NOTES

REGULATING WEAPONIZED NANOTECHNOLOGY: HOW THE INTERNATIONAL CRIMINAL COURT OFFERS A WAY FORWARD

*Lucas Drayton Bradley**

TABLE OF CONTENTS

* J.D., University of Georgia, 2013; History & Political Science: B.A., Duke University, 2010.

I. INTRODUCTION

Nanotechnology is emerging as a tool that will increasingly change the way that scientists approach the world. While a subject matter or a mode of inquiry defines traditional scientific fields, an inquiry of a microscopic level advancement defines nanotechnology.[1] Because of this broad definition, nanotechnology encompasses a wide array of technologies that exist at that scale.[2] Advances in nanoparticles and nanorobotics are already altering conceptions of surgery, mechanization, and construction.[3] Materials that emerge from the field could soon be ubiquitous in worldwide technology, and scientists promise further advances.[4]

Against this promising background, it is easy to overlook the dangers that nanotechnology presents. Nanoparticles interact unpredictably and unprecedentedly with the human body.[5] Nanorobots may soon possess the ability to create new nanorobots or even to replicate themselves many times over.[6]

These technologies, if managed negligently, could lead to catastrophic accidents. If intentionally weaponized, they could represent a paradigm shift in warfare. Because of its difficulty to trace, its unpredictability, its capacity for grave biological harm, its potential ability to infiltrate technological systems, and its possible ability to self-replicate in the future, nanotechnology could contribute to devastating new weapons.[7] These weapons could contribute to massive human rights violations, both because of the numbers of people they could endanger and the horrific types of damage they could inflict.[8]

The international community needs an effective deterrent to both governments and individual actors that seek to weaponize nanotechnology. It also needs a reliable system for prosecuting these crimes in the future and a cognizable set of crimes that accurately captures the potential harms of weaponized nanotechnology.

---

1 Wei Zhou, *Ethics of Nanobiotechnology at the Frontline*, 19 SANTA CLARA COMPUTER & HIGH TECH. L.J. 481, 482 (2003).

2 *Id.*

3 Oak Ridge Nat'l Lab., *Nanotechnology Overview*, ADVANCED MATERIALS & PROCESSES, May 2000, at 48.

4 *Id.*

5 *See* Hitoshi Nasu & Thomas Faunce, *Nanotechnology and the International Law of Weaponry: Towards International Regulation of Nano-Weapons*, 20 J.L. INF. & SCI. 21, 27 (2010) (describing the difficulty in treating physical injuries sustained as the result of nanoparticles because of their unpredictability).

6 Vasily E. Tarasov, *Quantum Nanotechnology*, 8 INT'L J. NANOSCIENCE 337, 337 (2009).

7 Nasu & Faunce, *supra* note 5.

8 *See infra* Part II.*C.1* (discussing the biological effects of weaponization).

The International Criminal Court (ICC) already has procedures for addressing the sorts of crimes that these technologies could enable. Rather than developing a new framework and yet another regulatory body to govern the technology, the ICC could fold nanotechnology crimes into the existing provisions of the Rome Statute. Specifically, the crime of aggression should contain language that addresses nanotechnology. These provisions should be capable of addressing both state-sanctioned military development and individual deployment of this weapon technology. The adoption of such provisions would speak to a global consensus that the international community will not tolerate the misuse of nanotechnology.

II. BACKGROUND

A. *What is Nanotechnology?*

1. *The Technology Itself*

In 1959, Richard Feynman presented a speech entitled *There's Plenty of Room at the Bottom: An Invitation to Enter a New World of Physics*.[9] In it, he posed a question to the audience: "Why cannot we write the entire 24 volumes of the Encyclopedia [Britannica] on the head of a pin?"[10] He asked the question to stimulate the crowd's imagination and to demonstrate that physics was not thinking small enough.[11] Feynman stated that someday in the future, scientists would be able to build structures a single atom at a time, affording scientists a greater degree of control over the structures produced than ever before.[12] He proposed that this new technology would have applications across scientific fields, and in particular, he singled out biology as a beneficiary of the ability to enhance structures on the atomic level.[13] He even articulated primitive versions of techniques that scientists use today.[14] Though Feynman had never heard the word "nanotechnology," and indeed,

---

[9] Richard Feynman, There's Plenty of Room at the Bottom: An Invitation to Enter a New World of Physics (Dec. 29, 1959), *in* 23:5 CALTECH ENGINEERING AND SCI. 22, 22 (Feb. 1960), *available at* http://www.calteches.library.caltech.edu/47/2/1960Bottom.pdf.

[10] *Id.*

[11] Luca Escoffier, *A Brief Review of Nanotechnology Funding and Patenting in Japan*, 4 NANOTECHNOLOGY L. & BUS. 101, 102 (2007).

[12] Feynman, *supra* note 9, at 34.

[13] *See id.* at 24 (citing better electron microscopes developed through nanotechnology as aiding the field of biology).

[14] *Id.* ("Why can't we manufacture these small computers somewhat like we manufacture the big ones? Why can't we drill holes, cut things, solder things, stamp things out, mold different shapes all at an infinitesimal level?").

the term itself had yet to be coined, he was effectively describing the nanotechnology revolution.

Nanotechnology's definition is amorphous. Some scholars define it as research involving the manipulation of structures that takes place on the scale of one or several nanometers.[15] This definition is scientifically unusual because areas of interest define scientific branches rather than artificially-denoted scales of focus.[16]

An alternative definition of nanotechnology is "the investigation of novel properties that manifest themselves at [nanometer] scale, and of the ability to manipulate and artificially construct structures at that scale."[17] Regardless of preferred definitional characteristics, nanotechnology offers the ability to manipulate individual atoms to effectuate more complex and efficient structures than otherwise possible.[18]

Nanotechnology can be approached "top-down" or "bottom-up."[19] In a top-down approach, scientists seek to whittle down at a macro-sized structure until all that is left is an atomic arrangement.[20] In the bottom-up approach, however, scientists actually create conditions that induce atoms to form desired structures of their own volition.[21]

Carbon nanotubes provide an example of such a bottom-up process. Scientists fire lasers at a graphite pellet, releasing an intense stream of atoms. They subject this stream to an array of hot and cold gases calculated to induce the atoms into hexagonal shapes; the resulting "tubes" are exceptionally strong and light.[22]

2. *Growth of Nanotechnology*

The field of nanotechnology is growing worldwide at a staggering rate. Global funding topped $4 billion in 2005 and has since increased.[23] Militaries are avidly researching nanotechnology; the United States, the United Kingdom, Sweden, Russia, and India are all turning to nanotechnology as a potentially useful area of combat research.[24] The

---

[15] Oak Ridge Nat'l Lab., *supra* note 3. A nanometer is one-billionth of a meter.
[16] *Id.*
[17] Ronald N. Kostoff, Raymond G. Koytcheff & Clifford G.Y. Lau, *Global Nanotechnology Research Literature Overview*, 74 TECHNOLOGICAL FORECASTING & SOC. CHANGE 1733, 1734 (2007).
[18] Oak Ridge Nat'l Lab., *supra* note 3.
[19] Escoffier, *supra* note 11, at 102.
[20] *Id.*
[21] *Id.*
[22] Oak Ridge Nat'l Lab., *supra* note 3.
[23] Escoffier, *supra* note 11, at 102.
[24] Nasu & Faunce, *supra* note 5, at 23.

