# Neg octas jack howe

## 1NC

### NC – T

#### Interp: Reduce means unconditional and permanent

**Reynolds 59** – Judge (In the Matter of Doris A. Montesani, Petitioner, v. Arthur Levitt, as Comptroller of the State of New York, et al., Respondents [NO NUMBER IN ORIGINAL] Supreme Court of New York, Appellate Division, Third Department 9 A.D.2d 51; 189 N.Y.S.2d 695; 1959 N.Y. App. Div. LEXIS 7391 August 13, 1959, lexis)

Section 83's counterpart with regard to nondisability pensioners, section 84, prescribes a reduction only if the pensioner should again take a public job. The disability pensioner is penalized if he takes any type of employment. The reason for the difference, of course, is that in one case the only reason pension benefits are available is because the pensioner is considered incapable of gainful employment, while in the other he has fully completed his "tour" and is considered as having earned his reward with almost no strings attached. It would be manifestly unfair to the ordinary retiree to accord the disability retiree the benefits of the System to which they both belong when the latter is otherwise capable of earning a living and had not fulfilled his service obligation. If it were to be held that withholdings under section 83 were payable whenever the pensioner died or stopped his other employment the whole purpose of the provision would be defeated, i.e., the System might just as well have continued payments during the other employment since it must later pay it anyway.  [\*\*\*13]  The section says "reduced", does not say that monthly payments shall be temporarily suspended; it says that the pension itself shall be reduced. The plain dictionary meaning of the word is to diminish, lower or degrade. The word "reduce" seems adequately to indicate permanency.

#### Violation: Patent buy outs keep some patents

#### Vote neg for limits and ground – they can defend affs that are extremely time-limited, which moots core neg ground predicated on the structure of IPR and long term impacts. Allows the aff to no link out of every Disad, and means we have to resort to stale generics

#### DTD on T-- indicts their ability to read the aff and the debate shouldn’t have happened to begin w if the aff was abusive

#### Competing Interps on T since its binary and a question of models—reasonability arbitrary

#### No rvis – it doesn’t make sense for them to win by being fair, baits theory, the aff last speech always wins

### NC - Theory

#### Interpretation: The affirmative must specify a primary and secondary enforcement mechanism in the plan text of the 1AC.

#### Violation: they don’t

#### Ground – SCOTUS, WTO, WHO, Congress, DSB, etc. are all different processes of the affirmative which kills fairness

#### Predictability – We don’t know what happens if people don’t follow the plan; i.e. criminalization, suits, etc.

### NC – NC

#### The standard is maximizing expected net well being

#### Paralysis is wrong

Rendall 17, Matthew Rendall, Lecturer in Politics and International Relations at the University of Nottingham Political Science degree from Columbia University, “PASCALIAN WAGERING AND CATASTROPHIC RISK: THE WEITZMAN-NORDHAUS DEBATE”, 5/9/17, <https://www.nottingham.ac.uk/climateethicseconomics/documents/papers-workshop-5/rendall.pdf> //CC

Jonas, however, feared not only the physical destruction of humanity but also losing ‘the essence of man’. His imperative also forbids taking any risks with the latter.37 Depending on how we interpret ‘the essence of man’, this might give it a much broader scope.38 Indeed, Jonas maintained that there were many “apocalyptic” threats, whether nuclear weapons or nuclear reactors.39 Interpreted that way, the imperative may seem to threaten the same paralysis as does Pascal’s Wager.40 Nordhaus warns that if we attached infinite disutility to existential risks, it could be rational to fight preventive wars to prevent barely discerned power shifts in the far future.41 If the imperative of responsibility is to avoid paralysis and paranoia, its scope must be restricted to a small number of truly apocalyptic risks.42

While it is true that nearly anything we do could in principle prove catastrophic, in most cases we have no more reason to believe that acting is riskier than abstaining. It is often more dangerous, for example, to launch preventive wars than to forego them. With climate change, on the other hand, we have a well-theorized causal mechanism, with good theoretical and empirical reasons for believing that higher greenhouse gas concentrations are more dangerous than lower ones.43 There are a small number of other apocalyptic threats that fall into this category—notably thermonuclear war—but for now there are not scores or hundreds.44

Still, there might be many actions for which we can construct a theoretically possible, albeit improbable, story of how they could lead to doom, and that seem slightly more likely than not to bring on the apocalypse. To adapt an example of Jon Elster’s, it is conceivable that commercial TV transmissions will attract visitors from outer space. While such extraterrestrials might either save the earth from some other threat or destroy it, it is unlikely that these probabilities exactly cancel each other out. In the absence of reliable information, it is rational to make use of whatever information we do have—even if it is merely a flimsy analogy or a vague hunch. Suppose we judge—very tentatively—that the chance that alien visitors will destroy the earth is slightly greater than that they will destroy it. Should this be a decisive consideration in whether or not to broadcast The Simpsons?45

Intuitively, the question seems absurd, but we should not reject it out of hand. In other contexts when policies appear to carry a small chance of apocalyptic destruction they should be taken seriously, and sometimes are. It was reasonable for Compton to take into account the chance that the atomic bomb would ignite the earth’s atmosphere even if it was only on the order of three in a million. It is reasonable today to consider the possibility that particle accelerators might destroy the earth in deciding whether to run them.46 The TV transmission question may seem absurd because we are by now accustomed to television broadcasts, and they have become an integral part of modern societies. That does not show that they are safe. It may instead indicate that the industrial revolution has led to the proliferation of existential risks. The Stern Review estimated a ten percent chance of human extinction per century. Surely no British government before the twentieth century, had it considered the matter at all, would have assessed the risk as nearly this high.47

Even if the number of apocalyptic threats to which we must respond is presently circumscribed, with technological development it is likely to grow. In that case the imperative of responsibility could become far more confining.48 Yet in a nightmare world where existential risks had become common, what could we reasonably do but exercise extreme caution? Perhaps the problem is not that the imperative of responsibility is too restrictive, but that technological development is too dangerous. We should not take for granted that industrialization’story has a happy ending.49 If century after century we continue to run even small existential risks, sooner or later, we are bound to lose the gamble.50

#### Risk is magnitude times probability—balances their framing with ours—BUT, probability first falls prey to psychological biases and leads to mass death.

Clarke ‘8 [Lee, member of a National Academy of Science committee that considered decision-making models, Anschutz Distinguished Scholar at Princeton University, Fellow of AAAS, Professor Sociology (Rutgers), Ph.D. (SUNY), “Possibilistic Thinking: A New Conceptual Tool for Thinking about Extreme Events,” Fall, Social Research 75.3, JSTOR]

In scholarly work, the subfield of disasters is often seen as narrow. One reason for this is that a lot of scholarship on disasters is practically oriented, for obvious reasons, and the social sciences have a deep-seated suspicion of practical work. This is especially true in sociology. Tierney (2007b) has treated this topic at length, so there is no reason to repeat the point here. There is another, somewhat unappreciated reason that work on disaster is seen as narrow, a reason that holds some irony for the main thrust of my argument here: disasters are unusual and the social sciences are generally biased toward phenomena that are frequent. Methods textbooks caution against using case stud- ies as representative of anything, and articles in mainstreams journals that are not based on probability samples must issue similar obligatory caveats. The premise, itself narrow, is that the only way to be certain that we know something about the social world, and the only way to control for subjective influences in data acquisition, is to follow the tenets of probabilistic sampling. This view is a correlate of the central way of defining rational action and rational policy in academic work of all varieties and also in much practical work, which is to say in terms of probabilities. The irony is that probabilistic thinking has its own biases, which, if unacknowledged and uncorrected for, lead to a conceptual neglect of extreme events. This leaves us, as scholars, paying attention to disasters only when they happen and doing that makes the accumulation of good ideas about disaster vulnerable to issue-attention cycles (Birkland, 2007). These conceptual blinders lead to a neglect of disasters as "strategic research sites" (Merton, 1987), which results in learning less about disaster than we could and in missing opportunities to use disaster to learn about society (cf. Sorokin, 1942). We need new conceptual tools because of an upward trend in frequency and severity of disaster since 1970 (Perrow, 2007), and because of a growing intellectual attention to the idea of worst cases (Clarke, 2006b; Clarke, in press). For instance, the chief scientist in charge of studying earthquakes for the US Geological Service, Lucile Jones, has worked on the combination of events that could happen in California that would constitute a "give up scenario": a very long-shaking earthquake in southern California just when the Santa Anna winds are making everything dry and likely to burn. In such conditions, meaningful response to the fires would be impossible and recovery would take an extraordinarily long time. There are other similar pockets of scholarly interest in extreme events, some spurred by September 11 and many catalyzed by Katrina. The consequences of disasters are also becoming more severe, both in terms of lives lost and property damaged. People and their places are becoming more vulnerable. The most important reason that vulnerabilities are increasing is population concentration (Clarke, 2006b). This is a general phenomenon and includes, for example, flying in jumbo jets, working in tall buildings, and attending events in large capacity sports arenas. Considering disasters whose origin is a natural hazard, the specific cause of increased vulnerability is that people are moving to where hazards originate, and most especially to where the water is. In some places, this makes them vulnerable to hurricanes that can create devastating storm surges; in others it makes them vulnerable to earthquakes that can create tsunamis. In any case, the general problem is that people concentrate themselves in dangerous places, so when the hazard comes disasters are intensified. More than one-half of Florida's population lives within 20 miles of the sea. Additionally, Florida's population grows every year, along with increasing development along the coasts. The risk of exposure to a devastating hurricane is obviously high in Florida. No one should be surprised if during the next hurricane season Florida becomes the scene of great tragedy. The demographic pressures and attendant development are wide- spread. People are concentrating along the coasts of the United States, and, like Florida, this puts people at risk of water-related hazards. Or consider the Pacific Rim, the coastline down the west coasts of North and South America, south to Oceania, and then up the eastern coast- line of Asia. There the hazards are particularly threatening. Maps of population concentration around the Pacific Rim should be seen as target maps, because along those shorelines are some of the most active tectonic plates in the world. The 2004 Indonesian earthquake and tsunami, which killed at least 250,000 people, demonstrated the kind of damage that issues from the movement of tectonic plates. (Few in the United States recognize that there is a subduction zone just off the coast of Oregon and Washington that is quite similar to the one in Indonesia.) Additionally, volcanoes reside atop the meeting of tectonic plates; the typhoons that originate in the Pacific Ocean generate furiously fatal winds. Perrow (2007) has generalized the point about concentration, arguing not only that we increase vulnerabilities by increasing the breadth and depth of exposure to hazards but also by concentrating industrial facilities with catastrophic potential. Some of Perrow's most important examples concern chemical production facilities. These are facilities that bring together in a single place multiple stages of production used in the production of toxic substances. Key to Perrow's argument is that there is no technically necessary reason for such concentration, although there may be good economic reasons for it. The general point is that we can expect more disasters, whether their origins are "natural" or "technological." We can also expect more death and destruction from them. I predict we will continue to be poorly prepared to deal with disaster. People around the world were appalled with the incompetence of America's leaders and orga- nizations in the wake of Hurricanes Katrina and Rita. Day after day we watched people suffering unnecessarily. Leaders were slow to grasp the importance of the event. With a few notable exceptions, organi- zations lumbered to a late rescue. Setting aside our moral reaction to the official neglect, perhaps we ought to ask why we should have expected a competent response at all? Are US leaders and organiza- tions particularly attuned to the suffering of people in disasters? Is the political economy of the United States organized so that people, espe- cially poor people, are attended to quickly and effectively in noncri- sis situations? The answers to these questions are obvious. If social systems are not arranged to ensure people's well-being in normal times, there is no good reason to expect them to be so inclined in disastrous times. Still, if we are ever going to be reasonably well prepared to avoid or respond to the next Katrina-like event, we need to identify the barriers to effective thinking about, and effective response to, disas- ters. One of those barriers is that we do not have a set of concepts that would help us think rigorously about out-sized events. The chief toolkit of concepts that we have for thinking about important social events comes from probability theory. There are good reasons for this, as probability theory has obviously served social research well. Still, the toolkit is incomplete when it comes to extreme events, especially when it is used as a base whence to make normative judgments about what people, organizations, and governments should and should not do. As a complement to probabilistic thinking I propose that we need possibilistic thinking. In this paper I explicate the notion of possibilistic thinking. I first discuss the equation of probabilism with rationality in scholarly thought, followed by a section that shows the ubiquity of possibilis- tic thinking in everyday life. Demonstrating the latter will provide an opportunity to explore the limits of the probabilistic approach: that possibilistic thinking is widespread suggests it could be used more rigorously in social research. I will then address the most vexing prob- lem with advancing and employing possibilistic thinking: the prob- lem of infinite imagination. I argue that possibilism can be used with discipline, and that we can be smarter about responding to disasters by doing so.

#### Extinction first---ethical obligation to future generations and forecloses massive potential value.

GPP 17 – [(Global Priorities Project, Future of Humanity Institute at the University of Oxford, Ministry for Foreign Affairs of Finland) "Existential Risk: Diplomacy and Governance," 2017, Global Priorities Project, <https://www.fhi.ox.ac.uk/wp-content/uploads/Existential-Risks-2017-01-23.pdf>] TDI

In his book Reasons and Persons, Oxford philosopher Derek Parfit advanced an influential argument about the importance of avoiding extinction:

I believe that if we destroy mankind, as we now can, this outcome will be much worse than most people think. Compare three outcomes:

(1) Peace.

(2) A nuclear war that kills 99% of the world’s existing population.

(3) A nuclear war that kills 100%.

(2) would be worse than (1), and (3) would be worse than (2). Which is the greater of these two differences? Most people believe that the greater difference is between (1) and (2). I believe that the difference between (2) and (3) is very much greater. ... The Earth will remain habitable for at least another billion years. Civilization began only a few thousand years ago. If we do not destroy mankind, these few thousand years may be only a tiny fraction of the whole of civilized human history. The difference between (2) and (3) may thus be the difference between this tiny fraction and all of the rest of this history. If we compare this possible history to a day, what has occurred so far is only a fraction of a second.65

In this argument, it seems that Parfit is assuming that the survivors of a nuclear war that kills 99% of the population would eventually be able to recover civilisation without long-term effect. As we have seen, this may not be a safe assumption – but for the purposes of this thought experiment, the point stands. What makes existential catastrophes especially bad is that they would “destroy the future,” as another Oxford philosopher, Nick Bostrom, puts it.66 This future could potentially be extremely long and full of flourishing, and would therefore have extremely large value. In standard risk analysis, when working out how to respond to risk, we work out the expected value of risk reduction, by weighing the probability that an action will prevent an adverse event against the severity of the event. Because the value of preventing existential catastrophe is so vast, even a tiny probability of prevention has huge expected value.67

Of course, there is persisting reasonable disagreement about ethics and there are a number of ways one might resist this conclusion.68 Therefore, it would be unjustified to be overconfident in Parfit and Bostrom’s argument.

In some areas, government policy does give significant weight to future generations. For example, in assessing the risks of nuclear waste storage, governments have considered timeframes of thousands, hundreds of thousands, and even a million years.69 Justifications for this policy usually appeal to principles of intergenerational equity according to which future generations ought to get as much protection as current generations.70 Similarly, widely accepted norms of sustainable development require development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs.71

However, when it comes to existential risk, it would seem that we fail to live up to principles of intergenerational equity. Existential catastrophe would not only give future generations less than the current generations; it would give them nothing. Indeed, reducing existential risk plausibly has a quite low cost for us in comparison with the huge expected value it has for future generations. In spite of this, relatively little is done to reduce existential risk. Unless we give up on norms of intergenerational equity, they give us a strong case for significantly increasing our efforts to reduce existential risks.

