No. 21-511

In the Supreme Court of the United States

TIM SHOOP, WARDEN,
Petitioner,
v.
RAYMOND A. TWYFORD,
Respondent.

On Writ of Certiorari to the United States Court of Appeals for the Sixth Circuit

BRIEF OF THE MASSACHUSETTS GENERAL HOSPITAL CENTER FOR LAW, BRAIN & BEHAVIOR AS AMICUS CURIAE SUPPORTING RESPONDENT

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April 4, 2022

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STATEMENT OF INTEREST OF AMICUS CURIAE

The Massachusetts General Hospital Center for Law, Brain & Behavior ("CLBB"), amicus curiae here,[1] is part of Massachusetts General Hospital ("MGH"), an institution founded in 1811. Consistently ranked among the top five hospitals nationwide, MGH is the third oldest general hospital in the United States and both the oldest, and largest, teaching hospital of the Harvard Medical School. While MGH is an autonomous entity with separate tax exempt status and governing board, it is also affiliated with Mass General Brigham ("MGB"), a non-profit integrated health care system. Together with MGB, MGH offers a broad range of psychiatric and neurologic services through its Department of Psychiatry and its Department of Neurology.

The MGH Department of Psychiatry has earned the top departmental ranking for fourteen consecutive years in the annual Best Hospitals survey of U.S. News & World Report. One of its divisions, the MGH Law & Psychiatry Service, has since 1989 provided forensic mental health consulting, training, and research on a wide variety of psychiatric and neurological issues

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[1] No counsel for a party authored this brief in whole or in part. No party or counsel for a party made any monetary contribution intended to fund the preparation or submission of this brief. No person or entity, other than amicus curiae, its members, or its counsel, made any such monetary contribution to the preparation or submission of this brief. Neither this brief nor the decision to file it should be considered to reflect the views of any judicial member of CLBB. All parties have consented to the filing of this brief.

which arise in the context of criminal and civil law, including competency to stand trial, competency to make medical decisions, and criminal responsibility.

The MGH Department of Neurology has consistently placed among the top four neurology departments in the United States according to U.S. News & World Report. In addition to its renowned expertise in the diagnosis and treatment of neurological conditions, it hosts one of the nation's largest hospital-based neuroscience research programs. Among its major milestones were the development of the first functional magnetic resonance imaging (MRI) scanner and the discovery of numerous genes that contribute to neurologic diseases.

CLBB is a free standing "Center for Excellence" within MGH and draws its faculty from these two stellar Departments, as well as from the Harvard Law School, the Harvard Faculty of Arts and Sciences, the Massachusetts Institute of Technology, and other national universities. Together, the staff assigned to CLBB creates a rare, ongoing collaboration among experts in subspecialties of law, psychiatry, psychology, forensic psychiatry, neurology, and neuroimaging.

Because of its unique multidisciplinary work, CLBB has a particular interest in proceedings in which brain injury and related behavior may or should have legal consequences. CLBB also has a particular interest in ensuring that, to the maximum extent permissible under law, scientific and clinical data bearing on such issues is gathered, rather than hampered in being gathered, and therefore made potentially available for better and more just decision-making by the

courts—whether as to capacity, guilt, innocence, or mitigation. CLBB is therefore both in a special position to explain, and has a special interest in explaining, why it matters at the intersection of law and science that this Court substantially uphold the actions of the United States District Court for the Southern District of Ohio, as affirmed by the United States Court of Appeals for the Sixth Circuit, in this case.

SUMMARY OF ARGUMENT

Respondent is being held in Ohio's Chillicothe Correctional Institution and is facing the death penalty. Last year, the United States Court of Appeals for the Sixth Circuit affirmed an order issued by the United States District Court for the Southern District of Ohio under the All Writs Act, 28 U.S.C. § 1651, in favor of Respondent. That order, Pet. App. 23a-33a, directed Petitioner, the Warden of the prison, to transport Respondent to The Ohio State University Wexner Medical Center for functional neurological imaging.[2]

This imaging is highly likely to reveal data not only relevant to Respondent's underlying clinical condition, but to brain abnormalities existing at the time of his crime, trial, and sentencing that bear on his petition for

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[2] Functional neurological imaging (or "neuroimaging") is the use of technology—such as the combined CT (computed tomography) and PET (positron emission tomography) scans recommended for Respondent, *see* Pet. App. 30a—to measure an aspect of brain function, typically with a view to understanding the relationship between activity in certain brain areas and specific mental functions. *See infra* pp. 16-18.

habeas corpus relief. Respondent cannot obtain such imaging in prison. CLBB therefore submits this brief amicus curiae in support of Respondent with respect to the decision of the Sixth Circuit upholding the District Court's order of transportation.

