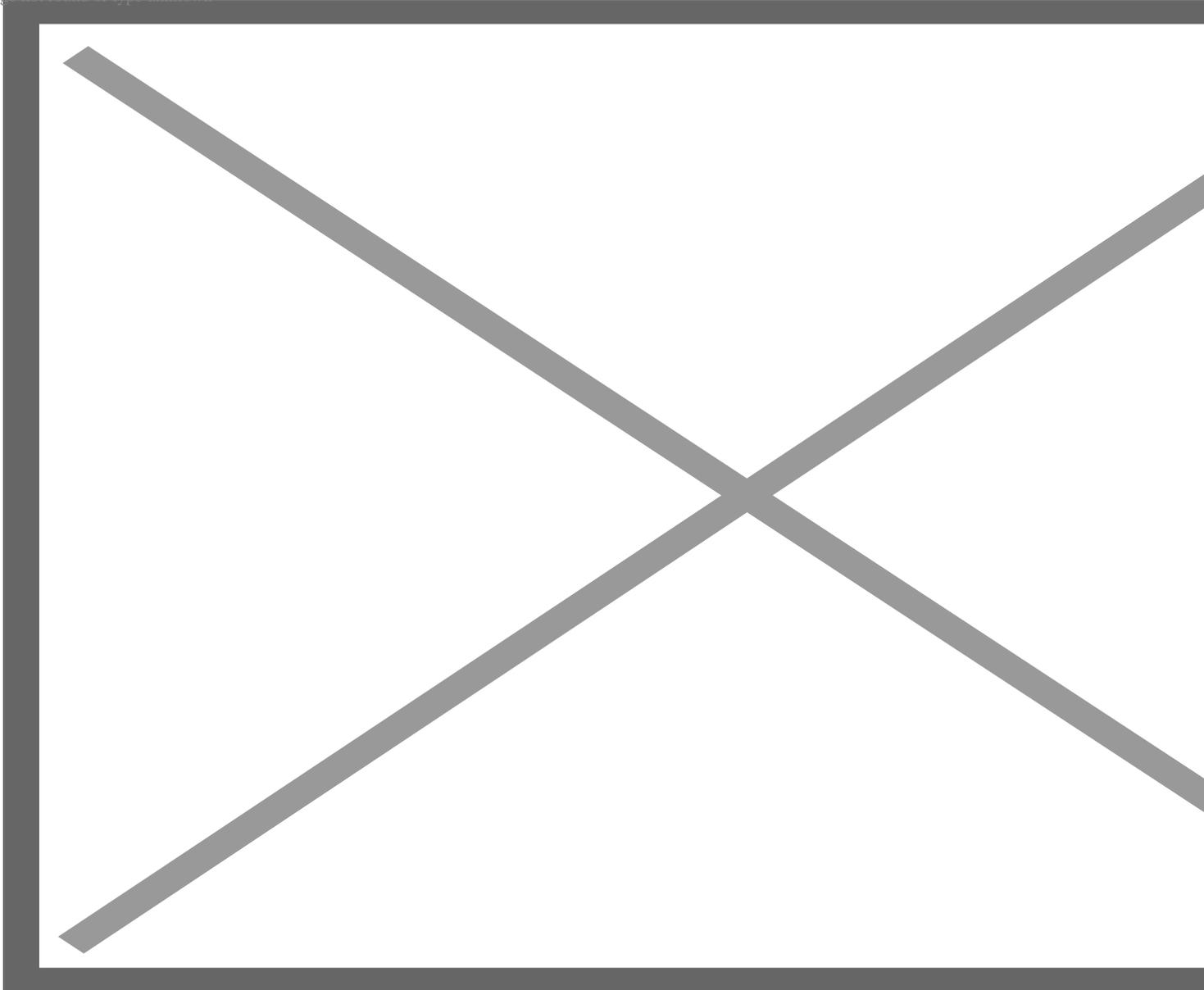


## Neuroweapons & neurohacking (dual-use neuroscience)

### Description

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**Janus**, Roman god of gates, doorways, beginnings, and endings, and Bellona, Roman goddess of war. Sculpture by Johann Wilhelm Beyer, Garden.

