

# Inquiry into Fetal Development and Activity

## Information about respondent:

Richard Thomas

[Rick.Thomas@cmf.org.uk](mailto:Rick.Thomas@cmf.org.uk)

020 7234 9660

6 Marshalsea Road, London SE1 1HL

Responding on behalf of The Christian Medical Fellowship, an association with over 5,000 medically qualified members throughout the UK.

Post: Researcher

Medical Practitioner (Rtd)

Interest: That professional guidelines be based on the best available evidence, honestly and simply expressed.

I do not wish that this evidence be kept anonymous.

## Q1. 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.

#### A. *Neurological development.*

By three weeks gestation the fetal brain has already differentiated into forebrain, midbrain, and hind brain, and the spinal cord has started to grow.<sup>1</sup>

By 4 to 5 weeks after fertilisation (6 to 7 weeks gestation), pain receptors first start to appear around the mouth, and at around week 6, the fetus first responds to touch.<sup>2</sup> By 18 weeks, pain receptors have appeared throughout the body.<sup>3</sup> Afferent nerve fibres from these receptors to the spinal cord begin development at 8 weeks and are complete by 30 weeks gestation.

The cerebral cortex begins to develop as early as week 6 and by 18 weeks has its full complement of neurons.<sup>4</sup>

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<sup>1</sup> Blackburn, ST. Maternal, Fetal, and Neonatal Physiology. 2nd ed (2003).

<sup>2</sup> Ibid.

<sup>3</sup> Valnaan HB, Pearson JP. What the fetus feels. British Medical Journal. 280 (1980) 233-234.

<sup>4</sup> Ibid.

The thalamus develops between weeks 8 and 16 and functions as the main relay centre in the brain for sensory impulses going from the spinal cord to the cerebral cortex.<sup>5</sup> Spinothalamic fibres (responsible for transmission of pain) begin to develop in week 14 and are complete by 20 weeks gestation;<sup>6</sup> thalamocortical fibres develop from 17 weeks and are completely developed by 26-30 weeks gestation.<sup>7 8</sup>

The fetus starts to make movements in response to being touched from 8 weeks, and more complex movements build up, as detected by real time ultrasound, over the next few weeks.<sup>9</sup> There is reaction to light, sound, touch and taste from 20 weeks gestation.

By 20 weeks all anatomical links - pain receptors, spinal cord, nerve tracts, thalamus, and cortex - needed for pain transmission to the brain, are in place. Further connections between the thalamus and cortex will continue to develop for another ten weeks or so. From 16 weeks' gestation pain transmission from a peripheral receptor to the cortex is possible and completely developed from 26 weeks gestation.

If cortical activity is considered a marker for fetal consciousness, EEG signals such activity from 19-20 weeks gestation and sustained EEG activity can be recorded in fetuses from 23 weeks gestation.<sup>10</sup> However, consciousness is possible in the absence of a cortex, as illustrated by the purposive and goal-directed behaviour in anencephalic children. It's clear that brainstem mechanisms are integral to the constitution of consciousness and that 'an adequate account of the neural mechanisms of the conscious state cannot be confined to the thalamocortical complex alone'.<sup>11</sup>

Experimental findings in third trimester pregnancies show that human fetuses can acquire distinct verbal memories from prenatal experiences supporting the concept that consciousness appears before birth, from 20-22 weeks gestation.

## **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.**

It is becoming increasingly clear that experiences of pain will be 'remembered' by the developing nervous system, perhaps for the entire life of the individual<sup>12</sup> and be associated with long-term harmful neurodevelopmental effects, such as altered pain sensitivity and, possibly, emotional,

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<sup>5</sup> Blackburn, ST. Maternal, Fetal, and Neonatal Physiology. 2nd ed (2003).

<sup>6</sup> Van Scheltema PNA et al. Fetal Pain. Fetal and Maternal Medicine Review. 19:4 (2008) p.313.

