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TORTURE

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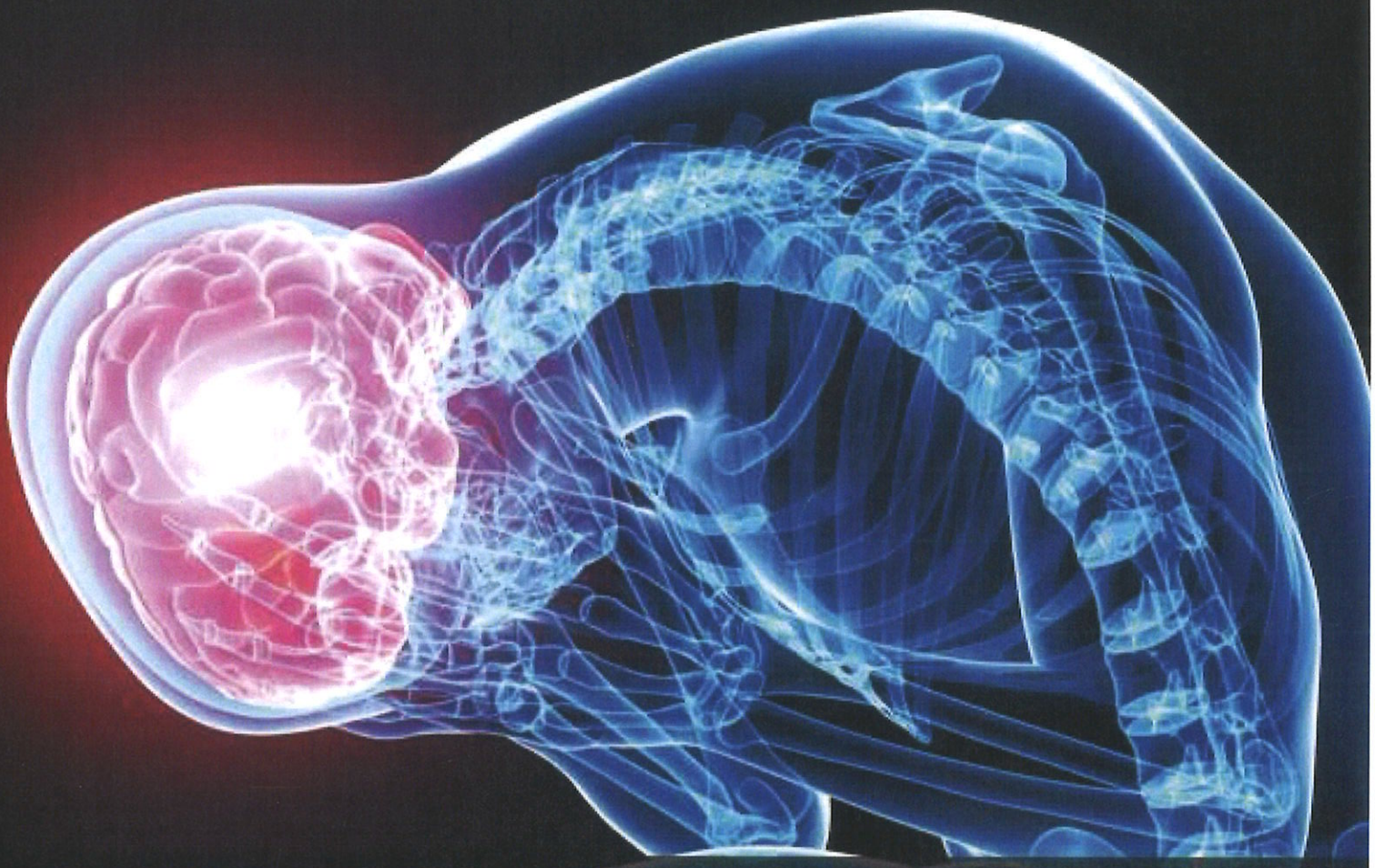

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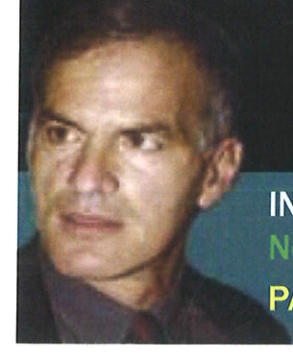

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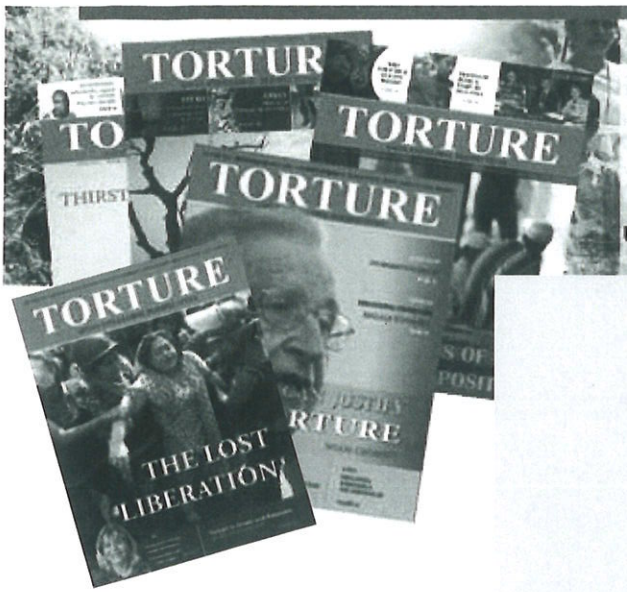

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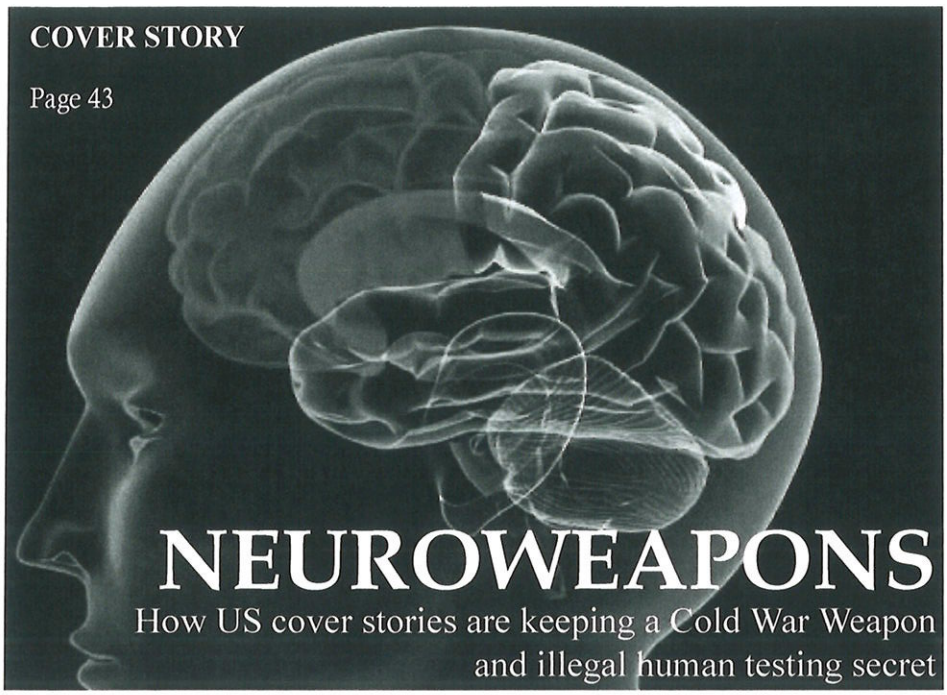

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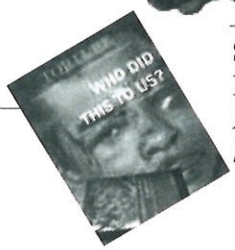

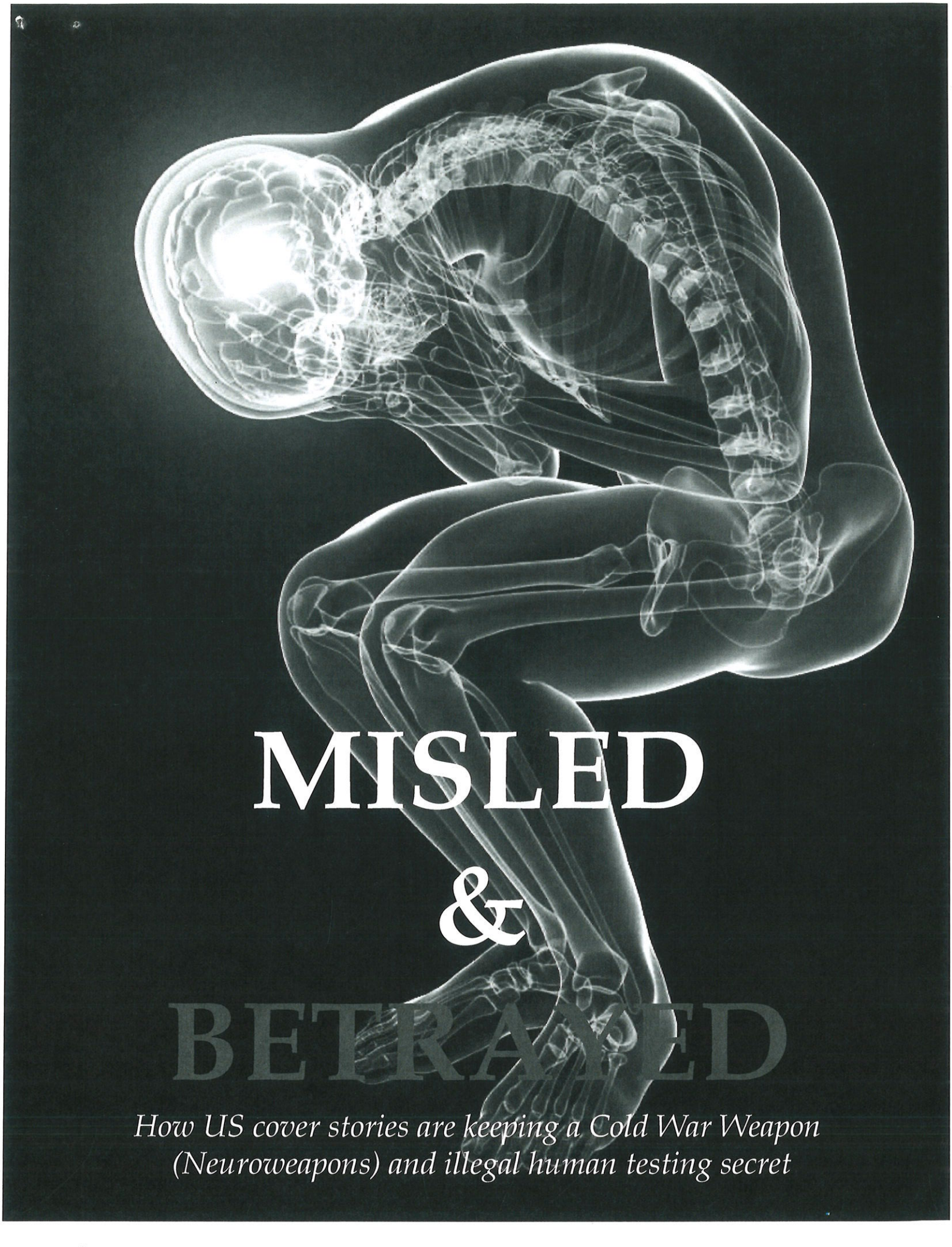

MISLED & BETRAYED

How US cover stories are keeping a Cold War Weapon (Neuroweapons) and illegal human testing secret

COVER STORY

by Cheryl Welsh

Terms and definitions: *For this paper, the term electromagnetic radiation (EMR) is used interchangeably with frequencies, radio-frequency (RF), radio signals, radio waves, microwaves, microwave signals, low- frequency, extremely low frequency (ELF), ELF frequencies, EM fields, beam weapons, directed energy weapons.*

1. Introduction

The US atomic bomb exploded and the world discovered the existence of a formidable secret weapon. By contrast, this paper will illustrate that there is proof that neuroweapons (mind control weapons developed during the Cold War) are another formidable weapon. However, their power lies partly in keeping them secret so they can be used surreptitiously. In principle, the science is possible to target and influence a person remotely and governments have been conducting secret research to develop neuroweapons. Based largely on the science of electromagnetic radiation (EMR), such weapons could be used to stop a person or many people by influencing their behaviors by manipulating various physical and psychological parameters related to brain functions; this could change how wars are fought. Shrouded in secrecy, few people have even heard of neuroweapons. Nevertheless, their importance has often been compared to the atomic bomb[1] and a brief summary of the significant amount of obscure information is presented below.

