

Solitary confinement is the act of physically and socially isolating individuals in closed cells for up to 24 hours per day. People held in solitary are often subject to intense surveillance and security measures, including shackling, and are deprived of educational and recreational outlets. **According to a 2023 report published by Solitary Watch and the Unlock the Box campaign, at least 122,000 people are in solitary on any given day in U.S. prisons and jails.**¹ Some remain in solitary for months, years, or even decades. According to the United Nations, the U.S. holds far more individuals in solitary confinement than other countries, for longer periods of time, and with fewer protections.²

Existing research on the psychological effects of solitary confinement suggest that the practice is extremely harmful, both emotionally and cognitively. One study showed that people in solitary are seven times more likely to commit self-harm and six times more likely to commit fatal self-harm than those held in general prison populations.³ Individuals held in solitary for any amount of time while serving a prison sentence are also more likely to die of all causes in the first year after release, especially of suicide and homicide.⁴

A growing body of research also shows that isolation has deep and lasting effects on the chemistry and functioning of the human brain and nervous system. This research provides convincing evidence that in addition to its devastating psychological impact, solitary confinement causes serious—and in some cases, permanent—neurological damage.

Solitary Confinement Rewires the Brain

“The brain is comprised of 100 billion cells, 500 trillion connections. It is an organ of social function. The brain needs to interact in the world.”

—Dr. Huda Akil, Professor of Neurosciences, University of Michigan⁵

Research into the exact neurological consequences of solitary confinement is limited, due to both ethical standards prohibiting the creation of such conditions in the lab, as well as lack of access to incarcerated individuals, preventing data collection in the field.

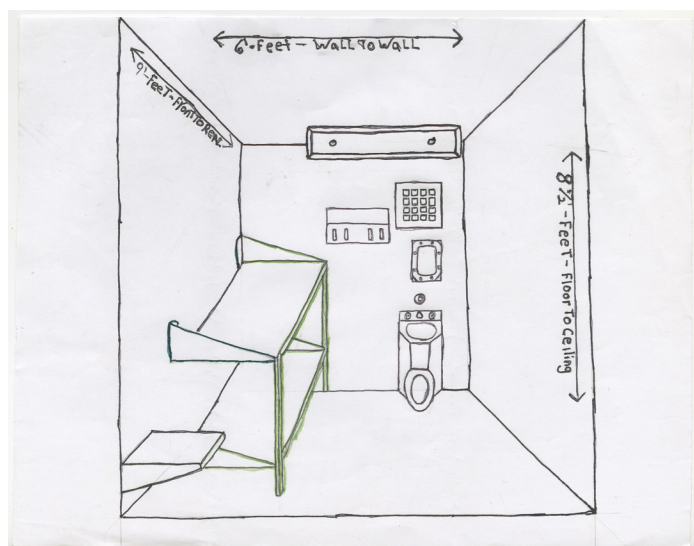
According to psychiatrist Stuart Grassian, however, the wide range of pathologies exhibited by many survivors of solitary confinement form a distinct “acute organic brain syndrome,” more neurological in nature than psychological. The symptoms of this syndrome include dissociative psychosis; loss of perceptual constancy (objects become larger and smaller; sounds become louder and quieter, etc.); hallucinations; hyperresponsivity to external stimuli; delirium; paranoia; agitation; and random, impulsive, and self-destructive behavior.⁶

Social Isolation Has Parallels to Physical Pain

“Isolation devastates the brain. There is no question about that. Without air, we will live minutes. Without water, we will live days. Without nutrition, we live weeks. Without physical activity, our lives are decreased by years. Social interaction is part of these basic elements of life.”