### NC – DA

#### Biotech R&D is set for high growth and investment now

NASDAQ 8/9 [NASDAQ is a stock market index that includes almost all stocks listed on the Nasdaq stock exchange. Along with the Dow Jones Industrial Average and S&P 500, it is one of the three most-followed stock market indices in the United States. This article was written by NASDAQ contributors and published on CNBC. The editorial staff of CNBC did not contribute to the creation of this study.) “Why the Nasdaq Biotechnology Index is poised for a run of sustainable growth” CNBC, NASDAQ, 8/9/2021, <https://www.cnbc.com/advertorial/2021/08/09/why-the-nasdaq-biotechnology-index-is-poised-for-a-run-of-sustainable-growth-.html>] RM

Between the recent bio innovation success stories in the battle against Covid-19 and the technology-driven advances ushering in new efficiencies for research and development (R&D), **the biotech industry has never been more relevant**.

As home to more than 265 companies, the pioneering Nasdaq Biotechnology Index (NBI) has long been committed to providing healthcare’s innovators with access to the capital they need to keep moving forward. Now, investors have access to the Index’s companies through a new ETF, the Invesco Nasdaq Biotechnology ETF (IBBQ).

Launched in 1993, in the wake of the original “biotech revolution” led by the discovery of recombinant DNA, NBI® remains the most representative index in the space. In fact, 98% of all U.S. listed biotech companies are listed on Nasdaq. When considering the massive growth taking place in the sector, it’s no surprise that NBI has outperformed both the S&P 500 (SPX) and Health Care Select Sector Index (IXVTR) in certain market environments.

According to Mark Marex, Index R&D Senior Specialist for Nasdaq who recently compiled an in-depth report on the NBI, global events and digital acceleration have contributed to the Index’s recent strong performance; and Nasdaq’s dedication to maintaining a true benchmark for technology-driven healthcare innovation has provided a framework for growth.

Building the ideal benchmark

Given the existence of pureplay biotech firms, hybrid biopharmaceutical companies, and less R&D-intensive pharmaceutical manufacturers, creating a single benchmark that truly captures the biotech sector and the symbiotic relationships among its players is no easy task.

One of the unique aspects of NBI, versus biotech-focused indexes created by other index providers, is its subsector classifications split between Biotechnology and Pharmaceuticals. As of June 30, 2021, ICB (FTSE Russell’s Industry Classification Benchmark) classified 222 NBI companies as Biotechnology and 47 as Pharmaceuticals. The resulting split by index weight is approximately 65% and 35%, respectively, which illustrates the major difference between the two groups: Pharmaceutical companies tend to be much larger than Biotechnology firms.

This split within a single index provides advantages for investors: While offering some exposure to more established pharmaceutical companies, it also includes R&D-heavy biotech firms that over time may transition into biotech-driven pharma companies. That’s exactly what happened this year when NBI’s largest company, Amgen (AMGN / $144Bn), was reclassified by ICB from Biotechnology to Pharmaceuticals. By retaining firms as they straddle the two classifications over the course of their lifecycle, NBI presents potential growth advantages when compared with index providers that focus rigidly on one classification versus the other.

Home to world-changing breakthroughs

Nasdaq’s vision for the Index has served it well, **both in terms of its longevity and its current role as a champion of the companies paving the way for a post-pandemic world through their technological advances and life-saving treatments**. The broad reach of NBI constituents across multiple fronts in the fight against Covid-19, for example — from diagnosis to vaccines and treatment —demonstrates the strength of its core approach.

NBI companies including Gilead and Regeneron made headlines for their successes during the pandemic with antiviral therapeutics and antibody-based therapeutics for high-risk patients. But it’s the stunning success of m-RNA vaccine technology from Moderna and BioNTech, two NBI companies, that most clearly showcase the home run potential among the biotech entrepreneurs in the space.

And while NBI is currently up 8.2% YTD on a price-return basis (as of June 30) **versus a broader market gain of 14.4% by SPX**, the S&P Biotechnology Select Industry Index (SPSIBI) is down 3.7%.

It’s worth noting that in 2020, NBI outperformed SPX with a price gain of 25.7% versus 16.3%, respectively. This shows the resilience of the NBI and the inherent strength of its current mix of companies.

The possibilities of accelerated R&D

As a whole, the life-changing work being done by NBI constituents requires enormous amounts of R&D. In 2020, R&D expenses for the entire group totaled $68.5Bn, nearly 31% of these companies’ revenue totals. Two-thirds of NBI’s firms reported R&D expenses that exceeded their revenues

For several NBI companies, however, these massive investments provided tangible benefits in the fight against Covid-19. Undoubtedly, years of back-end work and minimal profits ultimately helped deliver the very products that are now driving historic returns. Psychologically, their breakthroughs demonstrated the enormous potential of science and technology to serve humankind.

Looking ahead, **revolutions in Mapping and Engineering processes, boosted by rapid advancements in Machine Learning and Artificial Intelligence, are fostering a true fusion of Biology and Technology that could transform the traditionally costly and labor-intensive R&D function**. Some research estimates these advances could reduce the failure rate of drugs by up to 45% and shorten drug trials by up to 50%. The result could be even more breakthroughs, performed much more efficiently, greatly increasing the returns on biopharmaceutical R&D.

Even a conservative interpretation of the above numbers would significantly reduce R&D costs and boost the market capitalization of therapeutics companies from the current $2Tn up to $9Tn as soon as 2024, according to estimates from ARK Financial.

Meanwhile, increasingly cost-effective human genomics could revolutionize several other industries, from agriculture to biofuels.

By any measure, there is much to be excited about across the spectrum of biotech — especially coming out of a global pandemic. And while no person, nor index, can truly predict what the future holds, chances are strong that companies sitting within NBI will have a hand in leading the way.

“**For investors**, the Index already serves as a fascinating lens through which to view human society’s scientific and technological advancements,” says Mark Marex. “To me, it’s very exciting to ponder what the researchers, scientists, and business leaders in this space will accomplish next.”

#### IPR protections are key to sustain healthcare investments and manufacturing. Independently, it’s key to broader vaccine production.

Roberts 6/25/21 [James M. Roberts is a Research Fellow for Economic Freedom and Growth at the Heritage Foundation. Roberts' primary responsibility as one of The Heritage Foundation's lead experts in economic freedom and growth is to edit the Rule of Law and Monetary Freedom sections of [Index of Economic Freedom](https://www.heritage.org/index/). An influential annual analysis of the economic climate of countries throughout the world, the Index is co-published by Heritage and The Wall Street Journal.) “Biden’s OK of Global Theft of America’s Intellectual Property is Wrong, Dangerous.” 6/25/2021, The Heritage Foundation, Commentary—Public Health] RM

Last month, President Biden advocated removing international intellectual property rights (IPR) protections for American-made COVID-19 vaccines.

**Foreign companies may take the president’s policy as a green light to produce reverse-engineered, counterfeit substitutes**.

The best way to prevent and treat new diseases is to ensure that private American pharmaceutical companies continue their innovative research and vaccine production.

Three U.S. companies—Pfizer, Moderna, and Johnson & Johnson—created and manufactured the world’s most effective mRNA COVID vaccines in record time. An increasing majority of Americans have now been inoculated, but much of the developing world remains in desperate need of vaccines. Americans naturally want to help. The question is how.

Last month, President Biden advocated removing international intellectual property rights (IPR) protections for American-made COVID-19 vaccines. This, he said, would help make the vaccines more plentiful and available in needy countries. **It’s a short-sighted approach and doomed to fail.**

Mr. Biden wants to waive the World Trade Organization’s “Trade-Related Aspects of Intellectual Property Rights” (TRIPS) agreement for U.S. vaccines and let foreign countries issue “compulsory licenses“ allowing their domestic pharmaceutical companies to manufacture the medicines without adequately compensating the companies that invented them.

Practically speaking, countries such as India and South Africa are unlikely to manufacture the vaccines. They lack an advanced infrastructure for cold supply-chain distribution and many other crucial resources required by these products’ capital-intensive, state-of-the-art manufacturing process.

But the Biden policy is bad for many other reasons.

Developing breakthrough medications takes tremendous ingenuity and immense financial investments. **It’s an extraordinarily high-risk endeavor, and the prospect of making a profit is what convinces private companies to undertake those risks.**

Signaling that the United States will not fight to defend their intellectual property rights **actively undermines innovation and manufacturing** in American health care and medicines.

It also erodes patient protections by undermining quality control. Foreign companies may take the president’s policy as a green light to produce reverse-engineered, counterfeit substitutes. Already there are reports of ineffective and even dangerous counterfeit COVID-19 vaccines being sold around the world.

Those pushing to break U.S. pharmaceutical patents say they want to do so for altruistic reasons. Consequently, they also insist that the prices for the medications be set far below their actual value.

But history shows us that forcing private companies to provide vaccines at an “affordable price,” regardless of the cost to the companies, actually impedes the manufacture of high-quality vaccines. Moreover, it inhibits the **future development of vaccines** needed to meet as-yet-unknown diseases.

Washington first imposed vaccine price controls as part of Hillary Clinton’s 1993 healthcare-for-all crusade. As the Wall Street Journal later noted, it was a body blow to the U.S. vaccine industry. Ironically, government-decreed prices left the companies unable to produce enough vaccines to meet Mrs. Clinton’s admittedly admirable goal of universal immunization of children. Since then, U.S. firms have largely eschewed the vaccine market because they could not recoup their R&D and manufacturing costs and earn enough profit to fund future innovation.

Ultimately, **compulsory licensing legalizes the theft of intellectual property**. Recognizing this, senators from both sides of the aisle have joined with other government officials and industry leaders to call on the administration to reverse this bad decision.

The U.S. patent protection system has served the nation well since its founding.  **It is and has been a bulwark of American prosperity**, but the strength of that protection has been weakening in the past few decades. **Compulsory licensing contributes to the erosion** of that protection.

As the U.S. and the rest of the world emerge from the pandemic, it is clear that more innovative medicines and vaccines will be needed for future protection from viruses and other emerging biological threats.

**The best way to prevent and treat those new diseases is to ensure that private American pharmaceutical companies continue their innovative research and vaccine production**.

That way, U.S.-manufactured vaccines can be made available to all Americans quickly. And governments can subsidize their export and sale to other countries far more effectively and less expensively than through compulsory licensing schemes.

Meanwhile, let’s hope Mr. Biden listens to the more reasonable and less-agenda driven voices in this debate and reverses course on the TRIPS waiver.

#### COVID was a precursor to deadlier pandemics—vaccine production will determine everything.

Lander 8/4/21 [Eric Lander, President Biden’s Science Advisory and Director of the White House Office of Science and Technology Policy) “Opinion: As bad as Covid-19 has been, a future pandemic could be even worse—unless we act now” 8/4/21, The Washington Post] RM

[Coronavirus](https://www.washingtonpost.com/coronavirus/?itid=lk_inline_manual_3) vaccines can end the current pandemic if enough people choose to protect themselves and their loved ones by getting vaccinated. But in the years to come, we will still need to defend against a pandemic side effect: collective amnesia.

As public health emergencies recede, societies often quickly forget their experiences — and **fail to prepare for future challenges**. For pandemics, such a course would be disastrous.

**New infectious diseases have been emerging at an accelerating pace,** and they are spreading faster.

Our federal government is responsible for defending the United States against future threats. That’s why President Biden has asked Congress to fund his plan to build on current scientific progress to keep new infectious-disease threats from turning into pandemics like covid-19.

As the president’s science adviser, I know what’s becoming possible. For the first time in our history, we have an opportunity not just to refill our stockpiles but also to transform our capabilities. However, **if we don’t start preparing now for future pandemics, the window for action will close.**

Covid-19 has been a catastrophe: The toll in the United States alone is [more than 614,000 lives](https://www.washingtonpost.com/graphics/2020/national/coronavirus-us-cases-deaths/?itid=lk_inline_manual_11) and has been estimated to exceed [$16 trillion](https://jamanetwork.com/journals/jama/fullarticle/2771764), with disproportionate impact on vulnerable and marginalized communities.

But a future pandemic could be even worse — unless we take steps now.

It’s important to remember that the virus behind covid-19 is far less deadly than the 1918 influenza. The virus also belongs to a well-understood family, coronaviruses. It was possible to design vaccines within days of knowing the virus’s genetic code because 20 years of [basic scientific research](https://science.sciencemag.org/content/372/6538/109.full) had revealed which protein to target and how to stabilize it. And while the current virus spins off variants, its mutation rate is slower than that of most viruses.

**Unfortunately, most of the 26 families of viruses that infect humans are less well understood or harder to control**. We have a great deal of work still ahead.

The development of [mRNA vaccine technology](https://www.washingtonpost.com/health/2020/12/06/covid-vaccine-messenger-rna/?itid=lk_inline_manual_17) — thanks to more than a decade of foresighted basic research — was a game-changer. It shortened the time needed to design and test vaccines to less than a year — far faster than for any previous vaccine. And it’s been surprisingly effective against covid-19.

Still, there’s much more to do. We don’t yet know how mRNA vaccines will perform against other viruses down the road. And **when the next pandemic breaks out, we’ll want to be able to respond even faster.**

Fortunately, the scientific community has been developing a bold plan to keep future viruses from becoming pandemics.

Here are a few of the goals we should shoot for:

The capability to design, test and approve safe and effective vaccines within 100 days of detecting a pandemic threat (for covid-19, that would have meant May 2020); manufacture enough doses to supply the world within 200 days; and speed vaccination campaigns by replacing sterile injections with skin patches.

Diagnostics simple and cheap enough for daily home testing to limit spread and target medical care.

Early-warning systems to spot new biological threats anywhere in the world soon after they emerge and monitor them thereafter.

We desperately need to strengthen our public health system — from expanding the workforce to modernizing labs and data systems — including to ensure that vulnerable populations are protected.

And we need to coordinate actions with our international partners, because pandemics know no borders.

These goals are ambitious, but they’re feasible — provided the work is managed with the seriousness, focus and accountability of NASA’s Apollo Program, which sent humans to the moon.

Importantly, these capabilities won’t just prepare us for future pandemics; they’ll also improve public health and medical care for infectious diseases today.

Preparing for threats is a core national responsibility. That’s why our government invests heavily in missile defense and counterterrorism. We need to similarly protect the nation against biological threats, which range from the ongoing risk of pandemics to the possibility of deliberate use of bioweapons.

Pandemics cause massive death and disruption. From a financial standpoint, they’re also astronomically expensive. If, as might be expected from [history](https://www.cfr.org/timeline/major-epidemics-modern-era) and current trends, we suffered a pandemic of the current scale every two decades, the annualized cost would exceed $500 billion per year. Investing a much smaller amount to avert this toll is an economic and moral imperative.

The White House will put forward a detailed plan this month to ensure that the United States can fully prepare before the next outbreak. It’s hard to imagine a higher economic or human return on national investment.

#### Ecosystem sensitivity from climate change means future pandemics will cause extinction—assumes COVID

Supriya 4/19 [Lakshmi Supriya got her BSc in Industrial Chemistry from IIT Kharagpur (India) and a Ph.D. in Polymer Science and Engineering from Virginia Tech (USA). She has more than a decade of global industry experience working in the USA, Europe, and India. After her Ph.D., she worked as part of the R&D group in diverse industries starting with semiconductor packaging at Intel, Arizona, where she developed a new elastomeric thermal solution, which has now been commercialized and is used in the core i3 and i5 processors. From there she went on to work at two startups, one managing the microfluidics chip manufacturing lab at a biotechnology company and the other developing polymer formulations for oil extraction from oil sands. She also worked at Saint Gobain North America, developing various material solutions for photovoltaics and processing techniques and new applications for fluoropolymers. Most recently, she managed the Indian R&D team of Enthone (now part of MacDermid) developing electroplating technologies for precious metals.) “Humans versus viruses - Can we avoid extinction in near future?” News Medical Life Sciences, 4/19/21, https://www.news-medical.net/news/20210419/Humans-versus-viruses-Can-we-avoid-extinction-in-near-future.aspx] RM

Expert argues that human-caused changes to the environment can lead to the emergence of pathogens, not only from outside but also from our own microbiome, which can pave the way for large-scale destruction of humans and **even our extinction**.