The consensus is that neuroweapons are still science fiction and any allegations of unlawful human subject experiments involving neuroweapons are just elaborate conspiracy theories. This paper will argue that the consensus is wrong; showing that secret CIA mind control research began as far back as the 1950s with the science of physical and psychological torture being investigated in the US in response to fears that Russia and China had developed new, similar techniques. Professor Alfred McCoy, an expert on US no touch torture, described the CIA research as "a massive mind-control effort, with psychological warfare and secret research into human consciousness that reached a cost of a billion dollars annually, a veritable Manhattan Project of the mind."[2] In the mid-1970s, some CIA mind control programs, including nonconsensual human subject experiments with LSD and other drugs, were exposed in congressional hearings while other programs remain classified.[3]

This paper will present emerging evidence supporting the argument that the consensus is based on misleading US government cover stories which have been presented as official

1 Hugh Gusterson, The militarization of neuroscience, *Bulletin of the Atomic Scientists (Online)*, April 10, 2007. Available at http://www.thebulletin.org/web-edition/columnists/hugh-gusterson/the-militarization-neuroscience.

2 Alfred McCoy, *Question of torture, CIA Interrogation, from the Cold War to the War on Terror* (2006), Introduction, Outline, 2.

3 Mark Mazzetti and Tim Weiner. Files on illegal spying show CIA skeletons from Cold War, *New York Times*, June 27, 2007. Available at http://www.nytimes.com/2007/06/27/washington/27cia.html?pagewanted=all&_r=0.

explanations while actually concealing secret programs and activities.[4] Steven Aftergood, a highly regarded secrecy expert described the US Cold War secrecy system as a "poisonous legacy": the excessive use of government cover stories was routine and secrecy manuals authorized active deception in order to promote believable cover stories.[5] This paper will present converging facts that strongly suggest two major cover stories concealed the existence of neuroweapons and illegal human testing, fooling nearly everyone for sixty years and counting. These cover stories should now be seen as obsolete with the evidence beginning to reveal that neuroweapons are likely to have already been developed. As mentioned above, the first cover story is that secret neuroweapons are still science fiction. The second cover story concerns the official US policy on EMR bioeffects; it being that there are no proven effects of EMR other than heating.[6] For example, most people know how a microwave oven works; the microwaves produce a thermal effect and heat or cook food as in a microwave oven.

1.1 Neuroweapons

Neuroweapons, no touch torture, and nonlethal weapons are three major US state tools that have emerged from the CIA's Cold War programs; all three are ideal for intelligence and psychological operations and counterinsurgency warfare. They are tools designed to neutralize the enemy without killing anyone but by influencing their behavior. All three programs represent a new form of weaponry which can be used on a large scale. The first of three US state tools, the CIA's no touch torture, has been described as a "revolutionary psychological approach" and the first new scientific innovation after centuries of [physical] torture.[7] The second tool is the nonlethal weapon, which is a weapon designed to stop the enemy without killing. Nonlethal weapons include several types of weapons but this paper will only discuss nonlethal weapons based on EMR. In 1994, Aftergood reported that "programs to develop so called 'non-lethal' weapons are slowly emerging from the U.S. government's secret 'black budget.'. . . The concept of non-lethal weapons is not new; the term appears in heavily censored CIA documents dating from the 1960s."[8] Few people are aware of the science research showing that EMR has significant bioeffects on humans other than just heating; this will be shown below.

For over half a century, the US and other governments have kept nonlethal weapons out of the public eye. A few examples illustrate the point. A 1991 *London Guardian* newspaper article described EMR crowd control weapons that do exist and were listed in the *British Defense Equipment Catalogue* until 1983 when the Ministry of Defense ordered any advertisements or mention of frequency weapons be removed.[9] A 1990 *International Committee of the Red Cross Review* article described directed energy weapons, weapons based on EMR that could target a

4 Steven Aftergood, The Soft-kill fallacy, the idea of 'non-lethal weapons' is politically attractive and purposely misleading, *Bulletin of Atomic Scientist*, September/October 1994, 45.

5 Ibid.

6 Sharon Weinberger, "Thought wars," *Washington Post Magazine*, January 14, 2007, p.W22. Available at http://www.washingtonpost.com/wp-dyn/content/article/2007/01/10/AR2007011001399.html.

7 McCoy, 14, n. 2 above.

8 Aftergood, n. 4 above. See also Douglas Pasternak, Wonder weapons: The Pentagon's quest for nonlethal arms is amazing. But is it smart? *US News and World Report*, July 7, 1997, 38. Available at http://www.usnews.com/usnews/culture/articles/970707/archive_007360.htm.

9 Peter Kennard, 'Field of nightmares,' *Weekend Guardian*, February 2-3, 1991.

person at battlefield distances. Some science seems to have confirmed modulated EMR can adversely affect brain function, although the research was heavily classified.[10]

In 1976, a US *Federal Times* article described alleged Soviet microwave weapons which caused disorientation, to disrupt behavior and cause heart attacks.[11] (To be clear, the US government official EMR bioeffects policy is that there are no *proven* bioeffects other than heating and the US government considers the Soviet weapons research scientifically *unproven*.) Another device targeted a person with microwave hearing to cause voices in head of the person that only the targeted person can hear.[12] The microwaves were modulated like a radio signal to carry the sound of words or music that a person can hear.[13] Microwave hearing has been demonstrated on a subject with successfully encoded speech (the spoken digits from one to ten) in a pulsed microwave signal.[14] Perhaps it is not surprising that the one nonlethal weapon based on EMR that has been revealed is the microwave heat weapon which beams EMR to create a burning sensation on whomever the weapon is directed towards.[15]

The third US state tool is the neuroweapons program; neuroweapons are considered a weapon of mass destruction. For example, in 2012, Russian president Vladimir Putin described a new military program to develop EMR weapons that target the nervous system: "Such high tech weapons systems will be comparable in effect to nuclear weapons, but will be more acceptable in terms of political and military ideology."[16] In 1986, Mikhail Gorbachev, the Soviet leader at the time, described EMR weapons that could be used as antipersonnel weapons, calling them "no less dangerous than mass strike weapons."[17] Gorbachev stated that the Soviet Union had not and would not test or deploy such weapons. Since the 1940s, the Soviet Union has been studying how EMR interacts with the human body and brain—called EMR bioeffects— and the US has monitored the research to find out if there was any possible advantage gained by the Soviets for espionage or weapons.[18]

Additionally, negotiations by the US and the former USSR at the UN Disarmament Agency regarding EMR weapons from 1975 through 1985 were described in a UN Department for Disarmament Affairs book.[19] For example, the former Soviet Union submitted a 1979 UN Committee on Disarmament document. It consisted of a draft agreement for the prohibition of new types of weapons of mass destruction and new systems of weapons. The document specifically listed weapons that use EMR to affect biological targets,

10 Louise Doswald-Beck and Gerald Cauderay, The development of new antipersonnel weapons, *International Review of the Red Cross*, 279, November 1, 1990, 19, 20.

11 'Microwave weapons study by Soviets cited' *Federal Times*, December 13, 1976.

12 Ibid.

13 Steven Wright, Weapons of control, *New Scientist*, 55. See also n. 11 above.

14 Don Justesen, Microwaves and behavior, *American Psychologist*, March, 1975. Available at http://www.raven1.net/v2success2.gif. Also available at http://www.raven1.net/v2success3.gif.

15 U.S. military heat ray weapon unveiled, *Huffington Post Canada*, March 13, 2012. Available at: http://www.huffingtonpost.ca/2012/03/13/us-military-heat-ray-weapon_n_1343092.html.

16 Christopher Leake, Will Stewart, Putin targets foes with zombie gun, *Mail on Sunday*, April 1, 2012.

17 Press conference on Gorbachev's nuclear arms elimination proposals, *BBC Summary of World Broadcasts*, January 21, 1986: Tass for abroad: SU/8162/A1/1. Available at Lexis Nexis

18 Nicholas Steneck, *Microwave debate (1984)*, 84.

19 *The United Nations and Disarmament: 1945-1985* (1985)New York, UN Publication Sales No. E.85. IX.6, 114, 115, 116.

with the likelihood of remote targeting within half a dozen years.[20] The document stated that weapons could target the brain and were scientifically possible, relying on international scientific literature.[21]

US military research includes EMR neuroweapons similar to the Russian weapons. The US Air Force (USAF) is funding "Controlled Effects" research and USAF chief scientists stated: "With the advent of directed energy and other revolutionary technologies, the ability to instantaneously project very precise amounts of various types of energy anywhere in the world can become a reality."[22] Despite the decades of US government secrecy and interest in neuroweapons, the US, like Russia, denies any secret development of such weapons, the argument being that the US government interest in EMR neuroweapons could be a ploy to throw off the Russians into spending more money on science fiction weapons.[23] However, as shown below, further evidence seems to indicate much more is going on: an ongoing secret arms race over neuroweapons between US and Russia that began in the 1950s.

The goal of the US neuroweapons program is to develop the capability of remotely targeting, communicating with and influencing a person's brain. It is a weapon of surveillance, influence, and control. US government publications on future weapons indicate that some neuroweapons are based on the science of EMR which allows for two main weapons capabilities. Firstly, in principle, EMR can be utilized as the most likely method for remote human surveillance, similar to radar that utilizes EMR to track objects such as airplanes or cell phones. As shown below, in principle, this capability is possible[24] but it is not known in unclassified research.

Secondly, EMR bioeffects can cause symptoms such as nausea, disorientation or confusion.[25] In principle, this capability can also be developed to include precise mind control, including forcing someone to carry out certain specific tasks, however it is unreported in unclassified science.[26] For all of the above reasons, EMR technologies for surveillance and EMR bioeffects for influence and control would seem to be major areas of the science required for neuroweapons development. However, the consensus has completely dismissed the science of EMR and EMR bioeffects for neuroweapons as rudimentary in their level of development and thus science fiction. However, as shown below, the consensus left out critical information, and therefore its conclusion is highly questionable.

The deployment of the three major US state tools would not necessarily eliminate the old, politically unacceptable methods of brutal physical torture and battlefield maiming and

20 V. L. Issraelyan, Representative of the USSR to the Committee on Disarmament. Union of Soviet Socialist Republics, Negotiations on the question of the prohibition of new types of weapons of mass destruction and new systems of such weapons, U.N Committee on Disarmament document CD/35 10 July 10, 1979.

21 Ibid.

22 William Baker, et al., Controlled effects: Scientists explore the future of controlled effects, AFRL's Directed Energy Directorate, Kirtland AFB NM, (2004). More information available at http://www.afrl.af.mil/techconn/index.htm.

23 Jonathan Moreno, Mind wars, Brain science and the military in the 21st Century (2012), 86, 87.

24 Michio Kaku, *Physics of the impossible, A scientific exploration into the world of phasers, force fields, teleportation, and time travel* (2008), 84-85.

25 Barbara Hatch Rosenberg, "'Sidebar: 'Non-Lethal' weapons may violate treaties," *Bulletin of Atomic Scientists*, September, October 1994, 45.

26 Robert Becker, The body electric: Electromagnetism and the foundation of life (1985), 321.

killing, but alternative methods (especially if they remain secret and therefore covert) could be used against enemies. No touch torture has already proven to be highly successful as a tool of domination and control: several government manuals show that since the 1960s, the techniques have been disseminated "from Vietnam through Iran to Central America."[27] Likewise, nonlethal weapons continue to be secretly developed in several US programs.[28] It will be shown below that the neuroweapons program, the least known and arguably the most consequential of the three CIA Cold War programs has also been secretly expanding.