In addition to its own arguments on this point, CLBB supports the position of Respondent, and of the United States as amicus curiae supporting neither party, that the All Writs Act empowers a District Court to order the transport of a state prisoner for medical testing in appropriate circumstances not covered by the specific habeas corpus authorization of 28 U.S.C. § 2241(c)(5). CLBB also agrees with Respondent that the particular situation presented to the District Court by Respondent *was* such an appropriate circumstance. This means that the United States is not correct that this Court should impose additional hurdles on Respondent's effort to obtain the requested imaging of his own brain.

The nature of functional neuroimaging indicates why this is so. First, an individual's access to his or her own neurological condition is not a matter of "discovery." The presence of overlapping clinical and legal rationales for the neuroimaging in this case underscores both that Respondent legally possesses the contents of his own brain and its activity, and that imaging those personal neurophysiologic processes is different than Respondent obtaining data from someone else.[3] The order of the District Court was

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[3] As a minority of the nation's state Attorney Generals note, "[t]he Sixth Circuit drew a distinction between formal discovery and

therefore entirely "agreeable to the usages and principles of law." 28 U.S.C. § 1651(a).

Second, Petitioner (and the United States) fail adequately to account for the nature of neurological and psychiatric analysis, including that based on functional neuroimaging, when they seek to impose requirements (as the United States puts it), of first "identifying a[] specific claim to which the resulting evidence would relate" and "establishing that the district court would be able to consider that evidence." Brief for the United States as Amicus Curiae Supporting Neither Party, *Shoop v. Twyford*, No. 21–511, at 8-9 (March 2022). Absent an examination, an individual such as Respondent likely would not be

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Twyford's request to gather 'imaging of his own brain.'" Brief of Amici Curiae State of Utah and 20 Other States in Support of Petitioner, *Shoop v. Twyford*, No. 21-511, at 21 n.21 (Mar. 4, 2022) (quoting Pet. App. 15a). These amici seek to classify the requested examination as "self-*discovery,*" *id.* (emphasis added), and by doing so bring it back within "discovery" limitations they assert must apply here because of *Cullen v. Pinholster*, 563 U.S. 170 (2011). Yet even Petitioner concedes that Respondent never characterized his request as identical to "discovery" and, indeed, formally disclaimed as much. *See* Brief of Petitioner, *Shoop v. Twyford*, No. 21-511, at 8 (Feb. 2022) ("Pet. Br.") (citing and quoting Pet. App. 245a-46a, 267a). The "discovery" argument is therefore fundamentally incorrect—and not required by *Pinholster*, which did not address the issue of what is "discovery" and what is not. *See* 563 U.S. at 180 ("We granted certiorari to resolve two questions. First, whether review under [28 U.S.C.] § 2254(d)(1) permits consideration of evidence introduced in an evidentiary hearing before the federal habeas court. Second, whether the Court of Appeals properly granted Pinholster habeas relief on his claim of penalty-phase ineffective assistance of counsel.") (internal citations omitted).

able to determine to what specific claim any resulting data might relate.[4] So the answer is not to require counsel to match a litany of hypothetical data to a litany of "specific claim[s]." The answer is first to determine if a scientific basis exists for seeking the data; if so, to obtain the data; and only then to make an evidentiary decision about whether the data would be admissible (and for what purpose).

CLBB sees, in the record below and in the District Court, a clear medical basis for the proposed imaging and a clear nexus between any potential brain findings from that imaging and the substance of Respondent's post-conviction challenges. Indeed, the data from the imaging is highly likely to be relevant, particularly as to Respondent's claims of ineffective assistance of counsel.

Whether it had a full scientific understanding of this likelihood, the Court of Appeals correctly

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[4] The lack of brain imaging data is problematic not only in individual cases, but in the aggregate. *See generally*, *e.g.*, Scott Marek, et al., *Reproducible Brain-Wide Association Studies Require Thousands of Individuals*, NATURE, Mar. 16, 2022, at 654, https://doi.org/10.1038/s41586-022-04492-9. But while Respondent correctly notes that "[i]t is impossible for medical experts—let alone federal judges—to know with any reasonable degree of confidence what results PET-CT scans will produce before they are conducted," Brief for the Respondent, *Shoop v. Twyford*, No. 21-511, at 48 (Mar. 28, 2022), it is possible to know, first, whether a patient's history makes such an examination medically appropriate and, second, whether the results that will be produced likely will be relevant to issues of the patient's brain function and behavior. The answers to both of those questions support the decision below in this particular case. *See infra* pp. 19-29.

addressed the issues in its requirement that Respondent show (as he did) that what he sought would at least "plausibly relate[]" to his habeas claims. Pet. App. 16a. This is not, contrary to Petitioner's argument, a "dangerous" standard that "if allowed to stand, . . . will require States to bring dangerous criminals to public settings so that they may collect irrelevant, unusable evidence." Pet. Br. at 17.

