

CAPITAL CASE
EXECUTION SCHEDULED – JUNE 11, 2026

No. 25A1381

IN THE
Supreme Court of the United States

GREG LOVELACE, COMMISSIONER,
ALABAMA DEPARTMENT OF CORRECTIONS, *et al.*,
Applicants,

v.

JEFFERY LEE
Respondent.

ON APPLICATION TO STAY TO THE UNITED STATES COURT OF
APPEALS FOR THE ELEVENTH CIRCUIT

**BRIEF OF AMERICAN THORACIC SOCIETY AS AMICUS CURIAE
IN SUPPORT OF RESPONDENT AND OPPOSING THE STAY APPLICATION**

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INTEREST OF AMICUS CURIAE¹

The American Thoracic Society (“ATS”) is an international organization founded in 1905 that represents over 30,000 physicians, scientists, and healthcare professionals. Its members include experts in pulmonary and critical care medicine who study the physiology of breathing, oxygen deprivation, and dyspnea.

While ATS does not take a position here on the morality or ethics of the death penalty, ATS submits this brief to assist the Court by providing a scientific explanation of the neurophysiology of nitrogen hypoxia and to ensure the Court’s analysis is informed by contemporary medical evidence.

INTRODUCTION AND SUMMARY OF ARGUMENT²

Execution via nitrogen hypoxia necessarily causes inhumane suffering. Central to that conclusion is an understanding of the neurophysiology of dyspnea—“a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity.”³ Air hunger dyspnea, the “perception of not getting enough (or of needing more) air,”⁴ is suffering. And nitrogen hypoxia, the method by which Alabama

¹ No counsel for a party authored this brief in whole or in part, and no entity or person other than amicus and its counsel contributed money intended to fund the preparation or submission of this brief.

² Unless otherwise noted, all citations, quotation marks, and alterations are omitted, and all emphases added.

³ Parshall et al., *An Official American Thoracic Society Statement: Update on the Mechanisms, Assessment, and Management of Dyspnea*, 185 Am. J. of Respiratory & Critical Care Med. 435, 436 (2012) (“Consensus Statement”).

⁴ *Id.* at 438.

seeks to execute Lee, causes extreme air hunger. Accordingly, nitrogen hypoxia executions cause intense, inhumane suffering.

The district court has entered judgment for Mr. Lee based on extensive testimony and evidence regarding the science of dyspnea adduced during a first-of-its-kind, three-day-long bench trial. The district court made thorough findings of fact, which the Eleventh Circuit declined to disturb, regarding that science. And based on the science, the Eleventh Circuit correctly recognized that the nitrogen hypoxia execution the State proposes would cause constitutionally impermissible suffering.⁵ *Lee v. Commissioner, Ala. Dep't of Corr. ("Lee II")*, No. 26-11864, 2026 WL 1651147, at *7 (11th Cir. June 8, 2026) (per curiam); App.75.

The Eleventh Circuit denied the State's subsequent motion for a stay of the judgment, recognizing that a stay would allow Mr. Lee to be "executed under a likely-unconstitutional method," one which would amount to "nothing more than the purposeless and needless imposition of pain and suffering." App.128, *Lee v. Comm'r, Ala. Dep't of Corr. ("Lee III")*, No. 26-12027, slip op. at 20 (11th Cir. June 10, 2026) (quoting *Enmund v. Florida*, 458 U.S. 782, 798 (1982)). Yet, the State again seeks a stay of the judgment from this Court on an emergency basis, so it can proceed with an execution that the science proves, and the courts have recognized, would cause inhumane suffering. At minimum, the State's request for an emergency stay so it can execute Mr. Lee would functionally moot his case and overturn the thoroughly reasoned opinions of

⁵ Because the Applicants are State officials whom Mr. Lee sued in their official capacities, Amicus refers to them collectively as the State.

the courts below. The State’s motion leaves this Court with less than a single day to parse the exhaustive record establishing the neurophysiological effects of nitrogen hypoxia. This Court should deny the State’s Stay Application.

