VIRGINIA:

IN THE CIRCUIT COURT FOR FAIRFAX COUNTY

COMMONWEALTH OF VIRGINIA	)	
v.	)	No. FE-2005-1764
ALFREDO PRIETO	)	

Prepared in STATE OF FLORIDA,
COUNTY OF ALACHUA

AFFIDAVIT OF DONALD D. PRICE, PH.D.

Donald Price, being first duly sworn, deposes and says as follows:

I. BACKGROUND AND EXPERTISE

1. My name is Donald D. Price. This affidavit is made upon my personal knowledge and information. I am over the age of twenty-one (21) years and I am competent to make this affidavit and to testify in court to the truth of these facts.

2. I reside in Alachua County, Florida. I hold a B.A in Zoology from the University of California, Davis, and a Ph.D. in Neurophysiology from the University of California, Davis. A true and accurate copy of my Curriculum Vitae is attached hereto as Attachment 1 and incorporated by reference.

3. My specialty training was in the field of electrophysiology of pain. The field of neurophysiology includes the study of the normal functioning of the peripheral and central nervous system ["CNS"]. Electrophysiology is that branch of neurophysiology dealing with the electrical properties of nerve cells, including the effects of electrical stimuli on nerve cells of the body.

4. My doctoral dissertation work involved the electrical recording of spinal cord nerve cells that were likely to be involved in the processing of pain. That work was completed in 1969. Since then, I have actively been engaged in research as to how nerve cells at different levels of the peripheral and CNS respond to and transmit messages about pain. This includes research on how electrical currents applied to body sites and to sites within the central nervous system result in and/or influence the experience of pain. Three basic categories of information were obtained for these studies: (l) reports of awake persons in response to electrical stimulation of sites within their brain and spinal cord; (2) the use of electrical recordings of nerve cells in animals; and (3) pain reports of persons in response to brief tolerable painful stimulation of body tissues. These studies were approved by Institutional Review Boards at the Medical College of Virginia and at

the National Institutes of Health. The studies were published in peer-reviewed international scientific journals.

5. I have held a Postdoctoral Fellowship in the Departments of Psychiatry and Anatomy at the University of California at Los Angeles. My postdoctoral training included learning the detailed neuroanatomy of the CNS, neuroanatomical techniques for identifying lesions (i.e., damage) to areas of the brain by means of gross examination and microanatomical histological techniques. My training also included further studies of pain processing using electrophysiological techniques.

6. I am a neurophysiologist and psychologist at the University of Florida. Prior to that, I was Professor of Anesthesiology and Director of Research at the Medical College of Virginia. My work history includes assistant and associate professorships at both the Medical College of Virginia and West Georgia College, and senior staff scientist positions at the National Institutes of Health in Bethesda, Maryland.

7. I have published over 115 peer reviewed articles and an additional 65 book chapters, and I have written two books, one titled "Psychological and Neural Mechanisms of Pain" and the other titled "Psychological Mechanisms of Pain and Analgesia." I also have been an associate editor or on the editorial board of three scientific journals. One is simply titled "Pain," and is the foremost international journal in the field of pain research. Another is called "Pain Forum," and was the journal of the American Pain Society from 1992 to 1999. The third is called "The Journal of Pain" and is now the official journal of the American Pain Society.

8. My experience in the scientific analysis of human pain and suffering includes direct observations made on patients whose brain and spinal cord were stimulated with electrical currents, evoking pain in the patients from that stimulation. Some of these observations resulted in research reports that were published in peer-reviewed scientific journals as previously noted above.

9. In addition to these published observations, I have directly witnessed the effects of electrical stimulation of sites deep within the human brain. When stimulated electrically, these sites are now well known to produce extreme experience of dread, horror and frank pain. These observations have a direct bearing on whether judicial electrocution in the electric chair produces uncommon pain and suffering. My direct observations, including those published and unpublished, are the result of my participating in rare opportunities for scientific collaboration between neurosurgeons operating on patients and pain research scientists. The systematic observations made during these collaborations have resulted in landmark studies, which have been highly cited in the scientific literature. Most critically, they have led to the general conclusions made by experts in pain research that pain, and other aversive experiences, can be consistently elicited by electrical currents applied at specific sites within the spinal cord and brain of humans who are awake.