Indeed, Petitioner's own arguments demonstrates one reason why: until the functional neuroimaging occurs, there is no way to conclude that the data it produces will be "irrelevant" or "unusable." The Court of Appeals' standard is therefore little different in risk than "commonsense" standards such as "reasonable suspicion" or "probable cause," *e.g.*, *Ornelas v. United States*, 517 U.S. 690, 695-96 (1996), where something is not knowable without further examination. But whatever the standard, its "substantive content" should derive "from the particular context[]" in which it is "being assessed." *Id.* at 696. The exceptional facts in this particular case certainly establish a context strongly supporting the functional neuroimaging requested by Respondent.

ARGUMENT

As characterized by Petitioner, the habeas corpus issues presented by Respondent in state court centered on whether he had received ineffective assistance of counsel when his lawyer failed to present at trial or sentencing evidence about a "head injury [that he] had suffered as a teenager." Pet. Br. at 7 (Feb. 2022) (quoting Pet. App. 234a). In the District Court, Respondent actually asserted a somewhat broader

range of habeas corpus issues.[5] But important to all of them (including whether he could have effectively engaged with the counsel who did not present evidence of his "head injury") is the condition of Respondent's brain.

In fact, Respondent's history is fully consistent with neurological damage even apart from the specific "head injury" to which Petitioner refers. Respondent's parents had a tumultuous relationship which included physical violence directed at Respondent's mother and infant brother. ECF No. 98-3, at 2241-46. His father abducted him at age 2, and police did not reunite him with his mother until age 4. ECF No. 98-1, at 1221-22.

After his mother remarried, he experienced severe beatings at the hands of his stepfather. *See* ECF No. 98-3, at 2241–46. His biological father, a lobsterman, died at sea when Respondent was 7 years old, and by the time he was 9, he had begun using alcohol and cannabis. *See* Pet. App. 193a.

These are factors that, by themselves, might well produce permanent brain injury visible in a functional neuroimaging scan. *See*, *e.g.*, Joanna S. Fowler, et al., *Imaging the Addicted Human Brain*, SCIENCE & PRACTICE PERSPECTIVES, Apr. 4, 2007, at 1, 11,

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[5] Respondent's claims include ineffective assistance of counsel at multiple stages, involuntary and coerced statements, lack of competency to stand trial, and denial of the right to present mitigation evidence. *See* ECF No. 98-1, at 1144. (Citations to "ECF" are to the electronic case filing document number in the District Court. *See generally* SUP. CT. R. 26.2.)

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2851068/pdf/spp-03-2-4.pdf.[6]

But then, at the age of 13, Respondent tried to kill himself. Pet. App. 3a. In that first suicide attempt (there were others later after he was raped in prison, *see* Pet. App. 204a), he shot himself in the head. The gunshot blinded him in the right eye and left some 20 to 30 lead bullet fragments in his skull—where they remained at the time of his subsequent crime, trial, conviction, and sentencing, and where they remain today. Pet. App. 30a.[7]

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[6] These authors note that PET imaging can reveal "reduce[d] cellular activity in the orbitofrontal cortex" (an area at the front of the brain roughly between and above the eyes) from drug use, and explain that the orbitofrontal cortex is "a brain area we rely on to make strategic, rather than impulsive, decisions (Figure 8)." *See also*, *e.g.*, Lindsay M. Squeglia, et al., *The Influence of Substance Use on Adolescent Brain Development*, 40 CLINICAL EEG NEUROSCIENCE, 31, 32 (2009) ("Functional magnetic resonance imaging" can reveal "alterations in brain structure . . . [and] decrements in brain functioning associated with adolescent substance use."); Heledd Hart and Katya Rubia, *Neuroimaging of Child Abuse: A Critical Review*, FRONTIER HUMAN NEUROSCIENCE, Mar. 19, 2012, at 1, 8 https://www.frontiersin.org/articles/10.3389/fnhum.2012.00052/ ("Functional imaging studies support" an "association between child abuse and deficits in IQ, memory, working memory, attention, response inhibition and emotion discrimination" by "reporting atypical activation in" specific "brain regions during response inhibition, working memory, and emotion processing.").

[7] "Patients with traumatic injuries to" the orbitofrontal cortex "display problems—aggressiveness, poor judgment of future consequences, inability to inhibit inappropriate responses—that are similar to those observed in substance abusers (Bechara et al., 1994, 2001; Eslinger et al., 1992)." Joanna S. Fowler, et al., *supra*

So the functional neurological deficits that trial counsel utterly failed to explore or present at any phase of trial were not just those of a "head injury" like a transitory concussion from a childhood football game. Rather they are the consequences of a gunshot between the eyes to someone with an extensive history of other physical and chemical brain insults. As discussed further below, the functional neuroimaging requested by Respondent is therefore not only medically appropriate, but highly likely to be relevant to his legal claims.

I. The Decision To Transport Respondent Should Be Upheld, Whether Functional Neuroimaging Is Considered "Discovery" or Not, Because of the High Likelihood of the Imaging's Importance for His Habeas Corpus Issues.

