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## **The UK's Animal Welfare (Sentience) Bill Excludes the Vast Majority of Animals: Why We Must Expand Our Moral Circle to Include Invertebrates**

The great 13<sup>th</sup>-century Persian poet Sa' dī ([1257] 1902, 12655) wrote:

“How sweet are the words of the noble Firdausi, upon whose grave be the mercy of the Benignant One!— ‘Crush not yonder [ant] as it draggeth along its grain; for it too liveth, and its life is sweet to it.’ A shadow must there be, and a stone upon that heart, that could wish to sorrow the heart even of an [ant]!”

Eight hundred years later, UK animal welfare legislation still hasn't caught up with the inclusive moral vision of these noble medieval poets.

Article 13 of the Lisbon Treaty explicitly recognises animals as sentient beings, enshrining – more theoretically than practically – the recognition of animal sentience in EU law. Even prior to Brexit, however, the UK mostly did not apply this recognition to invertebrate animals, who constitute approximately 99.9998% of all animals on our planet (Bar-On, Phillips and Milo, 2018). This amounts to a gargantuan number of individual lives: Bar-On et al.'s (ibid.) major study estimated that there are around a *sextillion* (a trillion billion or  $10^{21}$ ) invertebrate animals on Earth at any given moment. According to other estimates, the number of individual invertebrate animals may be closer to *ten sextillion* (i.e.  $10^{22}$  - Tomasik, 2009; Ray, 2017), *or even several orders of magnitude higher than this* (Ray, ibid.). Our planet is teeming with neglected, mistreated and suffering life. There is no clearer example of the inconstancy of prevailing human “ethics” than the fact that it spares no thought for the well-being of the vast majority of non-human animals.

In addition to failing to challenge the continued infliction of immense violence and suffering against countless vertebrate animals, the government's Animal Welfare (Sentience) Bill, now in its report stage in the House of Lords, also excludes *all invertebrate animals* from even the slightest ethical consideration. In other words, the Animal Welfare (Sentience) Bill provides no protection and gives no moral consideration to at least around 99.9998% of non-human animals!

This is convenient from the tyrannical standpoint of the Earth's dominator species, which tends to empathise more readily with those more like itself. Invertebrate animals are the ultimate “Others” whose feelings are not taken into account and who are therefore nullified/rendered non-existent in prevailing human systems of “morality”, according to which might is usually right. The idea that we have a moral obligation to treat crustaceans, insects and other invertebrate fellow Earthlings with compassion is still commonly met with dismissal and derision.

So was the idea that horses deserve moral consideration when Richard Martin, the MP for Galway, introduced the Ill Treatment of Horses Bill in 1821. The idea of outlawing cruelty to horses was met with laughter in the House of Commons, his fellow MPs remarking that such a bill would, absurdly, lead to legislation against cruelty to dogs and cats (Legge and Brooman, 2000)! It has always taken moral courage to advocate ethical consistency by expanding the circle of compassion to include the excluded and nullified beings. Society's moral circle has been expanding for millennia, leading to increasing compassion for non-human animals and increasing legal protections for them. There is no valid reason to suppose that this process cannot continue now and in the future. Many people already seek humane ways of dealing with insects, for example (e.g. Dowling, 2021).

Currently, however, even the very few invertebrate animals – such as octopuses – who have long been granted the status of “honorary vertebrates” (Barnes, 2021) in laws on animal experimentation on account of their particularly high cognitive abilities, are omitted from the proposed legislation, which is to say that these sensitive beings are still being relegated to the status of *things* as far as the government’s proposed legislation is concerned.

### **Minds without Spines**

As the philosopher of science and bioethics Irina Mikhalevich (2018) has also pointed out, human moral judgment and treatment of “minds without spines” (ibid.) are inconsistent with the extensive evidence about invertebrate sentience (see Animal Ethics, n.d.), and are distorted by false human beliefs and cognitive biases against the inclusion of invertebrates into the circle of moral consideration.

In *Measure for Measure* William Shakespeare ([1603] 1803, 396) wrote: “The poor beetle, that we tread upon, / In corporal sufferance finds a pang as great /As when a giant dies”. In fact, the renowned evolutionary biologist Richard Dawkins (2017) has even posited that, since pain exists to warn the animal to avoid damaging situations, less intelligent animals may have evolved to feel more intense pain than humans because it would have adaptive value as a survival advantage that may help to compensate for their lack of higher intelligence.

