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21ST CENTURY THREATS

Threats to our safety and security are in the news and certainly seem to be multiplying. In these 4 lectures I will review personal and family disaster preparedness, explain biological threats, discuss the dangerous hotspots around the world that could ignite a global conflict, and examine how future wars are likely to be fought. Disasters, biological warfare, pandemics, rising nationalism, cyber war, robots, and artificial intelligence seem to be coming out of Pandora's box and although somewhat scary, they demand our attention and best efforts to prepare and defeat them. It is a fraught time.

- **I. The first lecture will be a general review of DISASTERS. I will spend some time with scenario based training and how to respond if a crisis occurs. Then in the second section will review some basics of personal, family, and home preparedness.**
- **II. Biologic threats, pandemics, and how the USA prepares to respond**
- **III. Future warfare: robots, drones, AI, biowar vectors**
- **IV. A review of the friction zones around the globe, ranked by my perception of the threat to the safety and security of the USA. A look at the top ten and why they matter.**

21st Century Threats

READING PERTAINING TO THE UPCOMING LECTURE # I – PREPARING FOR DISASTER

Plan how you and your neighbors could work together during a disaster.

Create a neighborhood communication plan.

Help neighbors with special needs, such as elderly or disabled persons.

Make plans for the care of children, if parents cannot get home.

Learn response plans for your children's schools or child care facilities.

Don't forget to include plans for your pets.

https://www.redcross.org/get-help/how-to-prepare-for-emergencies/make-a-plan.html

https://www.fema.gov/emergency-managers/national-preparedness

www.ready.gov

BleedingControl.org

https://www.ready.gov/water

https://www.ccwater.com/860/Rainwater-Harvesting-101

https://www.armystudyguide.com/content/army_board_study_guide_topics/field_sanitation/field-facilities-for-huma.shtml

https://www.cdc.gov/disasters/earthquakes/supplies.html

https://www.ready.gov/build-a-kit

Check for Hazards in the Home

Fasten shelves securely to walls.

Place large or heavy objects on lower shelves.

Store breakable items such as bottled foods, glass, and china in low, closed cabinets with latches.

Hang heavy items such as pictures and mirrors away from beds, couches, and anywhere people sit.

Brace overhead light fixtures.

Repair defective electrical wiring and leaky gas connections. These are potential fire risks.

Secure a water heater by strapping it to the wall studs and bolting it to the floor.

Repair any deep cracks in ceilings or foundations. Get expert advice if there are signs of structural defects.

Store weed killers, pesticides, and flammable products securely in closed cabinets with latches and on bottom shelves.

Have Disaster Supplies on Hand

Flashlight and extra batteries.

Portable battery-operated radio and extra batteries.

First aid kit, manual and an earthquake supplies kit.

Emergency food and water.

Nonelectric can opener.

Essential medicines.

Cash and credit cards.

Sturdy shoes.

Fire Extinguisher – up to date?

Develop an Emergency Communication Plan

In case family members are separated from one another during an earthquake (a real possibility during the day when adults are at work and children are at school), develop a plan for reuniting after the disaster. **Designate a fallback point if you cannot meet at home.**

Ask an out-of-state relative or friend to serve as the "family contact." After a disaster, it's often easier to call long distance. Make sure everyone in the family knows the name, address, and phone number of the contact person.

REFERENCES FOR LECTURE #2 -PANDEMICS AND BIOLOGIC THREATS

National Pandemic Strategy https://www.cdc.gov/flu/pandemic-resources/national-strategy/index.html

Pandemic Oversight https://www.pandemicoversight.gov/

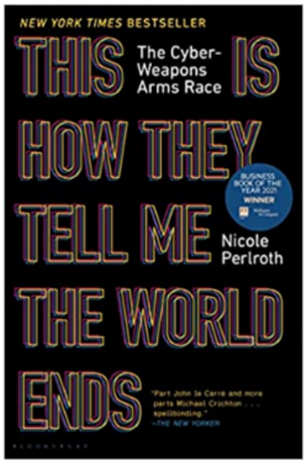
1. Baker, MS, Kevany, S, Canyon, D, and Baker, J: The Intersection Of Global Health, Military Medical Intelligence, And National Security In The Management Of Transboundary Hazards And Outbreaks. https://apcss.org/nexus_articles/the-intersection-of-global-health-military-medical-intelligence-and-national-security-in-the-management-of-transboundary-hazards-and-outbreaks/
2. Coronavirus disease (COVID-19): Herd immunity, lockdowns and COVID-19, World Health Organization, 31 December 2020, https://www.who.int/news-room/questions-and-answers/item/herd-immunity-lockdowns-and-covid-19
3. Coronavirus (COVID-19) Vaccinations Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data. https://ourworldindata.org/covid-vaccinations
4. Science Brief: Emerging SARS-CoV-2 Variants, January 28, https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/scientific-brief-emerging-variants.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fmore%2Fscience-and-research%2Fscientific-brief-emerging-variants.html
5. Crager, S.E.: Improving Global Access to New Vaccines: Intellectual Property, Technology Transfer, and Regulatory Pathways, Am J Public Health. 2018 December; 108(Suppl 6): S414–S420. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6291766/#bib1
6. Summers, J., Cheng, H., Lin H., et al, Potential lessons from the Taiwan and New Zealand health responses to the COVID-19 pandemic, The Lancet Regional Health Review, 4(100044), NOVEMBER 01, 2020 https://www.thelancet.com/journals/lanwpc/article/PIIS2666-6065(20)30044-4/fulltext
7. World Health Organization, International Health Regulations. https://www.who.int/health-topics/international-health-regulations#tab=tab_1. Last accessed 05 January 2022.
8. Rogin, J. Politico, 3/8/2021. “In 2018, Diplomats Warned of Risky Coronavirus Experiments in a Wuhan Lab. No One Listened.” https://www.politico.com/news/magazine/2021/03/08/josh-rogin-chaos-under-heaven-wuhan-lab-book-excerpt-474322 . Last accessed 05 January 2022.

