1.Please give an outline of your background experience and the particular area of expertise that you bring to this inquiry.
2.Please explain to us the limitations of Science when assessing fetal pain.
3.Your Testimony in 2013 was a comprehensive assessment of fetal pain at the time. What updates do you have on the evidence since then?
4.What is your professional assessment of the RCOG guidelines on Fetal Development 2010?
5.Is there anything else that you would like to add to help us with the Inquiry?

1. I am an Associate professor of Neurobiology and Anatomy at the University of Utah School of Medicine, where I have held a faculty position since 1997. I received my undergraduate degree from the University of Chicago, and my doctorate from the University of California at Berkeley. My research concerns the development of the sensory nervous system and the role of stem cells in embryonic development. I have taught human embryology for over thirty years, and am currently the content director of human embryology in the University of Utah Medical curriculum. I have thoroughly reviewed the current scientific and medical literature on the topic of fetal pain in preparation for this inquiry.

2. Pain is both a physiologic response to noxious, or potentially damaging, stimuli and also a psychological experience. While science can determine with some accuracy the time course over which pain-responsive neural circuitry develops and begins to function, science cannot directly determine the quality of a psychological response in any human subject, except by verbal report of the subjects themselves. As a scientist, it is impossible for me to know precisely how another adult, a teenager or a child experiences pain. In the case of the fetus, science can observe the behaviorial, hormonal and neurological responses to painful experiences, but it cannot determine the precise psychologic experience of the fetus.

3. I have provided for your consideration an update of the testimony I delivered in 2013 that includes 43 citations to new literature published in the last five years. This work covers large range of topics, including current research on consciousness, emotion and pain perception, all of which expand upon and confirm the conclusions of the original review.

Perhaps the most significant new information has been in the area of fetal viability and the consequences of painful experiences for extremely preterm infants. In the last five years, five independent studies have determined that between 23-60% of fetuses born at 20 weeks fetal age (22 weeks of pregnancy, as dated from the last menstrual period) survive if they are given appropriate medical treatment, many without immediate or long-term neurologic impairment. The current youngest surviving infant was born at 19 weeks, 5 days fetal age and, at 43 months of age, was reported to have a good neurologic outcome (https://www.ncbi.nlm.nih.gov/pubmed/29215809). The increase in survival of extremely pre-term infants has led to heightened concern regarding the long-term effects the many painful procedures these infants endure, with several recent reviews demonstrating adverse long-term consequences of repeated painful procedures on the neurodevelopment for infants born earlier than 27 weeks of age. One expert review unambiguously concludes that even for the youngest

preterm infants considered (those born at 22 weeks fetal age), “it is important that pain-related stress in preterm neonates is accurately identified, appropriately managed, and that pain management strategies are evaluated for protective or adverse effects in the long term.” (https://www.ncbi.nlm.nih.gov/pubmed/24500615). This clearly indicates that infants experience pain well prior to the point at which the Royal College of Obstetricians and Gynecologists assert pain is possible, and that painful experiences have severe long-term consequences on neurodevelopment that can be prevented by appropriate medications to reduce the suffering of the infant.

A second important finding of the last five years has been in the area of anesthesiology. At least seven independent studies have concluded that anesthesia is warranted in cases of fetal surgery, beginning well before the second trimester, with one author concluding 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.”

These recent studies clearly conclude that the fetus is capable of experiencing pain as early as the 13th week of life, that painful experiences can be relieved by appropriate analgesia and anesthesia and that repeated painful experiences have significant negative effects on long-term neurodevelopment.

4. My professional assessment is that the RCOG guidelines on Fetal Development 2010 presents an incomplete and inadequate analysis of the development of fetal pain response that does not provide accurate and complete information to parents and should not be used as the basis of medical practice.

5. Due to the inherent limitations in the ability of science to determine the psychological experience of the fetus or of any other human subject and to the personal nature of suffering, uncertainty regarding the precise psychological and emotional experience of the human fetus will undoubtedly persist. It may never be possible to scientifically determine whether the fetus experiences pain in the same manner as an infant, a child or an adult. Yet, as noted by Glover and Fisk in their 1999 review of fetal pain, in the absence of unambiguous evidence, the fetus should be given the benefit of the doubt. These authors stated:

“The eighteenth century philosopher, Jeremy Bentham, wrote of animals ‘The question is not Can they reason? not Can they talk? but Can they suffer?’ This caused a change in attitude towards animals and their treatment that is continuing today, such that in the UK, even frogs and fishes are required by Act of Parliament to be protected by anaesthesia from possible suffering due to invasive procedures. Why not human beings?”

The ample scientific evidence presented in my 2013 testimony and updated in the document provided to you clearly indicates that the circuitry required for conscious pain perception develops between 12 and 18 weeks in the human fetus and that late-developing neuronal

circuitry is not required for either consciousness or for suffering –a conclusion that is more than sufficient to require an answer to the question, “Why not human beings?”