

Inquiry into Fetal Development and Activity

Written Submission to the
All-Party Parliamentary Pro-Life Group

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Submitted on behalf of the Charlotte Lozier Institute
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All of the submission may be made public.

1. Fetal development and activity – current state of evidence

1.1 Please provide an outline of the current evidence regarding fetal development and what age of development each milestone is likely to begin to occur.

Response to noxious stimuli.

The scientific evidence regarding development of pain-responsive circuitry in humans is entirely undisputed, and has been reported with essentially the same interpretation given here in every modern review of fetal pain. *Fetal age is given as weeks following sperm-egg fusion.*

1) The earliest rudiment of the human nervous system forms by 28 days (4 weeks). (Nikolopoulou, Galea et al. 2017) At this stage, the primitive brain is already patterned; i.e., cells in different regions are specified to produce structures appropriate to their location and function in the nervous system as a whole. (Puelles, Harrison et al. 2013) The brain grows enormously over the next several weeks, such that by 50 days (approximately 7 weeks), the major subdivisions of the central nervous system are all recognizable, based both on anatomy and on distinctive patterns of gene expression. (Puelles and Rubenstein 1993)

2) In the neocortex, the earliest neurons are generated during the fourth week. (Bystron, Molnar et al. 2005, Bystron, Rakic et al. 2006, Bystron, Blakemore et al. 2008, Cheng, Tian et al. 2011) Synapses are also detected in the cortex at this time, (Zecevic 1998) forming the first functionally active cortical circuits. (Molliver, Kostovic et al. 1973, Kostovic and Rakic 1990)

3) The neural circuitry responsible for the most primitive response to pain, the spinal reflex, is in place by eight weeks.(Okado, Kakimi et al. 1979, Wozniak, O'Rahilly et al. 1980, Okado 1981, Milokhin 1983, Fitzgerald 1991) This is the earliest point at which the fetus is capable of experiencing pain in any capacity (i.e. detecting and reacting to painful stimuli).

4) The earliest connections between neurons in the subcortical-frontal pathways (regions of the brain involved in motor control and a wide range of psychological phenomena, including pain perception) are detected by 37 days and are well established by 8-10 weeks. (Kostovic and Vasung 2009, Vasung, Huang et al. 2010) Components of these circuits include the basal ganglia, limbic system, thalamus and hypothalamus.

5) Connections between the spinal cord and subcortical nuclei in the thalamus begin to form around 12 weeks and are completed by 18 weeks. (Kostovic and Goldman-Rakic 1983) Recent evidence demonstrates that infants also become viable around this time; i.e. Between 23% (Rysavy, Li et al. 2015) and 60% (Mehler, Oberthuer et al. 2016) of infants born at 20 weeks who receive active hospital treatment will survive, many without immediate (Rysavy, Li et al. 2015, Mehler, Oberthuer et al. 2016, Younge, Goldstein et al. 2017) or long-term (Holsti, Adamsson et al. 2016, Serenius, Ewald et al. 2016) neurologic impairment.

6) Thalamocortical connections and long-range connections within the cortex do not arise until later in fetal life, beginning to form around 22-24 weeks, (Kostovic and Judas 2010, Corbett-Detig, Habas et al. 2011, Kostovic, Judas et al. 2011, Gatti, Becucci et al. 2012) and continuing to develop for an exceptionally long time, not reaching full maturity until approximately 25 years after birth.(Sowell, Peterson et al. 2003, Gogtay, Giedd et al. 2004, Moriguchi, Ohnishi et al. 2007)

1.2 Please provide an outline of psychological, physical or behavioural examples of how life in utero might impact later life, whether childhood or adult.

There is evidence from several studies that pain and stress may affect fetal survival and neurodevelopment. Anna Taddio, a pain specialist from Toronto, found that circumcised boys responded to later painful stimuli with increased distress, compared to non-circumcised boys, suggesting that their neural pathways were actually changed by the early painful stimuli. Other studies have shown similar alterations in pain perception. According to an article by Lowery *et al*, (2007) “it is important to reduce pain exposure in the fetus and newborn, since pain exposure has been shown to induce significant adverse long-term neural–developmental changes.”