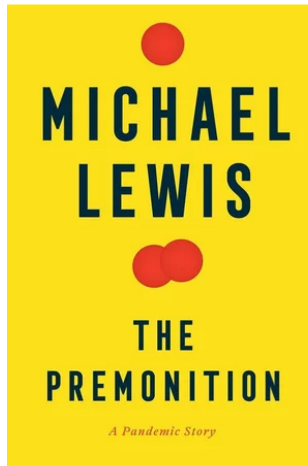
9. Intelligence, Surveillance, and Reconnaissance Design for Great Power Competition; June 4 2020; Congressional Research Service. https://crsreports.congress.gov/product/pdf/R/R46389 Last accessed 05 January 2022.
10. Hedberg, K., Maher, J.: The CDC Field Epidemiology Manual; Collecting Data | Epidemic Intelligence Service | CDC. https://www.cdc.gov/eis/field-epi-manual/chapters/collecting-data.html
11. Dion, M., AbdelMalik, P., Mawudeku, A. Big Data and the Global Public Health Intelligence Network (GPHIN). Can Commun Dis Rep. 2015 Sep 3;41(9):209-214. https://pubmed.ncbi.nlm.nih.gov/29769954/ Last accessed 05 January 2022.
12. Shangguan,Z. Wang, M.Y., Wen, S.: What Caused the Outbreak of COVID-19 in China: From the Perspective of Crisis Management. Int J Environ Res Public Health. 2020 May; 17(9): 3279. Published online 2020 May 8. doi: 10.3390/ijerph17093279
13. Myers, S. L.: China Spins Tale That the U.S. Army Started the Coronavirus Epidemic; March 13, 2020; The New York Times (nytimes.com). https://www.nytimes.com/2020/03/13/world/asia/coronavirus-china-conspiracy-theory.html
14. Bennett, B., Myers, D.: North Korea: Denying COVID-19. North Korea: Denying COVID-19 | RAND. https://www.rand.org/blog/2020/04/north-korea-denying-covid-19.html
15. Kevany, S., Canyon, D., Ostergard, R., Baker,M., Eagan,S., Baker, J.. Planning For Military Involvement in an Indo-Pacific Pandemic Vaccination Program. Nov 2020 https://apcss.org/wp-content/uploads/2020/11/N2543-Canyon-Military-Involvement-in-South-Pacific-Vaccinations.pdf
16. Department of Defense Instruction. Number 6420.01, March 20, 2009 DoDI 6420.01, "National Center for Medical Intelligence (NCMI)," March 30, 2009; Incorporating Change 3 on September 8, 2020 (whs.mil)
17. Ritter, S. The Staggering Collapse of U.S. Intelligence On The Coronavirus. The American Conservative. March 24, 2020. https://www.theamericanconservative.com/articles/the-staggering-collapse-of-u-s-intelligence-on-the-coronavirus/
18. Roston, A., Taylor, M. Exclusive: White House told federal health agency to classify coronavirus deliberations – sources. Reuters. March 11, 2020. https://www.reuters.com/article/us-health-coronavirus-secrecy-exclusive-idUSKBN20Y2LM
19. National Health Security Strategy, 2019-2022. https://www.phe.gov/Preparedness/planning/authority/nhss/Documents/NHSS-Strategy-508.pdf
20. National Biosurveillance Integration Center. https://www.dhs.gov/national-biosurveillance-integration-center
21. National Network of Fusion Centers Fact Sheet. N.D. http://www.dhs.gov/national-network-fusion-centers-fact-sheet

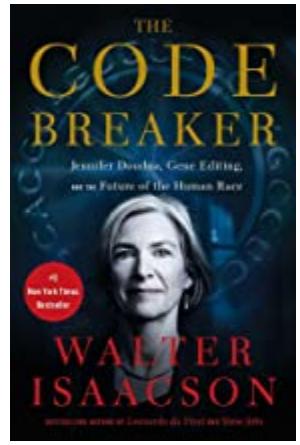
22. Canyon, D., Kevany, S., Baker, M.S., and Baker, J.: An International Biodefense Shield Alliance Against Pathogens from China. August 2020. https://apcss.org/nexus_articles/an-international-biodefense-shield-alliance-against-pathogens-from-china/
23. Real-Time Assessment of The Federal Response To Pandemic Influenza; October 27, 2009. Hearing Before The Subcommittee On Emerging Threats, Cybersecurity, And Science And Technology Of The Committee On Homeland Security House Of Representatives One Hundred Eleventh Congress. https://www.dhs.gov/news/2009/10/27/written-testimony-oha-fema-and-ice-house-homeland-security-subcommittee-emerging
24. Bouey, J. From SARS to 2019-Coronavirus (nCoV), U.S.-China Collaborations on Pandemic Response, February 5, 2020. https://www.rand.org/pubs/testimonies/CT523.html
25. Coleman, J. US intelligence warned in November that coronavirus spreading in China could be 'cataclysmic event': report. April 8, 2020. US intelligence warned in November that coronavirus spreading in China could be 'cataclysmic event': report | TheHill
26. ASEAN Disaster Management Reference Handbooks, 2015. Center for Excellence in Disaster Management and Humanitarian Assistance. https://reliefweb.int/sites/reliefweb.int/files/resources/ASEAN%20Disaster%20Management%20Reference%20Handbooks.pdf
27. Kevany, S, and Baker, MS: "Military Global Health Diplomacy: Applying Smart Power via Global Health Engagement, Armed Forces Journal, JFQ 83, 4th Quarter 2016, p. 83-90. http://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-83/Article/969672/applying-smart-power-via-global-health-engagement/