In a study published in the *Proceedings of the National Academy of Sciences of the United States*, Barron and Klein (2016) concluded that “the insect brain also supports a capacity for subjective experience”. Furthermore, researchers have found that insects can experience not only acute but chronic pain as well (Daley, 2019), prompting *Newsweek* to point out in the title of its article about the study that “Injuring a Fly May Condemn It to a Lifetime of Pain, Scientists Find” (Osborne, 2019)<sup>1</sup>.

It has also been discovered that insects are capable of performing fairly complex cognitive tasks. Ants, for example, can even recognise themselves in a mirror (Cammaerts, 2020), and bumblebees can learn to use tools (American Association for the Advancement of Science, 2017). Yet, in the immortal words of the moral philosopher Jeremy Bentham from his book *An Introduction to the Principles of Morals and Legislation* published in 1789, “the question is not, Can they reason?, nor Can they talk? but, Can they suffer? Why should the law refuse its protection to any sensitive being?” (Bentham, [1789] 1948, 310-11).

In his 1872 book *The Expression of Emotions in Man and Animals*, Charles Darwin ([1872] 1965, 349) wrote that insects “express anger, terror, jealousy and love”. More recently, the leading neuroscientist Antonio Damasio (2016) has stated that “feeling implies the presence of a mind and a mental experience, [or] consciousness (...). I have every reason to believe that invertebrates not only have emotions but also the possibility of feeling those emotions”. Indeed, eminent scientists have explicitly concluded that excluding small-brained invertebrates such as insects from bioethics is not justified by the available scientific evidence but is rather a product of bias (Baracchi and Baciadonna, 2020).

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<sup>1</sup> Furthermore, there is evidence that smaller animals and animals with a faster metabolic rate generally have the perception of time passing more slowly, which is another factor that may increase – or at least prolong – their experience of suffering (Healy et al., 2013). A contributing factor to the discrimination of insects and other very small invertebrates is precisely their size. To give a prominent example, humans find it easier to ignore animals writhing in agony if it is harder to see them.

There is evidence to suggest that sentience is such an ancient phenomenon in the evolution of life that it extends beyond cephalopod animals such as octopuses, beyond crustaceans such as crabs and lobsters, and beyond social insects such as ants and bees, who have been found to have emotions as well (Benson, 2016; see also Schukraft, 2019). Other invertebrates such as other insects, snails, nematodes, and even the tiny mites – who possess a central nervous system and a brain (Colloff, 2010) – may also be capable of experiencing pain and suffering<sup>2</sup>. Responses to noxious signals generated by neurons and neuronal circuits have been identified in nematodes and in fruit flies as well (Tobin and Bargmann, 2004). Unsurprisingly considering its potential utility in the pursuit of self-preservation, anxiety appears to be one of the most primitive and ancient of emotions. Indeed, there is evidence that it is shared by invertebrates as diverse as crayfishes (Fossat et al., 2014) and fruit flies (Asian Scientist Newsroom, 2016).

### **Developing a Consistent Ethics of Nonviolence**

A consistent ethics of nonviolence would be informed by the amount of total suffering on Earth today, the vast majority of which – as the aforementioned extensive evidence points out – is happening to sentient, feeling invertebrate beings. The consequence of ignoring the sentience of beings that have experiences – including invertebrate animals – is the infliction of an unfathomably vast amount of suffering.

Even in cases of invertebrate animals where there may be a lack of evidence to support the conclusion that they are sentient, the precautionary principle still needs to be applied, especially considering the unfathomable vastness of their numbers (see Birch, 2017). In other words, we are obligated to give them the benefit of the doubt. That is the morally decent thing to do. Gambling with the possibility of inflicting avoidable suffering on sextillions of individual beings is a moral disaster<sup>3</sup>.