10. My background is relevant to the question of whether judicial electrocution results in pain. The effect of electrical current supplied to the human body, the extent to which those currents penetrate the human brain and affect body tissues throughout the body is relevant to the kinds of studies that I have conducted. The different kinds of observations that are made of prisoners who

are executed in the electric chair, including observations of prisoners' behavior during judicial electrocution, are related to the kinds of observations that I have made routinely in studying people in pain, in hospitals and in experimental contexts. It is also relevant that my studies include the effects of electricity applied externally, as it is during judicial execution, on the brain, and what areas of the brain are affected by electricity.

11. I have testified as an expert neurophysiologist on the effects of judicial electrocution for the states of Georgia (once in 1998 and twice in 2001), Florida (1997 and 1999), and Nebraska (2000). My testimony in Georgia is discussed extensively in the recent Georgia Supreme Court ruling that judicial electrocution is cruel and unusual. My testimony was instrumental in helping the judges to arrive at this judgment. In addition, my testimony in Nebraska helped the Supreme Court of that state to conclude that electrocution is cruel and unusual. I have prepared previous affidavits in preparation for testifying in the states of Indiana, Alabama, Virginia, Tennessee, Nebraska, Georgia, and Florida. In developing my opinion that judicial electrocutions result in pain, I have relied on my research experience and training, as well as several personal observations. I have also considered approximately 120 autopsy reports of prisoners executed in the electric chair. I have also read numerous reports about anatomical examinations of the brains of judicially electrocuted persons, including microscopic examination, and have made my own microscopic examination in one case. I have consulted with experts in engineering, neurology, neurophysiology, and psychology on this question. I have reviewed materials reporting the experiences of persons who have undergone electrical trauma, either from manmade devices or from lightning strikes. I have also reviewed eyewitness accounts of judicial electrocutions in Florida, Georgia, Tennessee, and Indiana. These types of materials are of the kind that is regularly used by experts in my field in forming opinions.

12. I have conducted and co-authored numerous research studies both on human pain and on treatments for pain. These include studies that address questions as to how pain is generated within the human central nervous system by electrical stimulation of the brain and spinal cord (e.g., Mayer, D. J., Price, D. D., and Becker D. P., Pain, 1:51-58; Price, D. D., and Mayer, D. J., Pain, 1: 59-72, 1972; Mayer, D. J., Price, D. D., Becker, D. P., and Young, H. F., J. Neurosurgery, 43: 445-447, 1975). These studies are directly relevant to the issue of brain stimulation during electrocution because they directly demonstrate that excitation and not inhibition or suppression of nerve cell activity results from electrical stimulation of central neural tissue and that pain consistently can be evoked by stimulation of such tissue at or close to the frequency of stimulation used during electrocution (i.e., 60 cycles/sec). Other published studies address the neural mechanisms by which stimulation of body tissues lead to the experience of pain. These include studies as to how heat stimulation of the skin by stimuli of varying intensities and stimulus area influence the experience of pain (e.g., **Price, D. D.,** McHaffie, J. G., and Larson, M A., J. Neurophysiology, 62: 1270-1279, 1989); Coghill, R. *C.*, Mayer, D. J., and **Price D. D.,** J. Neurophysiology. 69; 703-716. 1993). These are also relevant to the issue of pain during electrocution for the purpose of execution because they demonstrate how both the area and the intensity of heat stimulation of the skin interact to determine one’s level of pain and distress. Clearly, considerable heat stimulation of skin and other body tissues take place during electrocution.