READ AHEADS FOR LECTURE # 3 – FUTURE WARFARE

BOOK TO READ:







ON LINE REFERENCES:

https://www.cnn.com/2021/12/02/politics/china-hackers-espionage-defense-contractors/index.html

https://unit42.paloaltonetworks.com/tiltedtemple-manageengine-servicedesk-plus/

https://en.wikipedia.org/wiki/Cyberwarfare_by_China

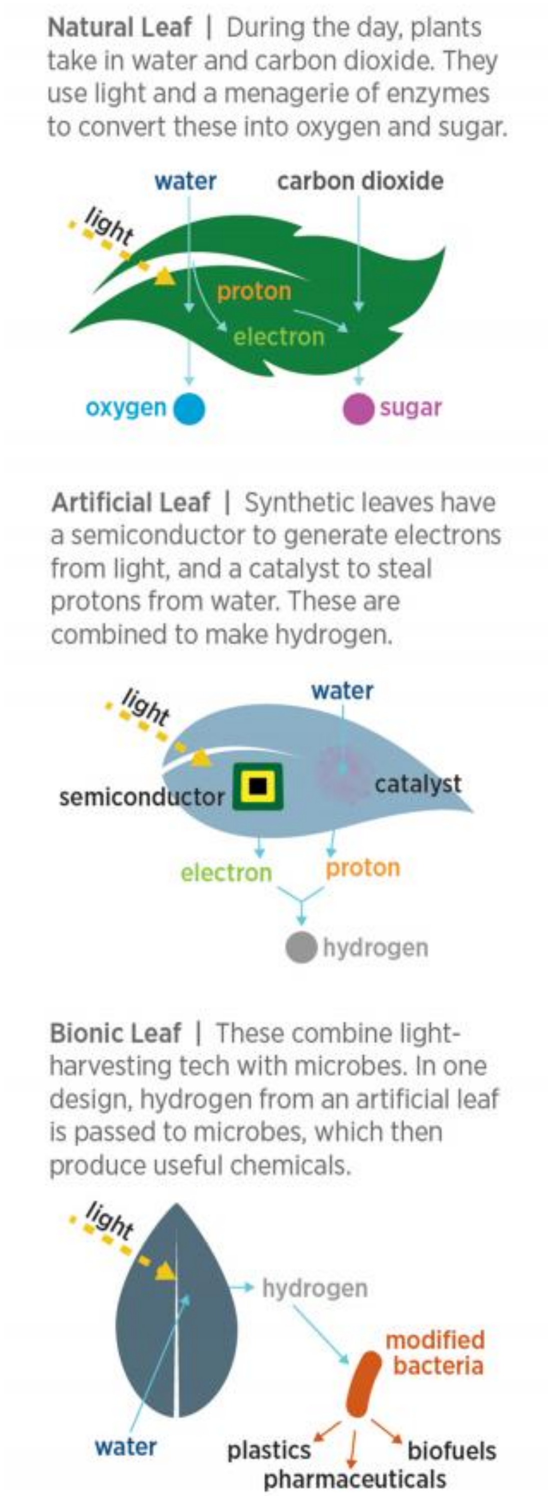
https://www.sciencefocus.com/news/environmentally-friendly-living-concrete-capable-of-self-healing/

PUBLICATION:

Synthetic Biology Will Change Warfare By Matthew Reyburn November 2021 Proceedings Vol. 147/11/1,425 https://www.usni.org/magazines/proceedings/2021/november/synthetic-biology-will-change-warfare

The appearance of synthetic biology will be a defining moment, ushering in the direct design and control of evolution at the protein level of life. Its integration with programmable matter and swarm robotics has the potential to be disruptive in barely imaginable ways. Right now, one may be thinking of some classic science fiction cyborgs: T-1000 from *Terminator*, Data from *Star Trek*, replicants from *Blade Runner*, or androids from *Aliens*. Although these cybernetic organisms might come to exist some day, most inventions within the next decade will not resemble these humanoid cyborgs. Programmable living matter (PLM) instead resembles small- (or even micro- or nano-) scale components of the larger entities.

Consider teeth. Through a process called biomineralization, DNA-controlled cells produce proteins to create organic structures on which minerals or salts are deposited. This process creates the hard enamel on teeth in distinct shapes and sizes based on the cells' self-determined organization. The teeth cells then protect and maintain the enamel over their lifetime. PLM will mirror this by taking control of the three main parts of the system: the cells, their organization, and their DNA programming. These parts can be used in different ways to create not only new living materials, but also power systems, communication systems, processors, sensors, and anything else that living cells can create today.



Physicist Richard Feynman described much of this nano/microrobotic field in his 1959 talk, "Plenty of Room at the Bottom."[1] But today, with considerable advances in the nanorobotics and biological fields, humanity is finally catching up to his ideas and surpassing them. For instance, in 2006 the Defense Advanced Research Projects Agency (DARPA) defined programmable matter as "an intelligent, or programmable, material that contains the actuation and sensing mechanisms to 'morph' into desirable/useful shapes under software control, or in reaction to external stimuli."[2] DARPA was speculating about "InfoChemistry," or building information directly into materials, but now the concept has advanced from merely creating *shapes* to creating *effects*.[3] DARPA's Engineered Living Materials (ELM) program, for example, seeks to create living materials that will construct and maintain buildings.[4]

ELM and InfoChemistry have mostly been limited to technology that impregnates biological life with inorganic materials, such as the bionic leaf or self-healing concrete, adding capabilities in response to external stimuli. The bionic leaf, as depicted in Figure 1, uses a biologic catalyst to split water into hydrogen and oxygen, then uses the hydrogen with bacteria to create a multitude of other materials.[5] Self-healing concrete involves a slightly different approach, impregnating the concrete mix with long-lasting capsules of bacteria and nutrients.[6] When the finished concrete cracks, it breaks the capsules, and, when water is added, the bacteria produce a hard filler, fixing the concrete. The past few years have seen rapid advancement in this field, including cement that mixes living nondormant bacteria and minerals to form self-replicating cement.[7] Damage to this type of cement can be repaired by adding some sand and nutrients. The living bacteria throughout the material will grow and mineralize, similar to the teeth example. Adding more will go beyond repair to expansion.