### Why Gene Editors Like CRISPR/Cas May Be a Game-Changer for Neuroweapons

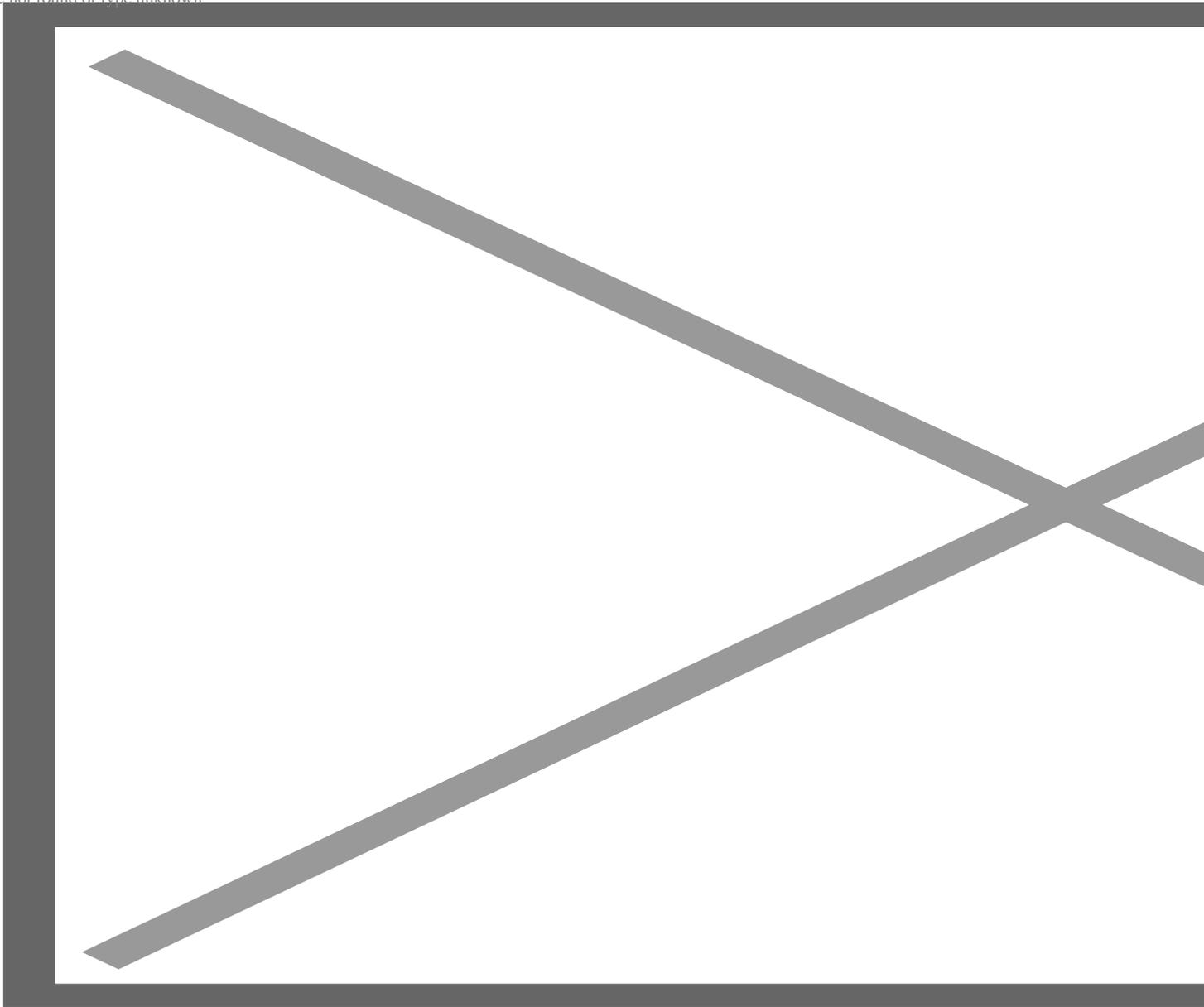
"This year marks the Eighth Review Conference (RevCon) of the Biological Toxins and Weapons Convention (BWC). At the same time, ongoing international efforts to further and more deeply