Several countries have made initial institutional steps to move beyond vertebrate chauvinism. New Zealand introduced some basic protections for cephalopods and some crustaceans 22 years ago (Animal Welfare Act 1999). Switzerland, Norway, Austria, some Australian states and territories, as well as some regions of Italy and Germany have since followed suit (Crustacean Compassion, 2018) with legislation offering some very basic protections – such as against being boiled or frozen alive – to some decapods (an order of crustaceans which includes crabs, lobsters and prawns) and cephalopods (including squids and octopuses). The UK has failed to provide even such minimal protections. Jason

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<sup>2</sup> Some scientists (e.g. Reber, 2016; Reber and Baluška, 2021) have argued that even the simplest unicellular prokaryotes possess at least some rudimentary type of sentience.

<sup>3</sup> The Many-Worlds Interpretation of quantum mechanics, which argues that the wave-function decoheres into vast numbers of separate branches of the Multiverse – i.e. that “random quantum processes cause the universe to branch into multiple copies, one for each possible outcome” (Tegmark, 2003, 46) – implies that the amount of suffering of sentient beings is unfathomably greater than these already vast numbers would suggest. Consequently, it appears that the key ethical implication of this formulation of quantum mechanics – which is very contentious yet is among the most widely supported interpretations of quantum mechanics among contemporary physicists (Schlosshauer, Kofler and Zeilinger, 2013; Wallace, 2013) – is to further augment and underscore the profound ethical importance of focusing on thoughtful, compassionate, beneficent action that aims to achieve the greatest possible reduction of suffering, even though there is a divergence of views about the type of focus this beneficent orientation should pursue in light of this particular theory of the physical world (see for example Pearce, 2015; Vinding, 2018).

Schukraft (2019) has pointed out that if a ban on boiling crustaceans alive was introduced across the entire EU, “it would spare billions of animals from what appears to be an extremely painful death”.

Researchers have long ago found strong evidence that crustaceans feel pain (Sample, 2007). Already in 1982 it was discovered that the injection of morphine-HCL in the crustacean mantis shrimp *Squilla* mantis produces dose-dependent pain relief (Maldonado and Miralto, 1982). The weight of evidence that decapod crustaceans are sentient has continued to increase since then, and it is compelling (Crustacean Compassion, n.d. - a).

Eleven years ago, the EU recognised the sentience of cephalopod invertebrates (including squids, octopuses, cuttlefishes and nautilus) in its Directive 2010/63/EU concerning the treatment of animals:

“In addition to vertebrate animals including cyclostomes, cephalopods should also be included in the scope of this Directive, as there is scientific evidence of their ability to experience pain, suffering, distress and lasting harm.”

The EU Directive no longer applies to the UK, yet the science has not changed: these animals did not lose their sentience due to Brexit. The UK government claimed that Brexit would lead to better treatment of animals, but it is now falling behind EU standards of animal protection, which are themselves devastatingly weak in many respects. The legal situation is also deeply contradictory because there is some general wording in The Welfare of Animals at the Time of Killing (England) Regulations 2015 (as well as in regulations in Wales and Northern Ireland, but not in Scotland) and in The Welfare of Animals (Transport) (England) Order 2006 (as well as in regulations in Wales and Northern Ireland, but again not in Scotland) which – in theory – provides some basic legal protections to invertebrates, though only to cold-blooded invertebrates in the case of The Welfare of Animals (Transport) Orders. The Animal (Scientific Procedures) Act – which was passed in 1986 – also continues to provide some protection to cephalopods, whose sentience the draft legislation does not recognise.

Yet, despite the aforementioned research and some very basic and poorly enforced protections, even the few “honorary vertebrates” in practice continue to be treated with unmitigated cruelty. Lobsters, for example, are routinely boiled alive or simply dismembered while still alive (Crustacean Compassion, 2021). These kinds of methods were identified as inhumane by the European Union’s Scientific Panel on Animal Health and Welfare already in 2005 (AHAW, 2005).

The law also permits other kinds of extreme cruelty. In 2015, “a supermarket in Surrey was found to be selling live crabs shrink-wrapped in plastic”, immobilised and slowly suffocating (Icard-Stoll, 2018). Amazon has been selling “live lobsters for delivery to customers through [the] post” (Barnes, 2018). The wretched creatures can “spend up to a week in the post” before being delivered to their killers (ibid.).

