

Is There a Neurobiology of Hate?

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I. INTRODUCTION

Some months ago at a Holocaust conference in Scottsdale, I had the pleasure of hearing a provocative presentation by Kenneth Stern on the sources of antisemitism and how antisemitism might be related to hatred. This occurred shortly after I had talked at the same conference about my experiences in 1946-1947 as a U.S. Army motion picture photographer at the Nuremberg Medical Trials, where I had witnessed and made sound movies of the trial of the 23 defendants, mostly physicians, accused of experimenting on concentration camp victims and causing the deaths of untold numbers of them. So I thought I had some firsthand experience of hatred and the individuals who practiced it. Most of my subsequent career has been centered on performing research in the neurosciences: neurophysiology and neuroanatomy. Stern and I had a brief discussion and I asked whether anyone had given any consideration to studying the role of the brain in order to understand the neurobiological origins and mechanisms of hate. His answer was that little if any attention had been devoted to that question, that the brain was essentially *cerebro incognito*; he urged me then to explore the topic and see what I might come up with. Naively, I agreed. So gradually I found myself sliding into the subject, not knowing where I would wind up. I found out soon enough that despite having had that firsthand, vivid Nuremberg experience, I knew little of hate's nature or explanations about its roots in the brain. I further found out that not many others had that knowledge.

This presentation is the result of my chat with Stern. It is an attempt to survey the kind of knowledge, and speculation as well, that neuroscience has provided about the brain's role in hate. To jump to the answer: there is surprisingly little that neuroscience has to offer on the topic. The reason is that the problem in relating the two is a difficult one for a variety of reasons. In the rest of this presentation I shall try to explain why that is by providing a basic introduction to a neuroscientific approach to hatred.

This presentation is intended as a synopsis of brain neuroscience as it might relate to hatred. I have tried to avoid as much as possible offering explanations of hate behavior that are not directly related to what is known about human brain function.

II. SOME BRAIN BASICS - PHYSIOLOGY, ANATOMY AND CHEMISTRY

However well we think we understand human behavior, we cannot understand it fully without understanding how the brain functions. Much is known, but uncertainty remains about how much of behavior is influenced by factors external to the brain and how much is influenced by the brain's inherited and inherent structure and by inheritance. This remains a puzzle to be solved.

In the years following WWII it was recognized that the nervous system, and the brain in particular, functioned in what was akin to the way electronic computers work, then a new technology. Much of our current way of looking at the brain has been influenced by our knowledge of computers, and much of the jargon of brain science has adopted computer terminology. Many of the terms that I use below have their origins in the analogy between the brain and the computer.

Simply put, in anatomical terms the brain is a vast assembly of neurons, the cells that are responsible for generating the behaviors that encompass physical movement, sensory perception, human emotions, and human intelligence itself. Neurons are not all alike. When seen through the microscope, their shapes, or morphologies, are different; and so are their internal structures, their micro-anatomy. The most obvious differences are in their size and shape, as well as in their slender branch-like extensions, their dendrites and axons by which they send and receive coded electrical messages and which determine how many communication connections (synapses) they make with other neurons both near to them and more distant. This variability in morphology is associated with an axiom of neuroscience: that different form connotes different function. Less visually obvious are the types of coded messages they send one another. The code (it may vary from neuron to neuron) appears simple, but has defied understanding for years. To transmit these messages, a neuron makes use of various types of brain chemicals called neurotransmitters.

Neurons join with one another to form neural networks that exchange information among themselves. Neural networks are best understood as constituting an assembly of neuronal computers that perform different functions in their differently located regions of the brain. But even though they are localized, they are tied together by these neural networks in ways that we do not yet fully understand. In particular, in the brain there is bidirectional communication among the systems, and this makes it difficult to tease out which element of the system is responsible for the expression of emotions or other behavior. Similarly, a malfunction of one of the system's elements will lead to disturbances elsewhere in the brain.

A prominent point of view is that many parts of the brain are "hard-

2008/09]

IS THERE A NEUROBIOLOGY OF HATE?