To the extent the Court focuses on the issue of whether facilitating the examination requested by Respondent involves "discovery" or not, CLBB believes that the examination itself is (by its nature) not "discovery" and that transporting Respondent to a facility where the examination can occur is not a "discovery" device. But whether the examination is or is not characterized as "discovery," the science of such an examination is such that it is highly likely to be not only "plausibly related" to the habeas issues presented, but in fact of significant import.

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p. 8, at 11. Depending on the location of the bullet fragments in his skull, the examination proposed by Plaintiff may reveal that he has such an injury and its related "problems."

A. Functional Neuroimaging of Respondent Is Not "Discovery."

As noted previously, an individual's access to his or her own neurological condition is not a matter of "discovery." No law can properly deny entirely an individual's access to that which he or she already inherently and legally possesses. Respondent therefore cannot rightfully be required to limit himself to external legal "discovery" standards in choosing to interrogate what is happening in his own body.

For example, while reasonable time, place, and manner restrictions might be appropriate to avoid interference with the rights of others, no law could properly require a prisoner to comply with a "discovery" rule before interrogating his or her own brain condition by talking out loud to a psychiatrist or neurologist on site in the prison. No more should or can the law consider transportation to a facility for an examination that cannot occur on site in the prison a "discovery" device, or require a prisoner to submit to a "discovery" rule to interrogate his or her own brain condition in that way. While the output of such a voluntary self-interrogation may yield evidence, just as voluntary speech may, that does not make the process "discovery."

Furthermore, while the information revealed by the proposed examination is not yet known, the conditions it addresses are. Bullet fragments are still in Respondent's head and Respondent's conditions as a result of that gunshot, and other insults to his brain, are chronic.

For example, in 1996, while incarcerated, Respondent complained of severe left-side facial pain. ECF No. 98-3, at 2220. This is a symptom consistent with the right-side gunshot to his head. An appropriate clinical intervention in such circumstances is functional neuroimaging. *E.g.*, John D. Medaglia, *Functional Neuroimaging in Traumatic Brain Injury: From Nodes to Networks*, FRONTIERS IN NEUROLOGY, Aug. 24, 2017, at 1; Andrei Irimia & John D. Van Horn, *Functional Neuroimaging of Traumatic Brain Injury: Advances and Clinical Utility*, 2015 NEUROPSYCHIATRIC DISEASE AND TREATMENT 2355 (2015). No one can reasonably argue that a clinical intervention requires compliance with "discovery" processes—and the current proposed examination likely would not be necessary had such a clinical intervention occurred at the time with respect to the conditions that Respondent still has today.

Because information about Respondent's internal neurological condition should not be considered a matter of "discovery," the order of the District Court was entirely "agreeable to the usages and principles of law." 28 U.S.C. § 1651(a). But even if acquiring such information might now be defined as equivalent to acquiring information in "discovery," the requested examination process here would more than satisfy any such new definition.

B. Functional Neuroimaging Is Highly Likely To Provide Information Important to Respondent's Habeas Corpus Issues.

While Respondent asserted several issues relevant to his habeas corpus arguments below, the most

obvious ones involve ineffective assistance of counsel. This Court announced its two-part test for establishing ineffective assistance in *Strickland v. Washington*, 466 U.S. 668 (1984). First, the petitioner must show that counsel's representation "fell below an objective standard of reasonableness." *Id.* at 688. Second, the petitioner must demonstrate prejudice by showing "a reasonable probability that, but for counsel's unprofessional errors, the result of the proceeding would have been different." *Id.* at 694.

Here, the Ohio Supreme Court has already held that the representation of Respondent by his trial counsel failed to satisfy "an objective standard of reasonable representation." Pet. App. 189a. But it also concluded (without any factfinder ever having considered what the effects of a bullet to the head might be) that this failure did not harm Respondent. *See id.* at 189a-91a. *See also* Pet. App. 197a (concluding Respondent had no "mental disease or defect.").[8] While it found that Respondent's history and background presented "some . . . modest, weight in mitigation," and that he may have endured a "difficult upbringing" with an abusive stepfather, the court believed that he had "made clear choices in his early life to rebel against authority and to spend his time and effort on self-

[8] In effect, contrary to the record before it, the state court treated trial counsel's failure to present information about the physical condition of Respondent's brain, and any resulting neurological effects, as if it were the rejection of a well-developed alternative trial strategy, as opposed to something not investigated by counsel at all. *See*, *e.g.*, Pet. App. 231a, 238a-39a.

gratification through drugs, alcohol, and property crimes." Pet. App. 197a.

This is not, however, a view that is binding here. Under clearly established federal law, *Strickland* prejudice is assessed by evaluating the totality of the mitigating evidence—both the evidence adduced at trial and the evidence adduced in habeas proceedings—and then re-weighing all of it against the aggravating evidence to determine if "there is a reasonable probability that at least one juror would have struck a different balance." *Wiggins v. Smith*, 539 U.S. 510, 537 (2003). *See also Williams (Terry) v. Taylor*, 529 U.S. 362, 397-98 (2000) ("[T]he graphic description of Williams' childhood, filled with abuse and privation, or the reality that he was 'borderline mentally retarded,' might well have influenced the jury's appraisal of his moral culpability").

