July 20, 2023

Darryll J. Pines, Ph.D.
President
c/o Danica Lovelace, Executive Assistant to the President
University of Maryland

Via e-mail: president@umd.edu; djpines@umd.edu; lovelace@umd.edu

Dear President Pines:

Thank you in advance for your time. I’m writing on behalf of People for the Ethical Treatment of Animals—PETA entities have more than 9 million members and supporters globally, more than 94,000 of whom live in Maryland. Based on the disturbing information presented below, we urge you to immediately terminate the ongoing decompression sickness/illness (DCS/DCI) experiment on animals at the University of Maryland (UMD), funded by the U.S. Navy, in favor of more effective, ethical, and economical animal-free research methods.

Records Confirm Animal Use for DCS/DCI Experiments at UMD

According to public records that PETA obtained from the U.S. Navy, UMD experimenter Stephen R. Thom conducts invasive, painful, and deadly procedures on more than 2,100 mice for his project titled “Neuroinflammation and Glymphatic Dysfunction in Decompression Sickness.”1 This experiment has been active since October 1, 2022, and will remain so until September 30, 2025, and it’s receiving $981,996 in taxpayer money.2

Per the project’s protocol, Thom confines mice to a hyperbaric chamber, subjects them to high pressures of 100psi for two hours, restrains them with a nose cone and bit bar, puts petroleum-based chemicals in their eyes, places them in carbon dioxide gas chambers, inserts a probe in their rectums, cuts into their scalps and drills into their skulls, injects chemicals into their brains, and kills them by bleeding them.3

Poor Data Translation From DCS/DCI Animal Testing to Humans

The management of detrimental effects from DCS/DCI or oxygen toxicity in humans (and other diving and non-diving animals)—ranging from

3U.S. Navy.
slight or severe pain to paralysis or even death—are well established.\(^4\)\(^5\)\(^6\) While the mechanistic triggers of these symptoms are still active areas of research, using animals in experiments as models for DCS/DCI or oxygen toxicity in humans is inhumane and ineffective. Meaningful evaluation of gas diffusion dynamics in live animals—and subsequent translation of this data to humans—is inaccurate due to the inherent complexity of the system under study, in which even the most subtle movements, such as breathing, can and too often do produce spurious results.\(^7\)

In his May 12, 2010, reply to PETA’s March 30, 2010, complaint regarding using animals in DCS/DCI testing to then Secretary of the Navy Ray Mabus, then Director of the Navy Medical Research and Development Center W.W. Cheatham, M.D., admitted, “The impact of physiological differences between species with regard to disease processes, to include diving related issues, is well recognized throughout the medical research community.”\(^8\) Numerous experts have noted the inherent limitations of using animals to predict the effects of DCS/DCI in humans. Diving expert John Lippmann has stated, “The problem with these animal experiments is that no animal model can replicate what happens in a human.”\(^9\)

The Naval Medical Research Command itself has stated, “[A]nimal DCS in many cases is more severe than that in humans and, therefore, appears ‘different’ from the average human case. … Among species, there certainly are differences in tolerance to decompression, with relative susceptibility to DCS tending to increase with species size. … These observations suggest that response differences among species to the insult of decompression may reflect a combination of factors, including differences in gas exchange and tolerance to excess gas in the body.”\(^10\)

**Superior Non-Animal DCS/DCI Research Methods Are Widely Available**

Thankfully, modern, non-animal technology is available for studying DCS/DCI based on

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human tissue and data obtained from human divers.\textsuperscript{11,12,13, 14,15,16} Some options include the following:

- **In vitro** studies of human endothelial cells—later confirmed by human trials—provided researchers with evidence in simulated diving conditions of nitric oxide dynamics, a chemical compound that can protect against bubble formation.\textsuperscript{17,18,19}
- Reanalysis of existing human diver data has led to improved models that may be better able to predict DCS/DCI symptoms and risk factors.\textsuperscript{20,21}
- Machine-learning techniques may aid in the prediction of symptoms such as seizures during hyperbaric oxygen therapy.\textsuperscript{22}
- Computational modeling can also improve the performance of dive computers to better equip divers in avoiding DCS/DCI,\textsuperscript{23} and laboratory studies using human subjects are yielding novel data.\textsuperscript{24,25}