9

wired”: that is, the brain circuitry is fixed and the interneuronal pathways are not changed by rewiring the axons that connect one location to another. However, the strength of these pathways can be altered to affect how much influence a particular pathway has upon the brain center to which it sends signals. (Not all pathways are equal in their influence.) This type of fluctuating influence occurs constantly and is responsible for the magnificent subtleties of thought processes. The alteration in the influence provided by the communicating pathways is controlled in part by the neurotransmitters. A variety of them are active in different parts of the brain. In some parts of the brain, for example those concerned with the sensory information involved in touch, hearing, and sight, the levels of the neurotransmitters are largely invariant. In other parts, as in those regions concerned with emotional activity, the levels of the transmitters are constantly fluctuating and consequently brain activity there fluctuates despite the fact that the brain circuitry there is largely fixed. Some parts of the brain are plastic, that is, they can be modified by increases and decreases in the strengths of the connections between the neurons. Learning and relearning is an example of this plasticity. One can say that in this sense the brain can be, in computer terminology, programmed and reprogrammed.

It is a fundamental tenet of neuroscience that each brain region is associated with a particular function or set of related functions, such as the previously mentioned sensory functions of sight, hearing, taste, smell, and touch. These regions occupy only a fraction of the entire brain. The brain regions in which we are most interested are those that are concerned with emotions and, in particular, fear, anxiety, apprehension, and anger. Emotional behavior originates in a complex network of neuronal nuclei (centers) that are situated both in the hypothalamus and a more diffuse, closely situated region called the limbic system. The functional relationships between these brain regions are quite complex and still not fully understood. But there are two regions included within this complex that are attracting more attention in the understanding of emotion: the amygdala and the hippocampus. We will return to this subject later.

Neuroscientists, perhaps most strongly of all scientists, have long been pursuing an understanding of these emotions and the regions with which they are associated. This current field of investigation is a part of what has been called cognitive neuroscience. The emotions are observable in many animal species, including primates. But it is essential in experimental neuroscience that the emotions be defined in terms that meet objective scientific criteria so that the experimental results can be verified by others performing the same or similar experiments. These experiments range from using microelectrodes to observe the electrical activity of individual neurons; to observing the EEG, the combined electrical activity of large groups

of neurons; to viewing MRI brain images such as the fMRI that give an indication of the metabolic activity of brain regions that respond to experimental stimuli. In the case of the limbic system, these might be pictures or voices that are intended to provoke the subject's emotional response. There are, for example, fMRI studies related to the localization of brain regions associated with anxiety (Etkin & Wager, 2007).

This brief presentation has considered only the normal brain. But as we know, not all brains are normal. They can be afflicted with a variety of pathologies that can occur throughout life. Particularly worth mentioning are those problems that may affect the emotional brain. All of them fall under the classification of neuropathology. They include imbalances in the neurotransmitters that are essential to normal neuronal communication. The imbalances may include a deficit or an excess of neurotransmitters. (I have excluded a discussion of substances of abuse introduced into the brain, that is, drugs. They only broaden the problem.) The result is that people with such imbalances suffer a variety of emotional and behavioral problems. This is an area of study that is now being intensively pursued; so I can observe only that there are ongoing studies about inherent brain abnormalities that affect emotion.

A useful introduction to the neurosciences is Barker, Barasi, and Neal's 2008 work, *Neuroscience at a Glance*.

III. WHAT IS HATE?

Hate is a bewilderingly elusive word in its everyday usage. Dictionary and thesaurus definitions range from a feeling of something that is casually aversive to something that is profoundly so, for example, from "dislike" to "odium." Here are a few common examples of its use in English:

"I hate to bother you."

"Oh, how I hate to get up in the morning. Oh how I hate to get out of bed." [Irving Berlin, 1917 WWI song.]

"I hate niggers" [or Jews, or Muslims, or whomever].

Other languages must surely have similarly ambivalent examples of their own. All that we can deduce from these expressions is that the word seems to cover the range from a mildly negative opinion to a powerful negative emotion that can indicate the speaker's disposition to commit violence. In a sense, *hate* functions here as a placeholder waiting to be replaced by a more specific term. Still, we all seem to know what real hate is, and it is closer to the last expression than the first. How do we get from there to a scientific definition that will permit the formulation of neuros-

2008/09]

IS THERE A NEUROBIOLOGY OF HATE?