At a minimum under this standard, the functional neuroimaging proposed by Respondent could reveal or confirm the existence of deficits caused by physical and chemical insults to Respondent's brain. These deficits, on their own or in combination with Respondent's alcohol use at the time of his crime, would bear directly on whether and to what extent he could have controlled his own actions and under what circumstances. This could have undermined any notion that Respondent made "clear choices" about his behavior, influenced the jury's assessment of Respondent's moral culpability, and provided the jury with added reasons for affording Respondent compassion in deciding whether to impose the death penalty. In short, the results of the functional neuroimaging would shed substantial light

on the issue of whether the "result of" Respondent's conviction, or the "result of" his sentencing in fact "would have been different" because of the ineffective assistance of his counsel (including his counsel's failure to explore additional testing).

1. *An Overview of Brain Imaging.*

Brain imaging can be roughly divided into two categories: structural imaging and functional imaging. Structural imaging takes a static picture at one moment in time. It can reveal abnormalities in the size of brain structures, the presence of acute blood, and the presence of tumors and lesions—but not how the brain is functioning.

CT scans and MRI scans are the most common structural imaging techniques. CT scans use conventional x-ray images taken from different angles and combined by computer to provide more detail.

MRI scans use powerful magnets to produce a magnetic field that causes protons in the body to align with the field. *See generally*, *e.g.*, NATIONAL INSTITUTE OF BIOMEDICAL ENGINEERING, *Magnetic Resonance Imaging*, https://www.nibib.nih.gov/science-education/science-topics/magnetic-resonance-imaging-mri (last visited Mar. 29, 2022). Energy released by the protons when the magnetic field is removed produces images of soft tissues in the body, such as the brain, much better than a CT scan. MRI scans cannot, however, be used for patients that may have iron, steel, or other magnetizable objects in their bodies. The magnets used can exert enough force to move such objects violently, causing serious physical injury.

In contrast, functional imaging captures the dynamic processes of a working brain, rather than a static picture. PET scans and fMRI (functional MRI) scans are the imaging tools of choice for learning how a diseased or injured brain is actually working, identifying a diagnosis, and developing treatment options.

A PET scan identifies brain functions and abnormalities by measuring the uptake of radioactive tracers in the brain as a proxy for brain activity. An fMRI scan shows the brain in action by measuring changes in blood flow to specific areas of the brain when they are active, using blood oxygen levels as a proxy rather than a radioactive tracer.

While highly valuable tools, PET and fMRI scanners are large and require sophisticated computer systems to convert mathematically acquired data into images. In the case of PET scans, they also require an infrastructure to generate the radioactive isotopes that are used as ligands (molecules that "tag" other specific molecules by binding to them) for these scans. As a result, such scans are not performed outside of "tertiary care" medical facilities.

2. *Respondent's Medical History Makes Functional Brain Imaging Appropriate.*

Functional brain imaging using PET and fMRI scans is not a process indicated for every possible neurological issue. But where a patient's medical history indicates that physical or chemical damage to the brain may have occurred, and where the patient's

behavioral history is consistent with such damage, such imaging is likely to be revealing.

Respondent's background is rife with such indicators. While mentioned earlier and in Respondent's own briefing, some of that background deserves further emphasis to demonstrate why the examination he has requested is scientifically appropriate.

Well before the crime resulting in his current sentence, Respondent suffered multiple physical and biochemical insults to the brain of the kind linked to subsequent cognitive and behavioral problems. Medical records indicate that this may have begun with a fall from a second-floor porch when he was in the second grade. ECF No. 98-4, at 2480-81. He was also kicked, hit with fists, and thrown through a wall by his stepfather. ECF No. 98-3, at 2244. He began using drugs, primarily cannabis and alcohol, perhaps as early as age 7, ECF No. 98-3, at 2214, and certainly by age 9, Pet. App. 193a.

In 1975, at the age of 13, Respondent illegally entered a school building. When discovered by police, he shot himself between the eyes in an abrupt suicide attempt. The shot sent bullet fragments into the bone (the orbit) housing his right eye, into his sinuses, and near (or perhaps into) his brain. His right eye had to be removed. An orbital CT scan performed two years later revealed that bullet fragments still "extend[ed] directly medially to the area of the nasopharynx and then along a tract posteriorly to approximately the level of the sphenoid sinus." ECF No. 98-3, at 2230.

Today, some 20 to 30 bullet fragments remain in Respondent's head. Pet. App. 30a, 193a, 263a. In addition to the loss of an eye, the injury has resulted in continuing clinical symptoms, including left-sided cluster headaches, chronic sinusitis, facial pain, and bloody discharge from his nose. *See* ECF No. 98-3, at 2220.

3. *Respondent's Behavioral History Makes Functional Brain Imaging Appropriate.*

The history of physical and chemical insults to Respondent's brain indicate that functional neuroimaging would be likely to reveal additional information about their effect on his behavior. Respondent's behavior itself, as reflected in clinical records, confirms this.