investigate the brain's complex neuronal circuitry are creating unprecedented capabilities to both understand and control neurological processes of thought, emotion, and behavior. These advances have tremendous promise for human health, but the potential for their misuse has also been noted, with most discussions centering on research and development of agents that are addressed by existing BWC and Chemical Weapons Convention (CWC) proscriptions. In this article, we discuss the dual-use possibilities fostered by employing emergent biotechnologic techniques and tools—specifically, novel gene editors like clustered regular interspaced short palindromic repeats (CRISPR)—to produce neuroweapons. Based on our analyses, we posit the strong likelihood that development of genetically modified or created neurotropic substances will advance apace with other gene-based therapeutics, and we assert that this represents a novel—and realizable—path to creating potential neuroweapons. In light of this, we propose that it will be important to re-address current categorizations of weaponizable tools and substances, so as to better inform and generate tractable policy to enable improved surveillance and governance of novel neuroweapons.

The authors discuss the dual-use possibilities fostered by employing emergent biotechnologic techniques and tools—specifically, novel gene editors like clustered regular interspaced short palindromic repeats (CRISPR)—to produce neuroweapons. They posit the strong likelihood that development of genetically modified or created neurotropic substances will advance apace with other gene-based therapeutics and assert that this represents a novel—and realizable—path to creating potential neuroweapons.”

[...] “In the interim, it is likely that more indirect means of manipulating the brain and behavior will be developed. “Neurohacking” will increase, and biotechnology, such as CRISPR/Cas and novel gene editors, will provide tools to realize production of novel neuroagents with dual-use potential. Simple acknowledgment of these facts, however, is insufficient. It will be essential to pursue and obtain a deeper and fuller understanding of the ways that genetic pathways to human cognitive and behavioral modification can be engaged for dual and direct use as neuroweapons, to formulate policies based on this level of understanding, and to engage surveillance of the use of these technologies in various silos of development and application, so as to afford both preventive and more preparatory capabilities.”

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DiEuliis, D., & Giordano, J.. (2017). Why Gene Editors Like CRISPR/Cas May Be a Game-Changer for Neuroweapons. *Health Security*, 15(3), 296–302.

Plain numerical DOI: 10.1089/hs.2016.0120

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### **Show/hide publication abstract**

“This year marks the eighth review conference (revcon) of the biological toxins and weapons convention (bwc). at the same time, ongoing international efforts to further and more deeply investigate the brain’s complex neuronal circuitry are creating unprecedented capabilities to both understand and control neurological processes of thought, emotion, and behavior. these advances have tremendous promise for human health, but the potential for their misuse has also been noted, with most