Research over the past 40 years has led to nanomachines for DNA-targeted drug treatment and nanorobotic production. New control methods have advanced rapidly, and potential breakthrough technology could arrive within a decade. Engineers and researchers have developed prototypes that include artificial DNA-based motors controlled by light, DNA-based robotic arms controlled by an electric field, and DNA tethered with metal nanoparticles controlled by electromagnetic signals.[8] These control methods have all been done in the lab under ideal conditions, and given time and resources, this research will build into complex programmable dynamic controls capable of macroscale effects.

Controlling individual cells or a few bacteria is not the same as controlling billions of cells in a large muscle. Thus, the final piece in the puzzle to a fully realized PLM is organizing large swarms of this material. Here, too, recent advances in fluid dynamics, cells, and nanoparticles are promising. A combination of algorithms and physical techniques will drive swarms to accomplish missions. For example, MIT's Self-Assembly Laboratory has created some striking effects with swarms, such as its replicating circles and a self-assembled chair.[9] Most research so far has focused on algorithms, which direct swarms toward or away from pheromones within the environment.[10] But many chemical or other signals could do this, controlling even individuals within the swarm. Thus, a tuned algorithm eventually will be the mass control needed for a pseudo-hive mind.

Military Applications

It is not difficult to speculate about the effects PLM could achieve in the next decade. For example, living buildings connected through a root or moss system might be resistant to disastrous weather. Self-healing roads could repair themselves using nearby materials. Quantum optical networks could grow themselves; self-driving cars might navigate by pheromones; and so on. The economy will see an everything-as-a-service industry revolution.

Threats to Global Stability and the Security of the United States DUE TO INTERNATIONAL FRICTION

While the effects of this technology will be enormous across human endeavors, they will have the most disruptive impact on the military. For instance, how will the military target PLM runways, bridges, or buildings that repair themselves? How will the Navy's plans be affected when PLM creates static living seabed communication and power lines? What happens when PLM can heal a solider's wounds on the battlefield? How will logistic supply chains change when any military can create oil from water and bacteria? How does a SEAL team protect itself when any tree or plant with infused PLM can sense and track movement? Perhaps scariest of all: What happens when the enemy uses PLM in humans to control and enhance them?

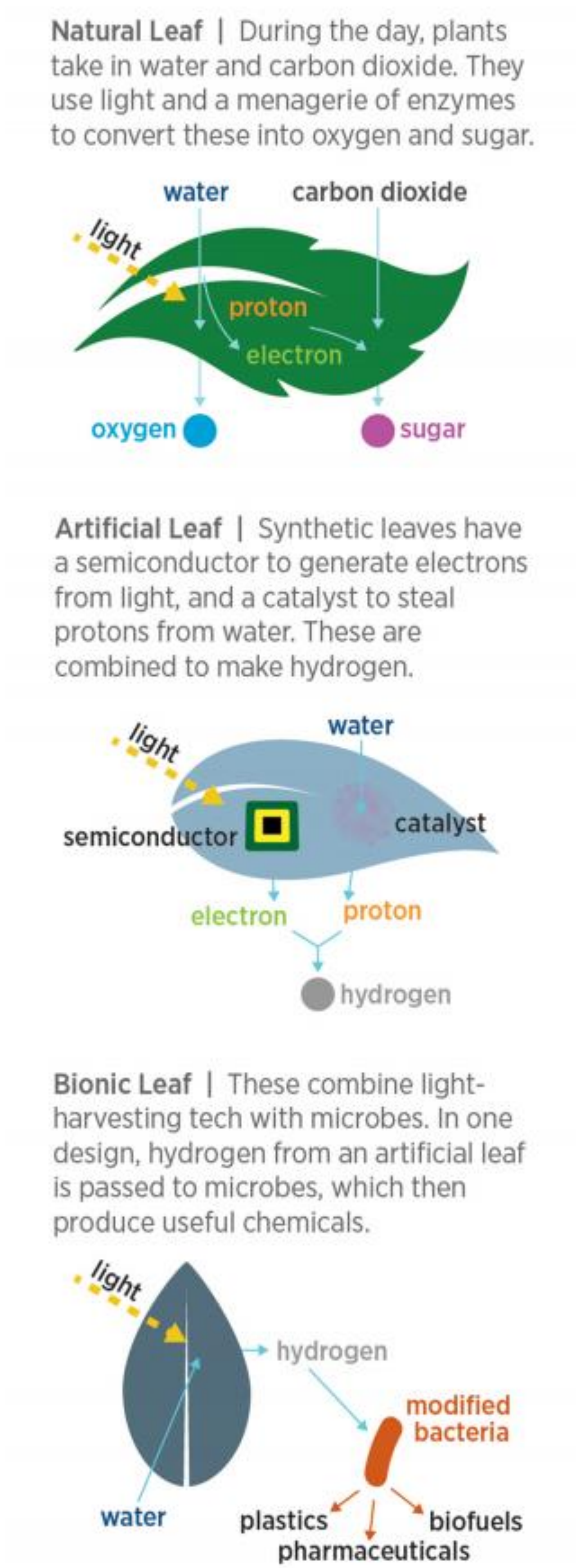
The answers to these questions could fundamentally change the character of warfare, much as cyber and space have done. The promise of additive manufacturing will be met and exceeded by PLM, bringing a truly decentralized, zero-length supply chain for many systems and vast possibilities in materiel.