Whenever there is a change in any system, it will cause other changes to reach a balance or equilibrium, generally at a point different from the original balance. Although this principle was originally posited by the French chemist Henry Le Chatelier for chemical reactions, this theory can be applied to almost anything else.

In an essay published on the online server Preprints\*, Eleftherios P. Diamandis of the University of Toronto and the Mount Sinai Hospital, Toronto, argues that changes caused by humans, to the climate, and everything around us will lead to changes that may have a dramatic impact on human life. Because our ecosystems are so complex, we don’t know how our actions will affect us in the long run, so humans generally disregard them.

Changing our environment

Everything around us is changing, from living organisms to the climate, water, and soil. Some estimates say about half the organisms that existed 50 years ago have already become extinct, and about 80% of the species may become extinct in the future.

As the debate on global warming continues, according to data, the last six years have been the warmest on record. Global warming is melting ice, and sea levels have been increasing. The changing climate is causing more and more wildfires, which are leading to other related damage. At the same time, increased flooding is causing large-scale devastation.

One question that arises is how much environmental damage have humans already done? A recent study compared the natural biomass on Earth to the mass produced by humans and found humans produce a mass equal to their weight every week. This human-made mass is mainly for buildings, roads, and plastic products.

In the early 1900s, human-made mass was about 3% of the global biomass. Today both are about equal. Projections say by 2040, the human-made mass will be triple that of Earth’s biomass. But, slowing down human activity that causes such production may be difficult, given it is considered part of our growth as a civilization.

Emerging pathogens

Although we are made up of human cells, we have almost ten times that of bacteria just in our guts and more on our skin. These microbes not only affect locally but also affect the entire body. There is a balance between the good and bad bacteria, and any change in the environment may cause this balance to shift, especially on the skin, the consequences of which are unknown.

Although most bacteria on and inside of us are harmless, gut bacteria can also have viruses. If viruses don’t kill the bacteria immediately, they can incorporate into the bacterial genome and stay latent for a long time until reactivation by environmental factors, when they can become pathogenic. They can also escape from the gut and enter other organs or the bloodstream. Bacteria can then use these viruses to kill other bacteria or help them evolve to more virulent strains.

An example of the evolution of pathogens is the cause of the current pandemic, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Several mutations are now known that make the virus more infectious and resistant to immune responses, and strengthening its to enter cells via surface receptors.

The brain

There is evidence that the SARS-CoV-2 can also affect the brain. The virus may enter the brain via the olfactory tract or through the angiotensin-converting enzyme 2 (ACE2) pathway. Viruses can also affect our senses, such as a loss of smell and taste, and there could be other so far unkown neurological effects. The loss of smell seen in COVID-19 could be a new viral syndrome specific to this disease.

Many books and movies have described pandemics caused by pathogens that wipe out large populations and cause severe diseases. In the essay, the author provides a hypothetical scenario where a gut bacteria suddenly starts producing viral proteins. Some virions spread through the body and get transmitted through the human population. After a few months, the virus started causing blindness, and within a year, large populations lost their vision.

Pandemics can cause other diseases that can threaten humanity’s entire existence. **The COVID-19 pandemic brought this possibility to the forefront**. If we continue disturbing the equilibrium between us and the environment, we don’t know what the consequences may be and **the next pandemic could lead us to extinction.**

### NC – DA

#### Biotech is the new frontier; America is ahead but China is dangerously close

Gupta 6/11 [Gaurav Gupta, Biotech Investor, Founder of Ascendant BioCapital, a life science investment firm based in New York. Previously, Gaurav worked at OrbiMed Advisors, and served as a resident in neurological surgery at Columbia University Medical Center. He has co-authored over a dozen articles in peer-reviewed journals, filed a patent on a device for use in spine surgery, and edited a book on the technical and ethical implications of using tissue engineered products in the operating room. Dr. Gupta obtained his M.D. from the Stanford University School of Medicine, where he was a Paul and Daisy Soros Fellow, and B.S. and M.S.E. in biomedical engineering from Johns Hopkins University, where he was a Charles R. Westgate Scholar.) “As Washington Ties Pharma’s Hands, China Is Leaping Ahead” Barron’s Magazine: Commentary, China., 6/11/2021] RM

There should be no doubt that we are living at the dawn of a golden age of biomedical innovation. The American scientific engine that produced Covid-19 vaccines in record time was fueled by a convergence of advances in genomics, biomarkers, data science, and manufacturing years in the making. The first Food and Drug Administration approvals of a host of new product formats—oligonucleotide, bispecific, oncolytic virus, CAR-T, and lentivirus/AAV—all took place within the last decade. These represent an unprecedented expansion of the armamentarium that physicians have at their disposal to treat and cure disease. In the last few years, [47% of all new medicines](https://www.efpia.eu/media/554521/efpia_pharmafigures_2020_web.pdf) were invented by U.S. biopharma companies, with [homegrown startups](https://www.cbo.gov/publication/57126) driving the majority of innovation. The bulk of the remainder were developed by foreign companies specifically for the U.S. market.

An indirect benefit of these trends is that most novel therapeutics undergo clinical development and early commercial launch here in the U.S. The rest of the world understands that the American patient has earlier and broader access to groundbreaking therapies via these mechanisms. Indeed, the past decade is filled with examples of medical “firsts” for American patients: the first cure for Hepatitis C, the first gene therapy for blindness, the first immunotherapy for cancer. Future rewards will be greater still if we preserve our current system of incentivizing and protecting innovation.

The remarkable innovation capacity of our biopharmaceutical industry ought to be a source of national pride. Yet while “Made in America” is the global standard for medicines in development today, misguided policy risks ceding our scientific prowess to other countries in the future. This is particularly true in the case of China, where biotechnology has become a strategic pillar for the health of its people and economy.

From 2016 to 2020, the market capitalization of all Chinese biopharma companies increased exponentially from [$1 billion to over $200 billion](https://www.bloomberg.com/news/articles/2021-03-01/xi-mobilizes-china-for-tech-revolution-to-cut-dependence-on-west). China saw over [$28 billion](https://www.bioworld.com/articles/506978-china-sees-five-year-highs-in-life-sciences-investments-and-partnering) invested in its life sciences sector in 2020, double the previous year’s amount. Returns on China’s investment are already arriving. The FDA approved a drug developed in China for the first time ever in 2019. While China’s innovation capacity currently remains behind America’s, my experiences as a biopharma professional make it clear they are doing everything they can to catch up and catch up fast.

In fact, when I speak to Chinese biotechnology executives, they boast that they can run clinical trials faster than their U.S. counterparts. The danger of misguided policies that disincentivize pharmaceutical innovation in the U.S. is effectively driving that same innovation to China. If we close off the market in the U.S. at the same time that China is opening its market to innovative new products, then we will see companies choose to first launch impactful novel medicines in China, based on clinical trials conducted in China. Because the FDA rarely accepts data generated entirely outside the U.S., this relocation of research capacity will negatively affect Americans’ access to cutting-edge therapies.

The biotechnology field is advancing rapidly. Promising technologies such as targeted protein degradation and gene editing are perhaps not far from being developed into impactful medicines, and the U.S. risks these technologies being mastered by Chinese companies.

It is widely held that allowing China to gain an asymmetric edge in critical technologies such as AI or quantum computing could destabilize the geopolitical balance of power. The same is true of biotechnology. Chinese scientists were the first to edit the genomes of human embryos, in [contravention](https://www.sciencemag.org/news/2019/12/chinese-scientist-who-produced-genetically-altered-babies-sentenced-3-years-jail) of international standards, and the U.S. national security community believes China is [pushing ahead](https://www.nbcnews.com/politics/national-security/china-has-done-human-testing-create-biologically-enhanced-super-soldiers-n1249914) with experimental concepts for biological and cognitive enhancement of soldiers and civilians. American policy should be focused on protecting, rather than undermining, the global dominance of our biotechnology industry.

#### The plan recapitulates IP to China, destroying competitive advantages

WSJ 5/6 [Wall Street Journal Editorial Board, WSJ Opinion Philosophy: “We speak for free markets and free people, the principles, if you will, marked in the watershed year of 1776 by Thomas Jefferson's Declaration of Independence and Adam Smith's “Wealth of Nations.” So over the past century and into the next, the Journal stands for free trade and sound money; against confiscatory taxation and the ukases of kings and other collectivists; and for individual autonomy against dictators, bullies and even the tempers of momentary majorities.” Edited by Paul A. Gigot and Daniel Henninger, “Biden’s Vaccine IP Debacle: His patent heist is a blow to the Covid fight and U.S. biotech.” The WSJ Opinion: Review and Outlook, May 6, 2021] RM

We’ve already criticized President Biden’s bewildering decision Wednesday to endorse a patent waiver for Covid vaccines and therapies. But upon more reflection this may be the single worst presidential economic decision since Nixon’s wage-and-price controls.

In one fell swoop he has destroyed tens of billions of dollars in U.S. intellectual property, set a destructive precedent that will reduce pharmaceutical investment, and surrendered America’s advantage in biotech, a key growth industry of the future. Handed an American triumph of innovation and a great soft-power opportunity, Mr. Biden throws it all away.

\*\*\*

India and South Africa have been pushing to suspend patents at the World Trade Organization for months. They claim that waiving IP protections for Covid vaccines and therapies is necessary to expand global access, but their motivation is patently self-interested.

Both are large producers of generic drugs, though they have less expertise and capacity to make complex biologics like mRNA vaccines. They want to force Western pharmaceutical companies to hand over IP free of charge so they can produce and export vaccines and therapies for profit. Their strategy has been to shame Western leaders into surrendering with the help of Democrats in the U.S.

But suspending IP isn’t necessary to expand supply and will impede safe vaccine production. The global vaccine supply is already increasing rapidly thanks to licensing agreements the vaccine makers have made with manufacturers around the world.

Pfizer and BioNTech this week said they aimed to deliver three billion doses this year, up from last summer’s 1.2 billion estimate. Moderna increased its supply forecast for this year to between 800 million and a billion from 600 million. AstraZeneca says it has built a supply network with 25 manufacturing organizations in 15 countries to produce three billion doses this year.

AstraZeneca and Novavax have leaned heavily on manufacturers in India to produce billions of doses reserved for lower-income countries. But India has restricted vaccine exports to supply its own population. IP simply isn’t restraining vaccine production.

Busting patents also won’t speed up production, since it would take months for these countries to set up new facilities. Competition will increase for scarce ingredients, and less efficient manufacturers with little expertise would make it harder for licensed partners to produce vaccines.

There’s also the problem of safety. Johnson & Johnson has experienced quality problems at an Emergent plant making its vaccines, and that’s in Baltimore. Imagine the potential problems with unlicensed producers in, say, Malaysia or Brazil. If vaccines made there have complications, confidence in licensed vaccines could plummet too. And who would Pfizer and Moderna sue to get their reputations back?

The economic self-damage is also hard to fathom. The U.S. currently has a competitive advantage in biotech and biologics manufacturing, which could be a growing export industry. Waiving IP protections for Covid vaccines and medicines will give away America’s crown pharmaceutical jewels and make the U.S. and world more reliant on India and China for pharmaceuticals.

Moderna has been working on mRNA vaccines for a decade. Covid represents its first success. Ditto for Novavax, which has been at it for three decades. Small biotech companies in the U.S. have been studying how to create vaccines using nasal sprays, pills and patches.

Thanks to Mr. Biden, all this could become the property of foreign governments. Licensing agreements allow developers to share their IP while maintaining quality control. Breaking patents and forcing tech transfers will enable China and low-income countries to manufacture U.S. biotech products on their own.

China’s current crop of vaccines are far less effective than those in the West, but soon Beijing might be able to purvey Pfizer knock-offs. The U.S. has spent years deploring China’s theft of American IP, and now the Biden Administration may voluntarily let China could reap profits from decades of American innovation.

\*\*\*

Instead of handing over American IP to the world, Mr. Biden could negotiate bilateral vaccine agreements and export excess U.S. supply. If Mr. Biden wants to increase global supply safely, the U.S. could spend more to help the companies produce more for export. Then the jobs would go to Americans. We thought this was the point of the production deal Mr. Biden negotiated between J&J and Merck.

Alas, this President seems to be paying more attention these days to Elizabeth Warren, Bernie Sanders, Alexandria Ocasio-Cortez and Nancy Pelosi. They think vaccines and new drugs can be conjured by government as a public good with no incentive for risk-taking or profit. This really is destructive socialism.

Mr. Biden ought to listen to Angela Merkel. Pfizer’s partner BioNTech is a German firm, and the German Chancellor said Thursday that she opposes the WTO heist: “The protection of intellectual property is a source of innovation and it must remain so in the future.”

At least IP is safe in Germany. Mr. Biden has sent a signal around the world that nobody’s intellectual property is safe in America.

#### China uses biotech offensively—uncertainty means you should err negative

Kania and Vonrndick 19 [Elsa Kania is an Adjunct Senior Fellow with the Technology and National Security Program at the Center for a New American Security. She is also a Ph.D. candidate in Harvard University’s Department of Government. Her views are her own. Wilson VornDick consults on national security, emerging technologies, and China for Duco and Rane.) “Weaponizing Biotech: How China's Military Is Preparing for a 'New Domain of Warfare'” Defense One, Commentary, China, Biowarfare, 8/14/2019] RM

We may be on the verge of a brave new world indeed. Today’s advances in biotechnology and genetic engineering have exciting applications in medicine — yet also alarming implications, including for military affairs. China’s national strategy of military-civil fusion (军民融合) has highlighted biology as a priority, and the People’s Liberation Army could be at the forefront of expanding and exploiting this knowledge.

The PLA’s keen interest is reflected in strategic writings and research that argue that advances in biology are contributing to changing the form or character (形态) of conflict. For example:

In 2010’s War for Biological Dominance (制生权战争), Guo Jiwei (郭继卫), a professor with the Third Military Medical University, emphasizes the impact of biology on future warfare.

In 2015, then-president of the Academy of Military Medical Sciences He Fuchu (贺福初) argued that biotechnology will become the new “strategic commanding heights” of national defense, from biomaterials to "brain control" weapons. Maj. Gen. He has since become the vice president of the Academy of Military Sciences, which leads China’s military science enterprise.

Biology is among seven "new domains of warfare" discussed in a 2017 book by Zhang Shibo (张仕波), a retired general and former president of the National Defense University, who concludes: “Modern biotechnology development is gradually showing strong signs characteristic of an offensive capability,” including the possibility that “specific ethnic genetic attacks” (特定种族基因攻击) could be employed.

The 2017 edition of Science of Military Strategy (战略学), a textbook published by the PLA’s National Defense University that is considered to be relatively authoritative, debuted a section about biology as a domain of military struggle, similarly mentioning the potential for new kinds of biological warfare to include “specific ethnic genetic attacks.”

These are just a few examples of an extensive and evolving literature by Chinese military scholars and scientists who are exploring new directions in military innovation.