11

scientific experiments designed to localize a place in the brain that gives rise to hate? At present, most neuroscientists ignore hate because it is too vague a term to work with; its existence is rarely acknowledged in brain research. Perhaps “hatred,” which is a more tightly defined term, should always be used in place of hate to signify that the feeling being addressed is one leaning toward intensity, that is, odium.

But practical difficulties also arise in attempting to deal with localizing hate within the brain. Neuroscience is advanced in terms of experiments on individual subjects, whether they be animals or humans. A single animal at a time can be tested while a microelectrode is situated within his brain to detect and record neuron activity. And a single animal or human can be studied while he is located within an MRI imaging system. This limitation can ultimately constrain how much effect neuroscience can have on understanding hate, which is a phenomenon often implicating more than one individual at a time.

Let’s see where we are, then, as far as a neuroscience of hate is concerned. There is no consensus on a definition of hatred that is scientifically useful to neuroscientists. Without one, it is useless to conduct brain studies on the presence and location of a “hate” region within the brain. Such experiments will produce nothing more than controversy in interpreting results of experiments that try to deal with hatred.

Only a few investigators have claimed the existence of a “hate” region somewhere in the brain (see below), and none has claimed it exists specifically within the limbic system. If a “hate” region exists within the brain, most investigators believe it is likely to be located within a confined brain region of the area that is referred to as the limbic system. A number of regions within the limbic system have been found that can be correlated with the emotions of fear, aggression, and anxiety. That is, these regions exhibit higher levels of brain activity when an experimental subject is exposed to situations designed to evoke such emotions. The amygdala is a principal example of a region exhibiting such an association with hate responsiveness.

Given the sparseness of the findings associated with localized responses that may be associated with hate as an emotion, hate responsiveness may turn out to be diffusely spread throughout a variety of brain centers and not be readily apparent to experimental probing that is performed by fMRI brain imaging. The fMRI is mostly directed toward the detection of highly active concentrated regions of brain activity, which are detected by their increases in local brain blood flow.

I make no claim that this list is exhaustive. What I want to point out is that there is so far a disconnect between current investigations of hate and neuroscientific studies of the emotions.

IV. CONJECTURES ON THE NEUROBIOLOGY OF HATRED

From what I have presented above, it is not clear that anyone has demonstrated any strong link between hatred and an anatomical location within the brain. There are ample reasons to surmise that such a connection exists, but, given the current status of neuroscience, there are few who would claim a strong link between hatred and the function of any particular brain center. Thus, the most suitable thing to do is to follow the leads that exist and make some suggestions and conjectures. The rest of this presentation has that goal.

The most persuasive argument about a brain hatred center is that hate is traditionally referred to as an emotion. If that is so, then the most likely place for a center of neurons that is responsible for generating hate emotions would be the limbic system. That is, there “ought” to be a limbic center of hatred. I could go further and speculate that if that is so, the hate center would have strong connections between centers that are responsible for fear and aggression and with memory, the latter because memory seems to be a vital component of human actions that are identified with hatred. A difficulty with this conjecture is that the only human brain study to date involving fMRI data (Zeki & Romaya, 2008) was performed on presumably normal human subjects and specifically points to structures outside the limbic system as sites for hate-related responses. It localizes the brain’s hate responses to two regions. The first is called the insula. It is a part of the cerebral cortex and is considered to be closely related to the limbic system. The putamen, on the other hand, is part of a structure called the basal ganglia and has at present an unclear role in emotional behavior. It is known to be involved with motor function. Thus, the outcome of this particular investigation is somewhat puzzling, making it hard to draw any conclusion about a hate center, but it does at least point to the likelihood that indeed there are brain sites associated with hatred and that the circuitry may be exceedingly complex. Furthermore, we still have the complication of how to deal with the investigators’ definition of hate, and we still need to consider that hate in its extreme forms may be a pathological phenomenon not occurring in normal humans. The point to be made is that it appears that there is evidence of hate-specific activity in the brain, something that can be localized and measured and that can lead to a better understanding of how to deal with the mechanism of hatred in humans before it erupts disastrously. We could postulate, for example, that if the hate center(s) is(are) inhibited, as by some yet-unknown medication targeting hate neurons, hate would be suppressed or removed, and the brain and the person would continue hate-free until the drug is discontinued. One might also suggest that there are other centers in the brain that connect to the hate center and are

capable of reducing or inhibiting its activity. By modifying the activity of these centers, therefore, one could also increase or decrease the level of hatred. But this kind of speculation goes far beyond simply pointing out that in a neuroscientific context, hate seems to exist in the brain and may be localized in several brain centers that may modulate its “flavor,” that is, the way it manifests itself.