The laws are extraordinarily unjust and inhumane as well as legally inconsistent. Fundamental inconsistencies are actually routine in UK “animal welfare” legislation: vertebrate aquatic animals, for example, have long been recognised as sentient in UK law, yet *billions* of them are subjected to extreme violence and torment by UK fishing fleets, even without any regulations to reduce the suffering of wild-caught vertebrate aquatic animals during capture and “processing” (Wildlife and Countryside Link and the UK Centre for Animal Law, 2018). The report “brought together through [the] Wildlife and Countryside Link and the UK Centre for Animal Law” (ibid., 20) remarked that vertebrate aquatic animals are “pursued to exhaustion by nets; crushed under the weight of other fish in

trawl nets; raised from deep water and suffer decompression effects e.g. burst swim bladders; snared in gill nets; confined in constricted seine nets; caught on hooks. In many types of fishing, the duration of capture can be very long, lasting hours or even days. Fish often die or are fatally injured during this process. Once landed, most fish are either left to asphyxiate, or die during further processing, which may include gutting, filleting and/or freezing while alive and conscious”.

Such practices were unaffected by Britain’s EU membership, although they radically contravened the Lisbon Treaty’s agreement that “the Union and the Member States shall, since animals are sentient beings, pay full regard to the welfare requirements of animals”. When the first principle is actually human selfishness, loftier principles and declarations are marginalised or altogether discarded. In fact, wherever animals are treated as goods or commodities, their interests are violated.

For those who care about animals there are many reasons to be alarmed about the draft legislation. For example, Michael Radford (2021), Reader in Animal Welfare Law and UK Constitutional Law at the University of Aberdeen, has pointed to a series of problems regarding the proposed Animal Sentience Committee and its proposed unambitious character and marginal role, which indicate that it is likely to loiter in passivity and powerlessness.

### **A High-Tech “Peaceable Kingdom”**

Tragically, the proposed legislation fails to show vision and real commitment to the well-being of animals. If we are to be consistent in pursuing harm reduction, we must strive to avoid doing things that inflict – or even *may* inflict – pain and suffering on them. Apropos invertebrates this also entails a clear rejection of brutal practices such as insect farming and silk production, since silkworms are boiled alive inside their cocoons so that humans can extract silk from them. It is feared that insect farms may soon be *killing more than 50 trillion insects a year* (Sebo and Schukraft, 2021).

A deeper commitment to compassionate treatment also requires of us to consider ways in which we may be able to aid defenceless invertebrate creatures. Seemingly more intractable problems present a longer-term challenge. However, rapid scientific and technological change is helping to enable increasingly radical developments to become feasible in the future, such as eliminating animal predation through genetic engineering based on the emerging gene drive technology, as the transhumanist philosopher David Pearce (n.d. - a) and the MIT biologist Kevin Esvelt (2019) have argued.

There is a need for meticulous research into the many complexities of how to reduce the amount of invertebrate suffering. Yet the contours of the way forward are becoming clearer thanks to the aforementioned technological advancements, as well as other helpful insights. As Brian Tomasik (2015) has pointed out, it is quite clear that the humane, carefully planned and controlled reduction in the numbers of invertebrates would be a particularly effective way of reducing their suffering. Effective methods of freeing them from their sore travails could therefore include the spreading of ecosystems that produce less animal suffering (Tomasik, *ibid.*), developing and promoting painless, humane forms of cross-species fertility regulation (Pearce, n.d. - b), sterilisation and euthanasia (Tomasik, 2018) specifically for the purpose of reducing suffering, while banning cruel methods such as the use of neurotoxins which cause prolonged dying. A number of possible large-scale interventions that could vastly reduce suffering are already well-established and have been proven to be very effective at controlling population numbers (Waldhorn, 2019). Artificial Intelligence can assist in the conceptualisation and implementation of existing and new interventions to reduce suffering, but it also

carries its own grave risk of creating immense suffering and even existential peril for humanity itself (e.g. Hawking et al., 2014; Russell, 2021).

The development and implementation of advanced suffering-reducing approaches to dealing with invertebrate beings may not even be particularly expensive. However, we must pursue harm reduction because behaving ethically towards countless other sentient creatures is the right thing to do – even when it is very difficult.

One of the major tasks ahead for effective altruists is to attain far greater and more detailed understanding of the best strategies for humane interventions into highly complex ecosystems and animal population dynamics with the aim of minimising both individual and total suffering. Benevolent actions can lead to extremely negative unintended consequences, which is why there is a need for meticulous thinking and research about possible interventions and their effects.