13. In developing my opinions relating to the extent of suffering endured by a person subjected to intentional electrocution, I have relied upon the following: 1) numerous published studies of

sensory and emotional experiences evoked by electrical stimulation of sites within the human brain and spinal cord, including my own work, as well as other direct observations I have made of these effects in human patients in clinical contexts; 2) neurophysiological and neuroanatomical studies of how pain is produced by mechanisms within the central nervous system, including my own work; 3) my careful review of autopsy information on executees presented to me in the context of another case. This information includes physical findings, available histological analysis, and photographs of executees; 4) data provided to me in another case concerning the electrical parameters and electrode configurations used to electrocute people during executions, including specific electrical parameters (current levels, voltages, and durations of application); 5) an extensive conversation with an electrical engineer, Dr. John G. Webster, who has already testified in cases of this kind, concerning the size, characteristics, and placement of the electrodes as well as his assessment of the relative distribution of current likely to occur throughout the human body during an execution; 6) an extensive conversation with Dr. Peter R. Breggin, a nationally recognized authority on effects of electroconvulsive shock on the brain, who has informed me that the parameters of electrical shock during executions differ significantly from those used in electroconvulsive shock such that it is far more likely that electroshock results in unconsciousness than does judicial electrocution, 7) an extensive conversation with Dr. Kenneth L. Casey, an internationally recognized neurologist, neurophysiologist, and expert on human pain, who informed me of commonly observed neurological observations of patients who sustained intense electrical shocks from lightning and from industrial accidents; 8) my reading of the affidavits of Orrin Devinsky, M.D. and Harold Hillman, M.D. after reaching the main conclusions described below. I find these affidavits to be in total agreement with my own conclusions; 9) my reading of a variety of scientific and non-scientific materials including:

(a) Freidrich Panse, “Electrical Trauma”, In: Handbook ofClinical Neurology (Part I), Edited by P. I. Vinken and G. W. Bruyn, Vol. 23, Elsevier, New York, 1975 683-730;
(b) Critchley M., “Neurological Effects of Lightning and Electricity”, Lancet, 1934; 226: 68-72;
(c) Critchley M., “Electrical Injuries”, Lancet, 1935; 229: 1002-1004;
(d) L. A. Haven “Comparative Study of Modified and Unmodified Electrical Shock Treatment,” Dis. Nerv. Syst., 1959: 19:28-34;
(e) Witness descriptions and newspaper accounts at the executions o fmany death row inmates.

14. Based on all of the information that I have reviewed, my consultations with other experts, and my training and experience, my scientific opinion is that judicial electrocution results in considerable, enormous conscious pain and suffering as well as negative emotional experiences, such as fear and dread.

15. This opinion was arrived at using scientific method. The scientific approach to this issue is to bring to bear as much as possible all of the observations about the circumstances and the mechanisms that pain might be produced or not produced and, through systematic observation, deduce whether such pain does or does not occur. Neurophysiological evidence, anatomical evidence, and behavioral psychological evidence support my opinion that conscious pain and suffering occurs in a judicial electrocution.

II. REVIEW OF EVIDENCE

16. As noted by the Supreme Court of Nebraska, the theory that judicial electrocution causes instantaneous and irreversible brain death is a myth. *State v. Mata*, 745 N.W.2d 229, 277, 275 Neb. 1, 65 (Neb. 2008).

17. The following discussion of evidence focuses on two general mechanisms by which pain and suffering can be elicited during a judicial electrocution. The first is through penetration of the human brain with electrical currents, currents that would repetitively activate pain-related and fear-related areas of the brain. The second is through effects of electrical currents on body tissues that result in damage and/or pain, including bums to the skin, muscle contractions, and stimulation of other body tissues such as the heart. Therefore, the evidence having bearing on these two mechanisms will be discussed in turn.

A. Mechanism #1: pain from electrical stimulation of brain

18. Pain may be caused through penetration of the human brain with electrical currents that occur during judicial executions. When an electrode is placed on the top of the head and another electrode is placed near the knee and alternating 60 cycle current is passed at a high amperage, part of that current, but only a very small part of that current, is likely to get into the brain. The penetration of the brain with the current from that electrode could activate many brain areas, some of which are clearly involved in pain and other negative emotions. Thus, pain and suffering can be directly evoked by means of electric currents that activate nerve cells of different brain areas. A person would experience the sensation of pain that they would normally sense from a peripheral nerve, without there being any nerve impulses transmitted from a peripheral nerve. I have made direct observations supporting the idea that application of the electric current excites regions of the brain. I have observed neurosurgeons electrically stimulating deep areas of the human brain with an electrode. In some instances, such stimulation produced fear and other types of aversive experience. Published articles in my field also support my opinion that application of electric current excites regions of the brain, sometimes producing pain or negative emotions.