—Dr. Michael J. Zigmond, Professor of Neurology, University of Pittsburgh⁷

Carceral facilities take extreme steps to deprive individuals held in solitary confinement of meaningful and sustained social interactions. People live in almost total isolation



Kenny Zulu Whitmore's drawing of his solitary cell at the Louisiana State Penitentiary at Angola.

while in their cells, with most contact with prison staff taking place through small meal slots in cell doors, or over intercom systems.⁸ In some isolation settings, communication with other incarcerated individuals is possible, but only through shouting or knocking and banging on walls.⁹ Contact with the outside world via letters, phone calls, or in-person visits is usually restricted, if permitted at all.¹⁰

Neurologists contend that social contact is a human need, as necessary as water, food, or shelter.¹¹ In one study, researchers asked participants to spend ten hours in complete isolation. Following the experience, fMRI scans showed activity in the brain almost identical to previous imaging captured during hunger cravings.¹²

In his expert testimony during one of the most significant legal challenges to solitary confinement to date, *Ashker v. Governor of California*, neuroscientist Dr. Matthew Lieberman presented data showing that the “social pain” of social exclusion and isolation activates the same regions of the brain as does physical pain.¹³

Studies into dementia, Alzheimer’s disease, and other cognitive degenerative disorders have found links between self-reported loneliness or social isolation and overall poor cognitive performance and increased cognitive decline, including in verbal fluency, memory, new learning, orientation, attention, comprehension, mathematics, and reasoning.¹⁴

Sensory Deprivation Shows Up on Brain Scans

“I’ve experienced times so difficult and felt boredom and loneliness to such a degree that it seemed to be a physical thing inside so thick it felt like it was choking me, trying to squeeze the sanity from my mind, the spirit from my soul, and the life from my body.”

—William Blake, survivor of solitary confinement in New York state prisons¹⁵

The material conditions of solitary confinement units force individuals into chronic ennui and idleness. The cells are usually smaller than a parking space, and contain a bed, toilet, sink, and sometimes a desk and stool. Cells contain small, high windows or are windowless. Most have solid steel doors, save a small meal slot. Some survivors of solitary confinement report incessant fluorescent lighting that never turns off, day or night, while others say they live in total darkness.

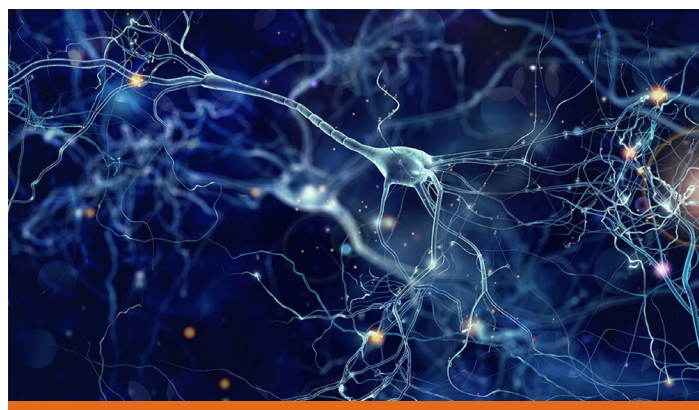
In addition to being chronically deprived of visual and auditory stimuli, victims of solitary confinement are also denied opportunities for intellectual stimulation. Extracellular programming (such as work or education) is usually forbidden, as are resources for enrichment and distraction such as reading and writing materials, radios, and art supplies.

Research on the effects of such deprivation conditions on humans and even primates are extremely rare, as they rarely meet ethical standards. One study conducted at McGill University in 1951, meant to last six weeks, was cut short after only seven days when participants complained of hallucinations and clouded thinking, amongst other troubling cognitive outcomes such as reduced competency in simple arithmetic and word associations, extreme fixation, and abnormal emotional outbursts.¹⁶

Several studies have shown reduced electroencephalography (EEG) frequency after time in deprivation environments, including in real-life solitary confinement settings, in as little as one week.¹⁷