Another major investment in the development of a truly compassionate civilisation would be the introduction of humane education in schools, teaching children the value of justice, kindness and care towards all sentient, feeling beings. There is some evidence that cultivating children's kindness to animals also has a significant generalising positive effect, increasing the likelihood of more compassionate interpersonal attitudes and more amiable relationships with their peers (Unti and DeRosa, 2003). Teaching children kindness to animals can help them to become kinder, more peaceable humans.

There is broad public support for expanding animal protection beyond the scope of the proposed legislation. According to a UK national survey conducted by the non-profit research organisation Rethink Priorities (2021), the majority of “participants agreed that lobsters (83.03%), octopuses (80.65%), and crabs (78.09%) can feel pain”, and 91.06% “of participants agreed that if scientific experts believe there is some evidence that an animal could be capable of feeling pain, we should be careful about potentially harming them”. Despite receiving relatively little publicity, Crustacean Compassion's petition to include decapod crustaceans in animal protection laws has received over 57,000 signatures (Crustacean Compassion, n.d. - b). Many eminent experts and public figures, as well as 42 animal rights and welfare organisations, the RSPCA and the British Veterinary Association, have joined this call.

Despite its fundamentally limited and impoverished approach focused on regulating rather than overcoming speciesist violence, exploitation and neglect, the current legislative process presents a historic opportunity to secure significant improvements to the Animal Welfare (Sentience) Bill. Crucially, this needs to include extending the recognition of sentience and of our attendant ethical obligations beyond only vertebrate animals. Expanding our moral circle to encompass all of our sentient, suffering fellow creatures – regardless of their size, their species and of whether they have spines – would help to prevent and mitigate vast amounts of suffering and harm, while simultaneously helping to culturally elevate humanity. It would help us to move towards a more ethically evolved society, a new culture of peace and nonviolence in which unbounded compassion and kindness would be our guiding lights.

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## References

AHAW (Scientific Panel on Animal Health and Welfare), *Opinion of the Scientific Panel on Animal Health and Welfare on a Request from the Commission Related to “Aspects of the Biology and Welfare of Animals Used for Experimental and Other Scientific Purposes”*, The EFSA Journal, Vol. 3, No. 12, 2005, [http://ec.europa.eu/environment/chemicals/lab\\_animals/pdf/efsa\\_opinion.pdf](http://ec.europa.eu/environment/chemicals/lab_animals/pdf/efsa_opinion.pdf)

American Association for the Advancement of Science, *Bees Can Learn to Use a Tool by Observing Others*, EurekAlert!, 23 February 2017, <http://www.eurekalert.org/news-releases/724673>

Animal Ethics, *Invertebrate Sentience: A Review of the Neuroscientific Literature*, n.d. (accessed on 9 October 2021), <http://www.animal-ethics.org/sentience-section/animal-sentience/invertebrate-sentience-a-review-of-the-neuroscientific-literature>

Animal (Scientific Procedures) Act 1986, <http://www.legislation.gov.uk/ukpga/1986/14>

Animal Welfare Act 1999, <http://www.legislation.govt.nz/act/public/1999/0142/latest/DLM49664.html>,

Asian Scientist Newsroom, *Flies Experience Anxiety, Too*, Asian Scientist, 25 March 2016, <http://www.asianscientist.com/2016/03/in-the-lab/flies-experience-anxiety>

Baracchi, D. and Baciadonna, L., *Insect Sentience and the Rise of a New Inclusive Ethics*, Animal Sentience, Vol. 29, No. 18, 2020, <http://www.wellbeingintlstudiesrepository.org/cgi/viewcontent.cgi?article=1604&context=animsent>

Barnes, S., *The Ethics of Eating Octopus*, The Spectator, 16 January 2021, <http://www.spectator.co.uk/article/the-ethics-of-eating-octopus>

Barnes, T., *Amazon Offers Live Lobsters for Delivery to Customers Through Post*, The Independent, 4 February 2018, <http://www.independent.co.uk/news/uk/home-news/amazon-live-lobster-delivery-post-online-shop-buy-animals-cruelty-a8193591.html>