ARGUMENT

Contrary to the State’s contention, *see* Stay Application 3-4, there is a “well-established scientific consensus,” *Baze v. Rees*, 553 U.S. 35, 67 (2008) (Alito, J., concurring), regarding the neurophysiology of dyspnea, which supports the conclusion that execution by nitrogen hypoxia is inhumane and causes extreme suffering. Indeed, the ATS published a “Consensus Statement” on dyspnea in 1999 and again in 2012 that summarized then-extant science on the neurophysiology of dyspnea.⁶ And, as discussed below, the scientific community’s understanding of dyspnea has only improved since then, especially since the advent of nitrogen hypoxia as a method of execution. The Eleventh Circuit’s conclusion that nitrogen hypoxia executions cause “severe air hunger and corresponding emotional distress, anxiety, physiological stress, and physical discomfort” that is constitutionally “intolerable,” *Lee II*, 2026 WL 1651147, at *7, is not only supported by the scientific literature on dyspnea, but it is also the only scientifically supportable conclusion based on both this record and the scientific consensus on dyspnea.

⁶ *See* Consensus Statement; American Thoracic Society, *Dyspnea: Mechanisms, Assessment and Management: A Consensus Statement*, 159 Am. J. Respiratory & Critical Care Med. 231, 232 (1999) (“1999 Consensus Statement”).

I. THE NEUROPHYSIOLOGY OF DYSPNEA

Given the unique role dyspnea plays in the experience of lethal hypoxia, any discussion of the science underlying nitrogen hypoxia executions must be grounded in the neurophysiology of dyspnea.

A. Dyspnea Generally

Dyspnea has long been the object of scientific inquiry, which has expanded in recent years.⁷ In 1999, the ATS issued a Consensus Statement on dyspnea, synthesizing that research and defining dyspnea as “a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity.”⁸ Since then, scientists have developed deeper understandings of the neurophysiology of dyspnea, leading the ATS to update its Consensus Statement in 2012.⁹ The recent onset of executions via nitrogen hypoxia stimulated additional research on dyspnea, which has further advanced the scientific community’s understanding of its causes and effects.¹⁰

There are three categories of dyspnea, which “vary in their unpleasantness and in their emotional and behavioral significance”: (1) work/effort, (2) tightness, and (3) air hunger.¹¹ Unlike pain, “which is typically a very easily localised discomfort, dyspnoea is an interoceptive experience that integrates signals from multiple sources throughout the

⁷ See, e.g., Bailey et al., *Physiology of nitrogen: A life or death matter*, 111 *Experimental Physiology* 270, 276-280 (2025).

⁸ 1999 Consensus Statement 232.

⁹ Consensus Statement.

¹⁰ See, e.g., Bailey et al. *Breath to death: nitrogen asphyxiation for execution and assisted suicide*, 139 *J. Applied Physiology* 1309, 1309 (2025) (noting need to provide updated scientific perspective given rise in nitrogen asphyxiation executions).

¹¹ Consensus Statement 436.

body.”¹² The experience of dyspnea “derives from interactions among multiple physiological, social, and environmental factors, and may induce secondary physiological and behavioral responses.”¹³

B. The Neurophysiology of Air Hunger Dyspnea

Since “there is no doubt that breathing pure N₂ evokes air hunger” because of the “extreme hypoxia” that results,¹⁴ understanding the neurophysiology of air hunger dyspnea is vital to assessing nitrogen hypoxia executions.

Air hunger—the “perception of not getting enough (or of needing more) air”¹⁵—is the result of a complex set of neurophysiological interactions and begins with the carotid bodies, “exquisit[ively] sensitiv[e]” organs that “continuously ‘taste’ the oxygen pressure in the arterial blood.”¹⁶ When the pressure of oxygen in the blood drops to abnormally low levels, the carotid bodies “trigger powerful respiratory and cardiovascular responses,” sending signals to the brain that drive the body to breathe.¹⁷ Those sections of the brain are central to the body’s most primal survival instincts, including fear.¹⁸

¹² Demoule et al., *Dyspnoea in acutely ill mechanically ventilated adult patients: an ERS/ESICM statement*, 63 *Eur. Respiratory J.* 2300347, at 6 (2024) (“Demoule 2024”).