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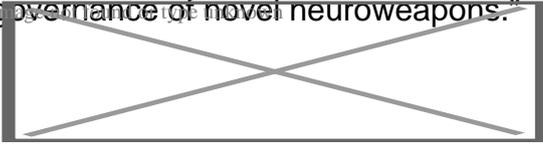
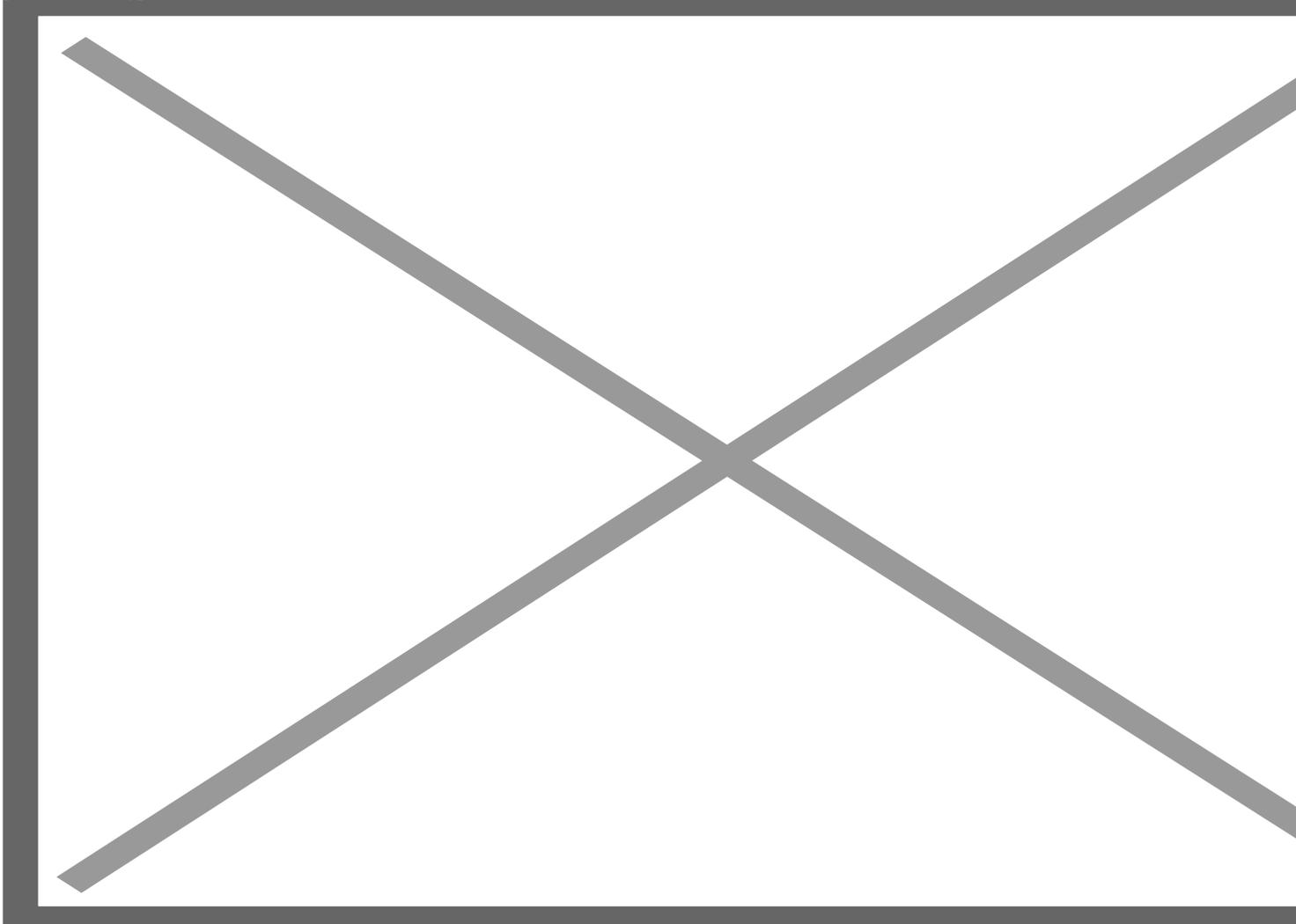


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Janus and his two faces: past and future.

"There is a scientific race for decoding the human brain. current and near future technology will make it possible to not only merely influence the enemy's mind and behavior, but to actually control it.