19. I understand that it was once theorized that electrocution would produce instantaneous and therefore painless death. There is substantial neurophysiological, behavioral, and anatomical evidence that this is not the case.

20. During electrocution, the brain is not instantly incapacitated or irreversibly depolarized. Part of the evidence is based on solid neurophysiological principles. When electrical currents are applied to the membrane of nerve (brain) cell, it becomes partially depolarized. Depolarization does not mean that the cell ceases to work. Alternating currents or repetitive pulses such as those used during judicial electrocutions do not inevitably inactivate or incapacitate nerve cells. The voltage varies from state to state, but it tends to be around 2,000 volts and between 6 to 9 ½ amperes. In my opinion, it is highly unlikely that the initial current surge in a judicial electrocution would instantly incapacitate the human brain.

21. The presence of a pulse after electrocution indirectly supports the opinion that the brain has not been incapacitated. There is frequently a pulse or heartbeat after an electrocution. Evidence

of a pulse indicates that the heart is pumping blood. Similar to the brain, it is necessary for impulses to travel throughout the heart for the heart to function (i.e., beat and pump blood). There is no reason to believe that the brain receives more electrical current than the heart, in fact, the brain is protected against the current to a major extent by the skull. If the current applied during judicial electrocution does not stop the impulses of the heart, there would be no reason to think that the same current would stop the impulses of the brain. Often when a pulse is detected after the first series of shocks, breathing is also present, providing yet further evidence that the brain has not been incapacitated. Breathing requires impulses from the brain. There is no direct way of ascertaining at what time after the beginning of judicial electrocution that the brain is eventually incapacitated.

22. Because of the tissues surrounding the brain, the current density near the top of the brain will be much greater than the current density deep in the brain during judicial electrocution. Autopsy reports and examinations of histological sections of the brains of judicially executed persons very often indicate no gross or overt damage to the brain, supporting the conclusion that there is not instant depolarization of the brain during judicial executions. Were there instant incapacitation of the brain, there would be anatomical damage on the gross or microscopic level. Such damage has not been uniformly present in the examinations of the brains of judicially executed persons. There is considerable variability in the amount of damage and other abnormalities of judicially electrocuted prisoners and most of them show very little damage or other abnormalities. Thus, of 22 autopsies of executed prisoners in the state of Alabama, only three showed extensive gross abnormalites, described as “a parboiled soft brain” or as “moderately widened gyri and corresponding narrowed sulci.” The remaining brains had only small focal damage or no evidence of damage whatsoever. This pattern of results provides two conclusions. First, there are large differences in the amount of damage to prisoners’ brains as a result of judicial electrocution, likely due to large differences in the amount of current penetrating their brains. Second, most of the brains show very little damage or no damage at all, contrary to assertions that prisoners’ brains are cooked or that they are completely and instantly incapacitated.

23. The amount of electricity that gets across the skull during a judicial execution is insufficient to cause instant and complete depolarization and/or incapacitation because only a small part of the voltage on one side of the skull actually reaches the brain. If ten volts are applied to the top of the head, only half a volt will reach through the skull. This estimate of this magnitude of voltage difference is based on comparisons of simultaneous electroencephalographic (EEG) recordings of brain voltage activity on the surface of the brain and on the surface of the scalp. The [incorrect] theory that electrocution causes instant incapacitation and death ignores the effect of the skull on the amount of electricity reaching the brain, and therefore wrongly concludes that a large amount of electricity reaches the brain during judicial electrocutions.