<sup>7</sup> Lee SJ, Ralston HJP, Drey EA, Partridge, JC, Rosen, MA. A Systematic Multidisciplinary Review of the Evidence. Journal of the American Medical Association. 294:8 (2005), p.950.

<sup>8</sup> Marc Van de Velde & Frederik De Buck, Fetal and Maternal Analgesia/Anesthesia for Fetal Procedures. Fetal Diagn Ther 31(4) (2012) p.206.

<sup>9</sup> Glover V. The fetus may feel pain from 20 weeks; The Fetal Pain Controversy. Conscience. 25:3 (2004) p.36.

<sup>10</sup> Goldman-Rakic PS. Development of cortical circuitry and cognitive function. Child development 1987; 58:601-22.

<sup>11</sup> Merker, B. (2007). Consciousness without a cerebral cortex: A challenge for neuroscience and medicine. Behavioural and Brain Sciences, 30(1), 63-81. doi:10.1017/S0140525X07000891

<sup>12</sup> Van de Velde M et al. Fetal pain perception and pain management. Seminars in Fetal & Neonatal Medicine. 11 (2006) p.234.

behavioural, and learning disabilities later in life.<sup>13</sup> The fetal stress response to noxious stimulation could have both short- and long-term adverse effects on the developing central nervous system.<sup>14</sup>

Where the available evidence is limited, the benefit of any doubt should be given to the fetus and steps taken to minimise the impact of intrauterine surgery, using appropriate pain relief as well as sedation and muscle relaxants. It has been shown that fetal anaesthesia is associated with a decrease in stress hormones (such as cortisol and  $\beta$ -endorphin) compared to their level when painful stimuli are applied without such anaesthesia.<sup>15</sup>

## **2. Fetal pain and use of analgesia - current state of evidence**

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

#### *A. Neurological evidence.*

After 16-20 weeks, the unborn child reacts to stimuli that would be recognized as painful if applied to an adult human, for example by withdrawal or recoiling.<sup>16 17</sup>

There is considerable and growing evidence to suggest that the 20 week fetus will experience pain. A fully developed thalamo-cortical connection may not be necessary for a fetus to feel pain.<sup>18 19</sup> It is clear that extremely premature babies born at 20 weeks are able to experience pain. Studies show anencephalic and hydranencephalic infants, whose cortex is severely reduced if not altogether missing, may experience pain as long as other neurological structures are functioning.<sup>20 21</sup> In adults, stimulation or ablation of the cerebral cortex does not alter pain perception, while stimulation or ablation of the thalamus does.<sup>22</sup> Anand notes that 'the structures used for pain processing in early development are unique and different from those of adults, and that many of these fetal structures and mechanisms are not maintained beyond specific periods of early development'<sup>23</sup> It seems increasingly clear that the fetus experiences pain mediated by the thalamus and that a functioning cortex is not necessary.

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<sup>13</sup> Ibid.

<sup>14</sup> Mark A. Rosen, "Anesthesia for Fetal Surgery and Other Intrauterine Procedures," in Chesnut's Obstetric Anesthesia: Principles and Practice, ed. David H. Chestnut et al (Philadelphia: Mosby, 2009), 131-132.

<sup>15</sup> Fisk NM et al. Effect of Direct Fetal Opioid Analgesia on Fetal Hormonal and Hemodynamic Stress Response to Intrauterine Needling. *Anesthesiology*. 95 (2001) p. 834.

<sup>16</sup> Gupta R et al. Fetal surgery and anaesthetic implications. *Continuing Education in Anaesthesia, Critical Care & Pain*. 8:2 (2008) p.74.

<sup>17</sup> R Gupta, et. al. Fetal surgery and anaesthetic implications, *Continuing Education in Anaesthesia, Critical Care & Pain*. 2008 8(2):71-75.

<sup>18</sup> Merker B. Consciousness without a cerebral cortex: A challenge for neuroscience and medicine. *Behavioral and Brain Sciences*. 30 (2007) p. 80.

<sup>19</sup> Anand KJS. Consciousness, cortical function, and pain perception in nonverbal humans. *Behavioral and Brain Sciences*. 30:1 (2007) 82-83.