United States military alone spent almost $400 million in 2010 on nanotechnology.[25] In the private sphere, the United States has issued over 4,400 patents for nanotechnology-related innovations.[26]

B. Positive Applications

In the minds of many academics, nanotechnology's promise is nearly limitless. Fields that are frequently mentioned as beneficiaries of the technology include medicine and mechanical engineering. Medical applications include drug delivery systems and microsurgery.[27] Nanoparticles could be engineered to enter the body and bloodstream more effectively in order to more quickly and completely administer pharmaceuticals.[28]

The prospect of microscopic nanorobots, capable of both self-replication and self-guidance, offers new opportunities for microsurgery. Such devices could even theoretically be delivered via viruses.[29] "Regenerative medicine"[30] is another eventual microsurgical promise, with nano-robots capable of tissue regeneration and engineering able to target microscopic flaws in damaged tissue and repair it to a degree modern surgery cannot.[31]

Nanotechnology also promises significant improvements in electronics and mechanical engineering. In the United States, medical nanotechnology patent grants are declining as a proportion of total patents granted, while the percentage of electronic nanotechnology patents has increased dramatically.[32] Applications include the creation of new fuel cells in which nano-structures efficiently regulate proton exchange across cells, thereby avoiding the energy loss usually associated with the exchange.[33] Carbon nanotubes, noted for their toughness and lightness, could have an immediate

---

[25] *Id.* at 25.

[26] Blaise Mouttet, *Nanotechnology and U.S. Patents: A Statistical Analysis*, 3 NANOTECHNOLOGY L. & BUS. 309, 310 (2006).

[27] Zhou, *supra* note 1, at 481; *see also* Nikhil Mali et al., *Carbon Nanotubes as Carriers for Delivery of Bioactive and Theraputic Agents: An Overview*, 3 INT'L J. PHARMACY & PHARMACEUTICAL SCI. 1 (2011) (discussing modifications that would allow carbon nanotubes to move through cell walls to deliver pharmaceuticals).

[28] Zhou, *supra* note 1, at 484.

[29] *Id.* at 485.

[30] Escoffier, *supra* note 11, at 103.

[31] Zhou, *supra* note 1, at 483.

[32] Mouttet, *supra* note 26, at 312.

[33] Oak Ridge Nat'l Lab., *supra* note 3.

impact on dozens of manufacturing industries,[34] a significant prospect considering the increasing application of current products like carbon fiber.[35]

C. *Weaponization and Potential Drawbacks*

For all the potential benefits of nanotech, its power presents significant risks. Hitoshi Nasu and Robert Pinson have pointed out the potentially catastrophic damage that nanotechnology could do if negligently mismanaged or intentionally weaponized.[36] The lack of an international regulatory structure compounds the risk of an unintentional catastrophe.[37] Furthermore, no defined framework exists for punishing either state or individual actors who intentionally misuse nanotech. The lack of a coherent strategy for punishment will present increasing problems as scientific advances increase nanotech's potential abilities.[38]

1. *Biological Effects of Weaponization*

The effects of a weapon engineered using actual nanotechnology could be catastrophic.[39] Indeed, the effects of available proto-nanotechnology are already severe.[40]

For example, the Israeli army has developed and deployed the Dense Inert Metal Explosive (DIME), an explosive device that scatters microparticles of shrapnel at intense heat and speed.[41] Microparticles, precursors to nanotechnology, have made these weapons possible because weapons designers can better control the shrapnel that such devices emit, and that shrapnel is increasingly deadly.[42] The result of this proto-nano-weapon

---

[34] *Id.*

[35] Stephen Trimble, *Lockheed Martin Reveals F-35 to Feature Nanocomposite Structures*, FLIGHTGLOBAL (May 26, 2011), http://www.flightglobal.com/news/articles/lockheed-martin-reveals-f-35-to-feature-nanocomposite-357223 (describing Lockheed Martin's consideration of the replacement of over 100 components of F-35 fighter aircraft with a "thermoset epoxy reinforced by carbon nanotubes"); *Carbon Fiber Racing Car Parts*, RIVERS CARBON, http://www.riverscarbon.com/carbon-fiber-race-car-parts (last visited Jan. 11, 2012) (describing advances in carbon fiber production and resulting increases in joint accuracy within cars); Ann M. Thayer, *Carbon Nanotubes by the Metric Ton*, 85 CHEMICAL & ENGINEERING NEWS 29 (Nov. 12, 2007), *available at* http://pubs.acs.org/email/cen/html/112207102848.html (describing the increasing use of carbon nanotubes in commercial industries and projecting future commercial uses of such tubes).

[36] *See generally infra* Section II.*C.1–3* (discussing weaponization and potential drawbacks).

[37] *See generally infra* Section II.*C.1–3* (discussing weaponization and potential drawbacks).

[38] *See generally* Nasu & Faunce, *supra* note 5.

[39] Robert D. Pinson, *Is Nanotechnology Prohibited By the Biological and Chemical Weapons Conventions?*, 22 BERKELEY J. INT'L L. 279, 281 (2004).

[40] *See id.* at 280–81.

[41] Nasu & Faunce, *supra* note 5, at 22.

[42] *Id.*

reveals the dangers of future weapons—the microparticles of shrapnel are nearly impossible for doctors to remove from the target of the weapon because there is nothing for them to essentially grab on to.[43]

The prospect of a DIME-style weapon that incorporates nanoparticles becomes more terrifying with the emergence of research as to the effects of these nanoparticles on biological systems. Even carbon nanotubes, which are designed for inherently peaceful, industrial purposes, are biologically devastating.[44] Studies have shown that they become lodged in the lungs and are nearly impossible for the body to break down because of their unique structure and tiny size.[45] The particles can eventually cause suffocation.[46]

A device that forces shrapnel into the skin, like the DIME device, would not be necessary to effectively weaponize nanoparticles because these particles can be inhaled.[47] Once they enter the bloodstream, they are theoretically capable of directly infiltrating the brain.[48] The nanoparticles can use body systems and pathways that typical biological pathogens cannot. For example, nanoparticles can travel along the olfactory nerves after inhalation. Even if they are kept out of the bloodstream, they may still be capable of infiltrating the brain.[49]