Following these lines of thinking, the PLA is pursuing military applications for biology and looking into promising intersections with other disciplines, including brain science, supercomputing, and artificial intelligence. Since 2016, the Central Military Commission has funded projects on military brain science, advanced biomimetic systems, biological and biomimetic materials, human performance enhancement, and “new concept” biotechnology.

Gene Editing

Meanwhile, China has been leading the world in the number of trials of the CRISPR gene-editing technology in humans. Over a dozen clinical trials are known to have been undertaken, and some of these activities have provoked global controversy. It’s not clear whether Chinese scientist He Jiankui, may have received approval or even funding from the government for editing embryos that became the world’s first genetically modified humans. The news provoked serious concerns and backlash around the world and in China, where new legislation has been introduced to increase oversight over such research. However, there are reasons to be skeptical that China will overcome its history and track record of activities that are at best ethically questionable, or at worst cruel and unusual, in healthcare and medical sciences.

But it is striking how many of China’s CRISPR trials are taking place at the PLA General Hospital, including to fight cancer. Indeed, the PLA’s medical institutions have emerged as major centers for research in gene editing and other new frontiers of military medicine and biotechnology. The PLA’s Academy of Military Medical Sciences, or AMMS, which China touts as its “cradle of training for military medical talent,” was recently placed directly under the purview of the Academy of Military Science, which itself has been transformed to concentrate on scientific and technological innovation. This change could indicate a closer integration of medical science with military research.

In 2016, an AMMS doctoral researcher published a dissertation, “Research on the Evaluation of Human Performance Enhancement Technology,” which characterized CRISPR-Cas as one of three primary technologies that might boost troops’ combat effectiveness. The supporting research looked at the effectiveness of the drug Modafinil, which has applications in cognitive enhancement; and at transcranial magnetic stimulation, a type of brain stimulation, while also contending that the “great potential” of CRISPR-Cas as a “military deterrence technology in which China should “grasp the initiative” in development.

AI + Biotech

The intersection of biotechnology and artificial intelligence promises unique synergies. The vastness of the human genome — among the biggest of big data — all but requires AI and machine learning to point the way for CRISPR-related advances in therapeutics or enhancement.

In 2016, the potential strategic value of genetic information led the Chinese government to launch the National Genebank (国家基因库), which intends to become the world’s largest repository of such data. It aims to “develop and utilize China’s valuable genetic resources, safeguard national security in bioinformatics (生物信息学), and enhance China’s capability to seize the strategic commanding heights” in the domain of biotechnology.

The effort is administered by BGI, formerly known as Beijing Genomics Inc., which is Beijing’s de facto national champion in the field. BGI has established an edge in cheap gene sequencing, concentrating on amassing massive amounts of data from a diverse array of sources. The company has a global presence, including laboratories in California and Australia.

U.S. policymakers have been concerned, if not troubled, by the company’s access to the genetic information of Americans. BGI has been pursuing a range of partnerships, including with the University of California and with the Children’s Hospital of Philadelphia on human genome sequencing. BGI’s research and partnerships in Xinjiang also raise questions about its linkage to human rights abuses, including the forced collection of genetic information from Uighurs in Xinjiang.

There also appear to be links between BGI’s research and military research activities, particularly with the PLA’s National University of Defense Technology. BGI’s bioinformatics research has used Tianhe supercomputers to process genetic information for biomedical applications, while BGI and NUDT researchers have collaborated on several publications, including the design of tools for the use of CRISPR.

Biotech’s Expansive Frontier

It will be increasingly important to keep tabs on the Chinese military’s interest in biology as an emerging domain of warfare, guided by strategists who talk about potential “genetic weapons” and the possibility of a “bloodless victory.” Although the use of CRISPR to edit genes remains novel and nascent, these tools and techniques are rapidly advancing, and what is within the realm of the possible for military applications may continue to shift as well. In the process, the lack of transparency and uncertainty of ethical considerations in China’s research initiatives raise the risks of technological surprise.

### NC – CP

#### The USFG should:

#### Supply multinational pharmaceutical corporations with generous financial inducements to build vaccine production capacity throughout the world

#### Create a network of producers to vaccinate individuals abroad

#### Pass legislation that limits shareholder suits

#### Strip existing patents from companies that do not comply with capacity-building strategies through tech transfer

Kay et. al. 5/13 [Tamara Kay is a sociologist studying trade, global health and globalization at the Keough School of Global Affairs, University of Notre Dame. Adnan Naseemullah is an international relations scholar at King's College London. Susan Ostermann is a political scientist at the Keough School of Global Affairs, Notre Dame and a former attorney at O'Melveny & Myers LLP, specializing in intellectual property law.) “Waiving patents isn't enough — we need technology transfer to defeat COVID” The Hil, Opinion Contributors: Healthcare, 5/13/21, 2:01 PM EDT, <https://thehill.com/opinion/healthcare/553368-waiving-patents-isnt-enough-we-need-technology-transfer-to-defeat-covid?rl=1>] RM

Fortunately, the U.S. government is well-placed to change the incentive structure of the global pharmaceutical industry. First, **it can supply multinationals with generous financial inducements to build capacity for vaccine production throughout the world, creating a network of producers that can vaccinate hundreds of millions, with positive spillover effects moving forward**. This is particularly compelling as it becomes increasingly likely that COVID-19 booster shots and even annual vaccines will be necessary. Such an effort would need to be paired with legislation that limits shareholder suits, because few corporate managers will want to be responsible for moves that, while clearly in the public interest, undermine shareholder value.

And, if necessary, the U.S. government can also use pressure. Companies that won't comply with capacity-building strategies through technology transfer can be stripped of existing patents for lucrative drugs. This is a move that international relations scholars call "issue-linkage." The state provides intellectual property protection as an incentive. It can be taken away in the same way that property owners refusing to pay taxes can lose their property.

Capacity-building for pharmaceutical production in the developing world is crucial given the pandemic and the need for global vaccination, now and in response to future threats. India's path to becoming a world-leading and cost-effective pharmaceutical manufacturer came initially from challenging the global intellectual property regime. In the 1970s, Indira Gandhi's populist government introduced a Patent Act which allowed companies to design alternative processes for popular products, spurring huge investments in production and innovation. Multinational pharma opposed this action, even though the same companies rely on the Indian pharmaceutical industry for production under license now. The reason why many medicines taken in the West are made by Indian firms is because of capacity-building. The fact that few countries have followed India as a global producer of pharmaceuticals is the result of politics just as much as economics — there is no reason why other countries cannot follow in India’s footsteps with the right support.

Reconceiving the structures of production through technology transfer will be difficult, both logistically and politically. But, resolving the COVID-19 crisis requires a much greater supply of vaccines and other medicines, and production in and for wealthy countries is not enough to manage COVID-19, nor is it morally justifiable. To democratize vaccine manufacturing and to ensure that progress made in the developed world is not undercut by new variants, we need to rethink how we might build capacity beyond the West. Why do we allow technology to remain as the exclusive domain of a handful of oligopolistic firms, despite public funding and windfall profits, when coronavirus is a global threat?

### NC – CP

#### CP: The member nations of the World Trade Organization ought to reduce intellectual property protections for all medicines except for medicines created by indigenous folks, for which all ownership ought to be transferred to the indigenous communities that originally developed the medicine.

Ngoc **Tang**, 3-24-**2020**, *Finance Major, CSULB 2021,* "The Importance of Native American Intellectual Property," California State University, Long Beach, <https://www.csulb.edu/college-of-business/legal-resource-center/article/the-importance-of-native-american-intellectual> //SR \*brackets in text\*

Native Americans are known for their distinctive cultures and special symbols. Protecting these cultures from being abused is difficult. In the article "Intellectual Property, Traditional Knowledge, and Traditional Cultural Expressions in Native American Tribal Codes,” author Dalindyebo Bafana Shabalala explains what is considered as Native American intellectual property and why it needs protection. According to Shabalala, Native American intellectual property includes traditional knowledge, traditional cultural expressions, and genetic resources (Shabalala par. 4). Traditional knowledge is skills, practices, and innovation concerning biodiversity, agriculture or health (par. 8). Various forms of art such as symbols, designs, painting, dance, music, literature, and performance are considered as cultural expressions (par. 10). Genetic resources include plants, seeds, and medicine formulas. There have been many cases where the Native American intellectual property has been used without first obtaining permission and authorization from the Native Americans. As mentioned in Shabalala’s article, Allergan, a pharmaceutical company, was using the Saint Regis Mohawk tribe’s formula to make their eye drop drug. However, that is not their original formula, so “on Friday, September 8, 2017, the pharmaceutical company” had to “[transfer] ownership of all federal U.S. patents for its Restasis drug to the Saint Regis Mohawk tribe; the tribe then licensed them back to the company” (par. 1). Another interesting case mentioned in the article is about the series Twilight ​​by author Stephanie Myers. The author of this book used the Quileute tribe’s origin story and incorporated it with the fictitious werewolf story without the permission of the tribe. Shabalala says that although the book or the movie “may have a valid copyright in the realm of federal property, the unauthorized use of the Quileute origin story may cause harm when outsiders begin viewing the unauthorized use of the cultural property as a true reflection of the source culture” (par. 11). These actions not only abuse the use of Native American intellectual property, but they also affect the images, the stories, and the cultures of the native people. With these cases of the property being misused, Shabalala raises a question of how the Native Americans protect their cultural properties and how the current federal law acts in protecting these properties. Each Native American tribe has its own laws and rules; these laws and rules are called tribal codes. In his study of a hundred tribal codes, Shabalala shows that there are only nine codes mentioned about intellectual property or something related to intellectual property. This study demonstrates that the native people are unaware in protecting their cultural property. The native people are unaware because they do not know or think that other people would use these properties for their own purposes. However, the current federal laws are not providing enough protection for Native American intellectual property. Shabalala mentions the Trademark Law Treaty Implementation Act (TLTIA) and the Indian Arts and Crafts Act (IACA). The purpose of the TLTIA is “to provide international uniformity of trademark registration’ (par. 77); however, “the Congressional Record regarding TLTIA is absent of any authority or mention of providing protection to Native American tribes” (par. 83). The purpose of the IACA is to prevent fraud in the Indian arts and crafts market. However, according to Shabalala’s research, “the IACA trademark system does not provide sufficiently, and arguably any, protection for Native American tribes' cultural property, nor was it ever intended to” (par. 46). Another act is the Native American Graves Protection and Repatriation Act (NAGPRA), an act with the purpose to provide “protection, return, and repatriation of Native American remains and artifacts found on federal or tribal lands” (par. 66). However, according to the article “An Analysis of the Lack of Protection for Intangible Tribal Cultural Property in the Digital Age,” author Chante Westmoreland states that the NAGPRA did “offer some protection for the tangible cultural property but omit protection for the sacred traditional knowledge the object conveys” (Westmoreland par. 10). There are many acts that try to provide protection concerning intellectual property, but they do not provide enough protection for the Native American intellectual property including traditional property, traditional cultural expressions, and genetic resources. According to the article called “Group Right to Cultural Survival: Intellectual Property Rights in Native American Cultural Symbols,” Terence Dougherty states that, “Intellectual property law in the context of cultural appropriation is particularly relevant to many Native Americans” (Dougherty par. 44). Dougherty also explains that with the significant misuse of the native symbols, cultural appropriation can greatly affect the cultural survival of the native people. Furthermore, in Westmoreland’s article, he states that “sacred traditional knowledge is not merely information, it is essential to the tribal way of life” (par. 9). This demonstrates that the intellectual property of the Native Americans is extremely important to them in their living and their culture. Therefore, to avoid the misuse that can cause a negative impact on the native people, anyone who wants to use the property must have authorization from the native people. Moreover, the federal government needs to provide a law that specifically protects Native American traditional knowledge, traditional cultural expressions, and genetic resources.

#### The CP gives indigenous nations resources for self sovereignty and centers discussions around native demands, which better allows for the accessibility of those medicines

Simon **Brascoupé and** Karin **Endemann**, Fall **1999**, INTELLECTUAL PROPERTY AND ABORIGINAL PEOPLE: A WORKING PAPER <https://www.wipo.int/export/sites/www/tk/en/databases/creative_heritage/docs/ip_aboriginal_people.pdf> //SR

Traditional Knowledge and Intellectual Property The Aboriginal legacy of traditional knowledge comes in two distinct forms. On one hand, an Aboriginal community is the custodian of a store of sacred knowledge, including ceremonies, symbols, and masks that is increasingly open to unauthorized commercial exploitation by individuals, companies or institutions. Some Aboriginal people contend it is not appropriate to use IP law to protect sacred traditional knowledge. On the other hand, many products and services associated with traditional lifestyles of Aboriginal people may have commercial value that could help to support the continuation of these lifestyles and the Aboriginal goal of self-sufficiency. The limited Aboriginal use of Canada’s current IP laws suggests that these laws may not be particularly well suited to protecting either of these forms of traditional knowledge. A distinction must be made between traditional knowledge held by an Aboriginal community and the innovations or new creations of an individual or an Aboriginal company. New products and works of art by Aboriginal inventors and artists qualify for protection under existing IP laws. Music, songs, dance, stories, designs and symbols are passed on in many Aboriginal communities from memory and by word of mouth. Each community is both a conveyer and a user of traditional knowledge. This knowledge is dynamic and evolves with the culture, so it is the product of a continuing creative process. Many Aboriginal artists and artisans create works inspired by the traditional knowledge of their community, and use copyright law extensively. Issues that are not addressed widely are: how Aboriginal people relate to their community in the context of the traditional and dynamic aspects of traditional knowledge; and how traditional knowledge itself can be effectively protected. Protecting Traditional Knowledge Within an Aboriginal Community Few legal mechanisms exist to help indigenous communities protect and preserve traditional knowledge. It is urgent that such mechanisms be developed, because of the increasing pace at which control of traditional knowledge is being lost due to misappropriation and pressures from the non-indigenous world. In the meantime, the use of existing legal tools can be part of a “web” of strategies to help Aboriginal communities better protect and control their traditional knowledge, and ensure benefits are shared in a way that meets community needs. These strategies could include: ! developing local mechanisms within communities to control and protect traditional knowledge; ! more effective use of contractual arrangements to recognize traditional customs and knowledge; ! developing guidelines to ensure that third parties secure proper and informed consent before an Aboriginal community shares traditional knowledge; and ! using existing IP laws. Many Aboriginal people have said that they need to consider how they share and protect traditional knowledge within their communities before deciding whether and how they will share this knowledge with others. Once a community identifies its traditional knowledge and adopts community-based measures governing the use of this knowledge, then the community will be more secure in its ownership and more effective in any negotiations to share its knowledge. It is important that Aboriginal communities develop a strategy to protect traditional knowledge. This will help them avoid losing control over this knowledge to third parties seeking academic advancement or commercial gain. Public disclosure of traditional knowledge has the potential to jeopardize an Aboriginal community’s ability to obtain protection under Canada’s IP laws. This is because knowledge that is disclosed may no longer qualify for IP protection because it is in the public domain. Aboriginal communities considering these issues should identify the scope and nature of traditional knowledge in their community. Part of this process is to identify what knowledge is most important to the community, and how the preservation of traditional knowledge and practices is at risk. Is traditional knowledge being lost because elders have been unable to pass their wisdom to the next generation? Is knowledge being lost because Aboriginal people are being displaced from their traditional environment or because they are influenced by outside media and culture? Has traditional knowledge been allowed into the public domain or been misappropriated by commercial or scientific interests from outside the Aboriginal community? Some Aboriginal people have identified a need for dialogue about traditional ways of sharing and preserving traditional knowledge. What are the obligations of individuals to their community when they use or share traditional knowledge? These issues are just beginning to be discussed within Aboriginal communities and First Nations, at the federal level in Canada, and internationally among indigenous peoples and within international organizations. It is also important for Aboriginal communities to consider what traditional knowledge is sacred and what knowledge may be shared with others or used commercially. Only after a full dialogue will these communities be in a position to determine the best mechanisms to control access to their traditional knowledge, and what knowledge they want to share with others. A number of approaches will be needed to reflect the varied nature and use of the community’s traditional knowledge. One option may be for Aboriginal communities to develop guidelines to prevent unwanted disclosure, and to ensure that traditional knowledge remains within the community. The process of developing guidelines will help ensure that the entire community is consulted in decisions concerning the protection of traditional knowledge and control over its commercialization. These guidelines would need to be enforced by the community, since an Aboriginal community may not have any recourse to the courts if one of its members violates the guidelines. Community guidelines might include policies on the publication of traditional knowledge, its use by others or the use of the community’s symbols. Aboriginal communities may also want to ensure that sharing traditional knowledge within the community continues, and is not restricted more than it was traditionally.