<sup>20</sup> Van Assche, FA. "Anencephalics as Organ Donors." *Am J Obstet Gyn* 163 (1990)

<sup>21</sup> Brusseau R. Developmental Perspectives: is the Fetus Conscious? *International Anesthesiology Clinics*. 46:3 (2008) p.17.

<sup>22</sup> Ibid:16.

<sup>23</sup> Anand KJS. Fetal Pain? *Pain: Clinical Updates*. 14:2 (2006) p.3.

The position, taken by the RCOG<sup>24</sup> that the unborn child remains in a coma-like sleep state that precludes the unborn child experiencing pain is inconsistent with the documented reaction of unborn children to painful stimuli. It is also inconsistent with the experience of fetal surgeons who have found it necessary to sedate the unborn child with anaesthesia and pain relief from 16 weeks to prevent the unborn child from moving about in reaction to invasive surgery.<sup>25</sup>

### *B. Fetal Reaction to Stress*

Fetal stress in response to painful stimuli is shown by increased cortisol and  $\beta$ -endorphin concentrations.<sup>26</sup> At 18 weeks, these hormones are released by a fetus injected by a needle, just as they are when adults feel pain. Hormone levels in those fetuses decrease as pain-relievers are supplied.<sup>27</sup> Other studies have revealed reduced blood flow to the brain of foetuses within 70 secs of painful stimuli, from as early as 16 weeks gestation.<sup>28</sup>

There is no correlation between maternal and fetal noradrenaline levels, suggesting a lack of placental transfer of noradrenaline.<sup>29</sup> This independent stress response in the fetus occurs from 18 weeks gestation.<sup>30</sup> Myers et al conclude 'that the human fetal hypothalamic– pituitary–adrenal axis is functionally mature enough to produce a  $\beta$ -endorphin response by 18 weeks and to produce cortisol and noradrenalin responses from 20 weeks' gestation'.<sup>31</sup>

In conclusion, there is substantial medical evidence that an unborn baby is capable of experiencing pain by 20 weeks after fertilization. Professor Wright, Chair of Paediatrics at Mercer School of Medicine, giving evidence before the US Congress House of Representatives Committee on the Judiciary, said: 'After 20 weeks of gestation, an unborn child has all the prerequisite anatomy, physiology, hormones, neurotransmitters, and electrical current to "close the loop" and create the conditions needed to perceive pain...The development of the perception of pain beings at the 6th week of life. By 20 weeks, and perhaps even earlier, all the essential components of anatomy, physiology, and neurobiology exist to transmit painful sensations from the skin to the spinal cord and to the brain.'<sup>32</sup>

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

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<sup>24</sup> Fetal Awareness: Review of Research and Recommendations for Practice. Report of a Working Party. Royal College of Obstetricians and Gynecologists. March 2010. Summary, para 2.

<sup>25</sup> Van de Velde M et al. Remifentanyl for Fetal Immobilization and Maternal Sedation During Fetoscopic Surgery: A Randomized, Double-Blind Comparison with Diazepam. *Anesthesia & Analgesia*. 101 (2005) p.256.

<sup>26</sup> Giannakouloupoulos X, Teixeira J, Fisk N. Human fetal and maternal noradrenaline responses to invasive procedures, *Pediatr Res*, 1999, vol. 45 (pg. 494-9)

<sup>27</sup> Giannakouloupoulos, X., Sepelveda, W., Kourtis, P., Glover, V., & Fisk, N. (1994). Fetal plasma cortisol and B-endorphin response to intrauterine needling. *Lancet*, 77-81.

<sup>28</sup> Teixeira JM et al. Acute cerebral redistribution in response to invasive procedures in the human fetus. *Amer J of OBs and Gynae* 1999; 181:1018-25.

<sup>29</sup> Gitau R, Fisk NM, Teixeira JM, Cameron A, Glover V. Fetal hypothalamic–pituitary–adrenal stress responses to invasive procedures are independent of maternal responses. *Journal of Clinical Endocrinology and Metabolism*. 86 (2001) 104-109.