The ease with which nanoparticles can enter the body, the bloodstream, and the brain is made worse by the difficulties encountered in treating their effects. Nanoparticles trigger oxidative stress, and "cationic [nanoparticles] have an immediate toxic effect at the blood-brain barrier."[50] These immediate and severe consequences are difficult to diagnose in time to counteract their effects. Nanomaterials can be "more chemically reactive" than normal particles.[51] They have a higher ratio of surface area to total area because of their small size and the precise structures to which they are engineered.[52] Nanoparticles actually are so small that their movements and interactions with surrounding particles are partially governed by the laws of quantum mechanics, which are inherently unpredictable.[53]

---

[43] *Id.*
[44] Pinson, *supra* note 39, at 280–81.
[45] *Id.*
[46] *Id.*
[47] L. James Valverde, Jr. & Igor Linkov, *Nanotechnology: Risk Assessment and Risk Management Perspective*, 8 NANOTECHNOLOGY L. & BUS. 25, 26 (2011).
[48] *Id.*
[49] *Id.*
[50] Masami Matsuda & Geoffrey Hunt, *Research on the Societal Impacts of Nanotechnology: A Preliminary Comparison of USA, Europe and Japan*, 19 BIO-MED. MATERIALS & ENGINEERING 259, 260 (2009).
[51] Valverde & Linkov, *supra* note 47, at 30.
[52] *Id.*
[53] *Id.*; *see also* Tarasov, *supra* note 6, at 338 ("The impossibility of ideally copying (or

Nanoparticles vary wildly in their individual reactions to the same stimuli because of their tiny scale, individual engineering, chemical reactivity, and subsequent interactivity with the laws of quantum mechanics.[54] A necessary first step for managing a public health crisis is making an accurate identification of the toxin, pathogen, or other catalyst causing the crisis.[55] However, without advance knowledge of the specific nanoparticle in question, the "immediate toxic effect" that Matsuda and Hunt describe could devastate a community before officials could react.[56]

The EPA's current modeling methods for predicting and containing environmental crises incorporate "probabilistic modeling" and "predictive structure-activity analysis."[57] However, the fragmented structure of nanoparticles and the enormous variability among them makes them resistant to these very analyses.[58] Because such models assume predictable structures on a molecular level, they cannot account for the altered molecular makeup of some nanoparticles. If malevolent actors deploy nano-weapons, the current public health response plan would not be sufficient to combat the crisis.

Experts in the emergency response field are expressing these concerns about modern nanoparticles such as carbon nanotubes. As new nanoparticles are developed, their specialization and complexity will only increase. The implications for intentional weaponization of these particles are stark, given their unpredictability. A DIME-like shrapnel device incorporating nanoparticles instead of microparticles and intentionally distributing different kinds of nanoparticles with different chemical reactions could present a public health nightmare.

2. Difficulty of Controlling Self-replicating Devices

In addition to concerns about the present biological effects of nanoparticles, the future development of nanotechnology presents another danger. In 1977, a physicist named K. Eric Drexler proposed that not only could scientists create and program robots on a nano-scale, but that those nano-robots could be programmed to construct and train future nano-

---

cloning) an unknown quantum state is one of the basic rules of quantum mechanics . . . . The no-cloning theorem tells us that cloning quantum machines cannot work ideally.").

54 Valverde & Linkov, *supra* note 47, at 30–31.

55 *Id.*; WORLD HEALTH ORGANIZATION, MANUAL FOR THE PUBLIC HEALTH MANAGEMENT OF CHEMICAL INCIDENTS 10 (2009).

56 Matsuda & Hunt, *supra* note 50, at 260.

57 Valverde & Linkov, *supra* note 47, at 32.

58 *Id.* at 31.

robots.[59] These nano-robots capable of fabricating similar machines are popularly called "assemblers."[60] Pinson notes that these assemblers are likely years from becoming a reality.[61] However, there are already products utilizing the benefits of nanotechnology, and the informatics, pharmaceutical, energy, and defense industries are investing heavily in research and development.[62]

Replicator nano-robots are the next logical step after assembler nano-robots. Vasily E. Tarasov, a quantum physicist at Moscow State University, believes that quantum replicating nano-robots are possible and will eventually be a reality.[63] Even outside of the quantum field, experts discuss replicators as a legitimate possibility.[64]

The basic theory of replicators is that the nano-robots could not only be trained to follow orders in the process of creating new nano-robots like assemblers, but also could actually automatically generate more and more copies of themselves.[65] These replicator nanorobots would theoretically be able to reproduce at a geometric rate.[66] The weaponization of replicator robots is a frightening thought. Because existing nanoparticles already carry formidable biological effects, the cascade effect of replicators that can manipulate nanotech is deeply troubling.

3. State or Individual? How to Punish Dissimilar Actors for Deployment of Weaponized Nanotechnology

The current dispersal of nanotechnology raises further difficulties in preventing weaponization: (1) the threat of a non-state actor weaponizing the technology, and (2) the uncertainty of prosecuting an individual who is either state-affiliated or legitimately operating as a rogue agent.

Not only are militaries researching the applications of nanotechnology to warfare, but some of this work is outsourced to universities and companies.

---

[59] Pinson, *supra* note 39, at 284; *see also* Rudy Baum, *Nanotechnology: Drexler and Smalley Make the Case for and Against 'Molecular Assemblers*,' CHEMICAL & ENGINEERING NEWS, Dec. 1, 2003, at 37 ("My proposal is, and always has been to guide the chemical synthesis of complex structures by mechanically positioning reactive molecules, not by manipulating individual atoms. This proposal has been defended successfully again and again.").

[60] Zhou, *supra* note 1, at 483.

[61] Pinson, *supra* note 39, at 285.

[62] *Id.* at 285–86.

[63] Tarasov, *supra* note 6, at 338.

[64] Nasu & Faunce, *supra* note 5, at 29; Meg McGinity Shannon, *Nanotechnology's Shadow*, 48 COMMUNICATIONS OF THE ACM 21 (2005) (discussing progression from individual nanoparticles to assemblers of nanoparticles to "productive nanosystems").

[65] Zhou, *supra* note 1, at 483.

[66] *Id.*

For example, the United States military is working with the Massachusetts Institute of Technology to determine applications of nanotechnology across a spectrum of uses in warfare.[67]

Universities are not the only private entities that already have access to advanced nanotechnology. Corporations and individuals account for over 75% of United States medical nanotechnology patents.[68] The numbers are similar in other major areas of patent grants.[69] Nanotechnology is therefore progressively owned by a more wide-ranging group of people. The increasing private ownership of the technology creates further avenues through which a malevolent actor could gain control of nanoscience and weaponize it—if more corporations, scientists, and universities have the technical schematics and equipment necessary to create nanoparticles, the pace of its proliferation will likely increase.