More recently, researchers attempted to recreate the conditions of solitary confinement with adult rats by creating two environments: one spacious and enriched with opportunities for the animals to socialize and exercise, and the other cramped, barren, and totally isolated from the other animals. After raising the rats in the enriched environment, researchers moved half of the cohort into its deprivation counterpart. One month later, scans of the isolated rats’ brains showed their neurons had shrunk by 20 percent in volume.¹⁸

Studies on rats also showed that “animals that languished in spartan, supermax-style cages had fewer connections between neurons and thinner cerebral cortexes... Various types of enriched or impoverished environmental exposures could alter the dimensions and even the cellular content of the cortex at any age from newborn to elderly. Even four days of impoverished environment could have an impact on the physiology of the cortex and its ability to navigate the world,” writes journalist Shruti Ravindran. “These were stunning discoveries. The cerebral cortex, what we refer to as ‘grey matter,’ is the part of the brain that makes us most human.”¹⁹



Neurons in a human brain. Experiments have shown that isolation can shrink neurons by as much as 20 percent.

Solitary Causes Chronic Stress

“[In solitary confinement] I would wake up in the middle of the night, my heart pounding... There is an intensity that I can still describe to this day... I could be walking and think about what it’s like to be in that space where you can’t even see color.”

—Dolores Canales, survivor of solitary confinement in California prisons²⁰

The combined trauma of extreme social isolation and sensory deprivation experienced by individuals housed in solitary confinement creates long-term and extreme stress, which in turn triggers the release of chronically high levels of cortisol and other stress hormones in the body.²¹

Research into depressive and post-traumatic stress disorders has established that sustained flooding of the brain with stress hormones can cause damage to one of its most essential structures, the hippocampus, by stunting new nerve cell growth (neurogenesis) and causing the region to “literally shrivel.”²² The atrophy of the hippocampus hinders its ability to perform essential executive functions related to memory retention, regulation of emotions, and spatial awareness.

Conversely, chronically high levels of stress hormones simultaneously cause hypertrophy, or growth and strengthening, in neurons in the amygdala, allowing them to fire faster in this region of the brain, which is thought to control fear responses. Studies on rats exposed to chronic stress linked these combined changes in both the hippocampus and amygdala to anhedonia (inability to feel pleasure, a principal symptom of major depression), increased “fight or flight” response, and altered coping strategies in response to stress.²³

Survivors of solitary confinement report a multitude of cognitive and mental health deficiencies consistent with changes in the hypothalamus and amygdala caused by chronic stress, including depression and suicidal thoughts,²⁴ anxiety-related behaviors,²⁵ and difficulties with memory²⁶ and spatial awareness.²⁷

Solitary Is Particularly Damaging to Developing Brains

“The experience of isolation is especially frightening, traumatizing, and stressful for juveniles... These traumatic experiences can interfere with and damage these essential developmental processes, and the damage may be irreparable.”

—Dr. Craig Haney, Professor of Psychology, University of California, Santa Cruz²⁸

Nearly half of all youth carceral facilities in the U.S. reported forcibly isolating children and using mechanical restraints to manage undesired behavior in 2014.²⁹ And 2015 data from the Justice Department revealed that approximately 17,000 children are held in solitary confinement in the U.S. at any time, a likely underestimate.³⁰

In the young, developing brain, the effects of solitary confinement are especially dangerous. Areas of the prefrontal cortex, the region of the brain responsible for “executive functions” like emotional regulation, reasoning, and decision making, continue to develop until our twenties. Thus, children are biologically less capable of coping with the trauma and stress of living in isolation.³¹

Children’s neurological vulnerability to the onslaught of poor psychiatric outcomes associated with solitary confinement are tragically clear: half of all suicides in youth detention facilities occurred when the child was in solitary confinement.³²

Neuroscientific Research Offers New Challenges to Solitary Confinement

“Think of your brain being similar to trees in spring with a lot of leaves and buds Visually, you can look at scans and see winter in the brain. [Solitary confinement] gives new meaning to the ‘winter of our lives.’”