2. Fetal pain and use of analgesia – current state of evidence

2.1 Please provide an outline of the current evidence regarding fetal pain.

What we directly observe about how a fetus responds to painful stimuli strongly supports the conclusion that the fetus detects and responds to pain in a multifaceted manner well prior to the development of cortical circuitry.

Multiple studies (Giannakouloupoulos, Sepulveda et al. 1994, Teixeira, Glover et al. 1999, Gitau, Fisk et al. 2001, Smith, Glover et al. 2003, Gitau, Fisk et al. 2004, Lam, Sharma et al. 2008, Kosinska-Kaczynska, Bartkowiak et al. 2012, Wynne-Edwards, Edwards et al. 2013) clearly indicate that, “the human fetus from 18–20 weeks elaborates pituitary-adrenal, sympatho-adrenal, and circulatory stress responses to physical insults,” that can be eliminated by appropriate anesthesia.(Fisk, Gitau et al. 2001)

In support of the conclusion that pain is experienced very early in human development, fetuses delivered prematurely also show clear pain-related behaviors (Gibbins, Stevens et al. 2008) that mature over time in utero. (Reissland, Francis et al. 2013) Strikingly, the earlier infants are delivered, the stronger they response to pain, (Badr, Abdallah et al. 2010) perhaps due hyperinnervation of peripheral structures early in development (Fitzgerald 2005) or to the absence of late developing cortical circuits that inhibit pain perception.(Kwon, Altin et al. 2014, Ossipov, Morimura et al. 2014, Schwaller and Fitzgerald 2014)

Finally, it is well established that painful experiences in premature infants have long-term negative impact on neural development and function, (Ranger and Grunau 2014) indicating that pain clearly has “meaningful,” systemic consequences for the nervous system. Many experts conclude these effects justify the use of fetal anesthesia, (Smith, Gitau et al. 2000, Huang, Deprest et al. 2004, White and Wolf 2004) with one author stating, “Whereas evidence for conscious pain perception is indirect, evidence for the subconscious incorporation of pain into neurological development and plasticity is incontrovertible.” (Lowery, Hardman et al. 2007)

These observations of fetal behavior and physiology have resulted in a clear consensus among professional anesthesiologists that the use of medications to relieve pain is warranted in cases of fetal surgery. (Rosen 2001, Tran 2010, Van de Velde and De Buck 2012, Bellieni, Tei et al. 2013, Ferschl, Ball et al. 2013, Kuczkowski 2013, Lin and Tran 2013, Sviggum and Kodali 2013, Hoagland and Chatterjee 2017) Many of the advocates of fetal anesthesia make no claims regarding the qualitative nature of fetal pain, but based on both the scientific literature and on their own observations, they clearly conclude that pain exists for the fetus and that they are obligated to medically address fetal pain, despite the many serious challenges and risks entailed in providing pain relief to a fetus in utero. In considering use of anesthesia for the fetal procedures, a recent review of the evidence concludes that from the 13th week onward (15th week, LMP), “the fetus is extremely sensitive to painful stimuli, and that this fact should be taken into account when performing invasive medical procedures on the fetus. It is necessary to apply adequate analgesia to prevent the suffering of the fetus.” (Sekulic, Gebauer-Bukurov et al. 2016)

2.2 In your opinion, from what age would you consider that a fetus:

(i) Is very likely to feel pain (>90% certainty of pain)

Feeling pain is not something that can be scientifically observed. Science can indicate when the circuitry responsible for detection and response to painful stimuli is in place. The earliest circuitry capable of detecting and responding to pain is in place between 8-10 weeks. Spino-

thalamic circuitry capable of mediating a conscious experience of pain develops between 12-18 weeks. The developing child in the womb can and does experience pain at least as early as 20 weeks post-fertilization (22 weeks gestation).

(ii-iv) see above

2.3 What reasons might a fetus have for experiencing more acute pain than an adult, and to what extent might this be experienced?