III. INEFFECTIVE ALTERNATE MEANS OF REGULATION OR DETERRENCE

Current nanotechnology regulation leaves much to be desired. It is highly questionable whether existing regulations could prevent rogue leaders, states, or other groups from deploying either nanoparticles or nano-robots in an intentionally destructive manner.

A. Current Regulation of Research, Development, and Other Peaceful Uses

Current regulation is almost entirely national in nature, rather than international.[70] Such regimes might incentivize responsible development of nanotechnology among corporate or research-based actors, because some regulatory frameworks on the national level do provide for penalties for malfeasance.[71] However, if the concern is malfeasance by a nation, or an actor with enough influence on a national level to enjoy de facto control, then regulations on the national level would prove ineffective. What

---

[67] Nasu & Faunce, *supra* note 5, at 26. MIT and the U.S. military collaborate through the Institute for Soldier Nanotechnologies and are researching nanotechnology's relevance to "protection; injury intervention and cure; and human performance improvement." *Id.*

[68] Mouttet, *supra* note 26, at 314.

[69] *Id.*

[70] Diana M. Bowman & Graeme A. Hodge, *A Small Matter of Regulation: An International Review of Nanotechnology Regulation*, 8 COLUM. SCI. & TECH. L. REV. 1, 1 (2006); Rick DelVecchio, *Berkeley Considering Need for Nano Safety*, S.F. CHRON., Nov. 24, 2006, at A1 (detailing a proposed local Berkeley regulation that would limit the production of nanomaterials until they could be more adequately studied. The town did not feel that even American regulations as the national level were protecting them sufficiently from industrial interests.).

[71] Bowman & Hodge, *supra* note 70, at 30.

international guidelines that do exist are exactly that—guidelines.[72] These guidelines offer prescriptive goals for what an ideal future of nanotechnology would look like.[73] However, they do not have the regulatory muscle or the threat of real sanctions so they do not truly shape the evolution of the technology or convince actors to alter their behavior in its deployment.[74]

On the national level, regulations that offer any meaningful guidance to nanotechnology innovators do not always recognize nanotechnology as a new field with unique challenges. As noted earlier, nanoparticles are fundamentally unstable because of their size.[75] They behave in ways that similar chemicals do not because unpredictable principles of quantum mechanics dictate how these particles move and interact with the environment around them.[76]

Case studies show that nations do not appreciate these distinctively unpredictable qualities.[77] For example, the current chemical regulatory scheme in the United Kingdom is tasked with governing nanotechnology but remains fundamentally chemical in nature.[78] These regulations address chemicals of the same type equally, even if one of these chemicals has a unique nanostructure and could behave unpredictably.[79] Laws in Australia, Japan, and the United States compound these problems; chemical regulations focus on "new chemicals."[80] Many novel nanoparticles are not defined as "new chemicals," and so the existing chemical regulations tasked with controlling them do not govern them nor have any jurisdiction over their deployment.[81] Nations seem unwilling to acknowledge the severe deficiencies in their regulatory frameworks. For example, the United States' various regulatory agencies have made it clear that they do not believe that nano-specific regulations are necessary.[82] This belief may be based on an unwillingness or inability to delve into the scientific complexity inherent to nanotechnology.[83]

Most regulations aim to prevent the misuse of non-reproductive nanoparticles and do not address the threat of self-replicating or self-

---

72 *Id.* at 45.
73 *Id.*
74 *Id.*
75 Valverde & Linkov, *supra* note 47, at 30.
76 *Id.*
77 *See* Bowman & Hodge, *supra* note 70 (discussing bureaucratic unwillingness to confront differences between nanotechnology and conventional chemicals).
78 *Id.* at 17.
79 Valverde & Linkov, *supra* note 47, at 31.
80 *Id.*
81 *Id.*
82 Bowman & Hodge, *supra* note 70, at 19.
83 Valverde & Linkov, *supra* note 47, at 34.

assembling nanorobots.[84] Although these technologies are not yet available, their very nature would make the current chemical-based regulatory structure obsolete because they share traits like self-replication with biological agents rather than chemical ones. Even for peaceful technology created in good faith, current regulation is insufficient and misguided.

B. Inadequate Alternate Theories for Regulating Weaponized Nanotechnology

Regulating nanoparticles as biologically lethal agents presents one of the first potential opportunities to bring nanotechnology under the general purview of weaponry and warfare-based treaties. Redefining popular conception of nanoparticles from mechanical technology to a biological-style agent would give international groups a coherent reason to impose strong international regulations. It would also entail an acknowledgement that the technology can be used for intentional destruction. Much of the current state of regulation seems to focus on preventing accidents in the development of otherwise well-intentioned products.[85] Viewing nanotechnology in the same light as biological weapons would also give a framework for punishing intentionally-created nanoweapons.

However, regulating these nanoparticles and nanorobots as biological entities also presents challenges. Robert Pinson points out many of the difficulties that would emerge from such a regulatory regime. He theorizes that the Biological Weapons Convention (BWC) might have standing to govern nanotechnology.[86] The United States, United Kingdom, and U.S.S.R. ratified the BWC in 1972.[87] It bans the development or deployment of biological agents for weaponry, and crucially for nanotechnology governance, prohibits toxins, "regardless of their properties."[88] The Chemical Weapons Convention (CWC), which went into effect in April 1997, also prohibits the deployment of "toxic chemicals and their

---

[84] *See* Oak Ridge Nat'l Lab., *supra* note 3 (discussing current nanotechnology research); Nasu & Faunce, *supra* note 5 (discussing current failure to adequately regulate nanoparticulate weapons and exposing the lack of forward-thinking nanotechnology governance); Bowman & Hodge, *supra* note 70, at 31 (discussing regulations that address only nanoparticles and do not even acknowledge them as chemically unique).

[85] *See* Bowman & Hodge, *supra* note 70, at 31 (explaining that nanotechnology currently falls under chemical regulatory regimes that govern industrial business, as "the commercialisation of products containing manufactured nano-particles continues to escalate").

[86] *See* Pinson, *supra* note 39 (pointing out the physical similarities between the adverse effects of inhaled or ingested nanoparticles and those of more traditional weaponized biological agents that the BWC clearly has jurisdiction to regulate).

[87] *Id.* at 291.

[88] *Id.* at 293.

precursors."[89] Given the consequences that nanoparticles, such as carbon nanotubes, can impose on human physiology, they might conceivably be brought under the purview of the Convention.