## Case

### Framing

#### We never say infinite future value – the sun exploding means eventually the impact would round out to 0; we just say there’s large value up until that point

#### Most existential risks disproportionately effect brown and black communities such as warming hurting people near the global equator and coastal areas, pandemics, effecting underdeveloped nations, and nuclear war which hits urban and clustered populations the most.

### Advantage

#### Vaccine buyouts suck – instead of distributing them, countries continue to hoard

Vanni 21 – Dr. Amaka Vanni is Lecturer in Law at the University of Leeds. ("On Intellectual Property Rights, Access to Medicines and Vaccine Imperialism," 3-23-2021, <https://twailr.com/on-intellectual-property-rights-access-to-medicines-and-vaccine-imperialism/>) julian

While the response to COVID-19 has shown what can be accomplished when the world works together, it has also underscored three interrelated points. First, the neoliberal framework – including the critical role intellectual property (IP) law plays in constituting this form of civilisation – is an unsuitable model for delivering the goods needed to respond to global health emergencies. The current economic/market system does not allow for equitable responses to infectious diseases, particularly access to sufficient medical and health resources. This inequity was obvious in the early days of the pandemic when test kits, PPEs, and ventilation machines were being distributed on the basis of who could pay the most rather than who needed them the most. Second, the beggar-thy-neighbor response currently adopted by developed countries hurts everyone because failing to stop the spread of the virus globally allows more mutations, which makes existing vaccines less effective. As COVID-19 has shown, no one is safe until everyone is safe. Yet, despite this warning, the hoarding of vaccines by developed countries continues unabated and speaks to the wider racist capitalist system we live in. If anything, this crude accumulation of vaccines reinforces North-South economic and political dominance and marks, as Onur Ince observes, the conceptual locus of political violence operative in the global genealogy of capitalism.

Third, while COVID-19 may endanger us all, it is far more costly to some than others. Numerous reports have shown how black and brown people are most impacted by the pandemic. In the United States, for example, indigenous Americans have the highest COVID-19 mortality rates nationwide while African American communities have COVID-19 mortality that is 2.3 times higher than the rate for Asians and Latinxs, and 2.6 times higher than the rate for Whites. Similar data is also emerging in the UK where people from black and minority ethnic groups are at greater risk of dying from coronavirus. This means those groups suffer higher loss of life compared to other racial groups due to inequities in healthcare access as well as higher rate of pre-existing conditions. In other parts of the world, the most vulnerable and the economically marginalized such as those working in the informal sector and living in shanty towns are feeling the effects of the pandemic the most. In Latin America and the Caribbean, 70 per cent of domestic workers have been affected by the pandemic where most have stopped receiving income. In Ghana, residents of slums at Old Fadama – a suburb in Accra – were made homeless when the government demolished their homes. The ensuing homelessness means there is little to no space of observing social distancing rules, access to running water and access to other resources to practice basic hygiene. Meanwhile in India, the pandemic has unsurprisingly hit the country along caste lines where the Dalits are most impacted because many are poor and have limited access to healthcare.

As Kimberlé Williams Crenshaw reminds us, the high number of minority deaths is not new. Rather, this crisis simply amplified racism and other forms of structural inequality as a pre-existing condition – an intersectional issue – where those disproportionately hurt are those who are already structurally marginalized. Thus, while recognising a broken global IP regime that triggered the scramble for vaccines, the racialized impact of the pandemic cannot be ignored, and it points to the entangled roots of race and capitalism.

The rest of this analysis takes a close look at some of the legal, political and economic forces that have animated IP rights and access to COVID-19 vaccine. It will focus on how the entanglement of corporate capture of global IP regime, state complicity and vaccine imperialism have come together to shape public health responses to the pandemic. It underscores how the law, in this case international IP law, consistently shelters capital and operates as an expression to further corporate pharmaceutical interests. If there is a lesson to be gleaned from this pandemic, it is that intellectual property is not failing us but is functioning the way it is set up to do. As the history of IP globalization has shown, the World Trade Organization’s (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) is a transplant of the Euro-American model of property, driven by multinational corporations who used their respective national governments to underwrite and export their domestic IP claims. Therefore, it is unsurprising that this international legal regime employed to advance the interests of particular classes, nations and regions at the expense of others continues to reproduce extreme inequality with human costs.

#### Expertise, processes, bio samples, cell lines, distribution, and cost are all alt causes to TRIPs – only IPR can reliably scale high quality low cost medicine

Shultz and Stevens 1/14 Mark Schultz is the Goodyear Endowed Chair in Intellectual Property Law at the University of Akron School of Law, United States. Philip Stevens is Executive Director of Geneva Network., Geneva Network, "Why intellectual property rights matter for COVID-19 - Geneva Network - Intellectual Property Rights and Covid-19", January 14th, 2021, https://geneva-network.com/research/why-intellectual-property-rights-matter-for-covid-19/ - BD

The real challenges

IP has underpinned the research and development that has led to the arrival of several game-changing vaccines. But the challenge does not end there. Perhaps the biggest hurdle is manufacturing billions of doses or new antibody treatments while maintaining the highest quality standards.

There’s more to it than starting a global manufacturing free for all by overriding or ignoring patents. A spokesperson for Regeneron, a manufacturer of a novel COVID-19 antibody treatment explained to The Lancet: “Manufacturing antibody medicines is incredibly complex and transferring the technology takes many months, as well as significant resources and skill. Unfortunately, it is not as simple as putting a recipe on the internet and committing to not sue other companies during the pandemic”.

John-Arne Røttingen, chair of the WHO COVID-19 Solidarity trial, explains that technology transfer will be crucial to scaling up production, but voluntary mechanisms are better: “If you want to establish a biological production line, you need a lot of additional information, expertise, processes, and biological samples, cell lines, or bacteria” to be able to document to regulatory agencies that you have an identical product, he explains.

“Manufacturing antibody medicines is incredibly complex and transferring the technology takes many months. Unfortunately, it is not as simple as putting a recipe on the internet”

The TRIPS waiver, he says, is the “wrong approach” because COVID-19 therapeutics and vaccines are complex biological products in which the main barriers are production facilities, infrastructure, and know-how. “IP is the least of the barriers”, he says.

Then there is the problem of distributing the vaccines to billions of people in every country. Even with plentiful supplies, a range of issues need to be considered such as regulatory bottlenecks; supply chain, transport and storage; maintenance of the cold chain; adequately trained staff; data tracking; and vaccine hesitancy amongst the population.

The costs of the vaccine itself is only a small component of the total cost of delivering doses to millions of people. The UK, for example, has spent around £2.9bn on procuring vaccines, far less than the official estimate of £8.8bn to be spent on distributing and delivering them. Comparable costs will exist for all other countries, even if they are subsidised by Overseas Development Assistance. Even then, the combined costs of vaccination are dwarved by the other economic costs of the pandemic.

IP is part of the solution

Far from being a problem, IP has repeatedly proven itself to be part of the solution in fighting disease. It allows innovators to manage production scale-up by selecting and licensing technology to partners who have the skills and capacity to reliably manufacture large quantities of high-quality products, which they distribute at scale in low and middle-income countries. It would make no sense for IP owners to use it to withhold access, when they can profit from supplying all demand. IP licensing is the way this is done.

This is the model unfolding for COVID-19, with new manufacturing licensing deals such as those between AstraZeneca and the Serum Institute in India (1bn doses), China’s BioKangtai (200m doses), Brazil’s FioCruz, Russia’s R-Pharm and South Korea’s SK Bioscience. Collectively, such deals will see the manufacture of 2 billion doses by the end of 2021. The Serum Institute has also entered into manufacturing licenses with a number of developers of yet to be approved COVID-19 vaccines, as have several other Indian vaccine manufacturers. Many of these doses will be procured on a non-profit basis by new collective procurement bodies such as COVAX, for distribution to low and middle-income countries.

IP is important because it allows the innovator to control which partners manufacture the product, ensuring the quality of supplies, while maximising low-cost access for low and middle-income countries. It also allows the innovator to preserve its ability to recoup costs from richer markets, meaning the preservation of incentives for future R&D investment.

Voluntary licensing has worked well in the past, particularly for low and middle-income countries. A recent academic analysis of hepatitis C voluntary licenses published by The Lancet Global Health concluded that they have increased access to medicines at a considerably faster pace than alternative access models, by avoiding the need for lengthy patent disputes and bringing to bear inter-company competition and economies of scale.

But again, these licenses model were criticised by public health NGOs and other stakeholders, who called for the confiscation of IP rights via compulsory licensing. Time has shown such calls to be mistaken.

Conclusion

As of January 2021, there are three vaccines approved by stringent regulatory authorities with several more likely to follow in the coming months. Prices of COVID-19 vaccines vary between more expensive but complex to manufacture, and cheaper ones based on existing technologies. Companies are offering their vaccines at cost, with pooled procurement mechanisms such as COVAX ready to leverage their enormous purchasing power to drive economies of scale and bring prices down further for developing countries, many of which will have the cost of vaccination subsidised by Overseas Development Assistance.

Meanwhile, the existence of multiple vaccines means there is no COVID-19 vaccine “monopoly”, and minimal risk of premium pricing. In fact, there is a competitive marketplace in which manufacturers are incentivised to refine and improve their vaccines – vital given the new strains of the virus which constantly emerge.

Providing COVID-19 vaccines rapidly at scale is a pressing challenge for all countries but there is no evidence that overriding intellectual property rights will achieve more than the licensing agreements currently being forged between innovators and reputable vaccine manufacturers in countries like India and Brazil.

Manufacturing of COVID-19 vaccines is continuing at speed, and mechanisms are gearing up to ensure a rapid global role out. Forceable tech transfer and other forms of IP abrogation such as those proposed by India and South Africa at the WTO TRIPS Council would throw manufacturing supply chain planning, financing and distribution systems into chaos for little upside.

Instead of sowing division and creating major distractions at venues such as the WTO, opponents of IP should stop the rhetoric. The IP system has put us in a position to end the pandemic. We should allow it to continue doing its job.

#### Vaccine IP is insufficient for imitation; originators will challenge with intense litigation, and nations don’t have necessary ingredients and materials. Independently, the plan will cause companies to disengage from global efforts.

Silverman 3/15 [Rachel Silverman is a policy fellow at the Center for Global Development where she leads policy-oriented research on global health financing and incentive structures. Silverman’s current research focuses on the practical application of results-based financing; global health transitions; efficient global health procurement; innovation models for global health; priority-setting for UHC; alignment and impact in international funding for family planning; and strategies to strengthen evidence and accountability. BA with distinction in international relations and economics from Stanford University.) “Waiving vaccine patents won’t help inoculate poorer nations” Washington Post, PostEverything Perspective, <https://www.washingtonpost.com/outlook/2021/03/15/vaccine-coronavirus-patents-waive-global-equity/>] RM

According to some activists, the solution to this inequity is relatively simple: By suspending protections on covid-19 vaccine patents, the international community “could help break Big Pharma monopolies and increase supplies so there are enough doses for everyone, everywhere,” [claims](https://peoplesvaccine.org/take-action/)the People’s Vaccine Alliance. Indeed, 58 low- and middle-income countries have mobilized in support of a proposed World Trade Organization [waiver](https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/IP/C/W669.pdf&Open=True) that would temporarily exempt [coronavirus](https://www.washingtonpost.com/coronavirus/?itid=lk_inline_manual_4)-related intellectual property from normal international rules and protections. And while the effort to waive IP protections has been a global health hot topic for months, it gained a high-profile endorsement in the United States recently from Sen. Bernie Sanders (I-Vt.). In a March 10 video statement, Sanders [called upon President Biden](https://twitter.com/GlobalJusticeUK/status/1369734275818549252?s=20) to support the IP suspension while slamming “huge, multibillion-dollar pharmaceutical companies [that] continue to prioritize profits by protecting their monopolies.”

The logic of the argument seems clear and intuitive — at first. Without patents, which serve narrow commercial interests, companies all over the world could freely produce the vaccine. Sure, Big Pharma would lose money — but this is a pandemic, and human life comes before private profit, especially when vaccines receive substantial public financing to support research and development. As with HIV drugs in years past, widespread generic production would dramatically increase supply and drive down prices to levels affordable even in the developing world.

Reality is more complicated, however. Because of the technical complexity of manufacturing coronavirus vaccines, waiving intellectual-property rights, by itself, would have little effect**.** **It could even backfire, with companies using the move as an excuse to disengage from global access efforts**. **There are more effective ways to entice — and to pressure — companies to license and share their intellectual property and the associated know-how, without broadly nullifying patents.**

The Moderna vaccine illustrates the limits of freeing up intellectual property. Moderna [announced in October](https://investors.modernatx.com/news-releases/news-release-details/statement-moderna-intellectual-property-matters-during-covid-19) that it would not enforce IP rights on its coronavirus vaccine — and yet it has taken no steps to share information about the vaccine’s design or manufacture, citing commercial interests in the underlying technology. Five months later, production of the Moderna vaccine remains entirely under the company’s direct control within its owned and contracted facilities. Notably, Moderna is also the only manufacturer of a U.S.- or British-approved vaccine [not yet participating in Covax](https://www.washingtonpost.com/world/coronavirus-vaccine-access-poor-countries-moderna/2021/02/12/0586e532-6712-11eb-bf81-c618c88ed605_story.html?itid=lk_inline_manual_9), a global-aid-funded effort (including a [pledged $4 billion from the United States](https://www.npr.org/2021/02/18/969145224/biden-to-announce-4-billion-for-global-covid-19-vaccine-effort)) to purchase vaccines for use in low- and middle-income countries.

It is true, however, that activist pressure — including threats to infringe upon IP rights — can encourage originators to enter into voluntary licensing arrangements. So the global movement to liberate the vaccine patents may be useful, even if some advocates make exaggerated claims about the effects of waivers on their own.

One reason patent waivers are unlikely to help much in this case is that vaccines are harder to make than ordinary drugs. Because most drugs are simple chemical compounds, and because the composition of the compounds is easily analyzable, competent chemists can usually reverse-engineer a production process with relative ease. When a drug patent expires, therefore — or is waived — generic companies can readily enter the market and produce competitive products, [lowering prices dramatically](https://www.fda.gov/about-fda/center-drug-evaluation-and-research-cder/generic-competition-and-drug-prices).