In addition to a polysubstance use disorder (demonstrated by his chronic drug and alcohol abuse), Respondent was variously diagnosed, before the crime for which he is currently sentenced to death, with two other serious psychiatric conditions: major depression and mixed personality disorder. *See* ECF No. 98-3, at 2246. These conditions had a long history.

Formal psychiatric examination for Respondent seems to have begun when his mother sent him for psychiatric hospitalization as a child. *See, e.g.*, ECF No. 98-3, at 2244. It continued when he was discharged into an adolescent psychiatric unit after recovering physically from surgery after his self-inflicted gunshot at age 13. *See id.* at 2245.

At age 23, Respondent was again hospitalized for psychiatric reasons, this time at the Cleveland

Psychiatric Institute in 1986. *See* ECF No. 98-3, at 2251-53.[9] Then in 1988, at age 25, while imprisoned at the Marion Correctional Institute, Respondent attempted suicide again, this time by cutting his right arm and pumping his fist to increase the blood loss. ECF No. 98-3, at 2241. He was transferred to a forensic psychiatric hospital for treatment.

In June of 1990, Respondent attempted suicide yet a third time, severely lacerating his left hand while articulating a wish to die. ECF No. 98-3, at 2251. A subsequent forensic psychological examination described him as "a despondent, depressed, rejected and highly suicidal individual." ECF No. 98-3, at 2257. He presented as impulsive, irritable, and with poor impulse control, and clinicians described him as intolerant of stress and frustration. ECF No. 98-3, at 2251. Clinicians also noted immaturity and the impulsive quality of his suicidal behaviors, ECF No. 98-3, at 2259, drawing a direct link between the two in the form of "[p]oor impulse control resulting in self-mutilative behaviors." ECF No. 98-3, at 2252.

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[9] When Respondent was 8 years old, his mother had a "nervous breakdown." Pet. App. 52a. She eventually was psychiatrically hospitalized at least three times for "manic depression" (bipolar disorder). ECF No. 98-4, at 2488. This means Respondent had an increased risk of developing a mental illness. *See, e.g.*, Roselind Lieb, et al., *Parental Major Depression and the Risk of Depression and Other Mental Disorders in Offspring*, 59 ARCHIVES GEN. PSYCHIATRY 365, 372 (2002) ("Major depression in parents increases the overall risk in offspring for onset of depressive and other mental disorders and influences patterns of natural course of depression in the early stages of manifestation.").

4. *Functional Brain Imaging Is Highly Likely To Reveal Relevant Data About Respondent's Brain and Behavior.*

In May 1996, Respondent underwent an ENT (ear, nose, and throat) consultation after continuing to experience severe pain on the left side of his face. A radiologist involved in the consultation ultimately determined that there were "tiny metallic densities at the ethmoid sinuses," indicating that bullet fragments were still present near Respondent's brain. ECF No. 98-3, at 2220.

In July 1996, to try to determine better the location of the bullet fragments in his head in aid of treatment of his conditions, Respondent had a structural CT scan performed. The scan revealed 20 or 30 metal fragments "scattered in his nasion" (the top of the bridge of the nose, between the eyes) and in the "right orbital and ethmoid sinus regions" (the hollow spaces in the bones of the right eye and between the eyes and behind the nose). Pet. App. 30a (quoting ECF No. 106-2, at 7088). But there was no "clear view of his frontal lobes or the rest of his brain." *Id.* As a result, the CT structural scan could not establish whether Respondent has bullet fragments in his brain, is suffering more residual damage from the fragments already visible, or both.

Respondent is not and was not a candidate for an MRI because of the metal nature of the bullet fragments in his head. But that condition does not preclude a functional PET scan. As the scientific studies noted earlier indicate, such functional brain imaging has high value in identifying the brain deficits caused by injury to areas such as the orbitofrontal

cortex. *See*, *e.g.*, Joanna S. Fowler, et al., *supra* pp. 8, 10 n. 7. Studies of injuries such as those in Respondent's history certainly support this.

In addition, traumatic brain injury in pediatric populations typically causes harm to brain cells rather than to gross structures. This harm will not show up in structural imaging of the brain, such as from a CT scan. And although the externally visible symptoms from head injuries such as concussions are, in that young population, typically brief in duration, long-lasting deficits from such injuries occur that can be particularly destructive to the developing brain of a child, with resulting changes in personality and behavior. *E.g.*, Meeryo C. Choe, et al., *A Pediatric Perspective on Concussion Pathophysiology*, 24 CURRENT OPINION IN PEDIATRICS 689, 693 (2012).