Now that we have touched on some aspects of the link between emotions and the limbic system, we can concentrate a little more on hate. But to do this in an acceptably neuroscientific way, we have first to know exactly what we mean by that word. Is hate by itself a free-standing emotion, or is it much more complex, some combination or assembly of other emotions, functioning together in a comprehensive assembly to produce the vicious actions that we commonly associate with hate? The notion of a hate center is rooted in the idea that hate has a biological foundation, that it arose from evolutionary causes that promote species survival as do emotions of fear and aggression. If hate exists in animals, one would expect it to be reported on for many species. The literature on hate in non-human species is sparse at best—almost nonexistent. There is no reference to hate in Wilson’s pioneering text *Sociobiology* beyond the discussion associated with aggression and competition. From this brief survey it appears that hatred does not exist in animals, that it arises *de novo* in humans. One explanation for this is that hate is a memory-dependent behavior, and to be evoked, it must be as a result of memories of previous experiences that provoke vengeance, fear, anxiety, rage, all emotions that are certainly represented in the limbic system. But vengeance, which seems to be a hallmark of hate, is absent in animals. If this be the case, then hate becomes a more complex behavior that is present only in humans. So animals behave more on a moment-to-moment basis as far as the limbic-based emotions are concerned. At least, that is what I assume to be the case. Then we have to blame hate on humans exclusively. But if we haven’t found the neural correlate of hate in the limbic system, does that mean that it doesn’t exist there, that it exists somewhere else in the brain? Or is it a combination of the two? We can also fall back even further and say that the underlying mechanisms for hate are so diffusely distributed in the brain that we may never pin its source down to one group of neurons or a specific brain circuit.

What about hate as a normally occurring human brain function? A recent article by Seabrook (2008) discusses the topic of psychopathy by reviewing the work of neuroscientists Kent Kiehl, Robert Hare, and several others. Psychopathy is a term used to describe individuals with severe personality disorders. Primary among them is acting without conscience. Kiehl is working with convicted criminals who have been diagnosed as psychopathic. He is attempting to link their problems to specific dysfunctions

of the brain. He has specifically named a brain region he labels the paralimbic system as being implicated in psychopathy, often in criminals convicted of violent, even horrendous crimes. According to accepted descriptions of psychopaths, one of their major behavioral attributes is acting without conscience. They are also said to be charming and intelligent, unreliable, dishonest, irresponsible, self-centered, emotionally shallow, and lacking in empathy and insight. Taken together, these personality characteristics could be applied to many of the major sufferers from and/or invokers of hatred throughout history. I also add the further comment of Kiehl that one of the professions likely to attract a psychopath is medicine (law enforcement, the military, and politics are others).

This comment is not made frivolously. In 1946-1947, when I was present as a U.S. Army motion picture photographer at the Nuremberg Medical Trials, I had the unique opportunity to witness and photograph the trials of the 23 defendants, mostly physicians, accused of horrendous medical experiments on concentration camp inmates. They were accused of actively participating in an array of horrendous medical experiments leading to the death and torture of uncounted inmates. Before the war they gave no outward indication of being anything other than intelligent, respected physicians. They left no surviving written hate-tainted or antisemitic writings or correspondence. During the trial they often expressed offense at the fact that they were on trial for their lives. That they could be sufferers from hate and brain pathology struck me only during the preparation of this paper.

The Appendix contains a more impressive bit of evidence that I encountered at the Nuremberg Medical Trials that suggests a link between psychopathy and hate. It arises from the correspondence of Dr. Sigmund Rascher, one of the more notorious of the concentration camp physicians and a subordinate of Heinrich Himmler. The history of Rascher and his wife at the end of the war is confusing. But Rascher never survived to get to the trials because he was shot at Himmler's order just at the war's end, probably to prevent him from testifying. (Rascher's equally despicable wife was also Himmler's secretary and possibly his part-time mistress. She was also shot by the Nazis before the end of the war.) It does seem clear that Rascher was behaving in some well-thought-out manner. Was it that Rascher was acting in his own best interests, playing a career-oriented game directed to advance his career and satisfy his psychopathy? To what extent might hatred be involved? Only continued research will establish a link between psychopathy and hate.