Vaccines, in contrast, are complex biological products. Observing their contents is insufficient to allow for imitation. **Instead, to produce the vaccine, manufacturers need access to the developer’s “soft” IP — the proprietary recipe, cell lines, manufacturing processes and so forth**. While some of this information is confidentially submitted to regulators and might theoretically be released in an extraordinary situation (though not without legal challenge), manufacturers are at an enormous disadvantage without the originator’s cooperation to help them set up their process and kick-start production. Even with the nonconsensual release of the soft IP held by the regulator, the process of trial and error would cause long delays in a best-case scenario. Most likely, the effort would end in expensive failure. Manufacturers also need certain raw ingredients and other materials, like glass vials and filtration equipment; overwhelming demand, paired with disruptive export restrictions, has constricted the global availability of some of these items.

#### Underinvestment and regulation drive vaccine inefficiency---licenses are already available

Tabarrok 5/6/21 [Alex Tabarrok is Bartley J. Madden Chair in Economics at the Mercatus Center and a professor of economics at George Mason University. Along with Tyler Cowen, he is the co-author of the popular economics blog Marginal Revolution and co-founder of Marginal Revolution University. He is the author of numerous academic papers in the fields of law and economics, criminology, regulatory policy, voting theory and other areas in political economy. He is co-author with Tyler of Modern Principles of Economics, a widely used introductory textbook. He gave a TED talk in 2009. His articles have appeared in the New York Times, the Washington Post, the Wall Street Journal, and many other publications.) “Patents are not the problem!” Marginal Revolution University, 5/6/21, Current Affairs, Economics, Law, Medicine, <https://marginalrevolution.com/marginalrevolution/2021/05/ip-is-not-the-constraint.html>] RM

For the last year and a half I have been shouting from the rooftops, “invest in capacity, build more factories, shore up the supply lines, spend billions to save trillions.” Fortunately, some boffins in the Biden administration have found a better way, “the US supports the waiver of IP protections on COVID-19 vaccines to help end the pandemic.”

Waive IP protections. So simple. Why didn’t I think of that???

**Patents are not the problem**. All of the vaccine manufacturers are trying to increase supply as quickly as possible. Billions of doses are being produced–more than ever before in the history of the world. Licenses are widely available. **AstraZeneca have licensed their vaccine for production with manufactures around the world, including in India, Brazil, Mexico, Argentina, China and South Africa**. J&J’s vaccine has been licensed for production by multiple firms in the United States as well as with firms in Spain, South Africa and France. Sputnik has been licensed for production by firms in India, China, South Korea, Brazil and pending EMA approval with firms in Germany and France. Sinopharm has been licensed in the UAE, Egypt and Bangladesh. Novavax has licensed its vaccine for production in South Korea, India, and Japan and it is desperate to find other licensees but t**echnology transfer isn’t easy and there are limited supplies of raw materials:**

Virtually overnight, [Novavax] set up a network of outside manufacturers more ambitious than one outside executive said he’s ever seen, but they struggled at times to transfer their technology there amid pandemic travel restrictions. They were kicked out of one factory by the same government that’s bankrolled their effort. Competing with larger competitors, they’ve found themselves short on raw materials as diverse as Chilean tree bark and bioreactor bags. They signed a deal with India’s Serum Institute to produce many of their COVAX doses but now face the realistic chance that even when Serum gets to full capacity — and they are behind — India’s government, dealing with the world’s worst active outbreak, won’t let the shots leave the country.

Plastic bags are a bigger bottleneck than patents. The US embargo on vaccine supplies to India was precisely that the Biden administration used the DPA to prioritize things like bioreactor bags and filters to US suppliers and that meant that India’s Serum Institute was having trouble getting its production lines ready for Novavax. CureVac, another potential mRNA vaccine, is also finding it difficult to find supplies due to US restrictions (which means supplies are short everywhere). As Derek Lowe said:

Abolishing patents will not provide more shaker bags or more Chilean tree bark, nor provide more of the key filtration materials needed for production. These processes have a lot of potential choke points and rate-limiting steps in them, and there is no wand that will wave that complexity away.

Technology transfer has been difficult for AstraZeneca–which is one reason they have had production difficulties–and their vaccine uses relatively well understood technology. The mRNA technology is new and has never before been used to produce at scale. Pfizer and Moderna had to build factories and distribution systems from scratch. There are no mRNA factories idling on the sidelines. If there were, Moderna or Pfizer would be happy to license since they are producing in their own factories 24 hours a day, seven days a week (monopolies restrict supply, remember?). **Why do you think China hasn’t yet produced an mRNA vaccine? Hint: it isn’t fear about violating IP**. Moreover, even Moderna and Pfizer don’t yet fully understand their production technology, they are learning by doing every single day. **Moderna has said that they won’t enforce their patents during the pandemic but no one has stepped up to produce because no one else can.**

The US trade representative’s announcement is virtue signaling to the anti-market left and will do little to nothing to increase supply.

What can we do to increase supply? Sorry, there is no quick and cheap solution. We must spend. Trump’s Operation Warp Speed spent on the order of $15 billion. If we want more, we need to spend more and on similar scale. The Biden administration paid $269 million to Merck to retool its factories to make the J&J vaccine. That was a good start. We could also offer Pfizer and Moderna say $100 a dose to produce in excess of their current production and maybe with those resources there is more they could do. South Africa and India and every other country in the world should offer the same (India hasn’t even approved the Pfizer vaccine and they are complaining about IP!??) We should ease up on the DPA and invest more in the supply chain–let’s get CureVac and the Serum Institute what they need. We should work like hell to find a substitute for Chilean tree bark. See my piece in Science co-authored with Michael Kremer et. al. for more ideas. (Note also that these ideas are better at dealing with current supply constraints and they also increase the incentive to produce future vaccines, unlike shortsighted patent abrogation.)

Bottom line is that producing more takes real resources not waving magic patent wands.

You may have gathered that I am angry. I am indeed angry that the people in power think they can solve real problems on the cheap and at someone else’s expense. This is not serious. I am also angry that they are sending the wrong message about business, profits and capitalism. So let me end on positive note. Like the Apollo program and Dunkirk, the creation of the mRNA vaccines by Pfizer and Moderna should be lauded with Nobel prizes and major movies. Churchill called the rescue at Dunkirk a “miracle of deliverance,” well the miracle of Moderna will rescue many more. Not only was a vaccine designed in under a year, an entirely new production process was set up to produce billions of doses to rescue the world. The creation of the mRNA vaccines was a triumph of science, logistics, and management and it was done at a speed that I had thought possible only for past generations.

#### Statistical evidence abounds – it’s not close.

Radelet ’16 (Steven; February 2016; Ph.D. and M.P.P. from Harvard University, B.A. from Central Michigan University, Distinguished Professor of the Practice of Development, and is Director of the Global Human Development Program at Georgetown University, former Professor of Government and Economics at Harvard University, former economic advisor to President Sirleaf of Liberia; Foreign Affairs, “Prosperity Rising,” https://www.foreignaffairs.com/articles/2015-12-14/prosperity-rising; RP)

Since the early 1990s, daily life in poor countries has been changing profoundly for the better: **one billion people** have escaped extreme poverty, average **incomes have doubled**, infant death **rates have plummeted**, millions more girls have enrolled in school, **chronic hunger** has been cut almost in half, deaths from malaria and other diseases have declined dramatically, **democracy has spread** far and wide, and the incidence of war—even with Syria and other conflicts—has fallen by half. This unprecedented progress goes way beyond China and India and has touched hundreds of millions of people in dozens of developing countries across the globe, from Mongolia to Mozambique, Bangladesh to Brazil. Yet few people are aware of these achievements, even though, in aggregate, they rank among the **most important in human history**. In 2013, the Swedish survey organization Novus Group International asked Americans how they thought the share of the world’s population living in extreme poverty had changed over the last two decades. Sixty-six percent of respondents said that they thought it had doubled, and another 29 percent said that it hadn’t changed. Only five percent knew (or guessed) the truth: that the share of people living in extreme **poverty had fallen by half**. Perhaps that ignorance explains why Washington has done so little to take advantage of these promising trends, giving only tepid support to nascent democracies, making limited investments in economic development and in new health and agricultural technologies, and failing to take the lead in building more **effective international institutions**. Whatever the reason, many developing countries are now responding to what they perceive as the United States’ indifference by looking elsewhere—especially toward China—for deeper engagement and advice on how to keep growing. At the same time, climate change, the slowdown in global growth, and rising tensions in the Middle East and beyond have begun to **threaten further progress**. As a result, the United States now risks missing out on a **historic chance** to strengthen its global leadership and help create a safer, more prosperous, and more democratic world—just at the moment when it could help the most. ONE GIANT LEAP Global poverty is falling faster today than at any time in human history. In 1993, about two billion people were trapped in extreme poverty (defined by the World Bank as living on less than $1.90 per day); by 2012, that number had dropped to less than one billion. The industrialization of China is a big part of the story, of course, but even excluding that country, the number of extreme poor has fallen by more than 400 million. Since the 1980s, **more than 60 countries** have reduced the number of their citizens who are impoverished, even as their overall populations have grown. This decline in poverty has gone hand in hand with much **faster economic growth**. Between 1977 and 1994, the growth in per capita GDP across the developing countries averaged zero; since 1995, that figure has shot up to three percent. Again, the change is widespread: between 1977 and 1994, only 21 developing countries (out of 109 with populations greater than one million) exceeded two percent annual per capita growth, but between 1995 and 2013, 71 such countries did so. And going backward has become much less common: in the earlier period, more than 50 developing countries recorded negative growth, but in the later one, just ten did. The **improvements in health** have been even bigger. In 1960, 22 percent of children in developing countries died before their fifth birthday, but by 2013, only five percent did. Diarrhea killed five million children a year in 1990 but claimed fewer than one million in 2014. **Half as many people** now **die** from malaria as did in 2000, and deaths from tuberculosis and AIDS have both dropped by a third. The share of people living with chronic hunger has fallen by almost half since the mid-1990s. **Life expectancy** at birth in developing countries has **lengthened by** nearly **one-third**, from 50 years in 1960 to 65 years today. These improvements in health have left no country untouched, even the worst-governed ones. Consider this: the rate of child death has declined in every single country (at least those where data are available) since 1980. Meanwhile, far more children are enrolling in and completing school. In the late 1980s, only 72 percent of all primary-school-age children attended school; now, the figure exceeds 87 percent. Girls in developing countries have enjoyed the biggest gains. In 1980, only half of them finished primary school, whereas four out of five do so today. These leaps in education are beginning to translate into better-skilled workers. Then there is the shift to democracy. Prior to the 1980s, most developing countries were run by left- or right-wing dictators. Coups and countercoups, violence and assassinations, human rights abuses—all formed part of regular political life. But starting in the 1980s, dictators began to fall, a process that accelerated after the Cold War. In 1983, only 17 of 109 developing countries qualified as democracies, based on data from Freedom House and the Center for Systemic Peace; by 2013, the number had **more than tripled**, to 56 (and that’s not counting the many more developing countries with populations of less than one million). As those numbers suggest, power today is far more likely to be transferred through the ballot box than through violence, and elections in most countries have become fairer and more transparent. Twenty years ago, few Indonesians could have imagined that a furniture maker from central Java would beat one of Suharto’s relatives in a free and fair election, as Joko Widodo did in 2014. Nor would many have predicted that Nigeria, then still under military rule, would in 2015 mark its first peaceful transfer of power between parties, or that Myanmar (also called Burma) would hold its most successful democratic election the same year. Across the developing world, individual freedoms and rights are honored to a much greater degree, human rights **abuses are rarer**, and legislative bodies have more power. Yes, many of these new democracies have problems. And yes, the march toward democracy has slowed since 2005—and even reversed in some countries, such as Thailand and Venezuela. But in many more—from Brazil to Mongolia to Senegal—democracy has deepened. Never before in history have so many **developing countries been so democratic**. As states have become wealthier and more democratic, **conflict and violence** within them have declined. Those who think otherwise should remember that as recently as the 1980s and early 1990s, much of the world was aflame, from Central America to Southeast Asia to West Africa. There were half as many civil wars in the last decade as there were in the 1980s, and the number of people killed in armed conflicts has **fallen by three-quarters**. Three major forces sparked this great surge in development progress. First, the end of the Cold War brought an end to the superpowers’ support for some of the world’s nastiest dictators and reduced the frequency of conflict. As ideas about economic and political governance began to change, developing countries introduced more market-based economic systems and more democracy. Second, globalization created vast new opportunities for economic growth. Increased flows of trade, investment, information, and technology created more jobs and improved living standards. Third, new and more effective leaders—in politics, business, religion, and civil society—began to forge deep change. Where courageous figures, such as Nelson Mandela in South Africa, stepped forward, countries progressed; where old-style dictators, such as Robert Mugabe in Zimbabwe, remained in power, countries languished. This **incredibly wide-ranging progress** should not obscure the considerable work that remains: progress has not reached everyone, everywhere. One billion people still live in extreme poverty, six million children die every year from preventable diseases, too few girls get the education they deserve, and too many people suffer under dictatorships. Countries such as Haiti, North Korea, Uzbekistan, and Zimbabwe lag far behind. But the fact remains that an **enormous transformation** is under way—one that has already substantially improved the lives of hundreds of millions of people. WIN-WIN The United States should welcome and encourage this progress. For starters, broad-based development **enhances global security**. It is not true that poverty necessarily breeds terrorism, as some argue—after all, most poor people are not terrorists, and many terrorists are not poor. But it is true that poor states tend to be weak states unable to prevent **terrorist and criminal networks** from operating on their soil. Sustained development strengthens government institutions and reduces the need for outside intervention. As former U.S. Secretary of Defense Robert Gates put it, “Development is a lot cheaper than sending soldiers.” Development also builds states’ capacities to fight pandemic disease. Guinea, Liberia, and Sierra Leone were overwhelmed by Ebola in 2014 largely because they all had weak health systems. The same was true in many of the countries hit hardest by the HIV/AIDS epidemic decades ago. As poor countries grow wealthier, however, they become better equipped to **fight diseases** that can spread quickly beyond their borders. A more prosperous developing world also benefits the U.S. economy. The spread of economic growth creates **new markets** for American businesses not just in China but also in Brazil, Indonesia, South Africa, and beyond. Developing countries are buying more and more aircraft, automobiles, semiconductors, medical equipment, pharmaceuticals, consultancy services, and entertainment. Although the growth in trade with developing countries has slowed during the last year, their economies will no doubt remain major market opportunities for U.S. companies. In 1990, such states accounted for one-third of the global economy; today, their share is half, and they purchase more than half of U.S. exports. In 2011, Walmart spent $2.4 billion to acquire a controlling share of a holding company that operates more than 350 retail stores in South Africa and 11 other African countries, signaling a level of interest in African consumers that would have been unimaginable two decades ago. To be sure, emerging markets also create competition for U.S. businesses and hardship for American workers who lose their jobs as a result. But they also create many new jobs, as American firms expand abroad and as companies in the developing world send more capital to the West. Moreover, developing countries are increasingly coming up with their own **innovations** and **technologies**, in medicine, agriculture, energy, and more. The United States should respond to this growing competition not with protectionism but by strengthening its own capacities: rebuilding its **infrastructure, improving** its **educational** system, and investing in new technologies. Finally, development helps spread and deepen the values that Americans hold dear: openness, economic opportunity, democracy, and freedom. These values tend to go hand in hand with growing prosperity: as incomes rise, citizens demand greater freedoms. History suggests that even governments that do not welcome these ideas eventually embrace them or are replaced by those that do. And as more developing countries achieve progress under market-based economic systems and democracy, other countries seek to **emulate the model**. The United States and Europe have a strong self-interest in encouraging this process, since it will enhance global stability and add to the number of like-minded partners that can help address future challenges. SUSTAINING THE SURGE What makes all this progress especially impressive is that it has continued despite a number of major shocks that in an earlier age could well have stopped it: the outbreak of the HIV/AIDS pandemic in the 1980s, the Asian financial crisis in 1997–98, the 9/11 attacks, the global food crisis of 2007–8, and the global financial crisis of 2008. In each case, pundits predicted that the disaster of the day would set back progress. Yet in each case, the gains continued. There are good reasons to believe they can continue well into the future. The forces that sparked these **changes were fundamental**, not transitory. Governments have learned from their mistakes and gotten much better at managing inevitable downturns. Global integration has made critical technologies available to more and more people. **State institutions** have become more effective, with improved (if imperfect) legal systems, clearer property rights, and greater respect for individual liberties. Democratic rules and norms governing the transfer of political power, free speech, and accountability have become more deeply entrenched. Civil society groups are more active. These deep-seated changes have put enormous additional gains well within reach. If **economic growth proceeds** along the lines of most projections over the next two decades, some 700 million more people will escape extreme poverty. Per capita incomes in poor countries will double again, **millions of** childhood **deaths** will be avoided, **tens of millions** of children will get the education they deserve, hunger will decline, and basic rights and freedoms will spread further. At least, that’s what should happen—but none of these future gains is guaranteed. Growth has slowed markedly since 2008 in emerging economies such as Brazil and China and throughout the developing world. Russia, Thailand, and Venezuela have turned less democratic, and South Africa and Turkey seem to be headed in that direction as well. The Middle East has seen the return of conflict and **authoritarian rule**. China’s aggressive actions in the South China Sea could **spark a major conflict** that could kill tens of thousands of people and devastate the region’s economies. Outbreaks of SARS and the H1N1 and Ebola viruses underscore humanity’s vulnerability to disease, and many doctors worry that growing resistance to antibiotics could reverse some of the hard-fought gains in health. Meanwhile, global population is on track to exceed nine billion by 2050, and the combination of more people, higher incomes, and warmer climates will place enormous strains on the world’s supplies of fresh water, food, and energy. Although there are ample grounds for pessimism, the doomsayers continue to **underestimate humanity’s growing ability** to cooperate in the face of new challenges. In the eighteenth century, when Thomas Malthus looked at population growth and foresaw catastrophic famine, he failed to appreciate the advances in agriculture, health, and governance that human ingenuity could create. The same was true for those that predicted a population disaster in Asia in the 1960s and 1970s. Today, the problems facing developing countries are plain to see, while the new ideas and innovations that will overcome them are harder to picture. Continued progress isn’t automatic or guaranteed. But with smart choices, it is within reach. LEADING BY EXAMPLE Most of the key choices will be made in developing countries themselves. Sustaining progress will require leaders there to reduce their countries’ dependence on natural resources, make their economies more inclusive, invest more in health and education, expand opportunities for women, and strengthen democracy and the rule of law. Yet the future of development will also **depend on the** actions of the **world’s leading countries**, since poorer countries can prosper only in a strong global system. The United States must do its part by regaining its economic leadership through major investments in infrastructure, education, and technological advances in health, agriculture, and alternative fuels. It must act to fix its long-term budget problems by improving the solvency of Social Security, Medicare, and Medicaid and strengthen the financial system through better regulation. The country must also do a much better job of leading by **example on democracy**. Deep political polarization, the lack of substantive debate, the unwillingness to compromise, misguided foreign policy adventurism, and the Great Recession have made liberal democracy look unattractive and ineffective. That malaise matters, because many developing countries are now engaged in a battle of ideas over which economic and political model they should follow. On the one side stands the model that has prevailed in the West since World War II: market capitalism coupled with **liberal democracy**. On the other is the model practiced by China, Vietnam, Ethiopia, and, increasingly, Russia, among others: state capitalism coupled with authoritarian rule. And there’s yet one more option, with a smaller but more dangerous following: religious fundamentalism, as promulgated by Iran and Saudi Arabia and groups such as the Islamic State (or ISIS) and Boko Haram in Nigeria. As the Western countries struggle and China continues to rise, authoritarian capitalism is becoming more appealing. Consider Beijing’s ties to Africa. China purchased $26 billion in imports from the continent in 2013; the United States purchased $9 billion. Chinese investment in Africa has been growing by 50 percent per year since 2000, whereas U.S. investment is growing by 14 percent per year. Make no mistake: many Africans still prefer to follow the American model and view China with suspicion. But those attitudes are beginning to shift, and Beijing’s apparent ability to get things done will only enhance China’s appeal, especially if Washington seems to talk big but deliver little. THE NEXT SURGE FORWARD Aside from the broader task of getting their own houses in order, the United States and other Western powers should also assert leadership in several specific areas to **keep the progress going**. The first is climate change, which presents one of the greatest threats to poverty reduction. Most of the world’s poor countries had little to do with creating the problem, yet they will bear the brunt of the damage. Rising sea levels, changing rainfall patterns, higher temperatures, and dwindling water supplies will derail progress, will undermine global food production, and could engender major conflict. Developing countries have an important role to play in curbing emissions, but they will not switch to low-carbon fuels and other clean technologies if their developed-world counterparts do not. Washington has taken important first steps to reduce power-plant emissions and raise automotive fuel-efficiency standards, but there is a very long way to go. Second, leading countries—especially the United States—should invest more in **technological innovation**. Much of the credit for recent improvements in living standards goes to vaccines, medicines, high-yielding seed varieties, cell phones, and the Internet. These new technologies (alongside old ones such as electricity and paved roads) have not yet reached everywhere, so simply making them more widely available would do wonders. But sustaining progress for the next several decades will also require **significant investments** in new vaccines, more powerful drugs, drought- and heat-resistant seeds, desalination techniques, and clean energy.