24. A behavioral line of evidence that intense pain and/or horror and dread accompany intentional electrocution for execution is based on reports of people who survive lightning strikes or electric shocks from man-made devices (Critchley M., Lancet 1934, 226: 68-72; Critchley M., Lancet 1935, 229: 1002-1004, Panse, 1975). The current path in lightning strikes is often similar to that occurring during intentional electrocution in that the path is from the head to the rest of the body, although it often occurs with much higher voltages. People who survive such lightning strikes do not necessarily lose consciousness and some report experiencing intense pain as well

as intense visual hallucinations during the strike. I have reviewed a case history wherein a boy accidentally exposed to 60-cycle alternating current passing from his head area through his legs and feet. The voltage was in excess of 3000 volts. Thus, the current path and electrical stimulus intensity were generally similar to that of judicial electrocution. This patient retained consciousness throughout much of the episode and recalled severe pain. The reviews and research reports cited above (Critchley, 1934; 1935; Panse, 1975) describe a large variability in effects of high intensity electrical shocks (lightening strikes, high voltage alternating currents) on human experience. Some individuals lose consciousness, whereas others experience extreme pain and/or other intensely negative emotional feelings. This variability is consistent with the large variability in the amount of damage found in brains of judicially executed prisoners, as described above. This variability is expected because of the considerable variability in the amount of electrical resistance present in various tissues (e.g., differences in skull thickness, differences in skin resistance due to amount of sweat) of executed prisoners.

25. Comparisons also may be drawn between effects of intentional electrocution for execution and effects of electroshock therapy. Based on my reading of the literature on this subject and on a conversation with a leading authority on this subject (Dr. Peter Breggin), my understanding is that patients develop a retrograde amnesia that extends for several hours before the electroshock therapy. However, this amnesia simply indicates that memory processes are somehow disrupted by the treatment, although the exact point of time during the shocks that memory disruption occurs probably cannot be determined with any certainty. In any case, retrograde amnesia cannot be used as evidence that the patient did not experience pain or some other aversive experience during the shocks. In fact, the available evidence indicates that something in the entire experience of electroconvulsive shock is extremely aversive. While patients receiving electroconvulsive shock therapy do not consciously remember the experience of being shocked, there is documented evidence that some patients develop a severe phobia and intense dread of having to undergo further electroshock therapy. These effects have been documented in patients who have had electroconvulsive shock without prior anesthesia, a method in common use before 1960.

26. Behavioral evidence from observations made during judicial electrocutions corroborates the finding that conscious pain and suffering occurs during judicial electrocutions. Moaning, screaming, gasping for air, writhing movements in the chair are all classic signs of pain and suffering that have been observed during judicial electrocutions. For example, of the last 26 judicial electrocutions in Georgia, two prisoners were observed to breath and move after the first series of electrical shocks. One prisoner, Alpha Otis Steven, was seen to bob his head from side to side both before and for at least 12 minutes after the first series of shocks were applied. This movement was not likely to occur in an unconscious person.

27. Scientists have studied behavioral indications of pain, including facial expressions. People have been given experimental pain, and videotapes have been made of their facial expressions. It also has been done through the use of photographs and through simple direct observation. Methods have been developed to validate a system of measurement of the severity of pain by looking at facial expressions. Facial expressions of pain differ from expressions of other emotions, positive and negative. There is a system for objective identification of facial expressions of pain, called the Ekman Scale of the Facial Expression. It was published in 1978, but had been developed several years prior to that. It has been validated in numerous studies.

During a recent judicial electrocution in Florida, the hood placed on a prisoner named Tim Davis was removed very soon after his execution and his face clearly bore the expression of severe pain. I based this conclusion on criteria developed by Ekman and testified to this effect in a Florida Court.

28. As I stated in my books, Psychological and Neural Mechanisms of Pain (1988) and in Psychological Mechanisms of Pain and Analgesia (1999), there are several regions of the human brain which, when electrically activated, result in intense feelings of fear, dread, and/or pain. For example, published studies have shown that intense forms of dread and fear result from electrical stimulation of the central grey matter of the midbrain and other studies have shown that pain results from electrical stimulation of specific sites within the human thalamus and even cerebral cortex. Studies have shown that pain results from 50 cycle alternating currents (0.02 to 0.05 mA) applied at specific sites deep within the human brain. My own direct observations made before I read these accounts directly confirm these published studies. I observed effects of electrical stimulation of deep brain structures and spinal cord sites in human patients undergoing neurosurgical procedures. I noted that among 18 patients tested, that pain sensations nearly always resulted from 50 -100 cycle/sec electrical stimulation of a specific portion of their spinal cords, known as the anterolateral quadrant (Mayer, Price, and Becker, Pain, I: 51-58, 1975). These pain sensations increased in intensity as the current increased from 0.09 to 0.5 milliamperes. In no case, did inactivation or inhibition result from such electrical stimulation. Consistent with these direct observations, a recent Medline literature search on this topic covering a span of the last 10 years and 1092 articles (using keywords electrical, stimulation, and brain) did not yield a single published study which indicates that single or repetitive electrical stimulation of sites within the spinal cord or brain causes the sites directly stimulated by the electrodes to become inactivated or inhibited, although nearly all of these studies (96%) directly or indirectly indicated that activation or excitation took place as a result of electrical stimulation at these sites.