1.2 Alleged mind control victims

At the same time the CIA programs have been taking place, a large and growing number of victims from around the world have alleged they have been remotely targeted, tracked, and suffered illegal human experimentation. Whether this is a coincidence or a cause and effect has remained an unanswered question. The claims of targeting seem to include physical and psychological torture with some features of advanced neuroweapons that the military claims have not yet been developed but that are included in future weapons plans. The claims include farfetched accounts of futuristic weapons that sound so bizarre, they have been dismissed as conspiracy theory or mental illness without further investigation. Most human rights groups and newspapers have received innumerable letters, calls or emails from victims with desperate pleas for help coupled with rambling accounts of crazy sounding mind control zapping and torture.[29] Some people may well be suffering from mental illness but without investigating the numerous claims, no one can be sure.

The 2006 Nature reviewed book *Mind Wars, Brain research and national defense*, and a 2007 *Washington Post Magazine* article, Thought Wars, covered the desperate victim accounts and raised issues of conspiracy theory and mental illness.[30] Although the publications included statements by scientists and military experts on secret government weapons programs, the interview statements supported that the symptoms and technologies described by victims were not scientifically possible based on unclassified research and therefore the victims must be conspiracy nuts or delusional. The statements were accepted at face value with only very general questioning, however as Aftergood noted above, secret military weapons programs can be cloaked in deceitful cover stories. Neither publication included independent investigation or recommended further evaluation.

By contrast, this paper examines experts, weapons, and technologies, and looks beyond the commonly accepted information to reach the opposite opinion: that the victim allegations may be true. Despite the complete rejection of the claims by nearly everyone and finding no relief from the targeting, victims continue to publicly plead their case. For example, one activist group recently placed a *Washington Post* ad addressed to President Obama seeking an investigation of advanced technologies that illegally target the brain.[31]

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27 McCoy, Outline, 14, n. 2 above.

28 Pasternak, n. 8 above.

29 Kevin Poulsen, Mind control madness, Wired.com, February 5, 2007. Available at http://www.wired.com/threatlevel/2007/02/mind_control_ma/. See also Weinberger, n. 6 above.

30 Moreno, n. 23 above, new edition of 2006 book. See also Weinberger, n. 6 above.

31 Moreno, n. 23 above, new edition of 2006 book. See also Weinberger, n. 6 above.
The Board of Freedom from Covert Harassment and Surveillance, 'To the President of the United States of America' *Washington Post Express*, July 16, 2013. Available at www.freedomfchs.com/washpostexprad.pdf.

1.3 The consensus position and alleged mind control victim position

The core of the disagreement between the alleged victims and the consensus is the question; how advanced is the science of secret neuroweapons today? The alleged victims say the science is already developed, extremely advanced and highly classified. The consensus position disagrees: stating that although such weapons might be possible, they have not been researched or developed. It is agreed that neuroweapons with the capability of remotely targeting, communicating with and controlling the enemy's brain is the ultimate weapon that major nations would want to develop. Experts also agree that in principle, neuroweapons and the capability of direct access to the brain and advanced precise mind reading and influencing human behavior—even mind control—are scientifically possible.[32] However, the consensus is that such weapons are only science fiction. A number of reasons are given in support of this consensus. Firstly, it is true that there is no theory for how the brain works and technologies to remotely access the brain remain undeveloped. Also, ethicists have only just begun to alert the public to the current explosion of neuroscience progress and the likelihood of the development of controversial new technologies. It is argued that neuroscience is still at a rudimentary level of development and therefore the development of advanced neuroweapons is not possible today. So it is argued that although advanced neuroweapons are scientifically feasible, their development is only possible in the far future. Secondly, it is argued governments would not be able to keep such weapons secret for decades.

32 Kaku, n. 24 above.

However, this paper will argue that the consensus is wrong for the following reasons. For decades, the US government prevented the science required for neuroweapons from developing in the unclassified realm; thereby allowing the US government to claim neuroweapons are science fiction, based on the best US science literature available. At the same time, secret neuroweapons research flourished and the US government employed extensive secrecy methods to disguise the fact that neuroweapons were scientifically possible not only in principle but were also proven with science experiments. Consequently, secret neuroweapons that are already developed are a serious threat but experts are not warning the public and they should be.

The paper is organized as follows. Section 2 presents a summary of the neuroscience required for neuroweapons. Section 3 presents the first of two cover stories; that neuroweapons are still science fiction. This cover story relies on the assumption that secret neuroweapons research would advance at a faster but similar development rate as unclassified neuroscience, therefore a brief chronology of the history of classified and unclassified neuroscience related to advanced neuroweapons is presented. The cover story and alternative position are compared before a brief analysis and conclusion are presented. Section 4 considers the second of the two cover stories for neuroweapons; that there are no proven EMR bioeffects except heating. The evidence that this cover story is obsolete is set out by presenting the science of EMR bioeffects related to neuroweapons and US military research based on EMR bioeffects, followed by a summarized history of their development. The cover story and alternative positions are again compared with a brief analysis and conclusion to follow. Section 5 briefly discusses one lesser known and extreme US secrecy method that was

implemented to maintain the secrecy of a CIA domestic surveillance program uncovered with the CIA mind control programs in the 1970s, mentioned above. Section 6 presents conclusions and a recommendation for further investigation.

2. The science of neuroweapons

The public needs to know very basic neuroscience required for neuroweapons development. This does not require rocket science or a neuroscientist to understand it but it does require information that has been missing in the public forum. Generally speaking, the science requirements necessary to develop neuroweapons are as follows. It is thought that the science of neuroweapons would require a general theory for how the brain works and so far there is no unclassified theory and neuroscience is too rudimentary to form the basis of a classified theory. However, this ignores the fact that to a great extent, neuroscientists do not theorize in comparison to other fields of science, for example physicists build theories to be tested.[33] It is well known that neuroscience literature includes voluminous research but few theories to make sense of the data, as science writer John Horgan explained: "Unfortunately, no one has any idea how the brain integrates the output of all its disparate components to create what we think of as a mind, or self. . . . Neuroscientists have done a great job of breaking the brain into pieces, but they have no idea how to put it back together again."[34] Therefore, the lack of a brain theory could be because neuroscientists don't theorize, not because a general theory for how the brain works is not possible.

Furthermore, in his 2010 book, *Creating modern neuroscience: The revolutionary 1950s*, Gordon Shepherd, a prominent neuroscientist, wrote that the 1950s can be considered the greatest decade in biology and neuroscience because there were so many discoveries, breakthroughs and milestones. For example, in biology, the structure of DNA was discovered and this led to rise of molecular biology and the Human Genome Project, a US project that sequenced human DNA.[35] In neuroscience of the 1950s, the ionic hypothesis explained how brain cells utilize electricity to communicate[36] and the hypothesis was the basis for a 1963 Nobel Prize. A great number of similar breakthroughs in the 1950s laid the foundation for modern neuroscience.[37] Shepherd suggested that this exceptional scientific activity was unparalleled in neuroscience before or since and for the most part, a general theory of how the brain works could be based on 1950s revolutionary research.[38]

Shepherd's book received favorable reviews; it has not been contested by neuroscientists; and it is the basis of two Yale University courses on neuroscience. The book won a 2010 International Society for the History of Neurosciences award. A reasonable speculation is that scientists conducting unclassified research would not have recognized a general theory for how the brain works as a result of being discouraged and prevented from researching critical areas of neuroscience required to develop neuroweapons, as shown below. At the same time, the utilitarian CIA mind control researchers would have recognized the

33 James Livingston *Driving force: The magic power of magnets* (1997), 249.

34 John Horgan 'Brain teaser: We think, therefore we are. But we don't know how we think,' *Washington Post*, October 17, 1999.

35 Gordon Shepherd, *Creating modern neuroscience: The revolutionary 1950s* (2010), 11, 12.

36 Eric Kandel, Larry Squire, Neuroscience: Breaking down scientific barriers to the study of brain and mind, Science, November 10, 2000.

37 Shepherd, 12, n. 35 above.

38 Shepherd, 232, n. 35 above.

potential for applying this knowledge to neuroweapons development. The US government would have classified any further critical neuroscience required to develop neuroweapons and would have utilized deceitful government cover stories, thus discouraging unclassified research in neuroscience that might reveal the scientific possibility of neuroweapons.

In addition to the requirement of a theory for how the brain works, developing neuroweapons requires knowledge of neuroscience. Neuroscience consists of "the collected multidisciplinary sciences that analyze the nervous system to understand the biological basis for behavior."[39] Consciousness is a branch of neuroscience research that is also defined as the study of the brain biology relationship.[40] Likewise, neuroweapons are weapons designed to influence and control the behavior of the enemy by controlling brain biology. Therefore, research on the brain biology and behavior relationship is essential for progress in both neuroscience and neuroweapons. However, as shown below, it is hard to believe but true; mainstream neuroscience did not include the study of the relationship between brain biology and behavior—the very basis of neuroscience and neuroweapons—until very recently.

2.1 The electrochemical brain

Solving how the electrochemical brain works and developing neuroweapons are both a physics problem and a biology problem. The study of electricity in biology, including the electrical properties of the human brain is called bioelectricity. Bioelectromagnetics, the study of electromagnetism in biology, is a branch of bioelectricity. Bioelectromagnetics includes the study of EMR bioeffects which is a critical area of science for neuroweapons, as shown below. Neuroscientists have established that the electricity of the brain communicates information between brain cells with electrical signals but much remains to be discovered and understood. Significantly, for the last sixty years, the basic science and technology requirements for solving how the brain works and likewise for developing neuroweapons have remained the same. Since the mid-twentieth century, neuroscientists have known that brain cells—including the most studied brain cells called neurons—communicate with electrochemical signals. This communication process translates into human activities such as dreams, thoughts, emotions, actions, hearing, seeing and more. Neuroscientists agree that the key to solving how the brain works is to decipher the language of the electrochemical signals, called the neural code.[41]

John Chapin, a Defense Advanced Research Project Agency (DARPA) program manager explained that deciphering the neural code is a high research priority for neuroscience because it is one of three great scientific unknowns, along with the origin of the universe and of life on Earth.[42]

Solving the neural code could lead to finally understanding the mind-brain problem, which is how the biology of the brain results in consciousness and human behavior.[43] It could lead to major advances in treating brain disorders and improving the capabilities of

39 Larry Squire et al., *Fundamental neuroscience, Fourth edition* (2013), 3.

40 Ibid. at 1091.

41 John Horgan, The myth of mind control: Will anyone ever decode the human brain? *Discover Magazine*, October 29, 2004. Available at http://discovermagazine.com/2004/oct/cover.

42 Ibid.

43 Ibid.

healthy people.[44] While neuroscientists agree that the brain is the most complex scientific problem today,[45] there is no agreement among neuroscientists on how to go about solving the neural code. Nevertheless, the brain can be divided into two fundamental components that the public can understand. Neuroscientists often describe the brain as "the electrochemical brain" because the brain consists of two essential and equally important properties—bioelectrical and biochemical.[46] Significantly, two critical facts to know about neuroweapons are that first, they are based on the bioelectrical properties of the brain, not the biochemical properties of the brain; and second, they require the development of technologies for remote communication and surveillance of the brain and only a bioelectrical approach--not a biochemistry approach—can lead to remote access to the electrochemical brain. Victor Chase authored a book on the importance of research on the electrical activity of the brain. Chase explained that "electrical signals provide the most efficient method of transmitting information within the body. No living creature could survive without electricity, because the body is, in essence, an electrical machine."[47] Neuroscientists still don't understand how the brain's electrical signals are transformed into human thought, actions, hearing, seeing, and more.[48]

There is no dispute that the electrochemical brain communicates with electrical, electromagnetic and magnetic signals as well as chemical signals. Additionally it is well established that electrical, electromagnetic and magnetic signals from outside sources can mimic, interfere with or directly communicate with brain cells. For example, neuroscientists have communicated with the brain by way of its electrical properties. Brain implants utilize electrical signals to affect or cause movements and actions, and to alter, influence, even control behavior. Jose Delgado, a Yale University neuroscientist, conducted research in the 1960s and 1970s which helped to establish that brain implants could be remotely controlled to electrically stimulate an animal's brain to control various complex behaviours, instincts, and emotions.[49] Delgado stated: "A new technology . . . has proved that movements, sensations, emotions, desires, ideas, and a variety of psychological phenomena may be induced, inhibited, or modified by electrical stimulation of specific areas of the brain."

