been observed in individuals who show antisocial behavior. Research cited (Brunner et al.) included investigations of a Dutch family where affected males showed mild mental retardation, decreased serotonin metabolite levels, and aggressive social behavior. This resulted from a rare mutation responsible for a functional knock-out of the MAOA gene. The research on trait and behavioral associations tied to this gene has been inconsistent to date. A more robust link emerges, however, when the role of early life experience is taken into account. Additional research cited (Caspi et al., 2002) suggests that MAOA-L by itself does not predict antisocial behavior, but when correlated with a background of childhood mistreatment, becomes a predictor for violent behavior.

In Buckholtz's own work (with Andreas Meyer-Lindenberg and Daniel Weinberger), using voxel-based morphometry, it has been demonstrated that individuals with MAOA-L have dramatically decreased gray matter volume in cingulate and amygdala. MAOA-L individuals were found to have decreased activity in the dorsal cingulate cortex (important for executive control) during response inhibi-

tion. Cingulate activity is decreased in mood and anxiety disorders, etc. , however, the direct relationships to violence and killing are not well established. As such, more research is needed in this arena of inquiry.

4. How might genetic variation in MAOA lead to these differences in behavior noted above?

Participants suggested that a wealth of preclinical data demonstrates excess perinatal serotonin disrupts cortical development and leads to emotion dysregulation. One participant posed two speculative questions: (1) do MAOA-associated changes in cortico-limbic circuitry lead to sociocognitive biases, and (2) is it possible that amygdala hyperactivity leads to the misattribution of hostility in response to social cues in MAOA-L individuals? This is typical in people who are abused as children, as well (hostile attribution bias (Dodge et al). It was suggested that this is an important factor in aggression/antisocial behaviors. Excess perinatal serotonin resulting from low-functioning MAOA alleles disrupts corticolimbic circuitry development, predisposing individuals with such alleles to greater sensitivity to the effects of childhood maltreatment. In a non-exposed child, this may come out as subliminal conditions. But in exposed children, it can lead to aggressive, antisocial behavior.

5. How did human evolutionary history shape modern cognitive adaptations? What are the implications for efforts to develop societies with less killing?

Joshua Duntley began by asking, "If we kill to survive what are the implications for the future and efforts to develop societies where there is no more killing?" His current research interests are based on the principle that "the two factors in human evolutionary history that are most important are sex and killing." In homicide adaptation theory, humans have evolved a number of specialized adaptations designed to murder other human beings. Murder is a qualitatively different, radically effective solution and not necessarily a part of a continuum of violence.

Unlike nonlethal violence, killing is often a costly strategy. Attempted murder may create significant dangers. So in evolutionary and historical context, the benefits have to outweigh the costs. Scenarios where this equation has a bearing include eliminating intra-sex competitors, protecting resources, eliminating costly children, eliminating competition for children, eliminating costs of relationship between irretrievable mate and a rival, benefits to the killer are costs to victim, i.e. loss of life.

In a more current application, evolutionary biology related to ambulance homicide theory suggests that without advances in traumatic care since Gulf War, there would have been many more killings/murders. This is also the case for improved application of antibiotics and other new medicines. So homicide rates are probably lower than homicidal behavior.

The evidence from sex differences data also is elucidated by evolutionary history. Understanding what is often called the “young male syndrome” is aided by evolutionary perspectives. Young men are entering a competition for mates. They have no experience, no resources, so engaging in risky strategies may be most effective.

Other evidence from human artifacts helps to understand the phenomenon of people killing other people. It was suggested more work is needed on understanding the general obsession and fascination with murder in the popular media and how this relates to evolutionary biology and our species history. How does bioarchaeological evidence, such as “The Ice Man”, help us understand? There is much archaeological evidence about killing to be found at ancient fortifications. There is cross-cultural evidence to be explored focused on tribal warfare, blood revenge in foraging societies, intrasexual homicide in all cultures, infanticide in all cultures, mate homicide in all cultures. Other evidence from famous homicides including wars need to be studied more.