29. My strongest impression that extremely negative experiences are reliably evoked from electrical stimulation of deep structures of the human brain is based on a case wherein a patient had electrodes implanted within an area known as the central grey of the midbrain. The neurosurgeon accidently used a somewhat high level of current (over 0.3 mA at 50 cycles/sec) to stimulate this region. As the current was being applied to her brain, I distinctly remember hearing the patient scream and beg to be removed from the room in which this brain stimulation took place. She later told me that this was an extremely horrible dreadful experience, one that she hoped would never be repeated again in her life. I recall that the duration of stimulation was brief, lasting only a few seconds. I still have the notes that I made of the panic, horror, and lasting impressions made in this patient. Several years later, another patient reported to me a similar experience as a result of deep brain stimulation.

30. These intense experiences are known to result from artificial activation of central nervous system tissue by electrical currents. Normally, these regions are activated by impulses coming in to these regions from other regions of the nervous system. The electrophysiological basis for excitation of nerve cells of the brain by electrical currents applied either directly to the brain or by electrical currents that spread to the brain is very well established and based on solid fundamental principles of excitation of nerve cells and other excitable tissues throughout the body. Electrical currents (cathodal current) applied to the outer cellular membranes of nerve

cells and muscle cells causes such cells to be depolarized to the point of generating action potentials, or in common language, "impulses." The number of brain cells that are caused to have action potentials or "impulses" will increase as the amount of current applied to the brain is increased. The generation of nerve cell impulses within various regions of the brain is the means by which human beings experience sensations such as sound, light, and pain. Electrical currents that simultaneously activate large regions of the brain are likely to cause sensations of sound, light, and pain and the both the magnitude of these sensations and the likelihood that they will occur will increase as the amount of electrical current applied to the brain increases. The reason for this relationship is that increasing currents will spread over greater brain regions and progressively excite more and more nerve cells. This is no doubt the reason why victims of electrical shocks by lightening strikes and by man-made devises have reported not only excruciating pain, but also intense visual and auditory hallucinations (See Panse and Critchely references above). In my opinion, alternating 60 cycle electrical currents that excite nerve cells in widespread areas of the brain are likely to simultaneously generate experiences of sound, light, dread, fear, excruciating unimaginable pain and several other possible experiences as a result of widespread activation of multiple brain areas. Exactly how much of the brain is repetitively activated during an execution probably cannot be known with complete certainty.

31. Although it is theoretically possible that the effect of the initial current surge during execution depolarizes the brain instantaneously and renders the prisoner totally and immediately unconscious, there are several reasons why this is highly unlikely. A major reason is that alternating currents close to 60 cycles/second are known to induce depolarization of nervous system tissue followed by repolarization and even hyperpolarization, so that the nerve cells do not remain in a constant depolarized inactive state. In fact, depolarization followed by repolarization constitutes the electrochemical basis for action potentials or nerve impulses themselves. Based on modern knowledge of electrophysiology of nerve cells, the most likely effect of 60-cycle alternating current on the brain would be depolarization and action potentials followed by the absence of action potentials during every cycle of the 60-cycle alternating current. Thus, during the application of electrical shocks, vast numbers of nerve cells throughout the brain would be firing action potentials at a frequency of at least 60 impulses per second, a frequency that would induce pain or other aversive experience when occurring within certain brain regions. A second reason that unconsciousness is not likely to immediately occur is that the brain regions that control arousal and hence consciousness exist in the lower part of the brainstem, regions within the brain that are the farthest distance from the external source of electrical currents.