Functional neuroimaging, unlike structural neuroimaging, can perceive these long-term effects of childhood and adolescent traumatic brain injury. Depending on which networks or cortical areas have been damaged, such injuries may decrease cognitive function (memory, reading, language, organization), mood regulation (rage, depression, anxiety), attention (distractibility, sleep dysregulation), and sensory or motor functions. The long-term consequences of these injuries, even without additional brain insults, can be a significant decrease in occupational, academic, and relational functioning and an increase in psychiatric illness. *See*, *e.g.*, John D. Medaglia, *supra* p. 12, at 1; Andrei Irimia and John Darrell VanHorn, *supra* p. 12, at 2358.

Nor is all traumatic brain injury caused by a physical insult. For example, the developing child and adolescent brain is particularly vulnerable to the effects of drug use, and such use increases the risk for developing substance use disorders later in life. B.J. Casey, et al. 1124 *The Adolescent Brain*, ANNALS OF THE NEW YORK ACAD. OF SCI.111, 116-17 (2008). In general, children who use alcohol have smaller prefrontal cortices and smaller hippocampi, areas in the brain responsible for planning, goal directed behavior, decision making, and impulse control. Early alcohol use also leads to smaller abnormalities in the temporal cortex and cingulate cortex, areas of the brain responsible for memory formation and reward anticipation. And, in general, adolescents with high alcohol use tend to demonstrate cognitive impairments, including difficulties with memory, attention, and response inhibition. *E.g.*, Krista M. Lisdahl, et al., *Dare to Delay? The Impacts of Adolescent Alcohol and Marijuana Use Onset on Cognition, Brain Structure and Function*, FRONTIERS IN PSYCHIATRY, Jul. 1, 2013, at 1, 4.

Early cannabis use also affects brain development in children and adolescents, including poor gray matter development in the prefrontal cortex, hippocampus, and other related memory encoding structures. *See*, *e.g.*, Krista L. Medina, et al., *Effects of Alcohol and Combined Marijuana and Alcohol Use During Adolescence on Hippocampal Volume and Asymmetry*, 29 NEUROTOXICOLOGY AND TERATOLOGY 141, 148 (2007). Functional neuroimaging studies show that such cannabis users can have poor connectivity between parts of the emotion regulating and executive

functioning networks, *i.e.*, the limbic system and the prefrontal cortex. If present, these brain alterations correlate with three important negative effects. First, adolescents who use marijuana (particularly before age 15) often have difficulty with impulse control, attention, memory, learning, and problem solving. Second, early cannabis use correlates with an increased risk for future substance use and mood disorders in later life. Finally, cannabis use in teens has been linked to a much greater risk of developing psychotic symptoms or a chronic psychotic disorder in young adulthood. *See generally*, Rebecca Crean, et al., *An Evidence-Based Review of Acute and Long-Term Effects of Cannabis Use on Executive Cognitive Functions*, 5 JOURNAL OF ADDICTION MEDICINE 1 (2011).

Finally, chronic cocaine use often produces changes in the pathways of the nucleus accumbens and the ventral tegmental area (structures more in the interior of the brain than those discussed above), changes that exacerbate both the desire to use the drug and that produce maladaptive responses to stress. *See* ECF No. 98-3, at 2219; ECF No. 99-3, at 6696 (referencing Respondent's cocaine use). Cocaine use also reduces functioning in the orbitofrontal cortex. This appears to underlie the poor decision-making, inability to adapt to negative consequences of drug use and lack of self-insight shown by people addicted to cocaine. *See* Nora D. Volkow, et al., *Addiction: Beyond Dopamine Reward Circuitry*, 108 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. OF THE USA, 15037, 15038 (2011); Hong Gu, *et al.*, *Mesocorticolimbic Circuits Are Impaired in Chronic Cocaine Users as Demonstrated by Resting-State Functional Connectivity*, 53 NEUROIMAGE 593 (2010);

Andreas Büttner, *Neuropathological Alterations in Cocaine Abuse*, 19 CURRENT MED. CHEMISTRY 5597-5600 (2012).

As these examples indicate, functional neuroimaging can reveal or confirm the existence of deficits caused by physical and chemical insults to the brain. These deficits, on their own or in combination with alcohol use by Respondent at the time, would bear directly on whether and to what extent he could have controlled his own actions (and under what circumstances).[10] Thus, the existence (or lack) of such data from the examination of Respondent will directly inform the likelihood that, if trial counsel had presented appropriate information about Respondent's brain at trial or sentencing, "the result of the proceeding[s] would have been different."

5. *A Further Example: Functional Brain Imaging and Post Traumatic Stress Disorder.*

Individuals who have experienced childhood psychological abuse, physical abuse, and high levels of intra-familial violence have a high rate of post-traumatic stress disorder (PTSD) in adolescence and adulthood. Gayla Margolin & Katrina A. Vickerman,

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[10] As one medical evaluator of Respondent noted, Respondent's "ability to exercise rational and voluntary choices at the time would have been adversely affected by any neurological deficits which resulted from having shot himself in the head . . . ." ECF No. 98-3, at 2198. *See also* ECF No. 98-3, at 2188-94 (similar as to any organic brain disorder caused by Respondent's early and long-term alcohol abuse).