It becomes highly relevant that research on the electrical properties of the electrochemical brain has lagged far behind research on the brain's biochemical properties. Progress on the electricity of the brain is still considered rudimentary.[50] Furthermore, since the 1960s, biochemistry is the area of research that mainstream neuroscience has completely focused on, at the expense of the equally important research on the bioelectrical properties of the brain. Consequently, it can be argued that bioelectricity, as one of two fundamental properties of the electrochemical brain, should be a major focus of neuroscience but for some reason it is not.

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44 Ibid.

45 Gwen Ifill, 'Will US forge public-private partnership to draw brain activity map?' *PBS NewsHour*, February 20, 2013. Available at: http://www.pbs.org/newshour/bb/health/jan-june13/medical_02-20.html.

46 Horgan, n. 41 above.

47 Victor Chase, *Shattered nerves: How science is solving modern medicine's most perplexing problem* (2006), 1, 2.

48 Ibid.

49 Jose Delgado, Physical control of the mind: Toward a psychocivilized society, Vol. 41, *World Perspectives* (1969)

50 Chase, 1, n. 47 above.

The second critical fact about neuroweapons is the requirement of the development of technologies for remote access to the brain. Notably, only a bioelectrical approach—not a biochemistry approach—can lead to remote access to the electrochemical brain. An example helps to clarify the difference between bioelectrical and biochemical brain technologies to access the brain. A cell phone caller makes a call and the cell phone transmits the voice message in the form of microwaves traveling through the air-in physics this is known as "action at a distance"—to the microwave cell phone tower. The cell phone tower then transmits the call in the form of microwaves to the cell phone of the person receiving the call which detects the microwaves and converts them back to a voice message. By contrast, action at a distance is not possible with biochemistry. For a chemical reaction to occur, such as two chemicals reacting in a solution to make a third chemical, physical contact is required. Likewise, biochemical brain technologies cannot communicate remotely with the brain, physical contact is required.

Because experiments with invasive technologies on healthy human subjects are unethical, technologies for remote or direct access to the brain are the preferred way rather than invasive technologies such as brain implants and surgeries. While neuroscientists have conducted some brain implant research, the concentration of research has been on indirect methods to access the brain, such as brain scanning technologies, for example, magnetic resonance imaging (MRI). One possible reason for the lack of remote technologies to access the brain is that much of this area of research has been classified since the 1950s and has been off-limits to unclassified researchers. Since then, only the US government has been developing technologies for remote access of the brain to any significant extent.

To summarize, the following will be shown below. The four major areas of neuroscience that are essential for neuroweapons development have been largely missing from mainstream neuroscience research; first, the brain biology and behavior relationship; second, the still undeveloped and rudimentary bioelectricity research; third, bioelectromagnetics research on the brain which seems to provide a method to remotely communicate with, influence, and perhaps even control the brain; and fourth, the bioelectrical technologies—not biochemical technologies—which allow for remote or direct access to the brain. The next sections are a chronology of the development of the basic science required to develop neuroweapons in classified and unclassified neuroscience research since World War II.

3. The development of bioelectricity in neuroscience

Bioelectricity in neuroscience has roots in the study of electricity in medicine and both have faced extreme controversy. Since the eighteen century, when Benjamin Franklin investigated electricity in medicine and concluded it was a charlatan's game; it has remained highly controversial.[51] In 1910, the Carnegie Foundation conducted a review of U.S. medical education and it dismissed the "unscientific" use of electric devices—some but not all were of questionable medical value—and also any medical practice not based on the prevailing biochemical theory.[52] So all mentions of medical devices

51 Becker, 70, 82, n. 26 above.

52 Andrew Marino, Going somewhere: Truth about a life in science, (2010). 73. Available at http://www.goingsomewherebook.com/.
See also Abraham Flexner, The Flexner Report, Bulletin Number Four, Carnegie Foundation for the Advancement of Teaching, (2010). Available at http://www.carnegiefoundation.org/publications/medical-education-united-states-and-canada-bulletin-number-four-flexner-report-0.

based on bioelectricity were driven from the classroom.[53] However, some medical electricity has been established as valid, as shown below. Although there was little intermingling between traditional biology and the study of electricity, Nobel Laureate Albert Szent-Gyorgyi conducted research on solid state physics in biology and another type of electricity besides the ionic current in neurons described above, known as semi-conduction. For example, semi-conduction is found in most computers today; its importance in biology is that the current is small but it can carry information rather than energy and travel long distances.[54]

In the early 1940s, Szent-Gyorgyi proposed an idea that was published in *Science* and *Nature*: that proteins may be semiconductors and this might prove to be the basis of the phenomenon of life.[55] The paper created much excitement but the theory was rejected on theoretical grounds; the scientific community lost interest and the research lacked funding. Nevertheless, Szent-Gyorgyi's theory later proved to be valid, although there was no interest in pursuing the research.[56] In the late 1970s, Szent-Gyorgyi provided a possible explanation for why his research was never followed up in mainstream neuroscience: "To sum up, there are four dimensions with which the biologist must be concerned: macroscopic, microscopic, molecular, and submolecular or electronic. Biology readily followed physics into the first three, but took practically no cognizance of the fourth."[57]

Szent-Gyorgyi understood that biology included a variety of electrical properties. However, most biologists have focused only on basic bioelectricity while concentrating most of their research on the many other areas of biology to be studied. Significantly, one of the founding fathers of neuroscience understood the importance of the many electrical properties of the brain. In the early 1960s, Francis Schmitt was instrumental in establishing the field of modern neuroscience.[58] In a journal article, Schmitt described promising future research that included bioelectricity with an emphasis on the electrical properties of the brain such as semi-conductivity, EMR bioeffects and electrostatic fields.[59] Significantly, Schmitt cited and recommended Szent-Gyorgyi's research as a promising area to pursue. However, Schmitt's recommendations on bioelectricity in neuroscience research have not been followed up to any significant extent.

Another example of the overall rejection of bioelectricity is the 1950s "biophysics bubble" which burst in the 1960s.[60] For a short time, biophysics – which included bioelectricity – experienced a short biophysics boom in the 1950s which included multidisciplinary research by physicists and biologists on the study of nerve and brain function. Archibald Hill, Detlev Bronk, and Schmitt, cited above, were all prominent neurophysiologists, scientific administrators and military advisors who promoted the importance of biophysics

53 Becker, 82, n. 26 above.

54 Ibid. at 92, n. 26 above.

55 Albert Szent-Gyorgyi, Study of energy-levels in biochemistry, *Nature*, 3745:157, August 9, 1941. See also, Albert Szent-Gyorgyi, *Introduction to submolecular biology* (1960).

56 Ralph Moss, *Free radical, Albert Szent-Gyorgyi and the battle over vitamin C* (1988), 244.

57 Albert Szent-Gyorgyi, *The living state and cancer* (1978), 4.

58 Shepherd, 4, n. 35 above.

59 Francis Schmitt, 'Psychophysics considered at the molecular and submolecular levels,' in Michael Kasha, Bernard Pullman, eds., *Horizons in biochemistry: Albert Szent-Gyorgyi dedicatory volume* (1962), 453.

60 Nicholas Rasmussen, The midcentury biophysics bubble: Hiroshima and the biological revolution in America, revisited", *History of Science* (1997), 35: 245.

during and after World War II.[61] In the mid-1950s, Schmitt, a director in the US National Institute of Health, (NIH) unsuccessfully attempted to implement biophysics research as a major area of government research on the same footing as biochemistry or molecular biology.[62] However, government documents indicate that NIH biochemists rejected this approach in various ways.[63] In the late 1950s, biochemists included physical chemistry in their research and this seems to have contributed to the disappearance of biophysics research in the 1960s.[64]

Significantly, since World War II, although most neuroscientists only study the brain through biochemical research, US government scientists conducting classified neuroscience research are known to have utilized EMR technologies and bioelectricity as well as biochemistry to study the brain. To explain, the 1940s led to the discovery of semiconductors, the invention of transistors and integrated circuits, and the invention of the computer. In the 1950s, quantum physics, electrical engineering and solid state physics led to classified research on radar, National Security Agency (NSA) surveillance capabilities and satellite reconnaissance. Radar, NSA surveillance, and satellite reconnaissance required EMR technologies to develop the capability of remote sensing, detection of foreign communications signals and more. As Hill, the military advisor cited above explained, radar work would be "useful preparation for a career in biophysics."[65] In fact, the physiologist Alan Hodgkin, one of three men to become a 1963 Nobel laureate for the ionic hypothesis of neurons in the brain, discussed above, applied his secret World War II research on radar to constructing electronic equipment for detecting the tiny electrical signals of squid brains.[66] Hodgkin was one of the few scientists known to have applied his wartime physics research to unclassified neuroscience research, with great success.

A major portion of physics papers after World War II remain classified[67] and major areas of physics that could contribute to the development of research on the bioelectricity of the brain remain unavailable to unclassified researchers. Paul Forman, author of a journal paper on quantum electronics for national security stated: "During the 1950s the cumulative number of announced and available number of papers [that were] properly published in US physics journals [was]—about 50,000—but it was probably only some small percentage of the (unknown) number of security classified reports in physics and its technical applications prepared in that decade."[68] Furthermore, classified scientific war research, which concentrates on national security objectives, is different in style from unclassified peacetime research; "in war, research goals were set, deadlines were tight but resources were no problem; the only thing that mattered were the research goals."[69]

As mentioned above, since the 1950s, only the US government has been developing technologies for remote access of the brain to any significant extent. In the 1980s, Richard

61 Soroya de Chadarevian, *Designs for life: Molecular biology after World War II* (2002), 1.

62 Gordon Rasmussen, *Picture control, The electron microscope and the transformation of biology in America, 1940 -1960* (1997), 195.

63 Ibid

64 Rasmussen, 195, n. 62 above.

65 Chadarevain, 74, n. 61 above.

66 Ibid. at 87, 88.

67 Paul Forman, Behind quantum electronics: National security as basis for physical research in the United States, 1940-1960, *Historical Studies in the Physical and Biological Sciences*, 18:1 (1987), 170.

68 Ibid.

69 Chaderevian, 88, 74, n. 61 above.

Cesaro, deputy director for advanced sensors at DARPA stated that animal experiments in the 1960s and 1970s confirmed microwaves can penetrate the brain and with modulation may be able to carry information to influence the brain.[70] Classified research such as the DARPA EEG research is based on the bioelectrical properties of the brain which seem to allow for remote surveillance; in 1976, DARPA reported to Congress that mind-reading machines are beginning to decipher a person's brain waves or EEG.[71] Agency scientists stated that current technologies require electrodes placed on the scalp, however, they described magnetic brain waves that could be detected a few feet away and greater distances could be achieved in the 1980s.[72] It is not known whether the DARPA research on remote access to the brain was ever developed.

As Dr. Ichiji Tasaki wrote in his 1982 book, *Physiology and electrochemistry of nerve fibers*: "One of the difficulties encountered in writing this book has been that many students of biology and medicine are not sufficiently familiar with the basic concepts in thermodynamics and electrochemistry." It seems likely that neuroscientists do not study beyond the basic physics of their educational requirements. It becomes obvious that biophysics and bioelectricity could have but did not become a significant part of mainstream neuroscience research.

3.1 Bioelectricity and the neuron doctrine

Bioelectricity in neuroscience has been met with further opposition from an unlikely source, the neuroscientists themselves who do not want to look beyond established doctrines even though they have been shown to be lacking. The neuron doctrine is a fundamental tenant of modern neuroscience; it states that the neuron is the primary functional signaling unit of the brain and connects with other neurons.[73] This is also the principle behind the so-called connectionist model; connectionism is an influential school of neuroscience thought, as will be shown below. The neuron doctrine is taught in every neuroscience textbook today,[74] however, it is considered incomplete and too simplistic to explain how brain biology is related to human behavior, without extending its principles.[75] This is not happening and some neuroscientists say that it should be.[76]

The action potential which is made up of the ionic current of the neuron described in the Nobel Prize winning ionic hypothesis cited above, remains the most studied area of bioelectricity in neuroscience. However, bioelectricity is based on the laws of physics which state there is no electricity without electromagnetic and magnetic fields, including in the brain. Therefore, besides the action potential, bioelectricity of the brain also requires the study of interactions of electricity, magnetism, and electromagnetism in the brain and measuring and studying how the brain communicates with electrical currents, electric signals, semi-conduction, direct and alternating currents, EMR, magnetic signals, and more.