In support of the conclusion that pain is experienced very early in human development, fetuses delivered prematurely also show clear pain-related behaviors (Gibbins, Stevens et al. 2008) that mature over time in utero. (Reissland, Francis et al. 2013) Strikingly, the earlier infants are delivered, the stronger their response to pain, (Badr, Abdallah et al. 2010) perhaps due hyperinnervation of peripheral structures early in development (Fitzgerald 2005) or to the absence of late developing cortical circuits that inhibit pain perception. (Kwon, Altin et al. 2014, Ossipov, Morimura et al. 2014, Schwaller and Fitzgerald 2014)

2.4 As medical science advances and surgery in utero can be performed even earlier, in your opinion, what will be the earliest fetal age that consultants need not administer any fetal analgesia and give muscle relaxant only?

With the advent of fetal surgery, our knowledge of how the fetus responds to pain has advanced to the point that fetal anesthesia is routinely given at 20 weeks. Recognition of the existence of fetal pain and the need for compassion has improved medical care for mothers and babies alike. Spino-thalamic circuitry capable of mediating a conscious response to pain develops between 12-18 weeks. Therefore, prior to 12 weeks consultants need not administer any fetal analgesia, and may give muscle relaxants only.

2.5 In your view, what will a fetus potentially experience during these procedures performed under the current published guidelines in the UK:

(i) Dilation & evacuation (used from around 15 weeks of pregnancy)

Conscious pain.

(ii) Feticide by potassium chloride (used from around 22 weeks of pregnancy)

Conscious pain

3. Views on the law, guidance and practice

3.1 Giving reasons, in your opinion, are the current guidelines (eg RCOG Fetal Awareness 2010) relating to fetal development and activity effective:

(i) For medical practitioners?

No. Current guidelines do not take into account an enormous and diverse body of data from both animal and human studies that indicates cortical circuitry is not required for a conscious experience of pain, and spino-thalamic circuitry is sufficient for this experience.

(ii) For women requesting an abortion?

No. Women have a right to be fully informed regarding fetal brain development and the likely experience of the fetus.

(iii) For the fetus?

Abortion is never in the best interest of the fetus.

3.2 Please make any recommendations for changes in the following areas that you think would reflect the current evidence regarding fetal development and activity:

a) Law

b) Guidance for:

(i) Medical practitioners

(ii) Women requesting an abortion

Women have a right to be fully informed regarding fetal brain development and the likely experience of the fetus.

(iii) Education

3.3 Giving your reasons, do you think the current systems (eg RCOG/DH) in place that develop and review guidelines on issues such as fetal development and activity are effective, accountable and impartial to outside interest? Can you suggest ways in which the current systems can be made more effective, accountable and impartial?

3.4 In what ways can you suggest improvements in reassurance to mothers requesting a late term abortion that their fetus will not suffer in terms of:

(i) Fetal pain

(ii) Being born alive after abortion

3.5 In what ways can you suggest to improve data collection and reporting on abortions (including, but not limited to, fetal pain and babies being born alive after abortion)

3.6 In your view, are there any useful precedents for abortion legislation or professional guidance reflecting evidence on fetal pain, awareness and physiological responses from other jurisdictions?

No **Yes**

If yes, please specify:

The first four points under Section 2 of the introduced U.S. federal bill, H.R. 36 (the Pain-Capable Unborn Child Protection Act) deal with basic fetal embryology.

3.7 Do you have any personal examples or experiences relating to fetal development and activity that you would like to communicate to this inquiry?

Dr. Aultman:

When I entered medical school, I believed that the availability of abortion on demand was solely an issue of women's rights. During my residency I was trained in first trimester abortions using D&C with suction and I sought and received special training in second trimester D&E during which the fetus is crushed and removed in pieces. During my residency I also moonlighted doing abortions. As I examined the tissue after each procedure I was fascinated by the tiny perfectly formed limbs and organs but because of my training and conditioning, a human fetus seemed no different than a chick embryo to me.

I continued to do abortions without reservation while pregnant, but when I returned to the clinic after my delivery I was confronted with some situations that changed my thinking.

During my rotation on the neonatal unit, I noticed that even the youngest neonates cried, grimaced, or withdrew from painful stimuli like needle sticks. Trying to start IV's or draw blood on those tiny defenseless babies was heart wrenching for me. It was during that rotation, that I also realized that I was trying to save babies in the NICU that were the same age as babies I was aborting. The only difference was that one group of babies was wanted and the other was not.

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