¹³ Consensus Statement 436 (quoting 1999 Consensus Statement).

¹⁴ Macefield et al., *Death by hypoxia: what were they thinking?*, 602 *J. Physiology* 991, 991-992 (2024).

¹⁵ Consensus Statement 438.

¹⁶ Bailey, 111 *Experimental Physiology* at 266-277.

¹⁷ Bailey, 139 *J. Applied Physiology* at 1310; Bailey, 111 *Experimental Physiology* at 277; Macefield, *supra* n.14 at 991; Consensus Statement 436, 440.

¹⁸ *See* Bailey, 111 *Experimental Physiology* at 277; Consensus Statement 436, 439-440; Bailey, 139 *J. Applied Physiology* at 1310.

The brain then signals to the body to stimulate breathing to return blood-oxygen levels to normal.¹⁹ Simultaneously, the brainstem sends a “copy” of those signals to the cerebral cortex.²⁰ Nerves in the pulmonary system monitor the body’s breathing and project feedback to the brain.²¹ The brain then compares its outgoing signals to the body’s corresponding responses.²² Where there is a mismatch, air hunger results.²³ That air hunger persists and only *worsens* in intensity as oxygen levels in the blood drop, as is the goal in nitrogen hypoxia executions.²⁴ *Contra* Stay Application 23-25 (criticizing conclusion that “severe” air hunger stays constant throughout and claiming condition would only be “brief”).

II. DYSPNEA IS A FORM OF STRESS THAT CAUSES SUFFERING

“[T]he feeling of air hunger ... is always alarming” to the individual experiencing it.²⁵ Contrary to the State’s characterization of air hunger as mere “discomfort,” *e.g.*,

¹⁹ Macefield, *supra* n.14 at 991.

²⁰ Bailey, 111 Experimental Physiology at 279; Consensus Statement 439 (collecting sources).

²¹ Bailey, 111 Experimental Physiology at 278-279; Consensus Statement 439.

²² Bailey, 111 Experimental Physiology at 278-279; Consensus Statement 439; *see also* Demoule 2024, *supra* n.10 at 8.

²³ Consensus Statement at 438; *see also* Bailey 111 Experimental Physiology at 279; Demoule 2024, *supra* n.12 at 8.

²⁴ *See, e.g.*, Consensus Statement at 439-440; Demoule 2024 at 16 (describing increasingly worsening “cycle of breathlessness and fear”); Poole & Bailey, *Death by nitrogen anoxia: On the integrated physiology of human execution*, 109 Experimental Physiology 1009, 1010-1012 (2024); Bailey, 139 J. Applied Physiology at 1310 (“The sensations are very different from those induced following ‘brief’ inspiration of pure nitrogen that does not result in [loss of consciousness] in cooperative research participants for estimation of the hypoxic ventilatory response.”).

²⁵ Bailey, 111 Experimental Physiology at 279 (quoting Hoover, *The bedside study of air hunger*, 87 J. Am. Med. Ass’n 813 (1926)).

Stay Application 10, 23, a survey of the scientific literature makes clear that dyspnea—particularly air hunger—is a distressing experience that causes suffering. One study of patients experiencing dyspnea found that “[d]yspnea is a particularly traumatic,” “disturbing,” and “terrifying” experience, which causes a “combination of a distressing threat to life and a feeling of helplessness [that] generates trauma.”²⁶ Similar studies concluded that “dyspnoea is an awful feeling, responsible for immediate psychological distress,” with patients describing their experiences graphically:

- “[H]ell”;²⁷
- “I felt that I was crying out, but no one could hear anything”;²⁸
- “Scared the shit out of me”;²⁹
- “Scared. I thought the world was going to end, like in a box”;³⁰
- “[T]he worst thing that could ever happen to you”;³¹
- “[L]ike a suffocation”;³² and
- “[W]hen the shortness of breath was at its extreme,...[I] saw a coffin beside me.”³³

Based on these and similar accounts, scientists have readily concluded that “[d]yspnoea causes suffering.”³⁴

²⁶ Demoule et al., *Prevalence, Intensity, and Clinical Impact of Dyspnea in Critically Ill Patients Receiving Invasive Ventilation*, 205 *Am. J. Respiratory & Critical Care Med.* 917, 918, 922-923 (2022) (“Demoule 2022”).