For decades, neuroscientists have known that brain electricity is much more than just ionic currents in the neuron. Nevertheless, the neuron doctrine prevailed throughout

70 Barton Reppert, Looking at the Moscow Signal, the zapping of an Embassy 35 years later, The mystery lingers, *Washington Associated Press*, May 22, 1988.

71 Norman Kempster, Mind reading machine tells secrets of the brain: Sci-Fi comes true, *Los Angeles Times*, March 29, 1976.

72 Ibid.

73 Kandel, n. 36 above.

74 Horgan, n. 41 above.

75 Shepherd, 112, n. 35 above.

76 Horgan, n. 41 above.

the twentieth century[77] and it had the effect of preventing any significant research on discoveries of additional methods of bioelectrical brain communication systems. In 1961, Robert Galambos, a neurophysiologist, wrote that the decades of research on the neuron and its action potential has not and will not provide an explanation for human behavior such as remembering a name.[78] The neuron doctrine and the neuron's action potential will never be able to explain how the brain works.[79] Theodore Bullock, another pioneering neuroscientist, echoed Galambos in a 1996 journal article, describing the neuron doctrine's grip over neuroscience as nearly absolute.[80] Regarding the electricity of the brain; little else but the neuron doctrine and the neuron's action potential are accepted as valid in mainstream neuroscience today. In a 2005 science magazine article, The Myth of Mind Control, Walter Freeman, a neuroscientist at the University of California at Berkeley, also explained that the focus on the neuron doctrine is misplaced and other bioelectricity approaches should be considered such as further study of EMR bioeffects.[81]

Without a doubt, bioelectricity research remained rudimentary and narrowly focused on the neuron doctrine, ionic currents, and action potentials. It is true that some neuroscientists have made significant progress on lesser known bioelectricity research other than the neuron doctrine, however, the research remains either a small part of neuroscience research as a whole, or it is side-lined and marginalized, with some of the research considered fringe science.[82]

Now the limits that the neuron doctrine has placed on bioelectricity research seems to be extending to major areas of future neuroscience research funded by the US government. In his 2013 state of the union address, President Obama proposed a Brain Mapping Project which is based on the neuron doctrine and the connectionist model.[83] An interview of Columbia University's Raphael Yuste, included this description of the project: "By mapping circuit activity, Yuste thinks researchers can "discover patterns that are the physical representation and origin of mental states--of thoughts, for example, or memories."[84] Yuste explained that researchers want to chart a functional

77 Robert Galambos, A Glia-neural theory of brain function, *Proceedings of the US National Academy of Sciences* Volume 47. No.1, January 15, 1961, 136.

78 Ibid.

79 Shepherd, 112, 113, n. 35 above.

80 Theodore Bullock, 'Neural integration at the mesoscopic level: The advent of some ideas in the last half century, *Journal of the History of Neuroscience*, Volume 4 No.3-4, 1995, 231.

81 Horgan, n. 12 above.

82 A.A.P. Leao, Further observations on the spreading depression of activity in the cerebral cortex, *Journal of Neurophysiology*, 10:409, November 1947. See also B. Libet, & R.W. Gerard, Steady potential fields and neurone activity, *Journal of Neurophysiology* 4:438, September 1941.
For brain/EMR interactions, see R.H.W. Funk et al., Electromagnetic effects, from cell biology to medicine, *Progress in Histochemistry and Cytochemistry* 43:185,189 (2009).
For dc brain currents, see Robert Becker, Electromagnetic forces and life processes, *Technology Review* 38 December, 1972. For advances in dc brain research, see Michael Nitsche et al., *Transcranial direct current stimulation: State of the art*, (2008) 206.
For semi-conduction, see Janos Ladik, Solid state physics of biological macromolecules: The legacy of Albert Szent-Györgyi, *Theochem*, 666-667:1, December 2003.
For analog digital brain communication, see George Gilder, *The silicon eye* (2005), 141. See also George Dyson, *Turing's Cathedral, the origins of the digital universe* (2012), 280, 281.

83 Ifill, n. 45 above.

84 Robert Gonzales, 'Here's how Obama's brain mapping project will actually work,' *IO9 blog*, February 22, 2013. Available at http://io9.com/heres-how-obamas-brain-mapping-project-will-actually-5986161.

model of the brain by mapping each of the billions of neurons in the human brain and observing their actions. Neuroscientists acknowledge that Obama's brain project will take decades to complete.

It is also significant that Obama's Brain Mapping Project, which is now a part of the BRAIN Initiative[85] has focused on developing invasive electronic technologies such as nanoprobes and wireless microcircuits that will float freely in the brain. The proposed technologies to access the brain involve physical contact, invasive procedures or bulky machines and cannot be done remotely. DARPA will have some influence on the BRAIN Initiative; the agency is funding 40 million of approximately 132 million of the start-up funding. It seems likely that the limits on bioelectricity research by the neuron doctrine will continue.

3.2 Three revolutions in science

As Shepard explained above, the revolutionary 1950s set the course for modern neuroscience. In the 1950s, three revolutions in science—the biology revolution, psychology's behaviorist revolution, and the cognitive revolution—resulted in tumultuous changes for neuroscience. Unclassified neuroscience developed with a focus on molecular biology and biochemistry and a significant lack of both bioelectricity and also the study of the brain biology behavior relationship.[86] As described in the previous section, neuroscience since the 1960s has focused on biology and biochemistry over biophysics. This section will look at how neuroscience is defined as the relationship of brain biology to human behavior, however, neuroscientists in the 1960s and beyond have focused on behavioral approaches to the study of the brain with no study of its relationship to the biology or biochemistry of the brain. The 1950s was the beginning of the biology revolution.[87] The biology revolution in science and the cognitive revolution in psychology took off in the 1960s and since then, molecular biology, cognitive psychology, and biochemistry have remained the dominant areas of research in neuroscience.[88] As explained above, the great interest in biophysics in the 1950s did not last through the 1960s.[89]

Although the study of bioelectricity is equally as important as the study of biochemisty of the electromagnetic brain, in unclassified neuroscience research, bioelectricity was absorbed by biochemistry, and molecular biology. Today, the major areas of research that have dominated neuroscience are cellular and molecular biology, cognitive psychology and systems neuroscience, which developed into brain imaging.[90] For example, in 2012, there were 40,000 members of American Society for Neuroscience with "massive representation of molecular biology, cognitive psychology and brain imaging."[91] "[M]olecular biology is now expected to take the dominant role in the twenty-first century that physics played in the twentieth."[92]

85 Joshua Sanes, Mapping the way to a brain survey, Harvard Magazine. July/August 2013. Available at http://harvardmagazine.com/2013/07/mapping-the-way-to-a-brain-survey. See also http://www.bioethics.gov/sites/default/files/news/Charge%20from%20President%20Obama.pdf

86 Larry Squire, Eric Kandel, *Memory: From mind to molecules*, (1999), 5, 6, 7.

87 Ibid.

88 Jean-Pierre Changeux, The good, the true and the beautiful (2012), 317.

89 Rasmussen, 245, n. 60 above.

90 Squire, preface, n. 39 above.

91 Changeux, 317, n. 88 above.

92 Chadarevian, 1, n. 61 above.

Additionally, since the 1950s, the behaviorist revolution has had the significant impact of preventing study of the relationship of brain biology to behavior, until the last few decades. From the early twentieth century through the 1960s, the behaviorism movement dominated psychology. Behaviorism included experiments utilizing for example, stimulus-response and observable behavior studies. Significantly, behaviorism excluded any study of biological factors and brain processes. In the 1950s, prominent scientists were also actively supporting the behaviorist approach in CIA mind control research. For example, Jolly West, a CIA scientist and the director of the University of California at Los Angeles Neuropsychiatric Institute, was instrumental in promoting behaviorism. There were several CIA scientists including Harold Wolff and Ewen Cameron, and others who wittingly and unwittingly were receiving CIA funds for the research.[93] This had the overall effect of limiting research on the brain biology relationship.

In the 1960s, the inability of behaviorism to explain cognitive factors such as intelligence and personality led to its downfall. After the 1960s, its restricting effect on biological causes of behavior remained in evidence, for decades. One psychologist explained: "Advocates of biological approaches to psychological problems found little financial support, little academic encouragement, and few outlets in psychological publications."[94] The cognitive revolution replaced behaviorism; and by joining the biology revolution, cognitivists began to study mental processes in the brain, although primarily with indirect tools such as brain scanning technologies. Two major areas of cognitive psychology developed; molecular biology and systems biology, which is the study of "mapping elements of cognitive function onto specific brain areas."[95]

The brain scanning technologies such as the PET scans and FMRI enabled research on systems biology to flourish. Although it is slowly starting to change, cognitive scientists have studied the mental processes but have ignored brain biology, instead taking a functionalist approach based on the belief that the functioning of a person can be studied independently of other factors.[96]

The functionalist approach in neuroscience remained a significant influence, for example in connectionist research;[97] neuroscientists who focused their research on the biology of the brain have not embraced the connectionist approach,[98] for reasons such as the connectionist modeling did not usually match how the brain functions in reality.[99] Thus, both the cognitive revolution and also the connectionist approach have been slow to reduce the enormous gap between the study of brain biology and human behavior that began with behaviorism.

The study of consciousness, which is another area of study of the brain behavior relationship, has been subject to centuries old religious and philosophical debates. The scientific approach to the study of consciousness was considered heresy[100] and the study of consciousness was off

93 Rebecca Lemov, *World as laboratory, Experiments with mice, mazes, and men* (2005), 189, 190.

94 Hans Eysenck, *The future of psychology*, in Robert Solso, ed., *Mind and brain sciences in the 21st Century* (1999), 283.

95 Squire, 6, 7, n. 86 above.

96 Francis Crick, *What mad pursuit: A personal view of scientific discovery* (1988), 149, 150.

97 Douwe Draaisma, *Metaphors of memory*: A history of ideas about the mind (2000), 190.

98 Ibid. at 201.

99 Ibid.

100 David Chalmers, The Puzzle of conscious experience, *Scientific American*, December 1995.

limits in psychology and also neuroscience throughout most of the 20th century.[101] In the late 1980s, Francis Crick, a physical chemist and Nobel laureate for discovery of the structure of DNA, and Christof Koch, a neuroscientist, began to study and publish papers on consciousness, in spite of the complete rejection of such research by most of their peers.[102] The science of consciousness remains a relatively small area of neuroscience research today.[103]

Benjamin Libet, a neuroscientist, described that the US National Institutes of Health (NIH) and the National Science Foundation (NSF) would not fund consciousness research.[104] At the same time, Libet stated that a large number of internationally prominent figures in neuroscience supported his consciousness research.[105] For decades, most neuroscientists did not believe anything could be found in the study of brain biology and behavior relationship.[106] Crick asked some of his peers in neuroscience why they think this way; reasons given included that the brain is so complicated, examining the brain closely won't result in significant progress.[107] Crick stated that he found this reasoning "most peculiar."[108]

Brief analysis and conclusions of the first of two cover stories

It can be argued that the new evidence of a 1950s theory for how the brain works is compelling evidence that should be considered in any evaluation of whether neuroweapons are science fiction or science fact. The consensus that neuroweapons are science fiction is based on the assumption that secret neuroweapons research would advance at a similar development rate as unclassified neuroscience. Nevertheless, this position can now be shown to be significantly flawed. Missing from the consensus is the following information. Unclassified neuroscientists had no theory for how the brain works to guide them. The major areas of unclassified neuroscience research, molecular biology, cognitive neuroscience, and brain imaging research, which had their beginnings in the 1950s, remain the dominant areas of research in neuroscience today. At the same time, research on the bioelectricity of the brain—with the exception of the extensive research on the action potential of the neuron--has remained classified in the 1950s CIA mind control programs and DARPA programs to develop technologies for remote access to the brain. It can be argued that the extremely skewed development of neuroscience research described above may have come about in large part to allow only classified CIA scientists to develop neuroweapons and therefore maintain complete secrecy.