<sup>30</sup> Marcus M, Gogarten W, Louwen F. Remifentanyl for fetal intrauterine microendoscopic procedures, *Anesth Analg*, 1999, vol. 88 pg. S257

<sup>31</sup> Myers LB et al. Fetal endoscopic surgery: indications and anaesthetic management. *Best Practice & Research Clinical Anaesthesiology*. 18:2 (2004) p. 242.

<sup>32</sup> Wright J. Pain of the Unborn: Hearing Before the Subcommittee on the Constitution. 109th Cong., 1st Sess., 2005:26-27.

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

From 20 weeks gestation

**(ii) Probably feels pain (>50% certainty of pain)**

From 18 weeks

**(iii) Possibly feels pain (>10% certainty of pain)**

From 16 weeks

**(iv) Is unlikely to feel pain, but is theoretically possible to (>1% certainty of pain)**

From 14 weeks

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

The highest density of pain receptors per square inch of skin in human development occurs *in utero* from 20 to 30 weeks gestation. Pain inhibitory mechanisms and pathways, such as the dorsolateral funiculus, do not develop until 32-34 weeks gestation or even postnally. It is therefore possible that a fetus of 20-32 weeks could experience a more intense pain than older infants, children or adults in response to equivalent stimuli.<sup>33</sup>

**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?**

Administration of fetal anaesthesia has been standard practice since the advent of fetal surgery more than 25 years ago and is practised worldwide. Analgesia is recommended for endoscopic procedures, intrauterine surgery on the placenta, cord and membranes and for late termination of pregnancy and should be provided from 16 weeks gestation onwards. This is important not only to ensure the fetus remains quiet and still during surgical procedures but also to protect it from possible harmful effects on the developing neurological system, and to provide reassurance to the mother that her unborn child will not suffer pain. The importance of fetal immobility, cardiovascular homeostasis, analgesia, and perhaps, amnesia have always been emphasized in fetal surgery practice.<sup>34</sup>

**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?**

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<sup>33</sup> Anand, KJS, in an expert report to the US Department of Justice, to assist the Court in its assessment of the Partial-Birth Abortion Ban Act of 2003.

<sup>34</sup> Rosen MA, Anesthesia for Fetal Surgery and Other Intrauterine Procedures, in Chesnut's Obstetric Anesthesia: Principles and Practice, ed. David H. Chestnut et al (Philadelphia: Mosby, 2009), 131-132

The 2010 guidelines suggest that ‘the evidence that analgesia confers any benefit on the fetus at any gestation is lacking’. They also recommend ‘that the fetus does not require analgesia for interventions occurring before 24 weeks of gestation’. This advice is dated (indeed, was already dated when it was published) and is inconsistent with the growing body of evidence that fetal pain awareness is not dependent on a fully functioning cortex or developed thalamocortical connections (see above) but is likely to be competent by 20 weeks, possibly earlier .

### **(ii) For women requesting an abortion?**

The 2010 guidelines state categorically, in answer to questions that women typically ask about abortions before 24 weeks, that ‘the fetus does not experience pain’. They go on to say ‘Current research shows that the sensory structures are not developed or specialised enough to experience pain in a fetus less than 24 weeks’. At the very least, the force of the language used appears to entertain an unwarranted degree of certainty given the present state of knowledge. In the light of more recent studies, cited above, it now appears misleading and must be changed.