Let me pause here to emphasize that when I refer to a neuroscience of hate I am speaking about a link within an individual, human or animal, and that the presentation is intended to suggest that hate can be localized within the brain. What I have ignored is hate that goes beyond the individual

2008/09]

IS THERE A NEUROBIOLOGY OF HATE?

15

brain. To put it in another way, inter-brain hatred exists. It will come as no surprise to anyone that the communication of hatred between individuals is commonplace and has resulted in incredible violence for thousands of years. There is no shortage of examples. Then, using our brain hatred model as a guide, is it fair to say that there is some sort of inter-brain transmission communication pathway by which one brain's hate center can reach another's brain and evoke (infect?) the same sort of neural activity there? Rather than pursue this diversionary notion further, I might also suggest that the propagation of hatred, mass hatred, to be truly successful in its violent ends, may require the existence of a hate region existing in specialized variations or mutations in different brains. The neuroscience of hatred would then be far more complex than we might now believe. I refer here to Cullen (2004) and his comments on the youths involved in the mass killings at Columbine. Besides referring to psychopathy, his claim is that the two killers behaved in a symbiotic way—that the killings could not have occurred without the two complementing one another. I can speculate here that hate, at least in its stronger manifestations, is a group phenomenon, that is that its evocation requires the cooperation of more than one individual or brain. One can envision experimental studies of several behaving subjects who can communicate with one another and whose electrical brain responses are studied simultaneously while they are permitted to interact in a test paradigm designed to evoke hate reactions. I am not aware that this kind of experiment has ever been attempted. But it certainly seems feasible and might show that several people (or more) acting in concert can generate some form of virulent hate behavior. This would indeed be a difficult hypothesis to prove, of course, and not neuroscience as I have introduced it. I only wish to point out that using a brain-oriented point of view can help broaden the perspective on hatred and perhaps result in new insights, if not scientific results.

We can add here another factor which is a vital ingredient in terms of how the brain as a whole works, not just the limbic system. As we are finding out, the brain does not come to us at birth fully wired, as the term is used, with all its neurons and circuitry and brain chemistry pre-configured. All the structural elements, down to cellular and subcellular elements of the brain, are determined by the DNA that the owner of the brain inherits from his or her forebears. As a result, an individual's debilities arise to an extent not yet fully understood from the genetic factors that are represented in the DNA. Upon these inherited influences are built the factors provided by an individual's culture and environment. This is not the place, nor am I the one, to discuss this in depth, other than to say that the brain works according to its genetic endowment that influences its anatomy as well as by what it learns. To a certain extent the structure of the brain is constant across a

species, but with important differences that are determined by the DNA that is passed from generation to generation. Individual variations in the DNA result in neurons that differ in small but important ways in their structure and in their neurochemistry. Sometimes the variations are large enough to produce debilitating diseases. More commonly, the differences produce differences in individuals that lead to the behavioral variations that we recognize within a normal population. This includes all the emotional problems to which civilization is subject, among them hate.

Emotions are the internal experiences of an individual, although they may be communicated to others by speech and images and by other methods that fall outside the range of neuroscience. While communication is a major aspect of emotion, emotion may be present in an individual without the awareness of others. Central questions are: (a) is hatred hard-wired, like the well known flight-or-fight reaction, or is it learned? (b) where does it originate? Is it in one specific location, or is it spread throughout many brain centers, complicating scientific exploration, or at least making it very difficult to pursue?

At this moment there appears to be only one practical way to detect the existence of hate in the brain: place a human subject inside an fMRI imaging system and run him or her through a gamut of psychological tests. The images resulting will reveal whether there was an increase in cerebral blood flow in a particular area(s) during the time the intentionally (and supposedly) hateful stimulus was applied. The duration of the response will necessarily be limited in time because of all the physical limitations of the experiment. So we can detect the presence of hate somewhere in the brain only for a short period. The response goes away, the subject goes away, but does the subject's evoked hate go away? The most positive result we would have for such a test would be to find a region that is highly active for a brief time in response to what we hope was a hateful stimulus. We would have found what works in one normal person. We would have therefore only opened the door to discovering hate in the brain. Finding one region that is positive for hate would not mean that there are not others. There may be other regions that are subthreshold hate responders that we do not yet know how to activate using all the complex stimuli that we know must exist. There may be hate regions that have more complex responses and involve emotions only as the culminating component of their actions. Other complicating possibilities exist. It could be that we will find hate only in limited (pathological?) populations. And because we are limited to experiments that can examine only one person at a time, we won't have anything to say about hatred that is beyond person-to-person odium.