Modern research needs to be done on homicidal ideations and it may provide a psychological window into homicide and thus killing and nonkilling behaviors. Duntley noted recent research shows that men experience more homicidal thoughts than women do, that men think about killing more people than women do, that people will think of killing non-relatives more often than kin, and that it seems homicidal fantasies are triggered by mate’s sexual infidelity. It seems that men are far more likely to target mates; women have almost equal likelihoods of targeting mates and non-mates and women are more likely than men to experience homicidal thoughts as a result of besmirching of their sexual reputation. As the amount of food being stolen increases, the probability of killing increases. In addition, research looking at tribal groups shows that when a group thinks another group is going to attack, they will engage in preemptive attacks. Also as the number of viable women in a group decreases, the likelihood of killing men in another group increases. This harks back to mate poaching notions and procuring means of reproduction.

6. Should we focus on drugs or do we focus on restructuring our communities?

In discussing geriatrics and recent research, Peter Whitehouse said, “I became unhappy with a medication approach to Alzheimer’s Disease (AD). Do you use drugs, or do you not use drugs? You can make anyone so sedated that they won’t kill anybody, but is that a desirable state to be in?” (He is not suggesting that people with dementia are dangerous only using this as an example of social challenges.)

Whitehouse said there are very few experts who would suggest AD is a single disorder. He observed the influence of the drug industry. It is easy to normalize AD and treat it as a continuum; then, the issue of prediction of violence comes up. He was careful about the language used and noted “I’m not using the term ‘killing’, because I don’t even know frankly of any case of someone with demen-

tia killing someone. But this discussion is about how we as a society regulate people's undesirable behaviors."

Relating his work with Alzheimer's to another social challenge, Whitehouse used an example from another part of the life continuum, children. He and his wife launched a multigenerational school with inner-city kids. The kids do well on tests. And adults at the school do well too, because the community can support those individuals by understanding them, including them and giving them a sense of their legacy. "One of the observations we've made is that, unlike most public schools, where the school requires metal detectors for safety, the presence of the adults creates a sense of community that reduces the likelihood of violence. So before you do anything else, you have to create a sense of decorum and dignity, a spirit of non-violence. We immediately address aggression by the children in word and action."

Whitehouse encouraged colleagues to be creative and think of options to address serious social questions such as violence, killing and the desire to develop cultures and societies where there is peace and no more killing. He emphasized that "an intervention of the kind our species needs to survive has a lot to do with being wiser about the kinds of cultures we create and promote in our society." Concerns about the prospects for magic pills and medicines to address violence, dementia and killing were loaded with ideas and comments about research needed and cautions about the ethical dimensions of these endeavors.

7. What do we know about human brutality, lethality, aggression and violence? How can humans commit genocide and mass atrocities? How does our knowledge shape our understanding of the possibilities for a world without human killing?

During her research while writing *Brainwashing: The Science of Thought Control* (Oxford University Press, November 2004) and *Cruelty: Human Evil and the Human Brain* (Oxford University Press, February 2009), Kathleen Taylor explored social science research and neuroscientific models of behavior. She thinks what was downplayed in both those areas of research and knowledge was that the person doing the behavior was an agent with motivations, rather than just a product of environment and genetics. "Cruelty is a behavior, but it's also a moral problem, and you cannot disentangle those. You can look at it scientifically—psychometric factors, or whatever—but you also have to make a moral determination—moral or immoral. And that depends on your societal standards, and who the observer is. For example, perpetrator, victim, and observer are three elements of the moral judgment system." Ruling out psychotic behavior, she suggested that the intention of cruelty has to be suffering rather than harm.

In her book on cruelty, Taylor notes there are many motivations for cruelty, including financial gain, peer pressure, and sadism, where the aim is stress and pain in the victim (although sadism is extremely rare). Callousness is also evident, and violence usually results from preconditioning. Taylor posits that de-

humanization/callousness can be called “otherization,” involving negative stereotyping, where others become less than human. An example of this was naming of the other tribe as cockroaches in the Rwandan genocide. These behaviors are cumulative and provide the preconditioning for violence.

Genocide never erupts spontaneously. There is always a precursor with escalating levels of aggression. Every genocide victim is portrayed as someone who had committed morally reprehensible acts. As the process becomes more advanced, the victim is caricatured and depicted as other than human. The prospective victim of cruelty/genocide is often portrayed either as inanimate agent (disease/virus) or as malevolent agent (witch, cockroach, devil, etc). These behaviors all drive towards making the person less human. An extreme case is World War II Europe, where the Nazi regime labeled certain groups, most notably Jewish people, as a social cancer that *must* be extracted for the health of the world. Under this reality, killing can be seen as healing and condoned or necessary.