The U.S. military will need to start small to implement effective new strategies as a result of PLM. The first phase could be to replace general construction materials for buildings, runways, bridges, and dams—anything requiring concrete. Next, replace infrastructure such as pipes, ducts, conduit, fiberoptics, lights, wires, and antennas—anything stationary but flexible. Such things often are damaged or destroyed in combat, and replacing them with PLM would shorten or eliminate supply chains.

The next phase would come with a jump in functionality, to PLM systems that can replace computing, communications, memory, and other silica-based devices. Shape shifting input/output devices could be difficult to reverse engineer; programmed DNA could be used as an embedded firewall soft/hardware system to thwart potential hackers. Further progress could bring new functionalities—entire platforms made of PLM and, one day perhaps, new worlds built with PLM.

PLM eventually could lead to autonomous or optionally manned platforms that perform the same missions as manned ships—except instead of carrying fixed-size and -shape payloads, the PLM ship would create the payloads it needs in the moment. Any chemical reaction can be recreated with the correct base chemicals on board. Against an adversary's PLM platform, a kinetic hit might not be the best response. Instead, these types of ships might manufacture PLM-focused biological weapons, ones that can tell the difference between synthetic and nonsynthetic biology, a hard but not impossible task.

To achieve these things will require sustained growth in research and development. The Department of Defense has created a triservice research program with $45 million in funding, but more must be done.[11] The Sea Services should increase partnerships with academic and commercial industries, specifically in the medical field, where much of this research is taking place. Programmable living matter is coming, and it is not a race the United States wants to lose.


Natural Leaf | During the day, plants take in water and carbon dioxide. They use light and a menagerie of enzymes to convert these into oxygen and sugar.
water
carbon dioxide
light
proton
electron
oxygen
sugar
Artificial Leaf | Synthetic leaves have a semiconductor to generate electrons from light, and a catalyst to steal protons from water. These are combined to make hydrogen.
light
water
semiconductor
catalyst
electron
proton
hydrogen
Bionic Leaf | These combine light-harvesting tech with microbes. In one design, hydrogen from an artificial leaf is passed to microbes, which then produce useful chemicals.
light
hydrogen
modified bacteria
water
plastics
biofuels
pharmaceuticals

Threats to Global Stability and the Security of the United States DUE TO INTERNATIONAL FRICTION

Synthetic Bioweapons Are Coming: Gene-editing advances pose a serious threat.

By Michael Knutzen

June 2021 Proceedings Vol. 147/6/1,420
https://www.usni.org/magazines/proceedings/2021/june/synthetic-bioweapons-are-coming

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The COVID-19 pandemic has revealed critical weaknesses in the human domain of warfare at just the moment technology has emerged that gives bad actors new power to exploit those weaknesses. Developments in synthetic biology will create next-generation bioweapons, "human-domain fires" that will fundamentally change the strategic environment and create a threat naval planners must consider now, before it is encountered at sea.

A Human-Domain Plague

In a March 2020 press release praising the effectiveness of its preventative medicine, the Navy proudly declared: "No cases of COVID-19 have been diagnosed aboard any U.S. 7th Fleet Navy vessel."[1] One week later, cases were spreading so rapidly, the USS *Theodore Roosevelt* (CVN-71) effectively became a "mission-kill."

COVID-19 has demonstrated that biological threats are almost entirely unaffected by sophisticated kinetic, cyber, and electromagnetic defenses. The French aircraft carrier *Charles de Gaulle* reported in April 2020 that 60 percent of her crew was infected with COVID-19. French Admiral Christophe Prazuck warned "that the [medical] measures onboard were 'obviously circumvented' by a 'stealthy, insidious virus.'"[2] It can be debated whether the U.S. or French carriers would have stayed in the fight if COVID-19 had broken out during wartime. But a more lethal, deliberately devised, weaponized agent could eviscerate a fleet.

This socially transmitted vector is characteristic of a critical military dimension. The *human domain*, which the Department of Defense says "consists of the people (individuals, groups, and populations) in the environment, including their perceptions, decision-making, and behavior," is a key component of the operating environment.[3] Maritime, air, land, cyber, and information activities all affect this space, seizing psychological and behavioral "terrain" in a form of human-domain maneuver. This terrain comprises individuals, networks, and communities linked by ideology or association, frequently spread across and informed—but not limited—by geography. Traditionally, this has been maneuver terrain, a place to "win hearts and minds." But new technology means fires in the human domain—biological fires especially—can now affect other domains, circumventing conventional defenses to find, fix, and finish targets with unnatural effect.

Recent developments in synthetic biology—which the National Academy of Sciences defines as "concepts, approaches, and tools which enable the modification or creation of biological organisms"—pose a profound threat.[4] Humans first edited organisms through husbandry and botany—imprecise, indirect processes that required years to centuries to achieve much. Polymerase chain reaction (PCR) was developed in 1985 and allowed DNA from one organism to be isolated, copied, and inserted into another in the first form of widely used genetic modification. A newer technique, clustered regularly interspaced short palindromic repeat (CRISPR-Cas9), was first harnessed for genetic editing in 2013.[5] Compared with PCR, CRISPR-Cas9 is cheaper, faster, and more accurate—a development likened to replacing vacuum tubes with transistors in the early days of computing.