Nanotechnology varies so greatly in its applications and effects that it may not fit within the definitions in the Biological and Chemical Weapons Conventions.[90] The drafters of the BWC and CWC intentionally kept the definition of "toxin" vague so that new technologies would not be excluded from regulation.[91] The current evolutionary path of nanotechnology, however, may become so divergent that it could no longer qualify as a toxin.[92] The BWC also prohibits more conventional, pathogen-based weaponry. It is questionable, however, if the BWC covers even replicator nanorobots, because it requires that the regulated quantity be "alive."[93] Man-made robots probably would not enter BWC jurisdiction, even if they behaved similarly to traditional pathogens.[94]

Indeed, modern regulatory frameworks are likely insufficient to deal with any intentional deployment of nanotechnology in a wartime setting. The field of nanotechnology could produce weapons that "span several traditional technological compartments and blur the distinction between conventional weapons and weapons of mass destruction."[95] The kind of biological dangers mentioned earlier are merely one example of this blurred line—the idea of self-replicating robots would theoretically allow a relatively small weapon to affect a disproportionately large area. Other weapons, with the exception of prohibited biological agents, are not noted for reproducing themselves after their deployment.[96] Not only does this ability to reproduce and continue causing damage distinguish nanorobots from traditional weapons, it distinguishes them from nuclear and chemical weapons as well.

The current substitute for a true international framework regulates nanotechnology from the edges rather than addressing it head-on. There is

---

[89] *Id.* at 294.
[90] *Id.* at 298.
[91] *Id.* at 292.
[92] *Id.*
[93] *Id.* at 298.
[94] *Id.*
[95] Nasu & Faunce, *supra* note 5, at 29.
[96] *See generally Nuclear Weapons: How They Work*, UNION OF CONCERNED SCIENTISTS, (Apr. 2010), http://www.ucsusa.org/nuclear_weapons_and_global_security/nuclear_weapons/technical_issues/nuclear-weapons-how-they.html ("Essentially, the destructive energy produced by such weapons is the result of three separate but nearly simultaneous explosions."); *Emergency Preparedness and Response: Facts About Sarin*, CENTERS FOR DISEASE CONTROL AND PREVENTION (Feb. 2006), http://www.bt.cdc.gov/agent/sarin/basics/facts.asp (explaining that one major chemical weapon, sarin, is very unstable and does not persist long in the environment once released: "Because it evaporates so quickly, sarin presents an immediate but short-lived threat.").

no current international treaty that regulates weaponized nanotechnology.[97] The most applicable current regulations ban or present guidelines on general technologies or delivery vehicles such as "expanding bullets, asphyxiating, poisonous or other gases, biological weapons, chemical weapons, blinding laser weapons, anti-personnel mines, and most recently, cluster munitions."[98] While these bans may remove some nanotechnology from the battlefield, the prevention will be incomplete. Some nanotechnology could be used to produce or augment these weapons, and even directly weaponized nanorobots or nanoparticles could be delivered via delivery vehicles that violate treaties.[99] However, nanotechnology is evolving into a field increasingly distinct from the sciences that influence traditional weapons production.[100] Because of this divergence, regulations on current weapons technologies likely will not accurately encompass future weaponized nanotechnology.

Pre-emptively developing a comprehensive international approach to intentionally weaponized nanotechnology is important because the technology's deployment would likely be deliberately calculated to inflict maximum damage. An industrial accident, on the other hand, might be limited and would likely fall within the scope of a nation's individual regulations.[101] Some scholars believe that even in the private research realm, significant regulations will not be enacted until there is a disaster to prompt them.[102] These scholars believe that such a disaster and the resulting regulation are probably "inevitable,"[103] but have publically resigned themselves to that inevitability. However, the "luxury" of waiting for an industrial accident does not exist in the wartime context.

The amorphous nature of nanotechnology presents problems even beyond the classification of weapons as conventional or weapons of mass destruction. One of the most prominent of these concerns is the ability of nanotechnology to alter body chemistry.[104] Nasu speculates that nano-medicine may be used on a country's own soldiers in a future war to enhance their physical capabilities, but with significant long-term harm to the

---

[97] Nasu & Faunce, *supra* note 5, at 30.
[98] *Id.* at 30–31.
[99] *Id.* at 32.
[100] *See* Oak Ridge Nat'l Lab., *supra* note 3 (discussing the unique methods used to produce nanomaterials); Tarasov, *supra* note 6 (emphasizing that some nanoparticles are so small that they do not conform to generally-understood rules of physics or chemistry).
[101] *Emergency Management Guide for Business and Industry*, FEMA 14–15 (Oct. 1993), http://www.fema.gov/pdf/business/guide/bizindst.pdf (discussing the possibility of hazardous spills and providing probability estimates and other tools for risk management).
[102] Bowman & Hodge, *supra* note 70, at 36.
[103] *Id.*
[104] Nasu & Faunce, *supra* note 5, at 29.

soldiers.[105] A regulatory regime must therefore encompass not only the acts of a rogue actor with access to nanotechnology and those of a state deploying nanotechnology against enemy combatants, but also those of a state turning these technologies on its own citizens.

Current regimes of common law within the international community also will be insufficient to address concerns of evolving nanotechnology. These definitions largely center on the differences between the intent behind actions and the consequences of those same actions.[106] In the case of some nanotechnology, this chasm could be far wider than with any other kind of weapons technology.[107] Further statutes hinge on the definition of "suffering," which retains an amorphous definition in international law.[108] Beyond this amorphous definition, there is uncertainty as to whether weaponized nanotechnology would cause "unnecessary" and "superfluous" damage. If the damage were defined as such, then international common law would be implicated, but otherwise, there would be little recourse within the international common law.[109]

Finally, preemptively shutting off the spigot of nanotechnology-based weapons may be nearly impossible without the catastrophe that Bowman & Hodge allude to[110] because nations will be unwilling to submit to nanotechnology regulations that preemptively deter weapons development.[111] The proscriptive measures currently available do not sufficiently deter states from weapon development given the powerful financial incentives favoring weapon development;[112] asking states to submit to pre-emptive checks of nascent technology with great economic potential is quixotic at best.[113]

C. *Ineffectiveness of Purely National Solutions*

The international nature of nanotechnology development presents unique problems for avoiding its weaponization. As previously mentioned, at least

---

[105] *Id.*
[106] *Id.* at 37–39.
[107] *Id.* (describing the current common-law regime); Zhou, *supra* note 1, at 483 (discussing the possibility of replicating nano-robots whose effects could spread far beyond the foreseeable range of their initial deployment).
[108] Nasu & Faunce, *supra* note 5, at 37–39.
[109] *Id.*
[110] Bowman & Hodge, *supra* note 70, at 36.
[111] Nasu & Faunce, *supra* note 5, at 24.
[112] *Nanotechnology Information Center: Properties, Applications, Research, and Safety Guidelines*, AM. ELEMENTS, http://www.americanelements.com/nanotech.htm (last visited Jan. 11, 2012) ("Nanotechnology is expected to have an impact on nearly every industry. The U.S. National Science Foundation has predicted that the global market for nanotechnologies will reach $1 trillion or more within 20 years.").
[113] *See* Nasu & Faunce, *supra* note 5, at 50.

five militaries are aggressively pursuing nanotechnological advantages.[114] Thus, a single country's regulation or goodwill can prevent the misuse of the technology. Countries also have different ideas of what constitutes proper regulation of science;[115] therefore, there may be different cultural ideas of how far weapons research could ethically proceed.