The same answer (and another given on page 22 to a question about fetal pain during feticide) suggests ‘increasing evidence exists that the fetus never enters a state of wakefulness inside the womb. The placenta produces chemicals that suppress nervous system activity and awareness’. Although there is some evidence that this may happen in experimental animals, such as sheep, there is no evidence that human fetuses lack awareness or exist in an unconscious state in the womb and it is misleading to women to report it as an established fact. Indeed, there is an extensive literature, in humans, on fetal sleep and wakefulness, fetal motility, fetal memory, fetal hearing, fetal breathing and its control and fetal behaviour – and these are just examples that scratch the surface. None of this work is easily reconciled with the notion of a permanently unconscious human fetus. Little wonder, then, that Dr Martin Ward Platt, in a BMJ editorial at the time, described the 2010 RCOG guidelines as ‘the Emperor’s new clothes’<sup>35</sup>

On page 21, line 5 the guidelines suggest attribute movements of babies born as a result of late term abortion without feticide as ‘a reflex action’. The language implies the baby is not truly born ‘alive’. Although it will not survive at 22-24 weeks outside a special care unit, those born prematurely at the same stage do sometimes survive. Guidelines should reflect the truth, even when uncomfortable, and not employ euphemisms.

On page 22 is a question: Does an anaesthetic or the pain relief I receive affect the baby? The answer given will confuse many. It states that anaesthetic agents and other pain relief will cross to the baby but not enough to cause harm. Yet every mother wants to be sure her baby will not suffer pain and will wonder how this will be achieved if so little reaches her baby. Adequate pain relief and muscle relaxant should be given directly to the baby in any procedure after 16-18 weeks and the answers to women should make this reassuringly clear.

### **(iii) For the fetus?**

Refer to answers under (ii) above.

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<sup>35</sup> Platt MW. Fetal awareness and fetal pain: the Emperor’s new clothes. BMJ 2010;96(4)

### **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**

Lowering the age limit for terminations on all grounds to 20 weeks would more accurately reflect the viability of an increasing number of premature babies surviving with expert care from 22-24 weeks. It would also resonate with changing public perceptions of disability and current understandings outlined above of fetal awareness and pain perception.

#### **b) Guidance for:**

##### **(i) Medical practitioners**

In the light of the growing evidence base that fetal pain awareness is not dependent on a functioning cortex (see above) but is likely to be competent by 20 weeks, possibly earlier, it seems quite incongruous that the RCOG guidelines should only recommend administering analgesia before an invasive procedure after 24 weeks. Guidance to practitioners needs to be changed and, in our opinion, should err on the safe side by recommending fetal anaesthesia for intrauterine procedures from 16 weeks. This would therefore include some second trimester abortions as well as all later ones and of course to intrapartum fetal destruction. Anaesthetic agents cross to the fetus more slowly than to the mother and it should not be assumed that a sufficient transfer will occur to ensure adequate fetal pain prevention.

The instincts of those involved at the 'sharp end' are to ensure pain relief for the fetus and reassurance for the mother. RCOG consultants now routinely administer fentanyl prior to a feticide. The RCOG should formally recognise this pragmatic wisdom, in the absence of incontrovertible evidence of fetal pain awareness beyond 20 weeks, and include it as part of their formal guidance to members.

##### **(ii) Women requesting an abortion**

It is misleading, in the light of recent studies, to state categorically to women that the pre-24 week fetus cannot feel pain. Similarly misleading is that statement that the fetus never enters a state of wakefulness inside the womb, for which there is no compelling evidence. Wording that reflects the likelihood that a 20 week fetus can feel pain should be substituted and the euphemism about the 'reflex actions' of babies delivered by late term abortion without feticide should be removed.

#### **c) Education**

At the very least, teachers and lecturers should update their lessons to reflect the current state of knowledge. Everybody craves certainty but where adequate, reliable research results are lacking, let honesty prevail. We must not draw firm conclusions, because it suits our particular perspective, when there is insufficient evidence to justify them. In their 2010 guidelines, it does however look as though the RCOG, rather than taking a dispassionate view of the scientific evidence, has rather cherry-picked experts who would deliver prescribed conclusions.

It is also somewhat ironic that the RCOG, whose members carry out virtually all Britain's late abortions, should state that babies at 18 to 24 weeks gestation are in a continual state of sleep and

lack the neurological apparatus necessary to feel pain. However, mothers feeling their babies kick at 16 to 20 weeks and indeed all parents who witness their progeny on a routine 18-week ultrasound scan, apparently sucking their thumbs, scratching their noses or yawning will intuitively feel sceptical of the RCOG's conclusions.