Bar-On, Y. M., Phillips, R. and Milo, R., *The Biomass Distribution on Earth*, Proceedings of the National Academy of Sciences of the United States of America, Vol. 115, No. 25, 2018, <http://www.pnas.org/content/pnas/suppl/2018/07/13/1711842115.DC1/1711842115.sapp.pdf>

Barron, A. B. and Klein, C., *What Insects Can Tell Us About the Origins of Consciousness*, Proceedings of the National Academy of Sciences of the United States of America, Vol. 113, No. 18, 3 May 2016, <http://www.pnas.org/content/113/18/4900>

Benson, E., *Don't Worry, Bee Happy: Bees Found to Have Emotions and Moods*, New Scientist, 29 September 2016, <http://www.newscientist.com/article/2107546-dont-worry-bee-happy-bees-found-to-have-emotions-and-moods/#ixzz78lGa8zdm>

Bentham, J., *An Introduction to the Principles of Morals and Legislation* [1781], Hafner, New York, 1948

Birch, J., *Animal Sentience and the Precautionary Principle*. Animal Sentience, Vol. 16, No. 1, 2017, <http://www.wellbeingintlstudiesrepository.org/cgi/viewcontent.cgi?article=1200&context=animsent>

Cammaerts, M.-C., *Invertebrates Should Be Given Ethical Consideration*, Animal Sentience, Vol. 29, No. 6, 2020, <http://www.wellbeingintlstudiesrepository.org/cgi/viewcontent.cgi?article=1587&context=animsent>

Colloff, M. J., *Dust Mites*, Springer Netherlands, Dordrecht, 2010

Crustacean Compassion, *Open Letter*, Crustacean Compassion, 2018, <http://www.crustaceancompassion.org.uk/open-letter>

Crustacean Compassion, *Written Evidence Submitted by Crustacean Compassion in Response to the EFRA Select Committee Call for Evidence on the Animal Welfare (Sentience) Bill*, Environment, Food and Rural Affairs Select Committee, House of Commons, June 2021, [http://committees.parliament.uk/writtenevidence/37671/html/#\\_edn15](http://committees.parliament.uk/writtenevidence/37671/html/#_edn15)

Crustacean Compassion, *The Case for the Legal Protection of Decapod Crustaceans*, Crustacean Compassion, n.d. - a (accessed on 9 October 2021), [http://8fd525d4-663c-4ad2-9429-d18b1bfe5cb1.filesusr.com/ugd/46ca59\\_7411260d5ec0448aa40ceefd9f7110bb.pdf?index=true](http://8fd525d4-663c-4ad2-9429-d18b1bfe5cb1.filesusr.com/ugd/46ca59_7411260d5ec0448aa40ceefd9f7110bb.pdf?index=true)

Crustacean Compassion, *Petition: Protect Crabs and Lobsters from Pain under the Animal Welfare Act 2006 (England and Wales)*, Change.org, n.d. - b (accessed on 9 October 2021), <http://www.change.org/p/george-eustice-mp-protect-crabs-and-lobsters-under-the-animal-welfare-act-england-and-wales-by-crustacean-compassion>



Daley, J., *Study Finds Insects Can Experience Chronic Pain*, Smithsonian Magazine, 16 July 2016, <http://www.smithsonianmag.com/smart-news/insects-can-experience-chronic-pain-study-finds-180972656>

Damasio, A., in Goldman, J. G., *I'll Bee There for You: Do Insects Feel Emotions?*, Scientific American, 30 September 2016, <http://www.scientificamerican.com/article/i-ll-bee-there-for-you-do-insects-feel-emotions/>

Darwin, C., *The Expression of the Emotions in Man and Animals* [1872], University of Chicago Press, Chicago, 1965

Dawkins, R., *Richard Dawkins: No Civilized Person Accepts Slavery So Why Do We Accept Animal Cruelty?* / *Big Think*, Talk on YouTube, 2 September 2017, [http://www.youtube.com/watch?v=\\_4SnBCPzBI0](http://www.youtube.com/watch?v=_4SnBCPzBI0)

Directive 2010/63/EU of the European Parliament and of the Council of 22 September 2010 on the Protection of Animals Used for Scientific Purposes, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:276:0033:0079:en:PDF>