As a result, unclassified neuroscientists could only study the biochemistry of the brain, even less so because of the restrictions imposed by the neuron doctrine and the restrictions on the study of the brain biology and behavior relationship. Without tools based on bioelectricity to remotely access the brain, few human experiments can be done ethically and neuroscientists conducting unclassified research can only study the brain indirectly, for example with brain scanning technologies. At the same time, the evidence suggests that US government scientists conducting classified neuroweapons research had tremendous, almost unbelievable

101 Ibid. See also Solso, 306, n. 94 above.

102 Christof Koch, *Consciousness: confessions of a romantic reductionist* (2012), 5, 6.

103 Greg Miller, What Is the biological basis of consciousness? *Science, Volume 309, July 1, 2005, 79.*

104 Larry Squire, ed., *History of neuroscience in autobiography, Volume 1* (1996), 446.

105 Ibid.

106 Draaisma, 190, n. 97 above.

107 Crick, 150, n. 96 above.

108 Ibid.

advantages. All of the requirements for the development of neuroweapons cited above were available: a 1950s theory for how the brain works, the study of both biochemistry and also bioelectricity of the brain, the brain biology and behavior relationship, and more advanced technologies for remote access the brain.

A reasonable conclusion would seem to be that the development trends found in classified and unclassified neuroscience research are either an alarming coincidence or a strong indication that the science of neuroweapons have been well hidden and well known for decades--but only to US government scientists conducting secret research. Furthermore, unclassified research gives glimpses of what is possible: the expectation is that classified research into bioelectricity would be far more developed, as further shown in the next section.

4. The second of two cover stories; EMR bioeffects policy

Since the 1950s, the US government has endorsed an EMR bioeffects policy which states that there are no proven EMR bioeffects, only heating effects. This section presents the following. The science of EMR bioeffects is briefly summarized, then a summary of the science of EMR bioeffects for neuroweapons is described. Next, a brief chronology of some of the history of EMR bioeffects policy, including a brief history of bioelectromagnetics, the science of EMR bioeffects is presented. Additionally, it will be shown that there are strong indications that the US EMR bioeffects policy is consequential to the Cold War history of an ongoing secret arms race between the US and Russia over neuroweapons. A short analysis and conclusions are given.

4.1 Science of EMR bioeffects

In the nineteenth century, James Clerk Maxwell discovered that all physical phenomena, from energies to chemical and solid bodies are built on oscillations. With oscillation comes EMR. Maxwell discovered all waves are mathematically identical with relationships along a continuum known as the electromagnetic spectrum, for example microwaves, light, and also the kilohertz oscillations by the neurons in the brain.[109]

EMR bioeffects are based on the fact that electricity, magnetism and electromagnetism are interconnected phenomena, including in the human body and the brain. EMR bioeffects are based on the well-established fact that electrical currents, (including those in the brain) produce electromagnetic fields. The brain can also be influenced by external electricity and electromagnetic and magnetic fields.[110]

An example of magnetic signals that can influence behavior is transcranial magnetic stimulation (TMS), a medical therapy that directs tiny magnetic signals at certain areas of the brain to relieve depression.

Alan Frey, a physicist, neuroscientist, and one of the founders of the Bioelectromagnetics Society, wrote that EMR is ubiquitous in biology and significantly, internal EMR signals are modulated with information like a radio for brain communication: "[L]iving beings are electrochemical systems that use very low frequency electromagnetic fields in everything from protein folding through cellular communication to nervous system

109 George Gilder, *Telecosm: How infinite bandwidth will revolutionize our world* (2000), 16.

110 Robert Becker, *Cross currents: The perils of electropollution, the promise of electromedicine* (1990), 69.

function. To model how EM fields affect living beings, one might compare them to the radio we use to listen to music. . . . This is the model that much biological data and theory tell us to use."[111]

The basic scientific concept behind EMR bioeffects is as follows: "Numerous independent experiments reported in the peer-reviewed journal research literature conclusively establish that nonthermal bioeffects of low-intensity EM fields do indeed exist. . . . Extremely weak EM fields may, at the proper frequency and site of application, produce large effects that are either clinically beneficial or harmful. Some specific frequencies have highly specific effects on tissues in the body, just as drugs have their specific effects on target tissues."[112] Significantly, a 1991 *International Review of the Red Cross (ICRC)* report on directed energy weapons described the same finding: "Research work has also revealed that pathological effects close to those induced by highly toxic substances could be produced by electromagnetic radiation even at very low power, especially those using a pulse shape containing a large number of different frequencies."[113]

A 2010 review of EMR bioeffects literature concluded that although EMR bioeffects science remains unsettled, there is no doubt that biosystems can be affected by EMFs at several levels: "There is also little doubt that biosystems can be the source of EMFs. The main question at hand is whether biosystems use EMF for a purposeful interaction (communication) and if so at what level of the bio-organism will it happen? The amount of data that support the latter notion is rapidly mounting."[114]

Most would agree that bioelectromagnetics is fundamental to human biology and yet other prevailing scientific viewpoints about EMR support the argument this research is still rudimentary: "Even though the body is basically an electrochemical system, modern science has almost exclusively been concerned with the chemical aspect."[115]

4.2 EMR bioeffects for neuroweapons

Conventional neuroscience maintains that electricity is the primary communication system in the brain, based on the neuron doctrine. As noted above, the current state of EMR bioeffects research is the determination of whether the brain communicates information among the brain cells with electromagnetic waves that are given off and received by the brain cells. This is unsettled science, as much remains to be discovered and understood. This is the area of science that is also politicized, controversial and classified.

Nevertheless, in the 1980s, research had begun to establish both internal and also external sources of electromagnetic radiation (EMR) can communicate with the brain and alter behavior.[116]

EMR bioeffects seems to be important for both future neuroweapons and for solving the brain's so-called neural code.[117]

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111 Allan Frey, ed., *On the nature of electromagnetic field interactions with biological systems* (1994), 4.

112 Beverly Rubik, et. al, Bioelectromagnetics applications in Medicine: Report to the NIH, (1992).

113 Doswald-Beck, n. 10 above.

114 Michael Cirfra, et al., Electromagnetic cellular interactions, *Progress in Biophysics and Molecular Biology* (2010).

115 Simon North, War in the desert, Electronic weapons, *London Guardian*, February 2, 1991.

116 Samuel Koslov, Bridging the gap, in Ross Adey, Albert Lawrence eds., International conference on nonlinear electrodynamics in biological systems (1984), 586. See also R.H.W. Funk et al., n. 82.

117 Horgan, 42. n.163 above.

Lewis Slesin, editor of the trade publication *Microwave News* explained that the science for EMR and its effect on human behavior has been established and the CIA's mind control programs have explored whether EMR can target people at a distance.[118] The results of the CIA research are not known; the research remains classified.[119] As will be shown, the science of EMR seems to be extremely important to US national security because it provides the most viable method known for remote access to the brain.

Therefore, a few examples of the science of EMR bioeffects research on the brain as it relates to neuroweapons is presented next. The research has held great weapons potential for decades and what little information that is available in unclassified research remains extremely rudimentary and speculative.

Robert Becker, one of the founders of the science of bioelectromagnetics in the 1960s[120] and twice nominated for a Nobel Prize for his bioelectromagnetics research,[121] described a major scientific principle of bioelectromagnetics:

The microwaves alone (unmodulated) have no effect. The two types of modulation that are biologically important are pulsed and amplitude. Modulation is the secret of transmitting information by means of electromagnetic fields. It appears that [*like AM radio*] the body also demodulates the signal when exposed to modulated radio-frequency or microwave fields; the biological effect is that of the low-frequency modulation. In this view, *all biological effects are produced by ELF frequencies*. This makes sense, because the body systems that pick up electromagnetic field are "tuned" to natural frequencies between 0 and 30 Hz.[122]

In the 1980s, Becker described a military report that stated microwave pulses appeared to produce stimulation in the central nervous system.[123] Becker stated the stimulation was comparable to Jose Delgado's research, cited above, that found brain implants could be remotely controlled to electrically stimulate an animal's brain to control various complex behaviours, instincts and emotions.[124] In other words, the same precise behavioral effects produced by stimulation of brain cells by implants could be produced by EMR alone directed at the brain—without implants. However promising the research is, there has been no follow up in unclassified research.

The following classified CIA research plan was released under the Freedom of Information Act. This research has yet to be experimentally proven, however, if proven, precise mind control would be possible:

The experimenter, J.F. Schapitz, stated: "In this investigation it will be shown that the spoken word of the hypnotist may also be conveyed by modulated electromagnetic energy directly into the subconscious parts of the human brain - i.e., without employing any technical devices for receiving or transcoding the messages and without the person exposed to such influence having a chance to control the information input consciously.

118 Louis Slesin, editorial, *Nation*, 14 March 1987.

119 Ibid. See also Mazzetti, n. 3 above.

120 Paul Rosch and Marko Markov, ed., *Bioelectromagnetic medicine* (2004), vii.

121 North, n. 115 above.

122 Becker, *Cross currents*, 212, at n. 110 above.

123 Ibid. at 304, n. 110 above. The report is: Paul Tyler, Lt. Col. David Dean, ed., 'The Electromagnetic Spectrum in Low-Intensity Conflict' (Maxwell air Force Base, Ala.: Air University Press, 1986). Available at http://www.icomw.org/archives/index.asp.

124 Becker, *Cross currents*, 304, n. 110 above. See also Becker, *Body electric*, 319, 320, n. 26 above.

As a preliminary test of the general concept, Schapitz proposed recording the brain waves induced by specific drugs, then modulating them onto a microwave beam and feeding them back into an undrugged person's brain to see if the same state of consciousness could be produced by the beam alone. . . .

The second experiment was to be the implanting of hypnotic suggestions for simple acts, like leaving the lab to buy some particular item, which were to be triggered by a suggested time, spoken word, or sight. Subjects were to be interviewed later. "It may be expected," Schapitz wrote, "that they rationalize their behavior and consider it to be undertaken out of their own free will."[125]

Significantly, as cited above, the ICRC and the report for the NIH also described EMR bioeffects that act like drugs. Additionally, in a 2002 US Department of Commerce, *Converging Technologies For Improving Human Performance*, Robert Asher of Sandia Laboratories proposed research on the effects of EMR on the brain: "This investigation may spawn a new industry in which the human is enhanced by externally applied electromagnetic pulses so shaped as to enhance specific biochemical changes within the body without drugs."[126]

Michio Kaku, a physicist, explained how EMR could be utilized to develop the capabilities that are fundamental to neuroweapons: "In principle the brain is a transmitter over which our thoughts are broadcast in the form of tiny electrical signals and electromagnetic waves. ... Radio waves can be beamed directly into the human brain to excite areas of the brain known to control certain functions."[127] Kaku explained that in the 1950s, Wilder Penfield, a neurosurgeon found that if he used electrodes to stimulate the brain, his patients would report effects as hearing voices or seeing things that originated in their mind.[128] Today, Penfield's research remains rudimentary in its development, nevertheless Kaku made the following conclusion: "In the future it may be possible to beam electromagnetic signals at precise parts of the brain that are known to control specific functions."[129]

In 2010, the prominent physicist Freeman Dyson speculated: "The essential facts that will make detailed observation or control of a brain possible" are microwave signals and two tools; first microscopic radio transmitters and receivers; and second, a tool to convert neural signals into radio signals and vice versa.[130]

Numerous further speculative examples of the rudimentary level of the unclassified science are available.

4.3 Chronology of EMR bioeffects policy

Many argue that the study of EMR bioeffects, called bioelectromagnetism, has been discredited during the first half of the twentieth century and has no scientific validity.[131] Physicians discovered that ionising EMR frequencies such as in x-rays could produce cancer and that non-ionising EMR frequencies below light did not seem to cause cancer. Therefore the general

125 Becker, *Body electric*, 321, n. 26 above.

126 US Department of Commerce, *Converging Technologies Report* (2002), · 355, 356. Available at http://www.wtec.org/ConvergingTechnologies/.

127 Kaku, n. 24, above.

128 Ibid.

129 Ibid.

130 Freeman Dyson, Radiotelepathy: Direct communication from brain to brain, in John Brockman, ed., *This will change everything: Ideas that will shape the future* (2010), 146.

