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Fetal pain and its relevance to abortion policy

T. V. Salomons and G. D. Iannetti

In the case that led the Supreme Court to overturn Roe vs Wade, the State of Mississippi made the strong claim that fetuses can feel pain. We argue that critical biological evidence used to support this claim was misinterpreted and that the State's argument conflated pain and nociception. Abortion policy has profound moral and ethical consequences and therefore needs to be grounded in the most accurate scientific arguments, as well as a clear understanding of what we mean when we use the term pain.

On 24 June 2022, the US Supreme Court ruled on the Dobbs vs Jackson Women's Health Organization case challenging the state of Mississipi's law banning most abortions after the 15th week of pregnancy. In claiming that the court had no legal or historical right to overturn an individual state's abortion legislation, the court effectively overruled the 1973 Roe vs Wade and the 1992 Planned Parenthood of Southeastern Pennsylvania vs Casey decisions, precedents that had protected abortion rights across the US. For some, this landmark decision has fulfilled a moral imperative to protect life in whatever form it takes. For others, it represents nothing less than a patriarchal state giving itself authority over women's bodies.

Regardless of one's opinion of the ruling, one thing is clear: it will allow state legislators, who are answerable only to their voters, to ban or severely restrict abortions. As such, abortion policy in the US will come to be less reliant on legal arguments aimed at winning court cases and more reliant on rhetorical arguments aimed at winning elections. In such a climate, it is critical that when scientific evidence is invoked to support these arguments, scientists involved in this research actively engage with the public to ensure that appropriate conclusions are drawn from that evidence. It is within this context that we evaluate a key argument that was put forward in the defense of Mississippi's abortion ban, namely that fetuses can feel pain as early as 12 weeks after conception. As scientists whose work was invoked in the Dobbs case, we feel compelled to clarify the evidence that was used to support the state of Mississippi's claim that fetuses can feel pain.

Fetal pain claims appeal to the public's protective instinct

When we see someone in pain, we use our own experiences of pain to imagine what they are feeling, and provide the help that we would want in a similar situation[1]. Thus, if the public believes that a fetus feels pain, they will project their own experience of pain onto it and shelter it accordingly. By evoking the idea that fetuses might feel pain, the state is appealing to the public's protective instinct. Given that the Supreme Court's decision gives control of abortion policy to voters at the state level, we expect that the same emotional appeal will be presented to those voters.

Assessing evidence of whether fetuses can feel pain

Two assertions subserved the claim that fetuses feel pain. The first is that fetuses show behaviors indicative of pain. Given the private, subjective nature of pain experience, there is broad consensus among pain scientist and clinicians that the only way to truly confirm that an individual is in pain is for them to describe their experience of pain[2]. Unfortunately, not all sentient beings are capable of self-report. For this reason, there is an ongoing effort to identify alternative ways to judge the presence or absence of pain in animals and non-verbal humans (including infants and fetuses). One method for doing so is to observe behaviors that commonly occur when individuals report pain. These might include facial expressions, protection of an injured body part, or evasive actions to avoid a noxious stimulus. In making the case that fetuses can experience pain, the state of Mississippi presented behavioral evidence that fetuses are responsive to nociceptive stimulation. For example, during noxious surgical procedures fetuses show reflexive withdrawal responses, as well as facial expressions that may resemble those of adult humans experiencing pain[3,4].

While behavioral evidence is often all we have to judge pain in non-verbal humans and animals, it is not by itself sufficient to confirm the presence or absence of pain. The International Association for the Study of Pain (IASP) defines pain[5] as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage." This definition is supplemented by an addendum specifying that "pain and nociception are different phenomena." Nociception ("the neural process of encoding noxious stimuli") frequently precedes pain but is not necessary or sufficient for the complex sensory and emotional experience of pain. Behavioral responses (for example, motor withdrawal) may occur as consequences of nociception but, as the IASP points out, "pain sensation is not necessarily implied" by such responses[6]. Behavioral consequences of nociception are observed in simple invertebrates such as fruit flies[7], but these responses are not taken as indications of pain, as these organisms lack even the most rudimentary neural structures required for pain. Thus, considering whether the organism has the biological capacity to experience pain becomes crucial.

It is exactly for this reason that the state of Mississippi's case relies on a second assertion: that fetuses are biologically capable of experiencing pain as early as 12 weeks after conception. This assertion relies on what the state's petition refers to as "mounting evidence" that the cerebral cortex — which develops only at week 24 (ref. [8]) — is not necessary for pain. Much of this evidence comes from a 2020 article in the *Journal of Medical Ethics* entitled 'Reconsidering fetal pain'[9]. Given that key evidence cited in that article comes from our own first-hand empirical research, we feel obliged to clarify these claims. Is the assertion that the cerebral cortex is unnecessary for pain perception supported by the empirical evidence that has been considered?