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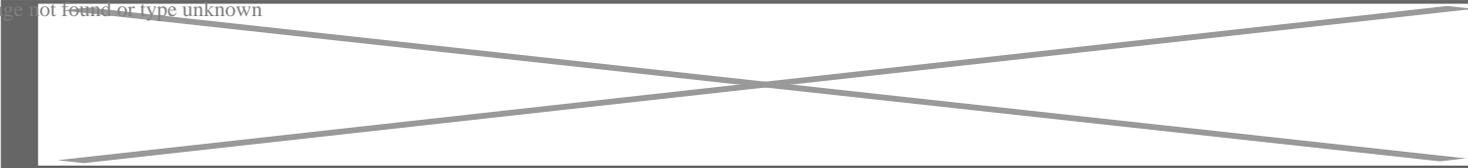
breakthroughs in neuroscience will enable new types of non-lethal weapons for precise behavioral manipulation, for example through behavior-altering neurotropic drugs, through remote electromagnetic brain monitoring and stimulation, through acoustic weapons beaming voices directly into enemy heads, and even through holographic projections and other 'complex battlefield illusions.' within ten years soldiers could be equipped with transcranial magnetic stimulation devices or brain-computer interfaces, which would make it possible for their commanders to steer their emotions and to control their thoughts. this paper will discuss how the emerging sixth domain of warfare (the mind) is likely to transform military operations and profoundly change how wars are conducted. it is argued that military operations will be increasingly centered on achieving desired psychological effects, which will, on the positive side, reduce the need for physical destruction and killing. at the same time, 'neuroweapons' will also create new and unprecedented dangers, resulting from misuse and proliferation, which will need to be addressed through development of a concept of 'neurosecurity' that will be outlined."

Krishnan, A.. (2014). From Psyops to Neurowar: What Are the Dangers?. Paper to Be Presented at the ISAC-ISSS Conference in Austin, 14-16 November 2014

### Show/hide publication abstract

"There is a scientific race for decoding the human brain. current and near future technology will make it possible to not only merely influence the enemy's mind and behavior, but to actually control it. breakthroughs in neuroscience will enable new types of non-lethal weapons for precise behavioral manipulation, for example through behavior-altering neurotropic drugs, through remote electromagnetic brain monitoring and stimulation, through acoustic weapons beaming voices directly into enemy heads, and even through holographic projections and other 'complex battlefield illusions.' within ten years soldiers could be equipped with transcranial magnetic stimulation devices or brain-computer interfaces, which would make it possible for their commanders to steer their emotions and to control their thoughts. this paper will discuss how the emerging sixth domain of warfare (the mind) is likely to transform military operations and profoundly change how wars are conducted. it is argued that military operations will be increasingly centered on achieving desired psychological effects, which will, on the positive side, reduce the need for physical destruction and killing. at the same time, 'neuroweapons' will also create new and unprecedented dangers, resulting from misuse and proliferation, which will need to be addressed through development of a concept of 'neurosecurity' that will be outlined."

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## Further References

Bruner, R. C., & Lentzos, F.. (2019). Militarising the Mind: Assessing the Weapons of the Ultimate Battlefield. BioSocieties

Plain numerical DOI: 10.1057/s41292-018-0121-4

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“Advancements in behavioural neuroscience have revolutionised the treatment of mental illness by elucidating the mechanisms underpinning human behaviour and cognition. these advancements are not completely benevolent, but have dual-use potential which harkens back to a darker time when states sought to influence and control each other’s citizenry through psychological means. this article puts proposed behaviour-altering neuroscience weapons into their appropriate technical, historical, and geopolitical contexts to present a sober and critical analysis of the threat arising from the weaponisation of behavioural neuroscience. it argues that by using psychiatric drugs, brain stimulation, brain imaging or neurobiochemical weapons, states may be able to leverage neuroscientific advances to influence, control, and manipulate human behaviour and cognition. however, these approaches are extremely nascent and face technical and operational challenges that make their deployment difficult. despite this, in consideration of the rapid pace of scientific advancement, growing geopolitical instability, and ambiguities in international law, scientists and the international community must remain vigilant as these technologies become more refined and the practical barriers to use begin to lower.” Evans, N. G.. (2021). Neuroweapons. In The Ethics of Neuroscience and National Security

Plain numerical DOI: 10.4324/9780429447259-6

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Dando, M.. (2015). Neuroscience and the Future of Chemical-Biological Weapons. Neuroscience and the Future of Chemical-Biological Weapons