131 Becker, Body electric, 70, 82, n. 26 above.

conclusion was that non-ionising EMR had no biological effects: "Classical concepts of physics simply did not allow for any meaningful interaction between any form of non-ionising electromagnetic radiation and living organisms."[132]

In addition, since World War II, the Department of Defense (DoD) has heavily relied on radar and other EMR technologies. Some argue that to prevent lawsuits over possible health effects from exposure to EMR, the DOD maintain a policy that there are "no proven biological effects" from EMR; only heating effects.[133] The electrical power line companies have also maintained that there are no proven EMR bioeffects.[134] In both cases, an EMR bioeffects policy avoids large legal pay outs for possible health effects from exposure to unhealthy levels of radar or from living near power lines.[135]

For decades, the American Physical Society (APS) has maintained the policy that EMR does not interact with human biology including the brain and there are only heating effects.[136] The APS has stated that the scientific basis for the policy is that there is no proven physical mechanism to explain bioeffects of EMR so there can't be any EMR bioeffects except heating.[137] This reasoning has been criticized on the grounds that mechanisms to explain EMR bioeffects may exist even though physicists haven't discovered them yet.[138] Many experimental effects are shown in science without a theoretical background. For example, gravity remains an unexplained phenomenon although it obviously exists. Another example, scientists don't have a theory for how the brain works but all know that the brain does work.

More recently, some have argued that exposure to microwave radiation from cell phones and cell phone towers may be harmful to a person's health. In 2012, a report reviewed 1800 new studies on EMR. The report referred to radio frequency radiation and wireless technologies and concluded: "Overall, there is reinforced scientific evidence of risk where there is chronic exposure to low-intensity electromagnetic fields and to wireless technologies (radiofrequency radiation including microwave radiation)."[139] Cell phone companies also seem to have an interest in maintaining the EMR bioeffect

132 U.S. Environmental Protection Agency website. 'Radiation that has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to remove electrons, is referred to as "non-ionizing radiation". Examples of this kind of radiation are sound waves, visible light, and microwaves.' Available at: http://www.epa.gov/radiation/understand/ionize_nonionize.html. Robert Becker, Electromagnetism and life, in Andrew Marino, ed, *Modern Bioelectricity* (1988), 1. See also the website http://andrewamarino.com/.

133 Christopher Ketcham, Warning: Your cell phone may be hazardous to your health, *Gentleman's Quarterly*, February 2010. Available at http://www.gq.com/cars-gear/gear-and-gadgets/201002/warning-cell-phone-radiation?currentPage=2.

134 Ibid.

135 Ibid. See also Marino, *Going Somewhere*, 73, n. 52 above.

136 David Hafemeister, Resource Letter BELFEF-1: Biological effects of low-frequency electromagnetic fields, *American Journal of Physics* 64.8, 1996, 974. Available at: http://works.bepress.com/dhafemei/13. For a critique, see Lewis Slesin, The science and politics of the EMF puzzle: The missing pieces in the Frontline story, *Microwave News*. Available at http://microwavenews.com/front.html.

137 Ibid.

138 James Livingston, *Driving force, The natural magic of magnets* (1997), 249.

139 29 authors from ten countries, BioInitiative Report 2012: A rationale for biologically-based exposure standards for low-intensity electromagnetic radiation (ELF and RF). Available at http://www.bioinitiative.org/

policy to avoid lawsuits from possible EMR health effects.[140]

These prevailing scientific viewpoints have been firmly in place for decades, some since World War II, and likely contributed to the current consensus that there is no proven scientific basis establishing EMR neuroweapons could be a serious threat comparable to the atomic bomb. Despite the decades of funding for secret EMR neuroweapons research beginning with the 1950s CIA mind control experiments, the weapons are not considered a significant threat to national security today. This is highlighted by recent civilian reports and articles on neuroscience applications to national security only examining rudimentary directed energy weapons under development.[141] However, the next sections will highlight the reasons why the development of the science of EMR bioeffects has remained rudimentary.

4.4 The 1950s EMR bioeffects national security threat

In the 1950s, the US and former Soviet Union (USSR, called Russia for this paper) seemed to have discovered the weapons potential of EMR. In 1953, Russia began bombarding the US Embassy in Moscow with low level EMR and "five presidents kept it secret."[142] The CIA analyzed the bombardment of the US Embassy with microwaves and discovered it matched those microwave characteristics mentioned in published Soviet experiments involving behavioral effects in rats.[143] Milton Zaret was contacted by Samuel Koslov (the advisor to the President on this issue); Zaret had previously conducted research for the CIA which suggested it might be possible for microwaves to be used to create mind control weapons. Zaret's experiments for the CIA replicated Soviet rat experiments on the behavioural effects of microwaves which were "translated into the different scientific nomenclature used in the United States, like a microwave Rosetta Stone."[144]

This is one of several indications that despite the prevailing scientific viewpoints on the lack of EMR bioeffects, some EMR bioeffects research was scientifically sound and it was also a significant national security concern.

In 1965, Koslov, who also worked for the Advanced Research Projects Agency (ARPA, now known as DARPA), ran the Pentagon's Project Pandora; which secretly studied the behavioral and biological effects of low-level modulated microwaves.[145] Ross Adey (a pioneer of bioelectromagnetic medicine), Zaret, and other bioelectromagnetics experts were consulted by US government agencies or conducted secret work on Project Pandora.[146] These experts found that EMR affected the nervous system; however Koslov later

140 Ibid.

141 Kate Kelland, Neuroscience: The new face of warfare, *Reuters*, February 7, 2012. Available at http://www.abc.net.au/science/articles/2012/02/07/3425093.htm. See also Jason Koebler, Scientists warn of ethical battle concerning military mind control, U.S. News, March 20, 2012. Available at http://www.usnews.com/news/articles/2012/03/20/scientists-warn-of-ethical-battle-concerning-military-mind-control?google_editors_picks=true.

142 David Jones, Opening Pandora's box, *Fulcrum Central Productions, BBC documentary, Channel 4, England*, 1984.

143 Marino, 1, n. 132 above. See also Andrew Marino website http://andrewamarino.com/.

144 Jones, n. 142 above. See also Steneck, 94, n. 18 above.

145 Marino, *Going somewhere*, 163, n. 52 above. See also Steneck, 94, n. 18 above.

146 Ibid. Marino, n. 52 above.

destroyed the Project Pandora documents[147], reporting he did not have enough room to store them.[148] Koslov concluded, without explanation, that "the Moscow microwave beam was not an effective mind-control weapon";[149] however, a recent Washington Post article stated that Project Pandora conclusions were uncertain: 'The results were mixed, and the program was plagued by disagreements and scientific squabbles.'[150]

At the same time, CIA EMR mind control research was considered of primary importance to national security.[151] For example, at a 1977 US congressional hearing on CIA mind control programs, CIA medical doctor Sidney Gottlieb's testimony discussed CIA mind control programs, the possibility of mind control using radiowaves and the Embassy bombardment: "It was felt to be mandatory and of the utmost urgency for our intelligence organization to establish what was possible in this field on a high priority basis.'[152]

4.5 1960s and 1970s; bioelectromagnetics research flourishes

As cited above, study of the neuron doctrine and the action potential seemed to restrict nearly all other possible methods of electrical brain communication in unclassified neuroscience research. At the same time, the EMR bioeffects research on the brain seemed to thrive in classified research and in Russia. For example, a 1961 Russian paper by Z. V. Gordon theorized that EMR led to changes in rat brain cells.[153] At that time, the US military controlled most of the EMR research funding and made the major policy decisions about EMR health exposure levels and other related matters.[154] The US military was concerned about the Russian EMR bioeffects brain research and as a result, US neuroscience studies involving EMR bioeffects were no longer funded in unclassified research and public discussions of EMR bioeffect research were discouraged.[155]

As mentioned above, secret military research was increased to determine if the Russians were developing EMR based mind control for espionage or weapons purposes.[156] In the 1960s and 1970s, the electromagnetic aspect of neuroscience research was well funded and classified by the US government.[157] It seems clear that the US government was aware of the EMR research that suggested the weapons potential of EMR bioeffects.

Furthermore, a small number of scientists were instrumental in establishing the scientific basis for bioelectromagnetic medicine.[158] The bioelectromagnetics researchers found "truly remarkable interactions between electromagnetic fields and the brain" but the "relevant experiments were hidden from

147 Ibid. at 164, n. 52 above. See also Reppert, n. 70 above, citing an April 1979 report by Senate Committee on Commerce, Science and Transportation criticizing the State Department's handling of the microwaves affair.

148 Ibid. Marino, n. 52 above.

149 Ibid, Marino, 164, n.52 above. See also Jones, n. 142 above. See also Reppert, n. 70 above.

150 Weinberger, n. 6 above.

151 Human drug testing by the CIA, Subcommittee on Health and Scientific Research of the Committee on Human Resources United States Senate, (Washington: U.S. GPO, 1977) September 20, 21 1977, 202. CIA medical doctor Sidney Gottlieb testimony.

152 Ibid.

153 Steneck, 84, 250, at n. 18 above.

154 Ibid.

155 Ibid.

156 Ibid.

157 Kathleen McAuliffe, Mind fields, *Omni*, February 1985.

158 Rosch et al., vii, n. 119 above.

view by the Cold War."[159] As a result of both secrecy and prevailing scientific thought, however, bioelectromagnetic research has remained underfunded and disregarded by the mainstream scientific community.[160] EMR bioeffects research has even been called junk science, however as Henry Lai, co-editor of *Electromagnetic Biology and Medicine* explained, the lack of funding means that researchers can't stay in the field for long[161] and consequently the research suffers. In the 1960s, Frey, cited above, tested microwave radiation on animals and found evidence that electricity seems to affect brain activity.[162] Frey stated that the Pentagon hired scientists who published research disputing Frey's findings while at the same time refusing to reveal their methodology and data.[163] Moreover, in the 1970s, his government contractors told him to cover up his research or they would terminate his contract.[164] Numerous bioelectromagnetics scientists reported similar treatment by the US government.[165] At that time, most researchers, including neuroscientists, still held the prevailing scientific viewpoints on the lack of proven biological effects of EMR.[166] Thus, the weapons potential of the bioelectromagnetics research remained out of the public view.

159 Vladimir Binhi, *Electromagnetic mind control: Fact or fiction? A scientific view* (2010), 1. See also Pasternak, n. 8 above.

160 Steneck, 84, 250, at n. 18 above.

161 Louis Slesin, Are magnetic fields in incubators confounding cell culture studies? Microwave News, March 12, 2013. Available at http://microwavenews.com/news-center/incubator-magnetic-fields-confounding.

162 Ketcham, n. 133 above.

163 Ibid.

164 Ibid.

165 Ibid. See also Pasternak, 40, n. 8 above. See also Becker, *Cross currents*, 344-347, n. 110 above. See also Steneck, 118, n. 18 above.

166 Steneck, 121, n. 115 above

4.6 The 1980s; a turning point for bioelectromagnetics researchers

In the 1980s, bioelectromagnetics researchers felt that their research could lead to EMR weapons comparable to the atomic bomb; a further indication that the study of the electromagnetic aspect of the electrochemical brain seemed to be critical to national security.[167] These researchers discovered that when information was embedded onto a carrier EMR wave it "induced the widest variety of biological effects;" although how this happened was not known.[168] Their experiments suggested "externally applied electromagnetic fields had a scientifically measurable effect on electromagnetic processes of transformation, transfer, coding, and storage of information in living systems; including in the brain."[169]

In the 1980s, Cesaro, cited above, helped to make sense of this disregarded science. He stated that a microwave weapon based on successful human experiments would be "more powerful than the atomic bomb."[170] Several researchers felt that a letter should be written to the President about the emerging weapons potential of bioelectromagnetics research, similar to the 1939 letter written to President Roosevelt about the weapons potential of nuclear physics.[171] As noted above, Becker cited a military report describing microwave pulses with the capability of precise mind control without

167 Koslov, 582, n. 115 above. See also Alexsander Presman, *Electromagnetic fields and life*, (1970).

168 Ketcham, n. 133 above.

169 Koslov, 586, n. 115 above. See also Presman, n. 167 above.

170 Reppert, n. 70 above.

171 Koslov, 586, n. 115 above.

the need for implants[172] and in the mid-1980s, Becker recounted several researchers surmised such a weapon was a possibility.[173] Most would agree that if developed, such a weapon could be comparable to an atomic bomb.