²⁷ Demoule 2024, *supra* n.12 at 9-10.

²⁸ *Id.*

²⁹ Banzett et al., ‘*Scared to death*’ *dyspnoea from the hospitalised patient’s perspective* 2, 7 *BMJ Open Respiratory Rsch.* 000493 (2020).

³⁰ *Id.*

³¹ *Id.* at 1.

³² *Id.* at 3.

³³ *Id.*

³⁴ *Id.* at 1.

Patients also reported dyspnea caused anxiety, panic, and fear, which, in turn, worsened their dyspnea.³⁵ That is unsurprising, as the “dyspnea-anxiety relationship is bidirectional,”³⁶ in that fear can trigger further dyspnea, causing a “vicious cycle.”³⁷

Several patients also reported that dyspnea increased pain.³⁸ Indeed, 75% of patients experiencing dyspnea scored their distress at levels high enough that, “[i]n the pain domain ... correspond to the three most painful procedures experienced by ICU patients and would trigger the prescription of analgesics.”³⁹

The suffering described by these patients is supported by science. *Supra* Section I. The State casts aspersions on these peer-reviewed studies but ignores both the underlying science supporting these patients’ experiences and the fact that dyspnea is “a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity.”⁴⁰ Dyspnea activates parts of the brain that overlap with our bodies’ most primal instincts, hence these patients’ graphic descriptions of their suffering.⁴¹ The neurophysiology of dyspnea, combined with accounts of patients who experienced it, lead to one conclusion: Dyspnea is a distressing experience that causes suffering.

³⁵ See Demoule 2024, *supra* n.12 at 10; Banzett, *supra* n.29 at 2.

³⁶ Demoule 2022, *supra* n.26 at 922.

³⁷ Banzett, *supra* n.29 at 2; *see also* Demoule 2024, *supra* n.12 at 10.

³⁸ Banzett, *supra* n.29 at 2.

³⁹ Demoule 2022, *supra* n.266 at 922.

⁴⁰ Consensus Statement 436.

⁴¹ Consensus Statement 440.

III. HYPOXIA CAUSES AIR HUNGER

The Eleventh Circuit correctly found that the nitrogen hypoxia protocol by which Alabama intends to execute Lee causes “severe air hunger and corresponding emotional distress, anxiety, physiological stress, and physical discomfort.” *Lee II*, 2026 WL 1651147, at *7. The neurophysiology of air hunger and hypoxia confirms “there is no doubt that breathing pure N₂ evokes air hunger” because of the “extreme hypoxia” that results.⁴²

Unfortunately, “legal reports and the medical literature,” as well as the State’s Stay Application, “are rife with misinformation,” based on misunderstandings of dyspnea’s neurophysiology.⁴³ Consistent with its interest in ensuring that accurate science informs the law, the ATS deems it necessary to explain why those misconceptions are incorrect.

The Carbon Dioxide Fallacy: Some claim that absent carbon dioxide buildup, the carotid bodies will not be stimulated to cause air hunger.⁴⁴ Numerous studies refute that, finding instead that it is the deficit of *oxygen* in the blood—regardless of carbon dioxide buildup—that triggers the carotid bodies to cause dyspnea.⁴⁵ Thus, nitrogen hypoxia

⁴² Macefield, *supra* n.14 at 991-992; *see also supra* Section II(B).

⁴³ Poole & Bailey, *supra* n.24 at 1012.