If the international community waits to enact these enforcements until nanotechnology is deployed in an international conflict, the consequences may be far worse for two reasons. First, the technology has shown enough destructive potential that an intentionally combative use of it could easily exceed the consequences of an industrial accident.[116] Second, it would be difficult to regulate this technology during an actual conflict because of the incentives of war and the uncertainties of classifying nanotechnology. Warfare naturally pits state actors against each other. Because nations at war are fighting for their own survival in a zero-sum game, Bowman and Hodge's proposed regulations on the national level are unlikely to succeed.[117] If a nation can gain a competitive advantage by suspending its own national policies, there may be an incentive to do so. As for the current international regulations that govern delivery vehicles and present technologies, nanotechnology is becoming increasingly difficult to define because of its unique properties.[118] A coherent international voice would clarify the acceptability of these new technologies. For example, there is currently debate about whether the DIME system that Israel recently deployed against the Palestinians violates international weapons treaties because it bears some similarities to banned chemical weapons; however, there is no body to issue a definitive international ruling on the subject.[119]

---

[114] *Id.* at 25 (identifying these countries as the United States, the United Kingdom, India, Russia, and Sweden).

[115] *See* Matsuda & Hunt, *supra* note 50, at 261 (discussing cultural differences in attitudes about research safety protocols and pointing out that some Asian countries have appreciably more laissez-faire attitudes about regulating nanotechnology than does the United States).

[116] *See Carbon Nanotubes That Look Like Asbestos, Behave Like Asbestos*, THE PROJECT ON EMERGING NANOTECHNOLOGIES, May 19, 2008, http://www.nanotechproject.org/news/archive/mwcnt [hereinafter *Carbon Nanotube Asbestos Dangers*] (noting that nanomaterials could produce detrimental, long-term health effects and discussing "a study [using] established methods to see if specific types of nanotubes have the potential to cause mesothelioma," which showed that "carbon nanotubes that look like asbestos fibers, behave like asbestos fibers"); Alexandra E. Porter et al., *Direct Imaging of Single-Walled Carbon Nanotubes in Cells*, 2 NATURE NANOTECHNOLOGY 713 (2007), *available at* http://www.london-nano.com/sites/default/files/uploads/Porter_imaging_single_walled_nanotubes_nnano2007_347.pdf (confirming that some "carbon nanotubes have been shown to be acutely toxic in a number of types of cells").

[117] Moshe Hirsch, *Game Theory, International Law, and Future Environmental Cooperation in the Middle East*, 27 DENV. J. INT'L L. & POL'Y 75, 82–84 (1998).

[118] Nasu & Faunce, *supra* note 5, at 29.

[119] *Id.* at 32.

Non-military research can also carry military implications. Japan is one of the largest researchers of nanotechnology in the world; lagging behind the United States in patents granted but leading in patents applications.[120] Japan has identified nanotechnology as an area of research focus and has invested the equivalent of several hundred million dollars in development as part of its Second Science and Technology Basic Plan.[121] Japan significantly lags behind other nations, including the United States, in the perception that the ethical issues surrounding nanotechnology are worthy of research and funding.[122] This lack of concern mirrors other casual attitudes towards safety in the Japanese research community; for example, the nation trails the United States in bioethics as a field.[123] That casual attitude is particularly troubling because scientists have already identified specific biological risks from current nanotechnology.[124] It is also generally troubling, because nanotechnology is an increasingly powerful force and the world does not have a coherent or cohesive attitude towards its dangers and regulation.

IV. ANALYSIS

Because of the current state of regulation, it will be necessary to articulate and implement structures for regulating nanotechnology as a weapon and not just as a new research technology. Current weapons regulations are at best inadequate and contain too many contradictions and ambiguities to function effectively. The International Criminal Court (ICC), while imperfect, is currently the best solution for such regulation. The ICC already exists and would not require the adoption of a new set of international treaties. Its charter seeks to prevent acts of large-scale destruction and crimes against humanity. This large-scale frame of reference is appropriate because one of the more serious effects of weaponized biotech could be biological

---

[120] Escoffier, *supra* note 11, at 104.

[121] *Id.* at 103.

[122] Matsuda & Hunt, *supra* note 50, at 261.

[123] *Id.*

[124] *Carbon Nanotube Asbestos Dangers*, *supra* note 116; *Nanotubes Highly Toxic*, INSTITUTE OF SCIENCE IN SOCIETY (Nov. 18, 2003), http://www.i-sis.org.uk/nanotubestoxic.php ("Under the microscope, the lungs of dead animals in the high dose group showed large aggregates of particles in macrophages (large white blood cells that 'eat' foreign particles) in the alveolar space (air sac), some of the aggregates were also found in spaces between cells, forming granulomas (tumour-like nodules consisting of the bloated white blood cells). There were also signs of inflammation. Granulomas were not detected in mice given the low dose of the nickel-yttrium nanotubes. The lungs of mice given high dose of either raw or purified iron-containing nanotubes showed prominent granulomas at 7 days.").

warfare.[125] Additionally, the ICC can target both elected state actors and private but prominent actors within states for their crimes.

A. The International Criminal Court

The ICC is an international body designed to punish "serious crimes of concern to the international community."[126] The Court was established in response to the African and Yugoslavian atrocities in the 1990s, after international consensus that a permanent body was necessary.[127] The signers of the Rome Statute, which established the Court, believed that it should be an independent court based on an international treaty.[128] Though the crimes of the mid-1990s were the crucial catalyst for the ICC's formation, the Nuremberg and Tokyo trials are also considered predecessors to the Court, and they addressed many of the same issues that the ICC faces today.[129]

The ICC prosecutes large-scale crimes, the main causes of action being genocide, crimes against humanity, aggression, and war crimes.[130] Scholars fear weaponized nanotechnology because in several years or decades, it could cause catastrophic damage that currently only weapons of mass destruction can.[131] Because these crimes could threaten broad populations,[132] they fit within the general scope of ICC prosecutions. After prosecuting African genocides,[133] the ICC would likely have more gravitas and institutional capability to deal with crimes of the magnitude that weaponized nanotechnology could facilitate.

The most straightforward path by which the ICC could prosecute weaponized nanotechnology is by incorporating the technology into its

---

[125] *See* Pinson, *supra* note 39, at 289 ("In addition, mature nanotech could itself act as an artificial chemical or biological agent."); *see also* Mali et al., *supra* note 27, at 1 (discussing the ability of carbon nanotubes to infiltrate and modify cells).

[126] *About the Court*, INTERNATIONAL CRIMINAL COURT, http://www.icc-cpi.int/en_menus/icc/about%20the%20court/Pages/about%20the%20court.aspx (last visited Mar. 29, 2013).