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\textsuperscript{25}Hess HW, Hostler D, Clemency BM, Johnson BD. Carotid body chemosensitivity at 1.6 ATA breathing air versus 100% oxygen. *J. Appl. Physiol.* 2020;129(2):247-256. doi:10.1152/japplphysiol.00275.2020
The technological advances of our time have also facilitated the development of a combined "biomimetic in vitro tissue phantom and a three-dimensional computational model, comprising a hyperplastic strain-energy density function to model tissue elasticity," investigate key areas of gas diffusion dynamics, and develop more accurate dive algorithms.26

**Precedents for Ending DCS/DCI and Oxygen Toxicity Testing on Animals**

Per public records obtained by PETA, in one Navy-funded decompression experiment at the University of Wisconsin–Madison initially approved from August 11, 2020, through August 10, 2023,27 two healthy sheep were placed in a hyperbaric chamber for behavioral and equipment monitoring. A UW-Madison internal investigation found that on October 11, 2021, “the compressor for the chamber was not working” and that the animals inside the chamber had shown “signs of discomfort” and were then euthanized.28 This experiment—and a separate Navy-funded decompression experiment at UW-Madison initially approved from June 2, 2021, through June 1, 2024, examining survival rates and cardiopulmonary function in sheep subjected to long-term exposure of hyperbaric air29—were both “terminated” on July 19, 2022, well ahead of schedule. This action follows the Navy’s decision to pull its funding for similar decompression experiments on sheep at UW-Madison in 2010, following a criminal investigation launched in response to a petition filed by PETA and Alliance for Animals,30 for which a court-appointed special prosecutor reported that “[t]he Department of the Navy has pulled its grant and the [decompression] research using sheep has stopped. In reviewing the more recent literature, it appears that the efficacy of these types of studies is now in question.”31

Internationally, both the British and French navies have already ended their respective DCS animal-testing programs.32 In 2008, then U.K. Parliamentary Under Secretary of State at the Ministry of Defence Derek Twigg wrote to the British Parliament, stating, “The Ministry of Defence (MOD) has today announced the end of its immediate requirement for testing on live goats as part of its hyperbaric research in support of the MOD’s Submarine Escape Rescue and Abandonment System (SMERAS).”33 He described the findings motivating this decision as follows:


The testing programme was aimed at improving the accuracy of the information relating to the likely probability and consequence of decompression illness following escape from a submerged submarine in varying depths and internal submarine pressures. This requirement has now been achieved, and the review has concluded that the remaining associated areas of uncertainty in submarine escape and rescue relate to events that are considered highly unlikely, and do not therefore need to be addressed by means of animal testing. The MOD has endorsed these recommendations and as a result, it has no immediate need to continue animal testing of this type.\textsuperscript{34}

**UMD’s DCS/DCI Testing on Animals Appears to Contravene Federal Standards**

The use of animals in DCS/DCI and oxygen toxicity testing flies in the face of existing regulations to minimize animal use in experiments. The U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training (1985) states, “The animals selected for a procedure should be of an appropriate species and quality and the minimum number required to obtain valid results” [emphasis added]\textsuperscript{35}. Given the widespread availability of non-animal, human-focused testing methods that can be used instead, the number of animals used for DCS/DCI and oxygen toxicity testing should be zero.

Furthermore, Defense Health Agency-Multi-Service Regulation (DHA-MSR) 6025.02 states, “Alternatives to animal use will be considered and used whenever possible and appropriate to attain the objectives of [Research, Development, Test, and Evaluation] or training if such methods produce scientifically or educationally valid or equivalent results” [emphasis added].\textsuperscript{36} It’s clear from the aforementioned precedents set at UW-Madison and by the British and French navies that there are valid alternatives to using animals for DCS/DCI and oxygen toxicity testing, and per this military regulation such animal-free experimental methods should be used in place of experiments on animals.

**Request for Action**

There is no scientific, ethical, or legal justification for subjecting animals to DCS/DCI or oxygen toxicity experiments. Therefore, we urge you to immediately terminate Thom’s cruel project and all such DCS/DCI and oxygen toxicity experiments on animals at UMD.

Thank you for your time and consideration of this important matter. I look forward to your response.

\textsuperscript{34}Hansard House of Commons.


Sincerely yours,

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