⁴⁴ *See, e.g.,* Copeland et al., *Nitrogen Induced Hypoxia as a Form of Capital Punishment* (Mar. 2015); Ernsting, *The Effect of Brief Profound Hypoxia Upon the Arterial and Venous Oxygen Tensions in Man*, 169 *J. Physiology* 292 (1963).

⁴⁵ *See* Moosavi et al., *Hypoxic and hypercapnic drives to breathe generate equivalent levels of air hunger in humans*, 94 *J. Applied Physiology* 141, 152 (2003); Poole & Bailey, *supra* n.24, at 1012; Bailey, 111 *Experimental Physiology* at 273-280; Timmers et al., *Denervation of Carotid baro- and chemoreceptors in humans*, 553 *J. Physiology* 3 (2003).

executions will cause air hunger regardless of carbon dioxide levels. *Contra* Stay Application 10 (suggesting lack of carbon dioxide buildup would alleviate dyspnea). The district court correctly rejected this fallacy. *See Lee v. Lovelace (“Lee I”),* 2026 WL 1493098, at *14 n.27, *16 (M.D. Ala. May 28, 2026), *rev’d sub nom., Lee II,* 2026 WL 1651147 (11th Cir. June 8, 2026).

The Nitrogen Narcosis Fallacy: Some studies suggest that execution by nitrogen hypoxia will not cause air hunger or similar distress because scuba divers who die from breathing nitrogen can experience “euphoria.”⁴⁶ But because the increased barometric pressure involved in such cases is required to induce “euphoria,”⁴⁷ such “euphoria” does not occur during nitrogen hypoxia executions.⁴⁸

The Rapid Unconsciousness Fallacy: A third misconception is that nitrogen hypoxia executions as “peaceful” because only one or two breaths of pure nitrogen will rapidly cause unconsciousness.⁴⁹ Not so. Numerous studies and accounts confirm that even breathing pure nitrogen under ideal clinical conditions results in a prolonged death, marked by extended periods of consciousness and profound suffering.⁵⁰ *Contra* Stay Application 9, 19. Even the district court found that an individual executed by nitrogen

⁴⁶ Bailey, 111 *Experimental Physiology* at 280.

⁴⁷ *Id.*

⁴⁸ *Id.*

⁴⁹ Copeland, *supra* n.44 at 6-7, 10.

⁵⁰ *See, e.g.,* Poole & Bailey, *supra* n.24 at 1012; *see also* Bailey, 139 *J. Applied Physiology* at 1310 (explaining that observations of nitrogen asphyxiation executions report “wide variation in the time to unconsciousness”).

hypoxia would consciously experience air hunger for a far longer period. *See Lee I*, 2026 WL 1493098, at *18.

IV. EXECUTION BY NITROGEN HYPOXIA IS INHUMANE AND CAUSES SUFFERING

Execution by nitrogen hypoxia is an “*inhumane* and ultimately flawed practice”⁵¹ that inherently causes intense suffering; “is considered too *inhumane* for euthanizing mice or dogs”;⁵² and has “spark[ed] widespread condemnation” among medical experts.⁵³ Consequently, the district court’s original conclusion—that “Lee ... failed to prove the Protocol causes more than ‘the necessary suffering involved in any method employed to extinguish life *humanely*’”—rests on a fundamentally flawed premise: that execution by nitrogen hypoxia is “humane[.]” *Lee I*, 2026 WL 1493098, at *1. The Eleventh Circuit’s decision holding that execution by nitrogen hypoxia would be constitutionally intolerable aligns with the science. *See Lee II*, 2026 WL 1651147, at *7.

Nitrogen hypoxia executions—by their very design—inflict severe neurophysiological distress. As the district court acknowledged, “air hunger causes extreme emotional distress, panic, anxiety, and fear,” and dyspnea “ranks among the *most distressing* experiences that human beings can endure.” *Lee I*, 2026 WL 1493098, at *8. And while dyspnea “shares many similarities with pain,” it “can be *far worse than pain* in that it summons a primal fear response.”⁵⁴ Even at moderate levels of oxygen

⁵¹ Bailey, 111 *Experimental Physiology* at 271.