Different types of violence are associated with different types of *temporary* brain dysfunction. “It’s very easy to take an average person and make them kill, in a relatively short period of time.” This notion, in particular, caught participants’ attention, leading to posing the question of how this impacts CGNK’s efforts to find solutions and paths toward a society where there is less and less human killing.

8. Can an understanding of a new consciousness/world view model as described in Morton’s Neurorealism paradigm contribute to a future where there is no more killing?

Bruce Morton argues that a shift is needed from a primitive unitary consciousness model in which we think that we are conscious and in charge of everything we do, towards a multileveled model in which we acknowledge that we are not aware of everything that goes on within our brain in terms of our behavior. A single consciousness model has not been able to account for the most of the complexities of human behavior. The Quadrimental Brain Model from Morton’s Neurorealism paradigm incorporates a number of discoveries, including non-motor behavior produced by the cerebellum.

The oldest level of the Quadrimental Brain Model, the Reptile Brain, deals with unconscious self-survival. Strong outputs from higher brain levels can usually control the naturally violent behavior of this brain element. This is important since the self-only, competitive laws of reptile instincts are opposite to the synergistic cooperative laws of the group.

The second level of the Quadrimental Brain Model is the Social Brain of the cerebellum. This contains our primary memory including awareness of the timing of sequences of events. From this it understands causality, meaning, and selfhood. Thus it becomes the source of morality, religion, wisdom, inspiration, and awe. Not only does it coordinate complex body movements, but also the complexities

of language syntax, and in this model, the complexities of social relations. Thus, it is also the source of cooperative behavior between humans.

The third level of the Quadrimental Brain Model is the Executive Brain. It is this brain element that judges, minute by minute, whether it is better to optimize survival by activating the Reptile Brain (self vs. jungle), or to activate the Social Brain (optimization of family well-being). Its unconscious cost-benefit analyses conclusion determines whether we will enter interactions behaving cooperatively or adversarially. The executive brain is housed in the limbic system including the anterior cingulate and frontal cortices.

The fourth level of the Quadrimental Brain Model is the late arriving Intellect. This is the source of our abstracting abilities and imagination. “It enables mock-ups of proposed behaviors to be tested first in our imagination to see if they will improve our survival or get us killed.” Until educated, it is generally unaware of the powerful actions of the lower three brain elements. It tends to think it is in charge of everything.

Morton notes that “although we have the capability and will never lose the capability for killing and for living strictly for ourselves in a violent manner, there’s a part of our brain that’s dedicated to something very different, which is the social brain. Of course, if you’re pinned to the ground and about to be killed, then your social brain is not going to dominate—your selfish brain is going to take over. But otherwise, the social brain can take control... , so when you move up to the level of family, you are automatically going to want to follow the social laws—not the individual laws at the lower level of the self which are by definition antisocial. The question becomes how to convert someone into recognition of being a member of a cooperative family.”

Insights and Observations

Colloquium participants highlighted many possible avenues for future work, research, policy development and education. Although the goal of the Colloquium was not to reach consensus but to explore the neuroscience frontier for insights, one major concept was supported by all participants, as noted earlier. This is the need for maternal nurturing (through holding and breastfeeding) from birth through especially the first three years of life, as this has significant impacts on brain development which affects the propensity, or not, for violence later in the life.

Beyond that, there were many valuable insights and observations worthy of future exploration and discovery, even though consensus did not emerge around these concepts. A sampling of ideas and tenets that will be considered in future work connecting neuroscience to the elimination of killing includes:

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- “We have to ask what the environmental stimulations are that are promoting agitation before we jump straight to [medication].”
- “In order to reduce killing, we need the people who have power to give up some of that power. Historically, that has not been easy, so I would be very interested to know to accomplish that.”
- “It’s difficult to adjust the power structures of society to shift towards reduced killing. It’s always the powerless who are judged worthy of treatment—the poor, the stigmatized. It’s the politicians who are the ones who actually lead us into war.”
- “Take people that are physiologically and psychologically healthy, and show that they have brain changes. Then show that it’s these changes, in multiplicative interaction with childhood abuse/trauma, that lead to anti-social behavior. So we’re extrapolating from the fact that epidemiological literature shows that trauma/abuse contributes to antisocial behavior.”
- “There is a correlation between low MAOA and aggression. Men who reported being more aggressive had lower concentration and activity of MAOA.”
- “A double-blind control study shows that in people who commit more violence in incarceration, the level of violence can be modified by providing a normal diet, which is abnormal for the incarcerated population. That study is currently undergoing replication.”
- “A lot of the research on suicide bombers shows that they are not pathological—they are not mentally ill, they are well adjusted, well educated and acting out of the best of intentions. And a lot of what other people call cruelty is done for high, noble reasons—love of family, love of nation, love of God. Another thing that comes out very strongly is that we have a strong preference for choosing our own group locally. And this idea of extending human rights globally is a very recent idea. We have to work with that, because in times of crisis, people will always revert to an ‘us-versus-them’ mentality.”
- “The shift in addiction discourse towards “brain disease” shifts focus from will and weakness and moral excoriation to suffering and disorder and treatment. Even if violence isn’t actually a disease, it’s a useful shift.”
- “Aggression is also a very prominent feature in many psychiatric problems.”
- “The medicalization of social problems is a dangerous practice.”

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- “How many of these complex problems are really likely to be solved by the genetic/molecular interventions that are the primary mechanism of medicine today?”
- “To affect neurochemical balances, it doesn’t have to be a pharmacological intervention. It can be a social intervention. The brain is a component of the environment, and so we shouldn’t separate it out... If we’re going to treat it as a fractal process, where some of the code is in the genetics, but then all the environmental factors play in, we shouldn’t separate it out.”
- “If you change the environment, you change the brain.”
- “The brain changes in response to consistent cognitive or emotional training, but certain medications can also facilitate that. Whatever works. Why does it have to be this or that or the other?”

What is clear is that there are few simple answers. While social interventions currently appear more favorable than genetic interventions, in the longer term genetic interventions might be useful. But this raises ethical questions related to tracking genetic predispositions and human engineering that will need to be resolved.

From a neuroscience perspective, upbringing, diet and environment all seem to play a role in potentially creating conditions for a propensity toward violence and killing, and these seem intensified when certain genetic and brain chemical conditions are present. Certainly a lot can be done to deepen our understanding of how interactions among these factors can lead to violence and killing, and from this, definitive strategies to eliminate these conditions and reduce killing.

Much can be said about the innate human tendencies towards killing. Arguments have been made from human evolutionary perspectives that explain some human tendencies toward killing. Other evidence exists that suggests “nonkilling” is the dominant human tendency, not killing. Since power and politics, and other social constructs, have been acknowledged as key factors in contributing to killing, greater exploration of the links between these and neuroscience would likely prove fruitful.

Recommendations for Future Research, Education and Policy Agendas

Colloquium participants were asked to share suggestions and recommendations for future efforts by CGNK and others with similar interests. These provide a rich array of ideas to explore as more effort is expended to apply knowledge from neuroscience and related fields to the challenge of reducing of killing in the world. It should be noted that ideas expressed were not tied only to neurosci-

ence, as participants used this opportunity to raise other thoughts they considered relevant for CGNK to pursue.

Education

- 1) Promote violence as an incompetency rather than a competency.
- 2) Develop ways to make nonkilling something people want to do, rather than something people feel like they ought to do? It's never going to catch on if it's an obligation. We've got to figure out how to market this, to make it "sexy."
- 3) Make nonkilling positive, affirmative, active.
- 4) Identify ways to make social psychology seem more relevant and integral to these issues. Look at anthropological studies of how memes spread but also how group pressures change people's perceptions.
- 5) Explore the impact of creating education tools and systems that promote sustainability and social justice, including how inter-generational activity brings in an intergenerational ethics – "seven generations" perspective.
- 6) Promote early childhood care. Create the socio/economic conditions whereby women can breastfeed for the first two years of life and physically carry the child for the first year of life.
- 7) Develop a Parenting Guide. It's important to steer away from the technical fix and steer energies towards social interventions.

Research

- 8) Collect baseline information not only on attitudes, but also beliefs and the conditions that stimulate violence and beliefs toward violence. We need baseline information on attitudes toward violence. Use that information to shape the message.
- 9) Identify research programs and use extant literature to support the formation of policy initiatives and recommendations.
- 10) Collect and share stories from kill zones, people who have been through genocide or great violence. There are many components to this, and that should include looking at compassion—how do people who have seen their families killed still look for a nonkilling world?
- 11) Collect and analyze weaning statistics in our society so we are better informed to assess current impacts and impacts from change.