Dowling, T., *Spare that Flea! How to Deal Humanely with Every Common Household Pest*, The Guardian, 5 July 2021, <http://www.theguardian.com/lifeandstyle/2021/jul/05/spare-that-flea-how-to-deal-humanely-with-every-common-household-pest>

Esvelt, K., *When Are We Obligated To Edit Wild Creatures?*, Leaps.org, 30 August 2019, <http://leaps.org/when-are-we-obligated-to-edit-wild-creatures>

Fossat, P., Bacqué-Cazenave, J., De Beurwaerdère, P., Delbecque, J.-P., Cattaert, D., *Anxiety-like Behavior in Crayfish Is Controlled by Serotonin*, Science, Vol. 344, No. 6189, 13 June 2014, <http://www.science.org/doi/abs/10.1126/science.1248811>

Hawking, S., Russell, S., Tegmark, M., Wilczek, F., Stephen Hawking: *'Transcendence Looks at the Implications of Artificial Intelligence - but Are We Taking AI Seriously Enough?'*, The Independent, 1 May 2014, <http://www.independent.co.uk/news/science/stephen-hawking-transcendence-looks-at-the-implications-of-artificial-intelligence-but-are-we-taking-ai-seriously-enough-9313474.html>

Healy, K., McNally, L., Ruxton, G. D., Cooper, N. and Jackson, A. L., *Metabolic Rate and Body Size Are Linked with Perception of Temporal Information*, Animal Behaviour, Vol. 86, No. 4, October 2013

Icard-Stoll, C., *A Compelling Case For Crustacean Compassion*, Faunalytics, 15 October 2018, <http://faunalytics.org/a-compelling-case-for-crustacean-compassion>

Legge, D. and Brooman, S., *Law Relating to Animals*, Cavendish Publishing, London and Sydney, 2000

Maldonado, H. and Miralto, A., *Effect of Morphine and Naloxone on a Defensive Response of the Mantis Shrimp (Squilla Mantis)*, *Journal of Comparative Physiology*, Vol. 147, No. 4, December 1982, <http://doi.org/10.1007/BF00612010>

Mikhalevich, I., *Minds Without Spines: Toward a More Comprehensive Animal Ethics*, Seminar at the Oxford Uehiro Centre for Practical Ethics, University of Oxford, 2018, <http://podcasts.ox.ac.uk/minds-without-spines-toward-more-comprehensive-animal-ethics>

Osborne, H., *Injuring a Fly May Condemn It to a Lifetime of Pain, Scientists Find*, *Newsweek*, 16 July 2019, <http://www.newsweek.com/injuring-fly-lifetime-chronic-pain-1449436>

Pearce, D., *Quantum Ethics? Suffering in the Multiverse*, 2015, BLTC Research, <http://www.hedweb.com/population-ethics/quantum-ethics.html>

Pearce, D., *Conservation Biology versus Compassionate Biology*, The Abolitionist Project, n.d. - a (accessed on 9 October 2021), <http://www.abolitionist.com/reprogramming/compassionate-biology.pdf>

Pearce, D., *Compassionate Biology: How CRISPR-based “Gene Drives” Could Cheaply, Rapidly and Sustainably Reduce Suffering Throughout the Living World*, The Abolitionist Project, n.d. - b (accessed on 9 October 2021), <http://www.hedweb.com/gene-drives/index.html>

Radford, M., *Animal Sentience – Job Part Done: A Perspective on the Animal Welfare (Sentience) Bill*, 14 May 2021, UK Centre for Animal Law, <http://web.archive.org/web/20210515093920/https://www.alaw.org.uk/2021/05/animal-sentience-job-part-done-a-perspective-on-the-animal-welfare-sentience-bill-from-mike-radford-reader-in-animal-welfare-law-uk-constitutional-law>

Ray, G., *How Many Wild Animals Are There?*, Wild Animal Suffering Research, 2017, <http://web.archive.org/web/20210413145324/https://was-research.org/writing-by-others/many-wild-animals>

Reber, A. S., *Caterpillars, Consciousness and the Origins of Mind*, Animal Sentience, Vol. 11, No. 1, 2016

Reber, A. S. and Baluška, F., *Cognition In Some Surprising Places*, Biochemical and Biophysical Research Communications, Vol. 564, 30 July 2021, <http://www.sciencedirect.com/science/article/abs/pii/S0006291X20317204>