Becker had witnessed decades of bioelectromagnetics research, the growing US and Russian interest in EMR weapons and excessive government secrecy including government deception and disinformation techniques. In conversation with another pioneer of bioelectromagnetics research (Professor A. R. Liboff), Becker always maintained the belief that both the US and Russian governments were very much involved in EMR mind control research.[174] Both Becker and Adey felt that electromagnetic mind control was inevitable.[175] On a 1984 BBC documentary on Project Pandora, Becker surmised that there could be a super-secret Manhattan Project to develop EMR weapons and that the best cover story, the official explanation for secret government research, would be that EMR weapons were not scientifically possible.[176] It seems that Becker's speculation was correct: the EMR bioeffects policy is a US government official science policy that denies EMR bioeffects and as shown below, the most prominent of experts have cited the EMR bioeffects policy to claim that EMR neuroweapons are not possible.

4.7 1990s and beyond; EMR neuroweapons and excessive secrecy

For decades, the military has officially endorsed the EMR bioeffects policy. The US seems to have gone to great lengths to keep EMR bioeffects science and its weapons potential out of the public eye. However, with the breakup of the Soviet Union, some in the US military threw out this fifty year old official policy. In 1997, the US military began providing new funding for the development of nonlethal weapons based on the biological effects of EMR.[177] Nevertheless, well established academic scientific organizations and officials, including the US Air Force, cited below, continued to endorse the EMR bioeffects policy.

Richard Garwin is a physicist and one of the founders of the US National Reconnaissance Office (NRO), the agency that conducts secret satellite surveillance for national security purposes. In his 1999 Council on Foreign Relations, (CFR) report, *Non-Lethal Technologies: Progress and Prospects*, Garwin reported there were already established major classified programs that included psychological warfare, information warfare, and nonlethal weapons.[178] In a 2004 Council on Foreign Relations report, Garwin recommended that skilled engineers and scientists work on directed energy, electromagnetic coupling, modeling, and physiology. He described the ongoing inter-service conflicts, the problem of redundancy,

172 Becker, *Cross currents*, 304, n. 110 above. The report is: Paul Tyler, Lt. Col. David Dean, ed., The electromagnetic spectrum in low-intensity conflict (Maxwell air Force Base, Ala.: Air University Press, 1986). Available at http://www.icomw.org/archives/index.asp.

173 Ibid. Becker, *Body electric*, 319, n. 26 above.

174 Binhi, xi, n. 159 above.

175 Ibid.

176 Jones, n. 142 above.

177 Pasternak, n. 8 above.

178 Richard Garwin, Independent Task Force, Non-Lethal technologies: Progress and prospects, *Council on Foreign Relations, (CFR), 1999.* Available at http://www.cfr.org/defense-and-security/nonlethal-technologies/p3326.

a burdensome secrecy system and the lack of accountability for weapons.[179]

In a 2005 "for the record" email to this author, Garwin stated that has evaluated electromagnetic weapons for the US Defense Department several times, but "there are always 'compartments' to which even people with high-level security clearances do not have access."[180] Garwin cited the official EMR bioffects policy to unequivocally dismiss the possibility of EMR weapons that could target and control the brain.[181] The EMR bioeffects policy seems to reach to the highest levels of US government.

Perhaps the clearest example that EMR bioeffects are disregarded in mainstream neuroscience is the following. In 2001, a group of experts including Professor Kenneth Foster, wrote an article in the IEEE Spectrum, an academic electronic engineering journal: "Such technology [new rat implant technology capable of transmitting signals to a rat's brain from a distance] had nothing to do with the fantasies of mind control by electromagnetic fields, long a staple of science fiction and lately of conspiracy theory Web sites."[182] Today, most neuroscientists are convinced that EMR bioeffects on the brain are fringe science.

In 2004, *The Lancet* obituary for Adey described his research showing that brain tissue is sensitive to EMR. The obituary noted that some rejected Adey's controversial research by citing the EMR bioeffects policy, such as Foster, one of the authors of the *IEEE Spectrum* article above. However, others have confirmed Adey's research and the writer of the obituary opined that Adey's controversial research will someday prove to be true.[183] Foster may argue that the US government's EMR bioeffects policy has nothing to do with neuroscience, however, in light of the evidence presented in this paper, it can be argued that this would appear to be an example of the EMR bioeffects policy utilized as a US government cover story spread by experts. Foster's conclusions omit two main facts; first, the decades of highly politicized EMR bioeffects research; and secondly, the decades of US government monopoly over unclassified and classified EMR bioeffects research; this combination resulted in the nearly complete restriction of EMR bioeffects research. As explained above, EMR bioeffects seem to have a role in brain functions, however the unclassified research remains rudimentary in its development.

In 2007, the official USAF science policy stated that its EMR bioeffects policy is that there are no non-thermal effects of microwaves.[184] At the same time, Dennis Bushnell, chief scientist at NASA's Langley Research Center, has described microwave attacks against the human brain as part of future warfare in a 2001 presentation to the National Defense Industrial Association about "Future Strategic Issues."[185] Recently the prestigious science journal Nature admonished the USAF in an opinion editorial for classifying EMR bioeffects research and

179 Richard Garwin, Independent Task Force, Nonlethal weapons and capabilities, CFR, 2004. Available at http://www.cfr.org/defense-technology/nonlethal-weapons-capabilities/p6793.

180 Richard Garwin, email communication to Cheryl Welsh, 2005. On file with author.

181 Ibid.

182 Kenneth Foster, et al., Bioethics and the brain, *IEEE Spectrum*, June 2003, 34. Available at http://www.eng.ucy.ac.cy/cpitris/courses/ece001/notes/IEEEarticles/Bioethics%20and%20the%20Brain%20-%20June%202003.pdf.

183 Ivan Oransky, Obituary: William Ross Adey, *Lancet*, Volume 364, July 17, 2004. Available at http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2804%2916699-3/fulltext.

184 Weinberger, n. 6 above.

185 Ibid.

stated that only weapons, not science should be classified.[186]

4.8 Brief analysis and conclusions

It can be argued that the EMR bioeffects cover story is obsolete even as the US government continues to endorse official EMR bioeffects policy. Since World War II, scientists have had few options for conducting research on EMR bioeffects on the brain; the scientists who do conduct EMR bioeffects research face government discrediting tactics, loss of funding, ostracizing by the scientific community, and more. As a result of the US government's dominance over EMR bioeffects research, the infrastructure that is necessary for an area of science to flourish are completely absent in the field of EMR bioeffects research including: consistent funding, the development of advanced technologies, adequate numbers of academic experts, and consistent standards for EMR bioeffects academic literature. Most scientists have no way of challenging the US government policy of EMR bioffects. Nevertheless, EMR bioeffects research has a firm scientific foundation in the study of bioelectromagnetics. Rather than a fringe area of science, EMR bioeffects research remains extremely rudimentary and has been highly classified and politicized.

A reasonable speculation is that the utilitarian CIA mind control researchers would have recognized the potential of EMR as a likely method for remote surveillance of the brain and also EMR bioeffects research for influencing and controlling human behavior for use in neuroweapons development. It could be argued that the official EMR bioeffects policy was utilized to publically encourage the belief that EMR only had a thermal effect. At the same time, the US government continued secret research looking at other impacts such as the possibility of altering and influencing behavior—even mind control—and also the possibility of EMR for remote surveillance and targeting of the brain.

The US government's reasons for implementing the EMR bioeffects may not be clearly established, however significant evidence suggests that the EMR bioeffects policy was instrumental in blocking nearly all EMR bioeffects neuroscience research for over sixty years. The science of EMR bioeffects on the brain continues to be marginalized, controversial, and mislabeled as fringe, even junk science.

5. An extreme US secrecy method

The consensus is that governments can't keep secrets for decades. However, as one expert, William Arkin explained, secrecy experts are in agreement that in the realm of national security secrets, vital or genuine national security secrets remain secret.[187]

Recently, headline news reported the NSA's Prism program for clandestine mass surveillance data mining that was leaked by Edward Snowden,[188] but few people have heard of the more extreme secrecy method of constant surveillance of government employees in highly sensitive positions and also the constant surveillance of their families. For example, Professor Hugh

186 Editorial, "Secret weapons," *Nature*, Volume 489, September 13, 2012, 177-178.

187 William Arkin, *Code names: Deciphering US. military plans, programs, and operations in the 9/11 world* (2005), 13.

188 Michael Kelly, Part two of Snowden's Guardian interview could rekindle the Prism 'direct access' debate, *Business Insider July 8, 2013.* Available at http://www.businessinsider.com/snowden-says-nsa-has-direct-access-to-tech-companies-2013-7.

Goodall described that his father worked for the CIA conducting domestic surveillance which took place much longer than the 1970s congressional committees uncovered. Goodall's father was scheduled to testify before the hearings but he died, his house was broken into and a moving van hauled away everything including his diary.[189] This happened to others including Bill Harvey who worked for the CIA and was involved in the attempted assassinations of Fidel Castro.[190]

Goodall described growing up in a classified family; his mother told him that they were always being watched everywhere they went and in their home.[191] Their home was fitted with listening devices and even their sex lives were not secret. In the 1960s and 1970s, some classified families lived on military posts and vehicles with listening devices would constantly record their daily conversation.[192] Goodall stated:

We were told we were being watched for our own good as well as for the good of our country. We were told that it was important to be watched because my father worked in a sensitive position, and people in these positions had to be carefully observed, as well as their families and friends and associates, because you just never knew who might be spilling what to whom.[193]

It seems unlikely that a vital national security secret such as the existence of secretly developed neuroweapons would be leaked given such extreme secrecy methods. Contrary to the consensus, it is plausible that neuroweapons which began in the 1950s CIA mind control programs could be kept secret.

6. Conclusions and recommendation

The new evidence in this paper suggests that two Cold War cover stories are now obsolete. It can be argued that the consensus, including nearly all of the prominent experts, overlooked significant information that has resulted in devastating consequences. Significant evidence supports that the unsettled areas of neuroscience—bioelectricity and bioelectromagnetics—are almost surely critical areas of science for neuroweapons development. US secrecy methods surrounding this research have included active deception, spreading disinformation, distorting and suppressing science research, covering up promising research and withholding funding from scientists with an interest in the area of research. By keeping the science from developing in the unclassified realm, the US government can cite mainstream science literature and claim neuroweapons are not possible, thus completely nullifying any opposing opinions. In this way, the US government breached its trust with the public by classifying and monopolizing whole areas of science as well as neuroweapons.

The two cover stories were based on the paradox between classified and unclassified neuroscience research that began in the 1950s. First, the revolutionary 1950s neuroscience research was the basis for a theory of how the brain works. Furthermore, the unparalleled decade of the revolutionary 1950s—and it can be argued, the 1950s CIA mind control programs--determined how modern neuroscience developed into the twenty-first century, a pattern of development with no foreseeable end in sight. Second, by both chance and design, unclassified neuroscience developed in an

189 Hugh Goodall, Jr., *A need to know: The clandestine history of a CIA family* (2008), 133, 229,230.

190 Ibid.

191 Ibid.

192 Ibid.

193 Ibid.

extremely skewed pattern with a focus on biochemistry, molecular biology, cognitive neuroscience and brain imaging and a significant lack of bioelectricity research. Third, although the US government actively discouraged mainstream neuroscience from investigating bioelectricity, research on the electrical properties of the brain is not only scientifically possible in principle but also experimentally possible, although it remains rudimentary. Additionally, the US government implemented its official EMR bioeffects policy, thereby actively restricting the research. Nevertheless, a handful of researchers established the basic bioeffects science in principle and experimentally, although it remains rudimentary. Both the bioelectricity and also EMR bioeffects research suggest that neuroweapons development is scientifically possible.

Last, the study of the electrochemical brain has been divided into two entirely separate research approaches; first, unclassified research with its incomplete biochemical brain approach that can never solve how the brain works; and secondly, the classified research, complete with all four of the requirements for the development of neuroweapons. Thus, it is possible—given the secrecy surrounding vital national security secrets—neuroweapons research has flourished in complete secrecy since the 1950s.

It sounds absolutely impossible. How could so many have been misguided by neuroscience and the biophysics of neuroweapons for so long? As the saying goes, "If the only tool you have is a hammer, you will see every problem as a nail." Likewise, for decades, prominent experts have overlooked obscure but critical information and thus have remained absolutely convinced that the science of neuroweapons is science fiction. This unwavering consensus remains firmly in place, however, today it can be shown that neuroweapons are not science fiction. This is why further research and investigation is called for; the alleged mind control victims deserve a fair and impartial hearing, as it is highly possible that secret US neuroweapons are more likely than not already successfully developed.

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