- 12) Identify critical periods of psychosocial development, whether there is a commonality of these steps and which have a bearing on later violence.
- 13) Examine transgenerational epigenetic influences on violence. Are there pathways where we can intervene in utero, to prevent psychosocial trauma during pregnancy.

Policy

- 14) Explore ways to redesign the punishment/reward system, and its impact on violence and killing.
- 15) Pursue the path of other countries which work towards greater legislative equality of men and women in Congress—50-50.
- 16) Adopt models that reduce community violence on a global scale. The violence interrupter model, taking people who were previously in a killing zone and placing them into a nonkilling context, that would interrupt habitually violent solutions with an environment where social cooperation is more personally rewarding than killing.
- 17) Pursue the discussion of medicalization/scientization of violence and killing. A dialogue ought to be opened between healers and the rest of a society about what needs to be healed.
- 18) Funding should be for neuroscience that is grounded in a richer understanding of what health is, and where intervention should occur.

CGNK is committed to taking the ideas generated and incorporating key findings into other organizational initiatives (e.g., the Nonkilling Parenting Guide being developed, the 2010 Leadership Academy, etc.). Likewise, future partnerships with Colloquium participants will be explored to move other recommendations forward.

i Sensory stimulation produces the neurointegrative brain and sensory deprivation produces the neurodissociative brain. These two sensory processes of pain and pleasure form our two cultural brains: 1) the subcortical emotional/social/sexual brain-- first in evolution and ontogeny; and 2) the neocortical, thinking, rational brain--second in evolution and ontogeny. How these two cultural brains are encoded with pain and pleasure determine the life paths of peace or violence that will be followed by the individual where culture (environment) shapes life experiences of pain and pleasure and the cultural brain that supports the behaviors of peace or violence. Pain produces the neurodissociative brain and pleasure produces the neurointegrative brain.

ii Research by Cannon (1939); Cannon and Rosenbleuth (1949) and Sharpless (1969, 1975) on the super-sensitivity of denervated structures provides the neurobiological foundation for much of Prescott's work. <http://www.violence.de/prescott/letters/Cannon-SSAD.pdf>

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Coleman (1971) documented deficits in platelet serotonin in violent maternal deprived monkeys compared to maternal non-deprived monkeys. <http://www.violence.de/coleman/article.html>

Saltzberg, Lustick and Heath (1971) first identified focal depth spiking in the scalp EEG of maternal deprived violent monkeys.

Berman, Berman and Prescott (1974), in a neurosurgical study, documented that paleocerebellar but not neocerebellar decortication in pathologically violent adult maternal deprived monkeys resulted in the elimination of virtually all pathological behaviors with the expression of physically affectionate behaviors not seen before surgery. This study confirmed abnormal paleocerebellar purkinje cells in the mother deprived monkey and the importance of MOVEMENT in postnatal brain development. Video documentation of post-surgical behavior can be seen at: <http://ttfuture.org/violence>

Harlow (1958) first identified experimentally the intrinsic nature of the maternal-infant relationship in the nature of love.

Heath (1972, 1975) documented abnormal electrical activity including subcortical septal and cerebellar "spiking" activity in pathologically violent adult maternal deprived monkeys which were absent in normally reared monkeys. <http://www.violence.de/heath/bfm/article.html>

Riesen, Dickerson and Struble (1977) documented anatomical changes in the primate brain consequent to maternal-infant separation. <http://www.violence.de/coleman/article.html>

Saltzberg (1977) developed a computer signal-processing program that could detect subcortical spiking from normal cortical EEGs for the detection of the violent offender. <http://www.violence.de/saltzberg/1980paper.pdf>

Floeter and Greenough (1979) documented cerebellar abnormalities in differently reared monkeys.

Subcortical spiking activity has been previously documented as a correlate of violent behavior in temporal lobe epilepsy. Mark and Ervin, 1970 state: "Human violence is the most threatening problem in our world" and "We have written this book to stimulate a new and biologically oriented approach to the problem of human violence". Tragically, there has been little advance since 1970 in the conceptual understanding of the origins and predictions of human violence, apart from the contributions of Harlow, 1958; Heath, 1964; Mason, 1968; Prescott, 1971; Mason and Berkson, 1975; De Wall and Lanting (1997).

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