⁵² Bickler et al., *Evidence Against Use of Nitrogen for the Death Penalty*, 331 *JAMA* 2075 (2024).

⁵³ Bailey, 139 *J. Applied Physiology* at 1309; *see also* Bailey, 111 *Experimental Physiology* at 276.

⁵⁴ Demoule 2024, *supra* n.12 at 1.

deprivation, symptoms may escalate “to a full-blown feeling of suffocation,” and “[a]t saturations less than 60%, the majority of people, *not yet unconscious*, report *significant distress* and shortness of breath.”⁵⁵

Consistent with those observations, the United Nations warned that “suffocation by nitrogen gas ... could amount to *torture* or other cruel, inhuman or degrading treatment or punishment under international human rights law.”⁵⁶ Eyewitness accounts of nitrogen hypoxia executions report clear signs of suffering. *See* Appellant’s Opening Br. 10-17, *Lee v. Lovelace*, No. 26-11864 (11th Cir. June 1, 2026) (collecting accounts). In short, these executions bore the hallmarks of prolonged suffocation and acute distress, not “humane” deaths.

Nitrogen hypoxia “is considered too *inhumane* for euthanizing mice or dogs[.]”⁵⁷ Likewise, there is no doubt that executing *humans* by nitrogen hypoxia—a method of death that is disfavored for *mice* because of the pain it causes⁵⁸—inflicts “unnecessary suffering” and “add[s] elements of terror, pain, [and] disgrace to the death penalty” itself. *See Bucklew v. Precythe*, 587 U.S. 119, 124 (2019). In sum: A method that predictably produces suffocation, panic, and prolonged distress is not “humane.”

⁵⁵ *See* Bickler, *supra* n.52, 331 JAMA 2075.

⁵⁶ *See* Press Briefing Notes, *US: Alarm over imminent execution in Alabama*, Office of the High Commissioner for Human Rights (Jan. 16, 2024), <https://www.ohchr.org/en/press-briefing-notes/2024/01/us-alarm-over-imminent-execution-alabama>.

⁵⁷ Bickler, *supra* n.52, 331 JAMA 2075; *see also* Leary et al., *AVMA Guidelines for Euthanasia of Animals* 27, Am. Veterinary Med. Assoc. (2020).

⁵⁸ *See* Leary, *supra* n.57 at 27.

Moreover, that individuals who are hanged to death experience may similar “physiological discomfort” is immaterial. *Contra Lee I*, 2026 WL 1493098, at *23. The last execution by hanging occurred decades ago,⁵⁹ and “there has [since] been enormous growth in knowledge about the neurophysiology of dyspnea.”⁶⁰ Further, unlike nitrogen hypoxia executions—where several minutes of extreme suffering is inherent in the design itself—a hanging is “intended to, and often d[oes], result in a quick and painless death,” *Baze*, 553 U.S. at 95 (Thomas J., concurring), because the individual’s “weight should cause a rapid fracture-dislocation of the neck.”⁶¹ While the ATS does not take a position on death by hanging, an individual who suffocates “for several minutes” by hanging would also experience air hunger and its attendant suffering described above. *See Lee I*, 2026 WL 1493098, at **10, 23.

In short: “[T]he use of nitrogen asphyxiation for execution ... rests on a profound misrepresentation of human physiology. *Far from being humane, painless, or peaceful, it provokes dyspnea, panic, suffering, and an unnecessarily violent death.*”⁶²

CONCLUSION

For the foregoing reasons, this Court should deny the State’s Stay Application.

⁵⁹ *See Methods of Execution*, Death Penalty Information Center, <https://deathpenaltyinfo.org/resources/high-school/about-the-death-penalty/methods-of-execution> (last visited June 10, 2026).

⁶⁰ Consensus Statement 435.

⁶¹ Death Penalty Information Center, *supra* n.59.

⁶² Bailey, 139 J. Applied Physiology at 1311.

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