Post-Traumatic Stress in Children and Adolescents Exposed to Family Violence: I. Overview and Issues, PROFESSIONAL PSYCHOLOGY: RSCH. AND PRACTICE, 38(6), Dec. 1, 2009, at 1, 2-4. The disorder is characterized by hypervigilance, hyperarousal, insomnia, agitation, irritability, impulsivity, memory deficits, withdrawal, confusion, aggression, and dissociation. Gerasimos Kolaitis, *Trauma and Post-Traumatic Stress Disorder in Children and Adolescents*, EUROPEAN JOURNAL OF PSYCHOTRAUMATOLOGY, Sept. 29, 2017, at 1. All othese reflect persistent and abnormal adaptations of the neurobiological systems regulating stress and fear. All of them are relevant to responsibility for criminal action (and the extent of such action).

Traumatic brain injury is also known to accentuate the risk of developing PTSD from subsequent traumatic experiences. Richard Bryant, *Post-Traumatic Stress Disorder vs Traumatic Brain Injury*, 13 DIALOGUES IN CLINICAL NEUROSCIENCE 251 (2011). Respondent's history therefore includes a remarkable number of the risk factors for the development of PTSD and its symptoms. *See*, *e.g.*, Alexandra Macdonald, et al., *PTSD and Comorbid Disorders in a Representative Sample of Adolescents: The Risk Associated with Multiple Exposures to Potentially Traumatic Events*, 34 CHILD ABUSE & NEGLECT 773, 774-83 (2010). A PTSD diagnosis would explain and unite many of Respondent's symptoms of mental illness documented by previous clinicians, including hypervigilance, irritability, insomnia, emotional dysregulation, dysphoria and impulse control deficits. *See*, *e.g.*, Gerasimos Kolaitis, *supra*, at 1.

Functional neuroimaging can reveal clear neurobiological correlates for PTSD by mapping biomarkers onto the structures and systems responsible for regulation of various important brain functions. For example, PTSD sufferers display a reduced volume of, and activity in, the hippocampus and the cortex, especially the prefrontal cortex, implicating altered stress responses and an impaired top-down control of fear. Jonathan E. Sherin & Charles B. Nemeroff, *Post Traumatic Stress Disorder: The Neurobiological Impact of Psychological Trauma*, 13 DIALOGUES IN CLINICAL NEUROSCIENCE 263, 265, 269 (2001). Because the cortex is responsible for executive functioning, planning, comportment, and control of impulsive responses, seeing such results in a functional PET scan (a distinct possibility in Respondent's case) would have obvious implications for issues of premeditated versus spontaneous or impulsive violence, an ability to control responses, an ability to recall and recount narratives appropriately, and a vulnerability to coercive interrogation.

Yet even though PTSD has been recognized as a serious mental illness since 1980, *see generally* AMERICAN PSYCHIATRIC ASSOCIATION, DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS (3d ed. 1980), there is no indication that Respondent's counsel or expert ever considered offering evidence that his medical, behavioral, and personal history was consistent with PTSD. The neuroimaging Petitioner seeks is therefore highly likely to be relevant to his claims of ineffective assistance of counsel.

II. Permitting the Functional Neuroimaging of Respondent's Brain Will Not Establish a "Dangerous" Standard Requiring the Collection of "Irrelevant, Unusable Evidence."

As the examples above indicate, the functional neuroimaging sought by Respondent is highly likely to provide information important to his habeas corpus issues, most obviously his claims of ineffective assistance of counsel. Those examples also indicate a high likelihood that the data produced will be relevant and usable.

Of course, not all patients who have endured adverse experiences in childhood or adolescence will show relevant biomarkers during functional neuroimaging and functional neuroimaging would not be appropriate for all such patients. But the exceptional number and severity of overlapping insults in this case (early head trauma, childhood physical assault, early substance use, and a gunshot wound to the head) greatly increase the likelihood that such a scan will reveal functional damage to brain areas mediating behavioral inhibition, memory, cognitive capacity, complex decision making, affect regulation, and motor control. This makes it easy to conclude that functional neuroimaging is both clinically and forensically indicated for Respondent.

To the extent the Court nonetheless has any concerns that subsequent prisoners seeking examinations that cannot be conducted in prison will misuse this precedent, the answer would not be to apply (in advance of knowing what the examination actually shows) standards related to discovery or

admissibility, but instead to apply a standard for what sort of examination is sought. If a proposed examination is supportable as a scientifically valid inquiry, it is unlikely to produce "irrelevant, unusable evidence" on a regular basis. The examination process proposed by Respondent certainly more than satisfies the standard of a scientifically valid inquiry.

CONCLUSION

This Court should affirm the decision of the Court of Appeals. To the extent the Court would seek prospectively to limit the scope of orders such as the one issued by the District Court, it should add to the Court of Appeals' decision only a requirement that a proposed examination be supported as a scientifically valid inquiry, not that a court first attempt to predict the output of such an inquiry.

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April 4, 2022