—Huda Akil, Professor of Neuroscience, University of Michigan³³

For the most part, U.S. courts have so far found that solitary confinement does not constitute cruel and unusual punishment and does not violate the Constitution because it does not involve the “deprivation of basic identifiable human needs.”³⁴ These “basic human needs” have usually been narrowly defined by the courts as physical needs such as food and exercise, and tend to dismiss the psychological pain brought on by isolation.

According to Federica Coppola of Columbia University’s Center for Science and Society, among others, new research showing that “social interaction and environmental stimulation are of vital importance for physiological brain function” may open up new legal avenues to challenge solitary confinement. These new insights, Coppola argues, show that “solitary confinement is in and of itself cruel and unusual punishment even under the current standards.”³⁵

Resources

Ahalt, Cyrus, Craig Haney, Sarah Rios, Matthew P. Fox, David Farabee, and Brie Williams. “Reducing the Use and Impact of Solitary Confinement in Corrections.” *International Journal of Prisoner Health* 13, no. 1 (March 13, 2017): 41–48. <https://doi.org/10.1108/ijph-08-2016-0040>.

Blanco-Suarez, Elena. “The Effects of Solitary Confinement on the Brain.” *Psychology Today*, February 27, 2019. <https://www.psychologytoday.com/us/blog/brain-chemistry/201902/the-effects-solitary-confinement-the-brain>.

Grassian, Stuart. “Psychiatric Effects of Solitary Confinement.” *Washington University Journal of Law & Policy* 22 (January 2006): 337–38. https://openscholarship.wustl.edu/cgi/viewcontent.cgi?article=1362&context=law_journal_law_policy.

Guenther, Lisa. *Solitary Confinement: Social Death and Its Afterlives*. Minneapolis, MN: University of Minnesota Press, 2013.

Ravindran, Shruti. “Twilight in the Box: What Solitary Confinement Does to the Brain,” *Aeon*, February 27, 2014: <http://aeon.co/magazine/society/what-solitary-confinement-does-to-the-brain/>.

Reiter, Keramet, Joseph Ventura, David Lovell, Dallas Augustine, Melissa Barragan, Thomas Blair, Kelsie Chesnut, et al. “Psychological Distress in Solitary Confinement: Symptoms, Severity, and Prevalence in the United States, 2017–2018.” *American Journal of Public Health* 110, no. S1 (January 22, 2020). <https://doi.org/10.2105/ajph.2019.305375>.

Schaeffer, Carol. “‘Isolation Devastates the Brain’: The Neuroscience of Solitary Confinement.” *Solitary Watch*, May 11, 2016. <https://solitarywatch.org/2016/05/11/isolation-devastates-the-brain-the-neuroscience-of-solitary-confinement>.

Notes

1 Solitary Watch and Unlock the Box, *Calculating Torture: Analysis of Federal, State, and Local Data Showing More Than 122,000 People in Solitary Confinement in U.S. Prisons and Jails*, May 2023, <https://solitarywatch.org/calculating-torture/>.

2 Jean Casella, James Ridgeway, and Sarah Shourd, *Hell Is a Very Small Place: Voices from Solitary Confinement* (New York: New Press, 2018).

3 Fatos Kaba et al., “Solitary Confinement and Risk of Self-Harm Among Jail Inmates,” *American Journal of Public Health* 104, no. 3 (2014): 445, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3953781/>.

4 Lauren Brinkley-Rubinstein et al., “Association of Restrictive Housing During Incarceration with Mortality After Release,” *JAMA Network Open* 2, no. 10 (2019): 5, <https://doi.org/10.1001/jamanetworkopen.2019.12516>.

5 Carol Schaeffer, “Isolation Devastates the Brain’: The Neuroscience of Solitary Confinement,” Solitary Watch, May 11, 2016, <https://solitarywatch.org/2016/05/11/isolation-devastates-the-brain-the-neuroscience-of-solitary-confinement/>.