The answer is a plain no. A basic scrutiny of the primary research sources is sufficient to demonstrate where this misunderstanding

came from. The studies cited were not designed to test whether the cerebral cortex is necessary for pain. Rather, they examined whether the 'pain matrix' – a widespread pattern of cortical and subcortical neural activity commonly observed in response to transient painful stimuli – is necessary or sufficient for the experience of pain. Activation in this set of regions was so ubiquitous in neuroimaging studies of pain that many considered this activation sufficient evidence that pain was occurring, leading to calls for pain matrix activation to be used as an 'objective' measure of pain in medical and legal settings[10,11]. Multiple papers questioned the specificity of these neural responses, including ours, in which we demonstrated that the pain matrix is activated in response to non-painful visual and auditory stimuli[12]. Perhaps even more compellingly, we demonstrated pain matrix activation in patients who are genetically incapable of experiencing pain (a rare condition called congenital insensitivity to pain)[13]. Although these works have been used in Mississippi's case to support the claim that the cortex is unnecessary for pain, they are in fact irrelevant to that assertion. These studies demonstrated that pain matrix regions are not specific to pain, not that they are uninvolved or unnecessary. A quote from one of these papers[12] directly addresses the state's misinterpretation of this evidence: "Importantly, our findings do not imply that the neural activities subserving the fMRI brain responses to nociceptive stimuli are not important for the experience of pain."

Evidence that more directly addresses the necessity of pain matrix regions for the experience of pain comes from a study that observed intact pain responses in an individual with extensive lesioning to key cortical and subcortical pain matrix regions, including the insular and anterior cingulate cortices[14]. While calling the necessity of specific brain regions for pain into question, this paper does not suggest that the cortex is unnecessary for pain. The patient in question had substantial sections of his cerebral cortex intact, including regions known to be involved in pain, such as primary and secondary somatosensory cortices and supplementary motor area. Furthermore, testing occurred nearly three decades after his original injury, leaving open the possibility that adaptive plasticity might have restored function despite damage to regions that are ordinarily critical for the experience of pain. Thus, while the evidence suggests that specific cortical regions might not be necessary for pain, they do not support broad conclusions about the necessity of the cerebral cortex such as those drawn by the state of Mississippi.

We conclude that the evidence presented by Missisippi's legal team is not sufficient to overturn the long-standing consensus that the cortex is necessary for pain experience, and that before cortical development a fetus is therefore incapable of feeling pain. This conclusion is shared by the United States Association for the Study of Pain and the 25 other pain scientists who joined us in signing an amicus brief to counter the state of Mississippi's claims that fetuses can experience pain in the second trimester[15].

Conclusion

We look forward to continuing to participate in a vigorous evidence-based debate over the neuroanatomical substrates of pain. But it should be made clear that such a debate is rooted not only in anatomy and physiology, but also in how one chooses to define pain. The state of Mississippi's case presents clear evidence that fetuses are capable of nociception. This would be sufficient evidence if we were to use a definition cited by the state at the District Court level: "pain is an aversive response to a 'noxious' (physically harmful or destructive) stimulus"[3]. Such responses would not be sufficient, however, using the IASP's definition cited above, to which we and the overwhelming majority of basic and clinical pain scientists adhere[5]. In addition to specifying that "pain and nociception are different phenomena" the IASP acknowledges the complexity of human pain by stating that pain is learned though life experience and influenced by "biological, psychological, and social factors"[5]. In humans with full cortical maturity, pain is not a simple sensory signal or motor imperative. It is also a complex emotion influenced not only by the unpleasantness of the perceptual experience, but also by its meaning for us and those around us. Our pain experience may include fears for our own safety, or worries about whether pain will prevent us from jogging, enjoying friendships, or providing for our families. Whether or not we choose to call the fetus' nociceptive response 'pain'[16], one thing is beyond debate: it is not the same as what a fully developed human feels.

Just because a fetus can't feel what we feel doesn't mean it feels nothing, or that we can wash our hands of ethical and moral obligations. What it means is that those who would compel a woman to carry a fetus to term so it won't feel pain must be clear about what they mean when they talk about pain. They can't ascribe pain to a fetus using criteria that would equally apply to a fish or a fruit fly, but then ask the public to project their own experience of pain on that same fetus. Fully developed humans have a cortex to process nociceptive input, and to associate that input with adaptively relevant sensory, cognitive, emotional, and social information. As we develop, these associations come to form the experience adults know as pain. Before cortical maturation, a fetus doesn't have the biological equipment to begin learning those associations.

Abortion policy has profound moral and ethical consequences. For this reason, it has to be grounded in the most accurate scientific arguments. It is also inevitably influenced by emotional arguments. Both are important, but they should not be conflated. Evidence supports the claim that a pre-viable fetus is capable of nociception. Any suggestion that it feels the same pain that a cortically mature human feels, however, is an emotional appeal that runs counter to what we know about the brain and how it generates complex subjective experiences.

T. V. Salomons[1] ✉ **and G. D. Iannetti**[2,3] ✉

[1]Department of Psychology, Queen's University, Kingston, Ontario, Canada. [2]Neuroscience and Behaviour Laboratory, Istituto Italiano di Tecnologia, Rome, Italy. [3]Department of Neuroscience, Physiology and Pharmacology, University College London, London, UK.
✉e-mail: tim.salomons@queensu.ca; giandomenico.iannetti@iit.it

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The authors declare no competing interests.

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