#### It’s key to CCS – link-turns every impact.

Graciela ‘16 (/16 – Professor of Economics and of Statistics at Columbia University and Visiting Professor at Stanford University, and was the architect of the Kyoto Protocol carbon market (being interviewed by Marcus Rolle, freelance journalist specializing in environmental issues and global affairs, “Reversing Climate Change: Interview with Graciela Chichilnisky,” http://www.globalpolicyjournal.com/blog/01/09/2016/reversing-climate-change-interview-graciela-chichilnisky)//cmr

GC: Green capitalism is a new economic system that values the natural resources on which human survival depends. It fosters a harmonious relationship with our planet, its resources and the many species it harbors. It is a new type of market economics that addresses both equity and efficiency. Using carbon negative technology™ it helps reduce carbon in the atmosphere while fostering economic development in rich and developing nations, for example in the U S., EU, China and India. How does this work? In a nutshell Green Capitalism requires the creation of global limits or property rights nation by nation for the use of the atmosphere, the bodies of water and the planet’s biodiversity, and the creation of new markets to trade these rights from which new economic values and a new concept of economic progress emerges updating GDP as is now generally agreed is needed. Green Capitalism is needed now to help avert climate change and achieve the goals of the 2015 UN Paris Agreement, which are very ambitious and universally supported but have no way to be realized within the Agreement itself. The Carbon Market and its CDM play critical roles in the foundation of Green Capitalism, creating values to redefine GDP. These are needed to remain within the world’s “CO2 budget” and avoid catastrophic climate change. As I see it, the building blocks for Green Capitalism are then as follows; (1) Global limits nation by nation in the use of the planet’s atmosphere, its water bodies and biodiversity - these are global public goods. (2) New global markets to trade these limits, based on equity and efficiency. These markets are relatives of the Carbon Market and the SO2 market. The new market create new measures of economic values and update the concept of GDP. (3) Efficient use of Carbon Negative Technologies to avert catastrophic climate change by providing a smooth transition to clean energy and ensuring economic prosperity in rich and poor nations. These building blocks have immediate practical implications in reversing climate change and can assist the ambitious aims of Paris COP21 become a reality. MR: What is the greatest advantage of the new generation technologies that can capture CO2 from the air? GC: These technologies build carbon negative power plants, such as Global Thermostat, that clean the atmosphere of CO2 while producing electricity. Global Thermostat is a firm that is commercializing a technology that takes CO2 out of air and uses mostly low cost residual heat rather than electricity to drive the capture process, making the entire process of capturing CO2 from the atmosphere very inexpensive. There is enough residua heat in a coal power plant that it can be used to capture twice as much CO2 as the plant emits, thus transforming the power plant into a “carbon sink.” For example, a 400 MW coal plant that emits 1 million tons of CO2 per year can become a carbon sink absorbing a net amount of 1 million tons of CO2 instead. Carbon capture from air can be done anywhere and at any time, and so inexpensively that the CO2 can be sold for industrial or commercial uses such as plastics, food and beverages, greenhouses, bio-fertilizers, building materials and even enhanced oil recovery, all examples of large global markets and profitable opportunities. Carbon capture is powered mostly by low (85°C) residual heat that is inexpensive, and any source will do. In particular, renewable (solar) technology can power the process of carbon capture. This can help advance solar technology and make it more cost-efficient. This means more energy, more jobs, and it also means economic growth in developing nations, all of this while cleaning the CO2 in the atmosphere. Carbon negative technologies can literally transform the world economy. MR: One final question. You distinguish between long-run and short-run strategies in the effort to reverse climate change. Would carbon negative technologies be part of a short-run strategy? GC: Long-run strategies are quite different from strategies for the short-run. Often long-run strategies do not work in the short run and different policies and economic incentives are needed. In the long run the best climate change policy is to replace fossil fuel sources of energy that by themselves cause 45% of the global emissions, and to plant trees to restore if possible the natural sources and sinks of CO2. But the fossil fuel power plant infrastructure is about 87% of the power plant infrastructure and about $45-55 trillion globally. This infrastructure cannot be replaced quickly, certainly not in the short time period in which we need to take action to avert catastrophic climate change. The issue is that CO2 once emitted remains hundreds of years in the atmosphere and we have emitted so much that unless we actually remove the CO2 that is already there, we cannot remain long within the carbon budget, which is the concentration of CO2 beyond which we fear catastrophic climate change. In the short run, therefore, we face significant time pressure. The IPCC indicates in its 2014 5th Assessment Report that we must actually remove the carbon that is already in the atmosphere and do so in massive quantities, this century (p. 191 of 5th Assessment Report). This is what I called a carbon negative approach, which works for the short run. Renewable energy is the long run solution. Renewable energy is too slow for a short run resolution since replacing a $45-55 trillion power plant infrastructure with renewable plants could take decades. We need action sooner than that. For the short run we need carbon negative technologies that capture more carbon than what is emitted. Trees do that and they must be conserved to help preserve biodiversity. Biochar does that. But trees and other natural sinks are too slow for what we need today. Therefore, negative carbon is needed now as part of a blueprint for transformation. It must be part of the blueprint for Sustainable Development and its short term manifestation that I call Green Capitalism, while in the long run renewable sources of energy suffice, including Wind, Biofuels, Nuclear, Geothermal, and Hydroelectric energy. These are in limited supply and cannot replace fossil fuels. Global energy today is roughly divided as follows: 87% is fossil, namely natural gas, coal, oil; 10% is nuclear, geothermal, and hydroelectric, and less than 1% is solar power — photovoltaic and solar thermal. Nuclear fuel is scarce and nuclear technology is generally considered dangerous as tragically experienced by the Fukushima Daichi nuclear disaster in Japan, and it seems unrealistic to seek a solution in the nuclear direction. Only solar energy can be a long term solution: Less than 1% of the solar energy we receive on earth can be transformed into 10 times the fossil fuel energy used in the world today. Yet we need a short-term strategy that accelerates long run renewable energy, or we will defeat long-term goals. In the short term as the IPCC validates, we need carbon negative technology, carbon removals. The short run is the next 20 or 30 years. There is no time in this period of time to transform the entire fossil infrastructure — it costs $45-55 trillion (IEA) to replace and it is slow to build. We need to directly reduce carbon in the atmosphere now. We cannot use traditional methods to remove CO2 from smokestacks (called often Carbon Capture and Sequestration, CSS) because they are not carbon negative as is required. CSS works but does not suffice because it only captures what power plants currently emit. Any level of emissions adds to the stable and high concentration we have today and CO2 remains in the atmosphere for years. We need to remove the CO2 that is already in the atmosphere, namely air capture of CO2 also called carbon removals. The solution is to combine air capture of CO2 with storage of CO2 into stable materials such as biochar, cement, polymers, and carbon fibers that replace a number of other construction materials such as metals. The most recent BMW automobile model uses only carbon fibers rather than metals. It is also possible to combine CO2 to produce renewable gasoline, namely gasoline produced from air and water. CO2 can be separated from air and hydrogen separated from water, and their combination is a well-known industrial process to produce gasoline. Is this therefore too expensive? There are new technologies using algae that make synthetic fuel commercially feasible at competitive rates. Other policies would involve combining air capture with solar thermal electricity using the residual solar thermal heat to drive the carbon capture process. This can make a solar plant more productive and efficient so it can out-compete coal as a source of energy. In summary, the blueprint offered here is a private/public approach, based on new industrial technology and financial markets, self-funded and using profitable greenmarkets, with securities that utilize carbon credits as the “underlying” asset, based on the KP CDM, as well as new markets for biodiversity and water providing abundant clean energy to stave off impending and actual energy crisis in developing nations, fostering mutually beneficial cooperation for industrial and developing nations. The blueprint proposed provides the two sides of the coin, equity and efficiency, and can assign a critical role for women as stewards for human survival and sustainable development. My vision is a carbon negative economy that represents green capitalism in resolving the Global Climate negotiations and the North–South Divide. Carbon negative power plants and capture of CO2 from air and ensure a clean atmosphere together innovation and more jobs and exports: the more you produce and create jobs the cleaner becomes the atmosphere. In practice, Green Capitalism means economic growth that is harmonious with the Earth resources.