It is much easier to use than PCR, too. CRISPR uses RNA (genetic information similar to DNA but which functions as a messenger within a cell) and the Cas9 enzyme to edit the genes. Biologists use the RNA to identify a sequence for removal or insertion and Cas9 to do the actual cutting and splicing.[6] One 2019 winner of the International Genetically Engineered Machine competition was a team of high school students who engineered E. coli bacteria to spin spider silk.[7] With CRISPR, to do the editing you simply have to know what genes control spider silk production and possible places to put them on the bacterial genome. With constant development, the technical obstacles to designing completely new traits and inserting them in designer organisms will only decrease. The opportunities and dangers are nearly limitless.

CRISPR-Cas9 gene-editing technology makes the threat of synthetic bioweapons more dangerous than ever before. Credit: Shutterstock

Choose Your Weapon

Of those dangers, next-generation bioweapons are the most serious. Unlike traditional bioweapons, which most states have abandoned as unreliable, synthetic bioweapons (SBWs) are weaponized biological threats modified through synthetic biology for novel effects, mechanisms, or processes.[8] Unshackled from natural biology, SBWs possess characteristics engineered to target populations or individuals, through socially transmitted rather than kinetic means. Although each of the military services and the entire U.S. population could be at risk from SBWs, the nature of the Sea Services' operations—far from home but necessarily dependent on local goods and services in forward-deployed locations—places them at particular risk.

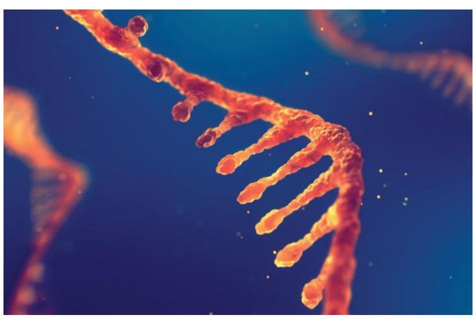
George Mason University's Gregory D. Koblentz says, "Biological warfare favors the attacker."[9] One possible use of synthetic bioweapons would be to neutralize a ship or task force preemptively, before any active conflict, incapacitating a crew instead of killing it. A tailored incubation period or high presymptomatic transmission can be a matter of planning rather than luck. Programmed obsolescence, by which a disease dies after a set number of generations or fails to transmit in nontarget environmental conditions, can protect the attacker. Chinese People's Liberation Army (PLA) Senior Colonel Guo Ji-Wei refers to this effect as "multiple vulneration," the idea that overlapping biological effects can aid targeting.[10]

"Binary weapons" are paired infections separated to evade detection that can later combine for desired effect.[11] Complementary, harmless viruses released in San Diego and Guam could synthesize, in a host exposed to both, to generate a debilitating illness. Such covert SBW fires could take a whole strike group off the board shortly before China launched an invasion of Taiwan, for example.

One threat that was once the stuff of science fiction may soon become real. Some researchers (including Lieutenant General Zhang Shibo, former president of the PLA National Defense University) foresee the possibility of "specific ethnic genetic attacks" on whole racial or ethnic groups, although there remain political and scientific obstacles at present.[12] A unique person with unique genes is easier to target than population-level differences in the nearer term. SBWs with high levels of asymptomatic transmission could pass from host-to-host through the human domain, until reaching a vulnerable target or targets possessing the "right" genes. (Procuring a president or admiral's DNA is easy. Simply invite the target to dinner at a venue you control.)

And China may already have hacked from medical records or purchased the genetic information of millions of ordinary Americans through genealogical companies such as 23andme.[13] Bill Evanina, former director of the National Counterintelligence and Security Center, warned against Beijing Genomics Institute–linked COVID-19 tests, noting: "Foreign powers can collect, store and exploit biometric information from COVID tests."[14]

Potential SBW effects include not only incapacitation and death, but also boutique outcomes. Colonel Guo emphasizes that "learning, memorizing . . . and even the 'bellicose character' can be injured precisely without a threat to life."[15] Making an adversary's leader docile (or erratic, confused, or hyper-aggressive) might be as effective as a kinetic decapitation strike. Further, the ability to reach and nonlethally modify a target creates opportunities for coercion. A compellent threat creates conditions to force change in an adversary's behavior. The ability to remotely hold a person's biology hostage—through degenerative, frustrating, or simply embarrassing symptoms—but promising a personal cure (or enhancement) could create enormous strategic leverage.



Cells use messenger RNA to copy and edit genes, which CRISPR-Cas9 takes advantage of to modify them. Credit: Shutterstock

Warfare Beyond Rules

Doctrinally, China has recognized the critical role the human domain will play, and some Chinese thinkers have already rejected moral limits on SBWs. In 1999, PLA Colonels Qiao Liang and Wang Xianghui published *Warfare Beyond Rules*, a treatise on asymmetric conflict that advocates for "warfare beyond all boundaries and limitations." Qiao and Wang emphasize that China must be prepared to synchronize all government capabilities at all levels of competition, with all tools considered legitimate. These include: conventional, "biochemical," "ideological war," and other means of conflict.[16]

In this framework, chemical and biological weapons "are nothing more than nontraditional weapons whose mechanisms have been altered and whose lethal power and destructive capabilities have been magnified several times over."[17] With nothing inherently immoral in their use, "new concept weapons" such as SBWs are evaluated strictly on military utility.[18] The work received high-level praise within China—Qiao was promoted to major general, and he and Wang still shape the next generation as national security lecturers.[19]

PLA Lieutenant General He Fuchu, vice president of the Chinese Academy of Military Science (AMS), has emphasized that "biotechnology [is] a new 'strategic commanding heights.'" His agency's 2017 *Science of Military Strategy* defined biology "as a domain of military struggle."[20] Such trains of thought culminate in new weapons perfectly suited for "warfare beyond rules."