Plain numerical DOI: 10.1057/9781137381828

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“This study is concerned with the potential misuse of advances in neuroscience. recently, fears surrounding the abuse of benignly-intended research in the life sciences –the dual-use problem — have focused on ‘Gain-of function’ experiments, in which deadly influenza viruses have been made transmissible through the air. however, many other aspects of the life sciences, besides the study of viruses, could be subject to hostile misuse. there is a century-long history of the development of novel neuroweapons, which is based on civil research and a vast, ongoing increase in research funding. these developments underpin an attempt to produce a mechanistic understanding of brain functions, which risk being subjected to misuse in the future. this study does not propose that this benignly-intended work be reined in, nor suggest that neuroscientists bear the sole responsibility for preventing the misuse of their work. however, they remain inextricably involved and should, one could argue, assume a certain level of accountability. thus, this book sheds light on how they, and international security specialists, can work to bolster efforts to minimise the potential for misuse of modern neuroscience research. part i: the past — 1. neuroscience and the developments of cbw — 2. the structure and function of the brain — 3. the cbw non-proliferation regime — 4. the dual-use challenge

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— part ii: the present — 5. modern civil neuroscience — 6. novel neuroweapons — 7. implications of advances in neuroscience — 8. the search for incapacitants — 9. bioregulators and toxins — part iii: the future — 10. the btwc and cwc facing scientific change — 11. where are we going? — 12. the governance of dual-use neuroscience.”

Dando, M.. (2015). Novel Neuroweapons. In Neuroscience and the Future of Chemical-Biological Weapons

Plain numerical DOI: 10.1057/9781137381828\_6

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“In 2007 a set of lecture powerpoint slides and speaking notes appeared on the internet.1 they were titled ‘protecting our national neuroscience infrastructure: implications for homeland security, national security and the future of strategic weapons’. what was interesting for a start was that the lecture was written by dr. robert e. mcreight who has spent 35 years in the united states state department working on global security arms control, biowarfare, treaty verification and other related issues.2 ”

Giordano, J. J.. (2015). Neurotechnology in National Security and Defense: Practical Considerations, Neuroethical Concerns. Advances in neurotechnology

### Show/hide publication abstract

“Neurotechnology in national security and defense: practical considerations, neuroethical concerns is the second volume in the advances in neurotechnology series. it specifically addresses the neuroethical, legal, and social issues arising from the use of neurotechnology in national security and defense agendas and applications. front cover; contents; series preface; foreword; acknowledgments; editor; contributors; chapter 1: neurotechnology, global relations, and national security : shifting contexts and neuroethical demands; chapter 2: transitioning brain research : from bench to battlefield; chapter 3: neural systems in intelligence and training applications; chapter 4: neurocognitive engineering for systems’ development; chapter 5: neural mechanisms as putative targets for warfighter resilience and optimal performance; chapter 6: neurotechnology and operational medicine; chapter 7: ‘neurint’ and neuroweapons : neurotechnologies in national intelligence and defensechapter 8: brain brinksmanship : devising neuroweapons looking at battlespace, doctrine, and strategy; chapter 9: issues of law raised by developments and use of neuroscience and neurotechnology in national security and defense; chapter 10: neuroscience, national security, and the reverse dual-use dilemma; chapter 11: neuroskepticism : rethinking the ethics of neuroscience and national security; chapter 12: prison camp or ‘prison clinic?’ : biopolitics, neuroethics, and national security; chapter 13: between neuroskepticism and neurogullibility : the key role of neuroethics in the regulation and mitigation of neurotechnology in national security and defensechapter 14: why neuroscientists should take the pledge : a collective approach to the misuse of neuroscience; chapter 15: military neuroenhancement and risk assessment; chapter 16: can (and should) we regulate neurosecurity? : lessons from history; chapter 17: engaging neuroethical issues generated by the use of neurotechnology in national security and defense : toward process, methods, and paradigm; chapter 18: postscript : a neuroscience and national security normative framework for the twenty-first centuryback cover.”