32. Finally, the extreme horror, dread, and pain resulting directly from electrical activation of he brain sites described above might be circumvented if electrical stimulation simultaneously produced immediate inactivation of the brain and hence unconsciousness by means of immediate destruction and hence death of the very brain cells that are stimulated by the electrical currents. In my opinion, this possibility is highly unlikely for several reasons. First, as pointed out above, it is far more likely that 60 cycle alternating current repetitively excites several regions of the brain than it permanently inactivates such regions. Second, based on my reading of several Instructional Manual for Electrocutions in different states (particularly the electrode configurations and electrical current parameters) and my conversation with the electrical engineer who has studied this problem, it is my opinion that the amount to current that passes across the skull during an electrocution for the purpose of execution is only a part of that which

is applied between the top of the head and legs and that which directly enters the brain is only a fraction of that which passes across the skull. Even so, currents that are only a small fraction of the overall current that is applied would be sufficient to activate but not inactivate brain tissue. Third, while there is some evidence of brain damage in some cases (see above), the interval between administration of current and verification of death varied between less than a minute to several minutes, leaving open the possibility for an indeterminate amount of pain and suffering before brain damage and death occurred.

33. A final line of evidence for Mechanism #1 is that of new knowledge concerning the anatomical locations of pain-related areas of the brain. This knowledge has been derived from brain imaging studies conducted only since 1990. In essence, these studies, which I describe in my most recent book, show that there exist multiple areas of the human brain that are involved in pain. These new findings are directly contradictory to prevailing theories that pain is represented only in a single discrete area of the brain. Many of these multiple brain areas were found in very deep areas of the brain, including the brainstem, thalamus, periaqueductal grey, and hypothalamus. Other pain-related areas were near the surface of the brain. These results have bearing on the question of pain during judicial electrocution for several reasons. First, the existence of multiple pain-related areas increases the chances that at least one of these areas would be electrically activated. Second, the fact that such areas are distributed both deep and near the top of the brain increases these chances still further. Because of the electrical resistance of the brain itself, current density would be much less for deep as compared to superficial brain regions, thereby decreasing the probability of their activation but also increasing the probability that these regions would be spared from damage. The latter event would allow pain to occur from intense stimulation of other body tissues, as described below.

B. Mechanism #2: Pain from intense stimulation of other body tissues

34. In addition to direct pain caused by electrical currents in the brain, pain is also produced through peripheral nerves during a judicial electrocution. The peripheral sources of pain include muscle contractions throughout the body, including the muscles for breathing. They include burning and charring of the skin that are evident in autopsy reports. They include pain associated with stoppage of the heart as the heart goes into irregular heartbeats, similar to a heart attack.

35. The peripheral pain experienced is from electrical currents traveling through the body. Electricity follows the path of least resistance, which is not necessarily the shortest path between the electrode placed at the head and knee. A high voltage application of electricity to the top of the head, exiting through the leg, will follow a path through blood vessels, muscle, cerebral spinal fluid, blood, and other highly conductive substances. The most conductive substances in the body are those that approach normal saline, such as blood and cerebral spinal fluid. These two fluids are the most conductive substances in the body. Muscles are the next highest in conductivity, followed by other tissues. The least conductive substances are cartilage and bone. The human brain is shielded by the skull. For this reason, it is entirely possible that minimal current gets to the brain during judicial electrocution.

36. In my opinion, persons undergoing electrocution suffer extreme pain, from both the direct stimulation of nerve cells in the brain, and from electric currents coursing through the body,

causing muscle contractions and charring. Immediate unconsciousness upon the initial charge is unlikely, given the poor conductivity of the bone and tissue surrounding the brain. Thus, persons undergoing judicial electrocutions may experience extreme pain and suffering for an indeterminate period of time. Evidence from autopsy reports and eyewitness accounts supports the finding that judicial electrocution does not result in immediate incapacitation of the brain, but in fact produces extreme pain and suffering before resulting in the death of the prisoner.