V. CONCLUSION

Like all science, neuroscience moves cautiously and deliberately, hesitant to make pronouncements and “discoveries” that may later turn out to be rash or wrong. This is particularly true concerning research on the awake, behaving brain, and even more so when it is the human brain. The study of human emotion is particularly vulnerable to this difficulty. There is a hesitance to enter into investigations that can provoke public controversy and outcry. In brain science the emphasis on understanding human emotions has focused on emotions that are associated with mental health and disease. In the United States, as elsewhere, this means the concern is with emotional disorders that are associated with medically identified mental disease. In the lexicon of mental disease entities, there is no syndrome specifically associated with hate. This emotion, or whatever it is, remains outside the realm of medical science. And it remains mainly outside the field of animal biology. This strange situation exists even though everyone knows about hate, its existence and its loathsome history. We as scientists can talk about it, read literature and listen to operas about it, decry its existence, but we don’t know how to handle it as a definable entity that can be probed and examined scientifically. Perhaps it is just too hot a potato for anyone to deal with scientifically or politically. Its definition is controversial at best. Is hatred just a “placeholder” term referring to a single emotion or to a set of emotions? Is it represented in a specific anatomical location within the brain, or is it diffusely distributed, requiring training to become fully developed and mature? Does it exist for genetic reasons more in some individuals and groups than in others? Is it a malfunction of brain structure and chemistry? Or does it have no particular brain correlate whatever—is it strictly a product of cultural upbringing? Not all the speculations can be true. The sobering fact is that without a link between hate as it is commonly recognized and a scientific insight into it as human behavior caused by brain structure, it will be difficult to do more than continue producing speculations as to how to explain it and how to control and eliminate it. I am left with the uncomfortable belief that much of hate springs from genetic factors and that, in the course of time, it is quite possible that the world will be afflicted with another individual whose talents for invoking hatred will be even greater than those of Hitler.

I can only hope that this work will promote further thought and encourage a new point of view in hate studies and in opening new approaches to the understanding of the mechanisms of hate.

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APPENDIX

HATRED, PSYCHOPATHY, OR EQUAL OPPORTUNITY KILLER?
DR. RASCHER LETTER TO HEINRICH HIMMLER [TRANSLATION]

Dear Mr. Reich Leader:

My humble thanks for your warm congratulations and the flowers on the occasion of the birth of my second son! It is a lusty boy again this time, though he arrived three weeks prematurely. Perhaps you will permit me to send you a snapshot of the children some time.

I would like to have a third child very soon, and I am very grateful to you, dear Mr. Reich Leader, for your help in making the marriage possible. SS Colonel Sollmann told me today by telephone that the 165 marks in question, lacking for a marriage, will be supplied by the "R" account and

2008/09]

IS THERE A NEUROBIOLOGY OF HATE?

19

will be included in the Ahnenerbe check. I thank you with all my heart! The Air Force has already seen my passport, but I still need a brief certificate confirming my aryan descent. I shall dictate a draft to Nini D, when I leave tomorrow, and she will then send it to you, dear Mr. Reich Leader.

I also wish to thank you warmly for the generous regular remittance, of special importance to mother and child at this time . . . I therefore ask this question in all seriousness: Cannot two or three professional criminals be made available for these experiments? The experiments will be conducted at the "Air Force Ground-Level Testing Station for High-Altitude Research" in Munich. The experiments, during which, of course, the test persons may die, will proceed with my collaboration. hey are definitely of importance in high-altitude flight research, and cannot be conducted with monkeys, as has been tried, since monkeys react altogether differently. I have talked about this matter in strict confidence with the deputy air surgeon who will conduct these experiments and he shares my view that the problems in question can be clarified only by way of experiments on human beings. (Feebleminded persons might also be used as testing material.)