Mounting a Response

U.S. reactions to synthetic biology attacks will be fraught with difficulties in attribution, signaling, and response. The traditional U.S. position on chemical or bioweapon use has linked any potential response to the nuclear deterrent, through the 1998 doctrine of *calculated ambiguity*. But Syria's unanswered mass use of chemical weapons (and North Korea and Russia's highly targeted use) has destroyed the credibility of threats of a nuclear response to all use of weapons of mass destruction.[21]

Indeed, attributing such an attack would be difficult in any case. The 1975 Biological and Toxic Weapons Convention outlawed the acquisition and stockpiling of all forms of biological weapons but lacked inspection or enforcement regimes. As the slow initial response to COVID-19 demonstrates, it takes time to recognize a new threat, understand it, identify its origin, and develop medical countermeasures. The characteristics of SBWs that make them so attractive to bad actors also magnify the challenges of reacting. Mustering the evidence to attribute the source of an attack and generate broad public support and political will for a vigorous response would be difficult, to say the least.

Given these barriers, what should the Sea Services do? First, investment in military biodefense is critical. This requires enhancing threat awareness by developing a global biothreat common operating picture (BioCOP) in coordination with national and international defense, public health, homeland security, and intelligence agencies. A BioCOP must be able to recognize and characterize SBWs through active bio-surveillance in vessels, ports, and facilities, with special attention for globally dispersed, binary weapons. Second, research organizations, such as the Defense Advanced Research Projects Agency's biotechnology office, need the resources to drive development of advanced biosensors, diagnostics, countermeasures, and other defenses to keep pace with changes in synthetic biology. National biodefense must not be exclusively reactive. A comprehensive counter-SBW plan would look for and respond to clear and present synthetic biologic dangers while advancing the country's knowledge about potential and emerging threats.

The government as a whole and the individual services in particular must develop flexible and muscular response plans that include well-maintained stockpiles of specialized sensors and protective equipment. Defensively, lessons learned from COVID-19 social distancing should inform reactions to SBW fires and associated doctrine. The federal government must assess, determine, and message what a proportional response to various levels of SBWs would be. These efforts should feature in military wargaming and principal-level exercises, with appropriate effort spent in developing and signaling tactical, operational, and strategic options.

At the same time, every effort should be made to limit the perception of an offensive advantage for U.S. SBW capabilities. If adversaries perceive that the United States takes an "SBWs for me, but not for thee" approach, an arms race could ensue. Transparency in bilateral and global messaging can mitigate these dangers. This must be considered a strategic priority.

Finally, international regimes must be strengthened. This should begin with Secretary of State Antony Blinken attending the December 2021 Biological Weapons Convention review conference—the pentennial meeting to make substantive improvements to the treaty. Adversaries and partners likely will mirror the U.S. action, creating political interest unseen in a decade. This is a strategic opportunity to address the convention's chronic financing and compliance issues and questions about its applicability to synthetic threats. U.S. diplomatic efforts should seek an international clarification that leans on Article VII to streamline access to biological samples so long as prenegotiated standards are met.[22] Even agreeing on standard template language or other means to reduce barriers would be critical in time-sensitive SBW response.

The United States should complement this effort with broad reengagement in global health, bioethics, and normative bodies to guide international standards in line with U.S. values and interests. International response plans should be developed within NATO, Indo-Pacific security agreements, and the so-called Five Eyes intelligence-sharing agreement. Reinforcing alliance and mutual-defense structures increases preparedness while also encouraging anti-SBW policies among powerful multilateral blocs. In turn, this can generate momentum in global efforts to strengthen the Biological Weapons Convention and other essential treaties.

COVID-19 revealed key U.S. vulnerabilities, and adversaries have taken note. SBWs provide a brand-new capability—human-domain fires without any conventional equivalent. In just eight years, CRISPR-Cas9 has transformed from an unknown technique with messy, collateral damage to a precise genetic surgery that has successfully cured diseases in human adults.[23] And the technology will only improve, creating more powerful options for those who pursue them. China seeks to become a biotechnology superpower, developing scientific capabilities whose military uses the PLA openly considers.[24] U.S. planners must recognize this synthetic sea change and prepare, before it is too late.

1. U.S. Seventh Fleet Public Affairs, "Navy Preventative Medicine Teams Embark Ships in 7th Fleet," Commander, Pacific Fleet, 20 March 2020.

2. Aurelian Breeden, "How an Invisible Foe Slipped Aboard a French Navy Ship," *The New York Times,* 19 April 2020.

3. U.S. Special Operations Command, *Operating in the Human Domain*, (Fayetteville, NC: U.S. Department of Defense, August 2015), 3.

4. National Academies of Sciences, Engineering, and Medicine, *Biodefense in the Age of Synthetic Biology* (Washington DC: National Academies Press, 2018), 1.

5. "CRISPR Timeline," The Broad Institute.

6. Ekaterina Pak, "CRISPR: A Game-changing Genetic Engineering Technique," *Harvard University Graduate School of Arts and Sciences Blog*, 31 July 2014.

7. Cindi Li, Jessica Liu, James Yang, and Miranda Zhong, "SPIDERMAN: SPIDroin engineeRing with chroMoprotein And Natural Dye," 2019 International Genetically Engineered Machine Competition, Cambridge, UK.

8. Department of State, *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments* (Washington, DC: U.S. Department of State, August 2019), 45–48.