37. The second general mechanism of producing extreme pain and/or horror during electrocution is that intense pain must result from the full muscle contraction and the burning and cooking of body parts that are obvious elements of electrocution. This burning and muscle contractions must be perceived by the person unless he/she is rendered immediately unconscious by the electricity, an unlikely possibility. My examination of the autopsy reports for evidence of pain also indicates that unless they were immediately rendered unconscious, each executee must have suffered extreme pain just from the number and type of burns suffered. Nearly all executees had severe burns of the scalp, head, and leg. Such burns often went deep to the bone and descriptions also include charring of the flesh. Some executees had burns in other regions, including thighs, torso, groin, and feet. These types of burns are excruciating, as documented in several studies reported in the journal Pain. The full muscle contractions that would simultaneously occur would only add to this excruciating pain associated with the burning of tissue. The magnitude of pain produced by such types of stimulation of skin and muscle will increase as a function of the total area of the body that is stimulated. This is known as spatial summation and I have published several research articles that spatial summation is a very powerful factor in determining ones level of pain. For example, it has been shown that the magnitude of pain increases as a function of the body area burned in bum patients. My examination of the photographs of some of the executees indicates to me that unless they were immediately unconscious at the onset of their electrocution, these people must have suffered extreme pain just from the burns to their skin. The full muscle contractions that simultaneously occur would only add to this excruciating pain.

III. Summary and conclusions

38. If someone who is being electrocuted is not immediately rendered unconscious by the electrical current, then he/she is likely to experience both the enormous pain resulting from extensive burns and maximal muscle contractions and the direct effects of current-induced excitation of many regions of the human brain. It is important to point out that these two general mechanisms of producing pain and/or suffering are complementary and not mutually exclusive. The greater the proportion of current that directly gets to the brain, the greater is the likelihood that pain, dread, and horror will be directly evoked by currents to the brain. On the other hand, if relatively less current reaches these brain sites, proportionately more current would be distributed to other body tissues. In such an instance there would be a greater likelihood that excruciating pain would be produced as a result of current-induced burning, cooking, and maximal muscle contractions, for which there is obvious evidence provided in the autopsy reports. It is entirely possible that both mechanisms contribute to this overall experience.

39. Although it is theoretically possible that electrocution produces immediate unconsciousness, it is impossible to determine at what time an executed person loses consciousness during his execution. It is not possible to determine by viewing an electrocution whether the person being

electrocuted is rendered unconscious, given the facts that the person's face is covered by a mask and his muscles are completely contracted. Moreover, any electroencephalographic (EEG) test of such a possibility would probably be impossible to carry out because of the tremendous currents that would obscure any attempt to record brain wave activity.

40. In the absence of electroencephalographical, morphological-pathological, or even behavioral evidence for immediate loss of consciousness during execution by electrocution, the types of evidence that have bearing on this issue are 1) evidence of effects of electrical stimulation of brain sites, 2) evidence of effects of intense electric shocks on the human body, or 3) other forensic evidence discussed in this affidavit (i.e., autopsy reports, eyewitness accounts of judicial electrocutions, etc). As has been indicated in the preceding text, these multiple lines of evidence strongly indicate that not only do subjects not immediately lose consciousness during execution by electrocution but that they are likely to suffer immense horror, dread, and excruciating pain.

41. Most of the evidence that I have discussed in this document has been obtained over the last 50 years and the synthesis and integration of various sources of evidence, to my knowledge, has only been conducted in preparation of my affidavits. Much of the evidence, such as new knowledge about where and how pain is evoked within the human brain by electrical and natural means, has only been obtained within the last 10 years. Therefore, the scientific evidence related to the question as to whether judicial execution is painful and/or tortuous has evolved and progressed rapidly in recent years.

42. Based on both old and new evidence, it is my opinion that death by judicial electrocution is an ultimate form of torture that is excruciatingly painful, cruel and highly unusual.

43. I understand that the defendant in this case, Mr. Prieto, has asked to see the protocols used by the Department of Corrections to affect death by electrocution, but he has not yet been given these protocols. I reserve the right to amend my testimony once these protocols become available. However, I do not expect my ultimate conclusions to change.

44. Finally, while I have alluded to hearsay sources of proof in this affidavit, my conclusions about the pain of judicial electrocution would remain the same in the absence of reliance on these sources.

Further, affiant saith naught.

_____

Donald D. Price, Ph.D.