Rethink Priorities, *Submission of Evidence to Animal Welfare (Sentience) Bill*, Environment, Food and Rural Affairs Committee, UK Parliament, 2021, <http://committees.parliament.uk/writtenevidence/37632/pdf>

Russell, S., *The Biggest Event in Human History*, 1<sup>st</sup> of the “Living with Artificial Intelligence” Reith Lectures, Alan Turing Institute at the British Library in London, BBC, 2021, <http://www.bbc.co.uk/programmes/m001216j>

Sa‘dī, *Garden of Perfume* [1257] (translated by Samuel Robinson), in Warner, C. D. et al., *The Library of the World’s Best Literature: An Anthology in Thirty Volumes*, Vol. XXXII, Warner Library Co., New York, 1917, <http://archive.org/details/libraryofworldsb32warn/mode/2up>

Sample, I., *Blow for Fans of Boiled Lobster: Crustaceans Feel Pain, Study Says*, The Guardian, 8 November 2007, <http://www.theguardian.com/science/2007/nov/08/animalrights.sciencenews>

Schlosshauer, M., Kofler, J., and Zeilinger, A., *A Snapshot of Foundational Attitudes Toward Quantum Mechanics*, Studies in History and Philosophy Science Part B: Studies in History and Philosophy of Modern Physics, Vol. 44, No. 3, 2013

Schukraft, J., *Invertebrate Welfare Cause Profile*, Rethink Priorities, 9 July 2019, <http://rethinkpriorities.org/publications/invertebrate-welfare-cause-profile>

Sebo, J. and Schukraft, J., *Don’t Farm Bugs*, Aeon, 27 July 2021, <http://aeon.co/essays/on-the-torment-of-insect-minds-and-our-moral-duty-not-to-farm-them>

Shakespeare, W., *Measure for Measure* [1603], in *The Plays of William Shakespeare*, Vol. VI, London, 1803, <http://archive.org/details/playsofwilliamsh06shak/mode/2up>

Tegmark, M., *Parallel Universes*, Scientific American, May 2003

Tobin, D. M. and Bargmann, C. I., *Invertebrate Nociception: Behaviors, Neurons and Molecules*, Journal of Neurobiology, Vol. 61, No. 1, October 2004, <http://pubmed.ncbi.nlm.nih.gov/15362159>

Tomasik, B., *How Many Wild Animals Are There?*, Essays on Reducing Suffering, 2009, <http://reducing-suffering.org/how-many-wild-animals-are-there>

Tomasik, B., *The Importance of Wild-Animal Suffering*, Relations. Beyond Anthropocentrism, Vol. 3, No. 2, November 2015, <http://www.ledonline.it/index.php/Relations/article/view/880/717>

Tomasik, B., *Humane Insecticides*, Essays on Reducing Suffering, 2018, <http://reducing-suffering.org/humane-insecticides>

Unti, B. and DeRosa, B., *Humane Education: Past, Present, and Future*, in Salem, D. J. and Rowan, A. N. (eds.), *The State of the Animals II*, Humane Society Press, Washington DC, 2003

Vinding, M., *Why the Many-Worlds Interpretation May Not Have Significant Ethical Implications*, 2018, <http://magnusvinding.com/2018/11/02/why-many-worlds-may-not-have-significant-implications>

Waldhorn, D. R., *Next Steps in Invertebrate Welfare, Part 2: Possible Interventions*, Rethink Priorities, 13 November 2019, <http://rethinkpriorities.org/publications/next-steps-in-invertebrate-welfare-part-2-possible-interventions>

Wallace, D., *The Everett Interpretation*, in Batterman, R. (ed.), *The Oxford Handbook of Philosophy of Physics*, Oxford University Press, New York, 2013

Wildlife and Countryside Link and the UK Centre for Animal Law (A-Law), *Brexit: Getting the Best Deal for Animals*, January 2018, [http://www.wcl.org.uk/docs/Link\\_A-Law\\_Brexit\\_Animal\\_Welfare\\_160118.compressed.pdf](http://www.wcl.org.uk/docs/Link_A-Law_Brexit_Animal_Welfare_160118.compressed.pdf)