6 Stuart Grassian, “Psychiatric Effects of Solitary Confinement,” *Washington University Journal of Law & Policy* 22, (January 2006): 337–38, https://openscholarship.wustl.edu/cgi/viewcontent.cgi?article=1362&context=law_journal_law_policy.

7 Schaeffer, “Isolation Devastates the Brain’: The Neuroscience of Solitary Confinement.”

8 Pizarro, Jesenia, and Vanja M. K. Stenius, “Supermax Prisons: Their Rise, Current Practices, and Effect on Inmates,” *Prison Journal* 84, (2004): 248–64, <https://doi.org/10.1177/0032885504265080>.

9 Peter Scharff Smith, “The Effects of Solitary Confinement on Prison Inmates: A Brief History and Review of the Literature,” *Crime and Justice* 34, no. 1 (2006): 449, <https://doi.org/10.1086/500626>.

10 Ibid, 443.

11 Matthew Lieberman, *Social: Why Our Brains Are Wired to Connect*, (New York: Crown, 2013).

12 Livia Tomova, Kimberly L. Wang, et al., “Acute Social Isolation Evokes Midbrain Craving Responses Similar to Hunger,” *Nature Neuroscience* 23, (November 2020): 1597–1605, <https://doi.org/10.1101/2020.03.25.006643>.

13 Matthew D. Lieberman, *Todd Ashker v. Governor of California* (expert report), United States District Court, Northern District of California, Oakland Division, 8–9, <https://ccrjustice.org/sites/default/files/attach/2015/07/Lieberman%20Expert%20Report.pdf>.

14 Nancy J. Donovan, Qiong Wu, et al., “Loneliness, Depression and Cognitive Function in Older U.S. Adults,” *International Journal of Geriatric Psychiatry* 32, no. 5 (May 2017): 564–73. Lara Elvira, Francisco Félix Caballero, et al., “Are Loneliness and Social Isolation Associated with Cognitive Decline?” *International Journal of Geriatric Psychiatry* 34, no. 11 (July 14, 2019): 1613–22, <https://doi.org/10.1002/gps.5174>. <https://doi.org/10.1002/gps.4495>.

15 Jean Casella and James Ridgeway, “America’s Most Isolated Federal Prisoner Describes 10,220 Days in Extreme Solitary Confinement,” Solitary Watch, May 5, 2011, <https://solitarywatch.org/2011/05/05/americas-most-isolated-federal-prisoner-describes-10220-days-in-extreme-solitary-confinement/>.

16 Michael Mechanic, “What Extreme Isolation Does to Your Mind,” *Mother Jones*, October 18, 2012, <https://www.motherjones.com/politics/2012/10/donald-o-hebb-effects-extreme-isolation/>.

17 Peter Scharff Smith, “The Effects of Solitary Confinement on Prison Inmates,” 471.

18 Laura Sanders, “Loneliness Is Bad for Brains,” *Science News*, January 28, 2020, <https://www.sciencenews.org/article/loneliness-isolation-brain-changes>. V. Heng, M.J. Zigmund, and R.J. Smeyne, “Neurological effects of moving from an enriched environment to social isolation in adult mice,” *Society for Neuroscience*, November 5, 2018, <https://www.abstractsonline.com/pp8/#/14649/presentation/20940>.

19 Ravindran, Shruti. “Twilight in the Box: What Solitary Confinement Does to the Brain,” *Aeon*, February 27, 2014: <http://aeon.co/magazine/society/what-solitary-confinement-does-to-the-brain/>.

20 Schaeffer, “‘Isolation Devastates the Brain’: The Neuroscience of Solitary Confinement.”

21 Greg Miller, “Why Loneliness Is Hazardous to Your Health,” *American Association for the Advancement of Science*, January 14, 2011, <https://www.science.org/doi/10.1126/science.331.6014.138>.