Dando, M.. (2015). Novel Neuroweapons. In Neuroscience and the Future of Chemical-Biological

## Weapons

Plain numerical DOI: 10.1057/9781137381828.0013

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Giordano, J., & Wurzman, R.. (2011). Neurotechnologies as weapons in national intelligence and defense – An overview. *Neurogenetics*

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“Advances in neuroscience and neurotechnology have necessitated discussions on the ways that such developments could be used as weapons in contexts of national security, intelligence, and defense. this paper defi nes the concept of neuroweapons, and elucidates operational issues associated with their use to aid informational and strategic intelligence, such as brain-machine interfaces to improve effi ciency in data analysis. as well, exploration of neuropharmacologic, neuromicrobiological, and neurotoxic agents are discussed relevant to their utility in combat scenarios. the limitations of emerging neurotechnologies as weapons are addressed, as both regards practical and operational frameworks, and implications relevant to formulation of ethico-legal guidelines and governance of research, development and potential use.”

Noll, G.. (2014). Weaponising neurotechnology: International humanitarian law and the loss of language . *London Review of International Law*

Plain numerical DOI: 10.1093/lril/lru009

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“In recent years, research on military applications of neuroscience has grown in sophistication, raising the question as to whether states using weapon systems that draw on neuroscience are capable of applying international humanitarian law (ihl) to that use. i argue that neuroweapons largely eliminate the role of language in targeting, render unstable the distinction between superior and subordinate, and ultimately disrupt the premise of responsibility under ihl. i conclude that it is impossible to assess whether future uses of these weapons will be lawful under ihl.”

DeFranco, J., DiEuliis, D., & Giordano, J.. (2020). Redefining Neuroweapons: Emerging Capabilities in Neuroscience and Neurotechnology. *PRISM*

### Show/hide publication abstract

“As global conflicts assume increasingly asymmetric and gray zone forms, the ability to employ current and newly developing techniques and tools of neurocognitive science to manipulate human thought and behavior must be viewed as a present and increasing challenge. ongoing developments in neuroscience and technology (neurost), which trend toward 5- to 10-year trajectories of progression, make the brain sciences valid, viable, and of growing value for operational use in warfare, intelligence, and national security (wins) applications. historically, biochemical weapons have included incapacitating or lethal agents such as nerve gas, irritants, vesicants, and paralytics. numerous

examples of such weapons can be drawn from world war i to the present. various forms of neuros/t have become available, and radical leveling and emerging developments in the brain sciences fortify and add to this current palette of weaponizable tools."

Nørgaard, K., & Linden-Vørnle, M.. (2021). Cyborgs, Neuroweapons, and Network Command. Scandinavian Journal of Military Studies

Plain numerical DOI: 10.31374/sjms.86

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"In this article, we will explore the emerging field of military neurotechnology and the way it challenges the boundaries of war. we will argue that these technologies can be used not only to enhance the cognitive performance of warfighters, but also as a means to exploit artificial intelligence in autonomous and robotic weapons systems. this, however, requires the practice of a collaborative network command and a governing framework of cyborg ethics to secure human control and responsibility in military operations. the discussion of these governing principles adheres to the tradition of military studies. hence, we do not aim to present a neuroscientific research program. nor do we wish to embark on technical solutions in disciplines such as artificial intelligence and robotics. rather, the intention is to make the highly specialized language of these sciences accessible to an audience of military practitioners and policymakers, bringing technological advances and challenges into the discussion of future warfighting."

[su\_spoiler title="Additional references" style="fancy" icon="folder-2? anchor="htmlv"] Giordano J, Forsythe C, Olds J. Neuroscience, neuro-technology, and national security: the need for preparedness and an ethics of responsible action. AJOB – Neuroscience 2010;1(2):1-3.

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## Tags

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8. Neuroweapon

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