[127] *Id.*

[128] *Id.*

[129] *Id.*

[130] Rome Statute of the International Criminal Court, art. 5, July 17, 1998, 2187 U.N.T.S. 90 [hereinafter Rome Statute].

[131] *See* Mali et al., *supra* note 27 (stating that nanoparticles are becoming more adept at infiltrating and changing cellular structure); Pinson, *supra* note 39.

[132] Pinson, *supra* note 39.

[133] Prosecutor v. Thomas Lubanga Dyilo, Case No. ICC-01/04-01/06, Judgment (Mar. 14, 2012), http://www.icc-cpi.int/en_menus/icc/situations%20and%20cases/situations/situation%20icc%200104/related%20cases/icc%200104%200106/Pages/democratic%20republic%20of%20the%20congo.aspx. Mr. Lubanga is charged with "[e]nlisting and conscripting children under the age of 15 years into the . . . [Patriotic Forces for the Liberation of the Congo] (FPLC) and using them to participate actively in the hostilities in the context of an international armed conflict." *Id.*

definition of the crime of aggression. Article 5 of the Rome Treaty recognizes a crime of aggression as one of the four major crimes that the ICC should prosecute.[134] However, the crime is not currently under the effective jurisdiction of the ICC.[135] The Rome Treaty delayed including an official definition, opting instead to incorporate the crime later.[136] The Treaty did not establish an official definition of the crime of aggression in time to incorporate it into the established war crimes, genocide, and crimes against humanity jurisdictions that were already codified within.[137]

The Special Working Group on the Crime of Aggression was formed to define the crime of aggression.[138] This group's task is to define the crime of aggression.[139] They are still refining these definitions and will not have an enforceable definition until 2017.[140] Because this definition is still being refined and modified, it could incorporate emerging areas of public policy without challenging the legitimacy of the Rome Treaty. It is therefore ideal for addressing nanotechnology-specific difficulties.[141]

The first article in their working proposition states that

> For the purpose of this Statute, "crime of aggression" means the planning, preparation, initiation or execution, by a person in a position effectively to exercise control over or to direct the political or military action of a State, of an act of aggression which, by its character, gravity and scale, constitutes a manifest violation of the Charter of the United Nations.[142]

---

[134] Roger S. Clark, *Negotiating Provisions Defining the Crime of Aggression, Its Elements and the Conditions for ICC Exercise of Jurisdiction Over It*, 20 EUR. J. INT'L L. 1103, 1103 (2009).
[135] *Id.* at 1106–07.
[136] *Id.* at 1103.
[137] Rome Statute, *supra* note 130, art. 5 § 1.
[138] Clark, *supra* note 134, at 1103.
[139] *Special Working Group's Proposal on the Crime of Aggression*, COALITION FOR THE INTERNATIONAL CRIMINAL COURT, http://www.iccnow.org/?mod=swgca-proposal (last visited Mar. 29, 2013) [hereinafter *The Proposal*].
[140] *Crime of Aggression*, COALITION FOR THE INTERNATIONAL CRIMINAL COURT, http://www.iccnow.org/?mod=aggression (last visited Mar. 29, 2013).
[141] *See* Jonathan A. Ophardt, Comment, *Cyber Warfare and the Crime of Aggression: The Need for Individual Accountability on Tomorrow's Battlefield*, 2010 DUKE L. & TECH. REV. 3 (expressing a similar hope that the ICC can regulate targeted cyber-warfare). Ophardt makes the case that some forms of cyber-warfare already fit the current definition of aggression, while some others require additional tailoring of the statute in order to fully enjoy ICC jurisdiction. *Id.*
[142] *The Proposal*, *supra* note 139, ¶ 1.

The rest of the recommendation attempts to define the crime of aggression in more specific terms.[143] These terms seem almost universally to apply to the movement of land-based or naval-based armies against a rival state power.[144] The recommendations (though current) spend little time addressing or considering the implications of modern technological power and its destructive effect on the broad-based civilian structures within societies.[145] The Working Group's recommendations seem keyed towards re-fighting the wars of the early twentieth century—they explicitly prohibit many uses of overt land warfare while ignoring current projection of nonconventional force.[146]

The crime of aggression's current definition omits language that could regulate nanotechnology. First, the ICC's promise is that it can potentially offer prosecutions against both official state actions and de facto state actions (or those undertaken by powerful interests within a country that still do not technically possess state power).[147] The current draft of the crime of aggression "distinguishes between the 'act of aggression' (what a state does) and the 'crime of aggression' (what a leader does)."[148] This gap addresses the difference between an actual national act of aggression against another state and the planning, initiation, and execution of such an act by the country's political leadership.[149] This gap in prosecutorial authority could severely hinder any number of decentralized crimes. Ophardt addresses the potential jurisdictional gap in terms of cyber warfare, but the gap applies equally to nanotechnology governance. Fundamentally, the current ICC theories on aggression rely on "traditional concepts of territorial integrity."[150] While this current definition might be insufficient, the regulation of aggression might prove more useful than initially imagined.

The apparent leadership gap in the ICC definitions of aggression could also cut in favor of some forms of nanotechnology regulation. Aggression is a "leadership" crime,[151] and charges can be brought not only against actual political leaders, but also those in a position to induce or influence significant policy changes within a state.[152] It is therefore more likely that influential scientists and technicians could be held to account for their influence in the

---

[143] *See generally id.*
[144] *Crime of Aggression*, *supra* note 140.
[145] *Id.*
[146] *Id.*
[147] Ophardt, *supra* note 141, at 11.
[148] Clark, *supra* note 134, at 1105.
[149] *Id.* The gap seems designed to protect the interests of private citizens subject to irrational or belligerent political leadership.
[150] Ophardt, *supra* note 141, at 30.
[151] Clark, *supra* note 134, at 1105.
[152] *Id.*

development of nanoweapons.[153] This flexibility of the Court could also help weak governments confront private developers of military nanotechnology within their borders. The ICC can either pursue cases *proprio motu* or based on a "referral from any State Party."[154]

In addition, the crime of aggression could include a provision for attempted aggression, even though some scholars currently see this as unlikely.[155] Article 25 of the Rome Treaty contains the general attempt provision, and there was argument as to whether it should apply in the case of state aggression.[156] Attempted aggression may allow for preemptive regulations against weaponized nanotech. The ICC generally has jurisdiction over attempted crimes if other jurisdictional requirements are met; it is not completely clear from the Special Working Group's drafting process whether the ability to prosecute for the crime of aggression would fall within the attempt framework.[157] While Clark hypothesizes that obvious cases of attempt would be justiciable under the ICC, it is possible that the regulations on attempt would curtail the research activities of weapons scientists.