22 Nadia Ramlagan, “Solitary Confinement Fundamentally Alters the Brain, Scientists Say,” *American Association for the Advancement of Science*, February 15, 2014, <https://www.aaas.org/news/solitary-confinement-fundamentally-alters-brain-scientists-say>.

23 McEwen, Bruce S, Carla Nasca, and Jason D Gray, “Stress Effects on Neuronal Structure: Hippocampus, Amygdala, and Prefrontal Cortex,” *Neuropsychopharmacology* 41, (August 19, 2015): 17, <https://doi.org/10.1038/npp.2015.171>. Bergland, Christopher. “Chronic Stress Can Damage Brain Structure and Connectivity,” *Psychology Today*, February 12, 2014, <https://www.psychologytoday.com/ie/blog/the-athletes-way/201402/chronic-stress-can-damage-brain-structure-and-connectivity>.

24 HALT Solitary Campaign, *The Walls Are Closing in on Me: Suicide and Self-Harm in New York State’s Solitary Confinement Units*, 2020, http://nycaic.org/wp-content/uploads/2020/05/The-Walls-Are-Closing-In-On-Me_For-Distribution.pdf. Prison Policy Initiative, “New Data: Solitary Confinement Increases Risk of Premature Death After Release,” October 13, 2020, https://www.prisonpolicy.org/blog/2020/10/13/solitary_mortality_risk/.

25 Rafael T. Han, Young-Beom Kim, et al., “Long-Term Isolation Elicits Depression and Anxiety-Related Behaviors by Reducing Oxytocin-Induced GABAergic Transmission in Central Amygdala,” *Frontiers in Molecular Neuroscience* 11, (2018), <https://doi.org/10.3389/fnmol.2018.00246>.

26 Grassian, “Psychiatric Effects of Solitary Confinement,” 335.

27 Schaeffer, “‘Isolation Devastates the Brain’: The Neuroscience of Solitary Confinement.”

28 Laura Dimon, “How Solitary Confinement Hurts the Teenage Brain,” *The Atlantic*, June 30, 2014, <https://www.theatlantic.com/health/archive/2014/06/how-solitary-confinement-hurts-the-teenage-brain/373002/>.

29 Charles Puzanchera and Sarah Hockenberry, “Data Reflect Changing Nature of Facility Populations, Characteristics, and Practices,” Office of Juvenile Justice and Delinquency Prevention, (August 2016), https://www.ojjdp.gov/OJSTATBB/snapshots/DataSnapshot_JRFC2014.pdf.

30 Timothy Williams, “Locked in Solitary at 14: Adult Jails Isolate Youths Despite Risk,” *New York Times*, August 15, 2015, <https://www.nytimes.com/2015/08/16/us/citing-safety-adult-jails-put-youths-in-solitary-despite-risks.html>.

31 Human Rights Watch, *Growing Up Locked Down: Youth in Solitary Confinement in Jails and Prisons Across the United States*, (2012): 32, <https://www.aclu.org/files/assets/us1012webwcover.pdf>.

32 Lindsay M. Hayes, “Juvenile Suicide in Confinement,” Office of Juvenile Justice and Delinquency Prevention, (February 2009), <https://www.ojp.gov/pdffiles1/ojjdp/213691.pdf>.

33 Christina Sterbenz, “4 Reasons to Ban Solitary Confinement,” *Business Insider*, February 28, 2014, <https://www.businessinsider.com/jules-lobel-says-solitary-confinement-is-unconstitutional-2014-2>.

34 U.S. Supreme Court, *Rhodes v. Chapman*, 452 U.S. 337 (1981).

35 Federica Coppola, “The Brain in Solitude: An (other) Eighth Amendment Challenge to Solitary Confinement,” *Journal of Law and the Biosciences* 6, no. 1 (October 2019), 184–225. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6813937/pdf/lsz014.pdf>.

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