No credible consciousness without critical thinking

In their essay, 'The ubiquity of consciousness', Trewavas and Baluska ask "on what experimental evidence, other than supposition, do we reject consciousness in other organisms?" [1]. The authors use some examples of adaptive behavioural responses of animals and plants to argue that consciousness is everywhere. Their ambition to approach the question of consciousness without bias is brave, but in our opinion not convincing. We argue that this uncritical approach is not useful to elucidate the phenomenon of consciousness.

The question of which types of organism have consciousness is of special interest for researchers in our field, animal welfare. In particular, sentience—the capacity for experiencing pleasure and pain—is of central importance. Evidence from new research in combination with societal discussions is shifting the frontiers between (presumed) sentient and (presumed) non-sentient organisms. As such, it is essential that assumptions about sentience or its absence are made on the basis of critical reasoning and appropriately used terminology.

By describing any kind of adaptive behavioural response as a sign of consciousness, self-awareness and intention, the authors empty these concepts of meaning. To understand consciousness we do not need a wider definition but a clear reasoning about what it is and what evidence we should be looking for in non-human beings. There are various and different sources of evidence, as research on consciousness is spread across many different fields with widely varying research paradigms. To understand consciousness it is helpful to consider opinions on its definition and prevalence from the fields of neurobiology, cognitive psychology, ethology and philosophy.

The first problem is a lack of a clear definition. It is generally considered that there are several levels of consciousness that range from the ability to feel, through knowing that you feel, to self-awareness—knowing that you exist as an individual. It is the first level that has most ethical/practical applications, in particular as it affects how we humans

should treat other living beings. Positions range from authors who do not believe that there is convincing evidence for consciousness in any non-human animal [2] to those who believe that all animals are conscious. Among the latter, Donald Griffin [3] has perhaps been the most influential. This is not a trivial question, as highlighted by the debate on whether fish can feel pain or not [4], which might have far-reaching consequences on animal welfare legislation.

Intermediate positions, especially on higher forms of consciousness, often focus on its function as opposed to the assumption that it is an epiphenomenon. It is not immediately clear what the function of consciousness is because even in humans a large part of behaviour is performed subconsciously. However, there are speculations that consciousness might be a late error-detection system. By comparing what one expects will happen with what is actually happening, an individual will be better able to detect and react to changes in the environment. If this is the function of consciousness, it requires an ability to form expectancies. We should therefore predict that consciousness only exists in animals that have expectancies, that is, which have episodic-like memory [5].

One approach to study expectancies and possibly emotions in animals is the contrast effect. If an animal receives a reward for a certain behaviour, it will perform more of that behaviour. If the reward is doubled, the performance of the animal is increased to a higher level than if it had been given the double reward from the beginning [6]. It demonstrates that it is not the size of the reward that is important, but the size compared to the expected reward, which strongly suggests that the animal has an expectation. All mammalian and avian species tested show this behaviour, but no fishes or reptilian species. This would support the view that only mammalian and avian species "know what they feel".

We believe that such critical reasoning, accompanied by suitable experiments and other studies, is a more fruitful approach than redefining consciousness to encompass all living beings. Consciousness is a complex

phenomenon and using only one criterion would be wrong. Being able to feel, being able to reflect on one's feeling and being able to reflect on one's existence are three different sets of capacities and lacking or having one of them does not automatically mean lacking or having another.

There is, and should be, a conflict between basic science and animal welfare research. In basic science, the lowest level of psychic ability, or consciousness, should be preferred as an explanation for any behaviour. In animal welfare, the animal should be given 'the benefit of the doubt'. The argument for this approach for animal welfare is that we have repeatedly underestimated the consequences for the animal of, for example, various routine surgical procedures such as debudding, tail docking or castration.

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Response to Olsson and Forkman

We welcome the contribution from Olsson and Forkman to the discussion about consciousness, but disagree with its main contention. The nub of their argument is that our use of the Margulis definition of consciousness—that "every organism is conscious ... in the