9. Gregory D. Koblentz, *Living Weapons: Biological Warfare and International Security* (Ithaca, NY: Cornell University Press, 2009), 22.

10. Ji-Wei Guo and Xue-sen Yang, "Ultramicro, Nonlethal, and Reversible: Looking Ahead to Military Biotechnology," *Military Review* 85, no. 4 (July 2005): 75–78.

11. "West Point Biochemist Warns about Threat of Bioweapons," CBS News, 20 January 2021.

12. Elsa Kania and Wilson Vorndick, "Weaponizing Biotech: How China's Military Is Preparing for a 'New Domain of Warfare,'" *Defense One*, 14 August 2019.

13. Gopal Ratnam, "Hey, Soldiers and Spies—Think Twice about That Home Genetic Ancestry Test," *Roll Call*, 24 December 2020.

14. Lucas Ropek, "U.S. Intelligence Claims China Wants to Steal Your DNA," *Gizmodo,* 29 January 2021.

15. Ji-Wei Guo, "The Command of Biotechnology and Merciful Conquest in Military Opposition," *People's Liberation Army Journal of Military Medicine* 171, no. 11 (2006): 1,150–54.

16. Ming Zhang, "China: War Without Rules," *Bulletin of the Atomic Scientists* 55, no. 6 (1 November 1999): 16–18.

17. Liang Qiao, and Xiansui Wang, *Warfare Beyond Rules* (Beijing: PLA Literature and Arts Publishing House, February 1999), 25.

18. Qiao and Wang, *Warfare Beyond Rules*, 24.

19. Zhang, "China: War Without Rules," 16–18.

20. Kania and Vorndick, "Weaponizing Biotech: How China's Military Is Preparing for a 'New Domain of Warfare.'"

21. Ben Hubbard, "Syria Used Chemical Weapons 3 Times in One Week, Watchdog Says," *The New York Times*, 8 April 2020; Mark Urban, "Skripal Poisoning: Third Russian Suspect 'Commanded Attack,'" BBC, 28 June 2019.

22. Michelle Rourke, Alexandra Phelan, and Rebecca Katz, "Access and Benefit Sharing: Implications for Accessing Biological Samples for United Nations Secretary-General Mechanism Investigations," Georgetown University Center for Global Health Science and Security, December 2019.

23. "CRISPR Technology to Cure Sickle Cell Disease," *Science Daily*, 21 January 2021.

24. "The Next Biotech Superpower," *Nature Biotechnology*, nature.com, 5 November 2019.

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RUSSIA / UKRAINE

https://www.nytimes.com/2022/04/08/opinion/ezra-klein-podcast-fiona-hill.html Fiona Hill on Whether Ukraine Can Win — and What Happens if Russia Loses

https://www.washingtonpost.com/politics/2022/01/16/why-would-putin-invade-ukraine/

https://news.harvard.edu/gazette/story/2022/01/is-putin-going-to-invade-ukraine/

https://www.theatlantic.com/ideas/archive/2022/01/ukraine-russia-kyiv-putin-bluff/621145/?mc_cid=fd669662c2&mc_eid=5d912dfd35

https://www.economist.com/1843/2022/04/04/what-vladimir-putin-misunderstood-about-ukrainians

https://www.economist.com/culture/writers-have-grappled-with-vladimir-putin-for-two-decades/21808311

https://www.economist.com/by-invitation/2022/03/11/john-mearsheimer-on-why-the-west-is-principally-responsible-for-the-ukrainian-crisis

https://www.economist.com/leaders/2022/03/12/the-stalinisation-of-russia The Stalinisation of Russia from The Economist

https://www.nytimes.com/2022/03/01/opinion/ukraine-zelensky-biden.html?referringSource=articleShare Biden Must Not Allow Ukraine to Fall

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CHINA

https://foreignpolicy.com/2020/05/22/china-superpower-two-paths-global-domination-cold-war/

https://www.cfr.org/backgrounder/chinas-massive-belt-and-road-initiative

https://www.cfr.org/global-conflict-tracker/conflict/territorial-disputes-south-china-sea

https://www.brookings.edu/research/how-chinas-actions-in-the-south-china-sea-undermine-the-rule-of-law/

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https://www.ucsusa.org/climate/impacts

https://www.usgs.gov/faqs/what-difference-between-global-warming-and-climate-change

https://api.nationalgeographic.com/distribution/public/amp/environment/article/global-warming-effects

https://climate.nasa.gov/

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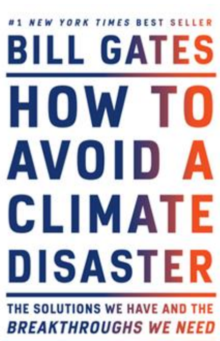
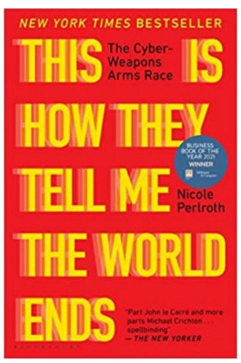
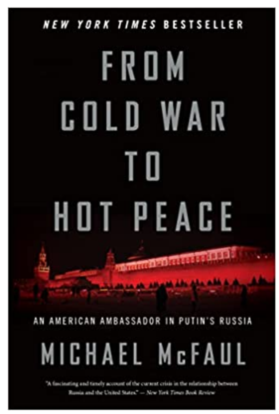
CIA Confirms Role in 1953 Iran Coup https://nsarchive2.gwu.edu/NSAEBB/NSAEBB435/

64 Years Later, CIA Finally Releases Details of Iranian Coup https://foreignpolicy.com/2017/06/20/64-years-later-cia-finally-releases-details-of-iranian-coup-iran-tehran-oil/







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