**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?**

The difficult questions around fetal awareness and pain sensation require a comprehensive, dispassionate, multidisciplinary approach and it is essential, in order to avoid research or interpretational bias, that those carrying out the report do not have vested ideological or financial interests in its conclusions. As the RCOG report is accorded such respect within Parliament, it would seem advisable that it be revised again by a truly multidisciplinary team with expertise, not just in obstetrics and gynaecology, but in paediatrics, anaesthesia, surgery, neurology, neurophysiology and neurodevelopment.

**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**

That pain relief and sedation with fentanyl and, as appropriate, a muscle relaxant, will be given routinely to the baby in any late term abortion.

**(ii) Being born alive after abortion**

Mothers having late term abortions, after 22 weeks, will know that some babies born prematurely at the same age survive with intensive care. They should be reassured that feticide using potassium chloride instilled into the fetal heart will avoid a live birth.

**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)**

The question about babies being born alive after abortion is highly relevant in view of a story in the Daily Mail which claimed that 66 babies survived NHS termination attempts in one year alone.<sup>36</sup>

The figure came from the CEMACH 2007 Perinatal Mortality report<sup>37</sup> which covers the year 2005. It carries the said figures on page 28. I quote: *'Sixty-six of the 2,235 neonatal deaths notified in England and Wales followed legal termination (predominantly on account of congenital anomalies) of the pregnancy ie. born showing signs of life and dying during the neonatal period. Sixteen were born at 22 weeks' gestation or later and death occurred between 1 and 270 minutes after birth (median: 66 minutes). The remaining 50 fetuses were born before 22 weeks' gestation and death occurred between 0 and 615 minutes after birth (median: 55 minutes).'*

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<sup>36</sup> <http://www.dailymail.co.uk/health/article-512129/66-babies-year-left-die-NHS-abortions-wrong.html>

<sup>37</sup> <http://www.erpho.org.uk/Download/Public/16203/1/CEMACH%202007%20report.pdf>



We have checked the CEMACH reports for 2009 and 2011 (covering 2007 and 2009 respectively) and found no similar reference, but in the latter a diagram on page 51 (figure 6.2) does say that figures of early neonatal deaths following termination of pregnancy have been (deliberately) excluded. The strong implication is that they are still happening, but just not being reported.

This data collection should be urgently resumed.

### **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?**

Many US states have outlawed late abortions, based on the assertion that a fetus likely experiences pain once past 20 weeks gestation, and thus abortion would be inhumane. Currently, 43 US states prohibit some abortions after a certain point in pregnancy.<sup>38</sup>

- 17 states impose prohibitions at fetal viability.
- 2 states impose prohibitions in the third trimester.
- 24 states impose prohibitions after a certain number of weeks; 17 of these states ban abortion at about 20 weeks post-fertilization or its equivalent of 22 weeks after the woman's last menstrual period on the grounds that the fetus can feel pain at that point in gestation.

The Republican-controlled US House of Representatives in 2013 passed a bill<sup>39</sup> that would reduce late abortions.

The plan to restrict terminations to the first 20 weeks after conception was approved by 228 votes to 196.

The Pain-Capable Unborn Child Protection Act, which was based on research showing that the unborn child can experience pain by at least 20 weeks gestation, marked the first time that the United States' Congress had voted to give affirmative protection to unborn children.

The debate followed polls showing that 64% of the American public would support legislation prohibiting abortion after 20 weeks (more detail is in Parliamentary Network for Critical Issues article<sup>40</sup>).

### **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?**

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<sup>38</sup> <https://www.guttmacher.org/state-policy/explore/state-policies-later-abortions?>

<sup>39</sup> <http://www.bbc.co.uk/news/world-us-canada-22963804> (visited 21.03.18)

<sup>40</sup> <http://www.pncius.org/update.aspx?id=84> (visited 21.03.18)