Further avenues of attack against nontraditional actors are enumerated throughout ICC regulations. For example, there is a regulation against "[a]llowing an attack by a State to originate from its sovereign territory," which "is also considered an act of aggression."[158] Ophardt speculates that the breadth of this definition could allow the ICC flexibility in legitimately prosecuting nations that harbor non-state groups within their borders and

[153] *Cf.* Prosecutor v. Ahmad Muhammad Harun ("Ahmad Harun") and Ali Muhammad Ali Abd-Al-Rahman ("Ali Kushayb"), Case No. ICC-02/05-01/07, Decision on 6 Applications for Victims' Participation in the Proceedings (May 17, 2010), http://www.icc-cpi.int/en_menus/icc/situations%20and%20cases/situations/situation%20icc%200205/related%20cases/icc%200205%200107/Pages/darfur_%20Sudan.aspx [hereinafter *Sudan Cases*]; Prosecutor v. Thomas Lubanga Dyilo, *supra* note 133. The ICC is currently prosecuting both the former Minister of State for Sudan and the founder of a powerful insurgent army within the Democratic Republic of the Congo. *Id.*; *Sudan Cases*, *supra*.

[154] *Situations and Cases*, INTERNATIONAL CRIMINAL COURT, http://www.icc-cpi.int/en_menus/icc/situations%20and%20cases/Pages/situations%20and%20cases.aspx (last visited Mar. 31, 2013).

[155] *The Proposal*, *supra* note 139. The Proposal currently proposes punishing "the planning, preparation, initiation or execution, by a person in a position effectively to exercise control over or to direct the political or military action of a State, of an act of aggression." *Id.* § 1.

[156] Clark, *supra* note 134, at 1108–09. Clark, however, believes that the more likely scenario is that a "bizarre case" that merits a charge of attempted aggression would be "left for judicial resolution." *Id.* at 1109; *see also* Claus Kreβ, *Time for Decision: Some Thoughts on the Immediate Future of the Crime of Aggression: A Reply to Andreas Paulus*, 20 EUR. J. INT'L L. 1129, 1135 n.24 (2009) (asserting that as currently worded, the proposed crime of aggression would not support a prosecution for attempted aggression).

[157] Clark, *supra* note 134, at 1109.

[158] Ophardt, *supra* note 141, at 50.

allow them to develop weaponized nanotechnology.[159] The functional predecessors of the ICC[160] also zealously prosecuted non-state actors for their complicity in human rights violations; the Nuremburg prosecutions included actions against those who financed the Nazi regime on the theory that their actions had enabled the atrocities that followed.[161]

The International Criminal Court's charter allows for prosecutions against states that commit crimes of aggression or leaders that commit crimes against humanity.[162] It contains multiple other avenues for theoretically attacking unorthodox and technically advanced crimes that can originate from either state or non-state impetuses.[163] And, it is an established body that actually has the mechanisms to try cases.[164] Other proposals for the creation of new bodies to regulate only nanotechnology do not acknowledge these realities.[165] The risks from intentionally weaponized nanotechnology are too great and too pressing to entrust to radically new legal provisions that are untested.

V. CONCLUSION

Nanotechnology promises rapid advancement to many areas of science. In the next decades, it may dramatically improve surgical techniques, durability of goods, and industrial processes.[166] There are many reasons to embrace the development of the technology. However, the unknowns surrounding nanotechnology affirm that the embrace should be cautious. Nanoparticles can have unpredictable and adverse effects on organisms,[167] and nanorobots could deal a crippling blow to a nation or business's

---

159 *Id.* at 51.

160 Tove Rosen, ed., *The Influence of the Nuremberg Trial on International Criminal Law*, ROBERT H. JACKSON, http://www.roberthjackson.org/the-man/speeches-articles/speeches/speeches-related-to-robert-h-jackson/the-influence-of-the-nuremberg-trial-on-international-criminal-law/ (last visited Mar. 29, 2013) ("The Nuremberg trials established that all of humanity would be guarded by an international legal shield and that even a Head of State would be held criminally responsible and punished for aggression and Crimes Against Humanity. The right of humanitarian intervention to put a stop to Crimes Against Humanity — even by a sovereign against his own citizens — gradually emerged from the Nuremberg principles affirmed by the United Nations.").

161 Ophardt, *supra* note 141, at 53.

162 Rome Statute, *supra* note 130, art. 5, § 1.

163 *See generally* Ophardt, *supra* note 141 (discussing cyber-warfare and the difficulties in prosecuting it).

164 Prosecutor v. Thomas Lubanga Dyilo, *supra* note 133.

165 *See generally* Nasu & Faunce, *supra* note 5 (arguing for such a body without defining its parameters).

166 Zhou, *supra* note 1, at 483.

167 *Carbon Nanotubes Asbestos Dangers*, *supra* note 116.

technology infrastructure if they achieve the ability to replicate themselves.[168]

Current methods of punishing the intentional misuse of nanotechnology are inadequate. The common law includes elements for war crimes that do not apply to nanotechnology.[169] Nanoparticles do not closely enough resemble biological or chemical agents to fall under the Biological Weapons Convention or the Chemical Weapons Convention.[170] Current international treaties regarding delivery vehicles and other traditional weapons will not capture the future evolution of nanotech.[171] And nations cannot be relied upon to regulate their own military technology in a time of war.

The International Criminal Court already exists.[172] It has prosecutors, and it has a defined power structure.[173] The ICC has prosecuted crimes across the globe,[174] so its reach is not in question. The ICC is designed to account for actions that affect broad swaths of people[175] like researchers speculate an advanced nanoweapon would.[176] Finally, the Special Working Group is still defining the crime of aggression,[177] so definitions specifically condemning the evils of weaponized nanotech could be plugged relatively seamlessly into the broad Rome Statute framework.

Before the military conflicts of the upcoming years and decades, nations should unequivocally state that nanotechnology has no place as a weapon. Its potential effects invoke our deepest fears. Properly weaponized, it could kill numbers of people that society currently believes only weapons of mass destruction can.[178] The international community should demonstrate the international criminal consequences that will accompany the deployment of such a technology. The ICC is the best option for accomplishing such regulation and deterrence.

---

[168] Pinson, *supra* note 39, at 284.
[169] Nasu & Faunce, *supra* note 5, at 37–39.
[170] *Id.* at 30–31.
[171] *Id.*
[172] *About the Court*, *supra* note 126.
[173] *Id.*
[174] *Id.*
[175] *See id.* (giving a general overview of the court and its reach).
[176] *See generally* Pinson, *supra* note 39 (comparing the effects of biological weapons and potential nanoparticle bombs and speculating that they could produce similar devastation).
[177] *See The Proposal*, *supra* note 139 (proposing amendments to the Rome Statute to codify the crime of aggression).
[178] *See* Pinson, *supra* note 39, at 289 ("Nanotechnology's microscopic size, easy dispersal, [potential] self-replication, and potential to inflict massive harm on persons, machines, or the environment makes it a tempting weapon." (internal citations omitted)).