#### Our ev is just better – prefer data over buzzwords.

Newman ’17 (Peter; 7/27/17; Curtin University Sustainability Policy Institute, conducting a twenty-year statistical analysis based on third-party meta studies; EDP Sciences, “The rise and rise of renewable cities,” <https://www.rees-journal.org/articles/rees/pdf/2017/01/rees170008s.pdf)>

Abstract. The **decoupling of fossil fuels** from growth in economic activity has been **proceeding rapidly** for most of the 21st century and is analyzed globally in terms of structures and technologies for energy efficiency and for switching to renewable energy in the world’s cities. This is leading to the **decline of coal** and oil. The evidence suggests that the changes are **based on demand** for the structures and technologies that are emerging, facilitating a **disruptive process**. The rise of renewable cities can therefore be expected to accelerate. 1 Introduction The rise of renewable cities began in the 1990s but has accelerated in the 21st century [1,2]. As shown below, both coal and oil have begun to fall in the nations of the world driven mostly by their cities as this is where **growth and change** is happening [3]. The question raised by this paper is whether the rise will continue and even accelerate. The theory behind whether the rise in renewable cities is likely to continue or accelerate is partly left to economists who project the future based on the past [4] and more recently by those who see disruptive innovation as causing the future and thus leading to much accelerated change [5,6]. Disruptive innovation is caused by demand rather than supply. The costs of supply need to be competitive but may not be the cheapest option when people discover they want it for many reasons and this changes the whole system that the market is based around. An example often given by Christensen [5] is how small floppy discs outcompeted the larger discs which were cheaper per unit of memory storage but were not as convenient to carry; the system changed in response by developing the portable lap top computer. Disruptive innovations can surprise businesses who focus just on supply costs and they can go bankrupt whilst their product is still the cheapest and the whole structural system around them changes in response to the new demand. This is known as the “Kodak effect” due to the way Kodak chose not to develop their digital cameras as they saw them as too expensive. This paper seeks to find evidence of whether the renewable city is being driven by disruptive innovations based on demand, as well as competitive costs of supply, leading to a whole system change. If it is so, then the rise in renewable cities is likely to continue and even accelerate based on demand for the structures and products of the renewable city at a surprising rate. The decoupling of economic growth and fossil fuels In 2017, the International Energy Agency confirmed that economic growth has been **decoupling from** greenhouse **emissions** and fossil fuels since the start of the 21st century and that this was now leading to the first **drop in fossil fuel consumption** and subsequent emissions [7]. How this relates to the rise of the renewable city is the focus of this paper. The mechanisms are first understood by looking at a range of national data as set out in Figure 1. Denmark decoupled relatively from the 1990s but absolutely over the last 17 years and is typical of many European nations and cities. The US and Australia have been slower but have now decoupled relatively from the 2000s and absolutely over the past 5–9 years. China decoupled relatively from 2005 and absolutely over the past few years with coal whilst **oil has plateaued**. India has started relative decoupling in the past decade and may change to an absolute decline in fossil fuels as it is investing strongly in renewables and urban electric rail [11]. These trends suggest a global process the rise of the renewable city as outlined by Droege [1,2]; this appears to be occurring much faster than expected and invites the question as to whether it will accelerate [3]. 3 Mechanisms for the rise of the renewable city The mechanisms behind the decoupling of wealth and fossil fuels and the resulting rise of renewable cities are likely to be based around **structural energy** efficiencies and **growth** in renewables. Whether they are disruptive, demand driven changes, will be examined with coal and oil. 3.1 The fall of coal 3.1.1 Structural built environment energy efficiencies In the period from 2000 to 2013 the Organization for Economic Cooperation and Development improved energy efficiency by a steady 0.6% per year but in 2013/14 it improved 1.5% and in 2014/15 it improved 1.8% [12]. This rapid growth seems to be more **structural** in its base as appliances and buildings are becoming **significantly more efficient** as shown by the Intergovernmental Panel on Climate Change [13]. This does appear to be a demand driven process involving digital smart systems in appliances and in construction and management of buildings leading to declines in electricity consumption [14]. 3.1.2 Renewable fuel growth Bloomberg New Energy Finance (BNEF) has made projections of the growth in renewables based on the relative costs of fuels. They suggest that from 2015 to 2040 renewables will become the **dominant power source** in the world; wind and solar will account for **64% of** the **new** generating **capacity**, and globally there will be 60% zerocarbon power, replacing coal and gas, which will decline from 57% to 31% [15]. The predictions are made based on trends and on declining costs for renewables relative to fossil fuels. The **biggest growth** is predicted to be roof top solar which will drop in cost by 60%. However, it may be driven at an **even faster rate** if it has demand driven characteristics. Carbon tracker researchers have suggested that the changes may be even more radical than BNEF are predicting as they appear to be following more rapidly than any previous predictions and are indicating elements of disruptive innovation [16,17]. The question is therefore whether there is any new evidence of the changes being disruptive with adoption of renewables proceeding more rapidly than supply cost projections. There is evidence from Australia of a **remarkably rapid adoption** of roof top solar at a time when little investment in power was happening in the aftermath of abandoning the Australian carbon-pricing scheme [18]. Perth in particular showed this as the city grew rapidly in wealth over the past decade and 25% of households invested in roof-top solar photovoltaics (PV). This happened well beyond what would have been predicted based just on supply costs and household solar is now the largest power station in the grid [18]. Battery storage is now following the same trends [19] and analysis in Perth shows solar-storage systems enable over **90% gridfree** electricity as well as producing more renewable energy to feed into the grid and generate income [18]. The technology of PV and batteries seems to fit into a niche for ordinary single residential householders [20]; recent demonstrations are showing similar heavy demand in medium density shared households that integrate PV and batteries using Citizen Utilities and blockchain software to enable peer to peer trading [21]. The signs are there that demand is driving the electricity system toward a rapid decline in coal even faster than supply costs would indicate. This may involve more gas in some cities like in the US where this is significantly cheaper but the attractions of roof-top solar and batteries are more than likely going to outcompete gas when the **market enables it to work** as it is in Australia with simple financing, permitting and installation [22,23]. 3.2 The fall of oil 3.2.1 Structural transport energy efficiencies Oil is embedded in the structure of cities through 50 years of automobile dependence in the practice of town planning; however this is changing as an unpredicted peak in car use per capita has occurred across the world’s developed cities and even into emerging cities [24]. This is driven by: – increases in density that have led to exponential declines in car use [24]; – rapid growth in transit across all the world’s cities as traffic congestion has led to faster rail options that bypass the traffic [25]; – similar trends in walking and cycling driven by health considerations and the demand for better networks [26,27]. These trends are all demand driven. Vehicle efficiency has also been slowly increasing despite an increase in vehicle size washing out some of this improvement [28]. 3.2.2 Electric mobility Electric vehicles are growing globally at **over 40% per year** and are expected to reach at least 25% of the vehicle fleet by 2040 [29]. Most of this growth is in China which is likely to mean cheaper exports. The demand for electric vehicles is high whether they are personal cars, buses, trains or electric bikes and certainly with cars this is happening well before the **supply cost** is competitive though the daily costs of operation are significantly lower and this is a strong demand factor for most consumers; some are therefore predicting even higher adoption rates [30]. There is another demand-based trend that will impact on the shift to **electric mobility**. The trend in electricity to become more **based on renewables** means that growth in solar-powered EVs are likely to be driven by demand s

imilar to roof top solar. EVs are already being used to fit cleverly into home PV and battery systems with the high potential for “vehicle to grid (V2G)” transfers of power to enable extra storage options in the grid. Electric transit is also beginning to be switched to renewable power as demand for clean transport grows across cities [24] and new ways of financing this demand are being found [31]. 4 Will the demand for renewable cities rise and rise? The rise of the renewable city has been quite dramatic and this paper suggests that it will continue to rise due to demand which **facilitates disruptive innovation** in replacing both coal and oil. Such demand is seen in the improved electricity systems that are emerging as a result of the demand for roof top solar and in the demand for re-urbanized cities where electric mobility can better service the needs of the community. There are two other demand factors that are likely to continue to drive the need for a **renewable city** the knowledge economy and the digital economy The knowledge economy is based around creative interactions where people work together in dense urban centers as these are where the innovative, face-to-face synergies occur between people [32]. Old central business districts and new suburban centers have been transformed back into functional walking cities and those which have done this best have attracted the most capital and young talent to work there [33]. The six most walkable cities in the US have 38% higher GDP. In Boston 70% of the knowledge economy workers live in walkable locations [24]. Transit systems and walking are the most spatially efficient forms of transport as well as being the most free of carbon. If one km of a lane of road was considered as a unit of travel then car traffic can fit about 800 people per hour down that lane in a suburban street, a freeway up to 2500, a busway around 5000, a light rail between 10,000 and 20,000 and a heavy rail up to 50,000 [24]. These striking differences in spatial efficiency are translating into competitive advantage based on the need to bring people together in centers. There is a strong demand for such cities because they represent the places where the new knowledge economy will most likely emerge and provide new opportunities. The data is also strong that there is demand for **low carbon buildings** in these new regenerating urban centers [34]. Indeed, cities are competing for residents and workers through the provision of new sustainability oriented precincts and neighborhoods; the data shows that sustainability features in buildings are a close third behind **affordability and location** [3,32,35]. As with many economic changes, there is another cultural dimension to this change that perhaps explains the rapidity of the changes observed above as well as the demographic complexion of the change. Young people (especially those involved in knowledge economy jobs) are moving to reduce their car use and switch to alternative transport faster than any other group. This has been recognized by a few commentators and has been related to the use of social media devices in the digital economy. On transit or walking (and even to an extent while biking) young people are already connected by their smart technology phones and tablets. They are hardly usable while driving a car. The report by Davis et al. [34] shows that the mobile phone is a far more important device than a car for younger people. This is a cultural revolution that partly underlies the rail revolution as well as the re-urbanization of cities. It is essentially a smart city phenomenon. Thus, the structural expression of this change is that younger people are moving to live in the walking city or transit city as these locations more readily enable them to express the kind of urban experience and culture that they aspire to as well as save precious time. This is the demand that enables peak car, the rail revival and city center renewal to continue. This can explain why cities like Washington, D.C. and Portland are demonstrating the decoupling of GDP from car use per capita (Fig. 2). 5 Conclusion The evidence gathered in this paper has shown that there is a **new trend**: the rise of the renewable city which has emerged this century from the **decoupling of fossil fuels** and economic **growth**. The fall of coal and the fall of oil are both caused by structural **energy efficiency gains** (smart technology and smart buildings for coal; smart, dense transit-oriented cities that reduce car dependence for oil) and by switching to renewable fuels (coal is being replaced by wind and solar especially roof-top PV; oil is being replaced by electric mobility). This appears to be led by demand in cities as well as somewhat competitive supply costs. The rise and rise of the renewable city is thus to be expected as demand is likely to continue to rise for the urban living advantages associated with renewable city technologies and structures.

#### Growth is sustainable and inevitable – unparalleled data proves tech solves, but transition doesn’t.

Bailey ’16 (Ronald; 12/16/16; B.A. in Philosophy and B.A. Economics from the University of Virginia, member of the Society of Environmental Journalists and the American Society for Bioethics and Humanities, citing a compilation of interdisciplinary research; Reason, “Is Economic Growth Environmentally Sustainable?” <http://reason.com/archives/2016/12/16/is-economic-growth-environmentally-sust1)>

Is economic growth environmentally sustainable? No, say a group of prominent ecological economists led by the Australian hydrologist James Ward. In a new PLoS ONE article—"Is Decoupling GDP Growth from Environmental Impact Possible?"—they offer an analysis inspired by the 1972 neo-Malthusian classic The Limits to Growth. They even suggest that The Limits to Growth's projections with regard to population, food production, pollution, and the depletion of nonrenewable resources are still on track. In other words, they think we're still heading for a collapse. I think **they're wrong**. But they're wrong in an instructive way. The authors describe two types of "decoupling," relative and absolute. Relative decoupling means that economic growth increases faster than rates of growth in material and energy **consumption** and **environmental impact**. Between 1990 and 2012, for example, China's **GDP rose 20-fold** while its energy use increased by a factor of four and its material use by a factor of five. Basically this entails increases in efficiency that result in using fewer resources to produce more value. Absolute decoupling is what happens when continued economic growth actually **lessens resource use** and impacts on the natural environment, that is, creating more value while using less stuff. Essentially humanity becomes richer while withdrawing from nature. To demonstrate that continued economic growth is unsustainable, the authors recycle the hoary I=PAT model devised in 1972 by the Stanford entomologist and population alarmist Paul Ehrlich and the Harvard environmental policy professor (and chief Obama science adviser) John Holdren. Human Impact on the environment is supposed to equal to Population x Affluence/consumption x Technology. All of these are presumed to intensify and worsen humanity's impact on the natural world. In Ward and company's updated version of I=PAT, the sustainability of economic growth largely depends on Technology trends. Absolute decoupling from resource consumption or pollutant emissions requires technological intensity of use and emissions to decrease by at least the same annual percentage as the economy is growing. For example, if the economy is growing at three percent per year, technological intensity must reduce 20-fold over 100 years to maintain steady levels of resource consumption or emissions. If technological intensity is faster then resource use and emissions will decline over time, which would result in greater wealth creation with ever lessening resource consumption and environmental spillovers. Once they've set up their I=PAT analysis, Ward and his colleagues assert that "for non-substitutable resources such as land, water, raw materials and energy, we argue that whilst efficiency gains may be possible, there are minimum requirements for these resources that are ultimately governed by physical realities." Among the "physical realities" they mention are limits on plant photosynthesis, the conversion efficiencies of plants into meat, the amount of water needed to grow crops, that all supposedly determine the amount of agricultural land required to feed humanity. They also cite "the upper limits to energy and material efficiencies govern minimum resource throughput required for economic production." To illustrate the operation of their version of the I=PAT equation, they apply it to a recent study that projected it would be possible for Australia's economy to grow 7-fold while simultaneously reducing resource and energy use and lowering environmental pressures through 2050. They **crank the notion** that there are nonsubstitutable physical limits on material and energy resources through their equations until 2100, and they find that eventually consumption of both rise at the same rate as economic growth. QED: Economic growth is unsustainable. Or as they report, "Permanent decoupling (absolute or relative) is impossible for essential, non-substitutable resources because the efficiency gains are ultimately governed by physical limits." **Malthus wins again!** Or does he? GDP growth—increases in the monetary value of all finished goods and services—is a crude measure for improvements in human well-being. Nevertheless, rising incomes (GDP per capita) correlate with lots of good things that nearly everybody wants, including access to more and better **food**, longer and **healthier lives**, more educational **opportunities**, and greater scope for life choices. Ward and his colleagues are clearly right that there is only so much physical stuff on the Earth, but even they know that wealth is not created simply by using more stuff. Where they go wrong (as so many Malthusians do) is by implicitly assuming that there are limits to human creativity. Interestingly, Ward and his colleagues, like Malthus before them, focus on the supposed limits to **agricultural productivity**. For example, they cite the limits to photosynthesis, which will limit the amount of food that humanity can produce. But as they acknowledge, human population may not continue to increase. In fact, **global fertility rates** have been **decelerating** for many decades now, and demographer Wolfgang Lutz calculates that world population will peak after the middle of this century and begin falling. Since the number of mouths to feed will stabilize and people can eat only so much, it is unlikely that the **biophysical limits** of agriculture on Earth will be exceeded. But it gets even better. Agricultural **productivity is improving**. Consider the biophysical limit on photosynthesis cited by the study. In fact, researchers are already making progress on installing more efficient C-4 photosynthesis into rice and wheat, which would **boost yields by** as much as **50 percent**. British researchers just announced that they had figured out how to boost photosynthetic efficiency to create a super-wheat would increase yields by 20 percent. In a 2015 article for the Breakthrough Journal, "The Return of Nature: How Technology Liberates the Environment," Jesse H. Ausubel of Rockefeller University reviews how humanity is **already decoupling** in many ways from the natural world. "A series of 'decouplings' is occurring, so that our economy no longer advances in tandem with exploitation of land, forests, water, and minerals," he writes. "American use of almost everything except information **seems to be peaking**." He notes that agricultural applications of fertilizer and water in the U.S. peaked in the 1980s while yields continued to increase. Thanks to increasing agricultural productivity, humanity is already at **"peak farmland"**; as a result, "an area the size of India or of the United States east of the Mississippi could be released globally from agriculture over the next 50 years or so." Ward is worried about biophysical limits on water use. But as Ausubel notes, U.S. **water use has peaked** and has declined **below the level of 1970**. What about meat? Ausubel notes the **greater efficiency** with which chickens and cultivated fish turn grains and plant matter into meat. In any event, the future of farming is not fields but factories. Innovators are already seeking to replace the entire dairy industry with milk, yogurt, and cheeses made by genetically modified bacteria grown in tanks. Others are figuring how to culture meat in vat. Ausubel also notes that many countries have already been through or are about to enter the "forest transition," in which forests begin to expand. Roger Sedjo, a forest economist at Resources of the Future, has projected that by the middle of this century most of world's **industrial wood** will be produced from planted forests covering a remarkably small land area, perhaps **only 5 to 10 percent** of the extent of today's global forest. Shrinking farms and ranches and expanding forests will do a lot toward turning around the alarming global reduction in wildlife. How about unsubstitutable stuff? Are we running out of that? Ausubel notes that the U.S. has apparently already achieved **absolute decoupling**—call it peak stuff—for a lot of materials, including plastics, paper, timber, phosphate, aluminum, steel, and copper. And he reports relative decoupling for **53** other **commodities**, all of which are likely heading toward absolute decoupling. Additive manufacturing is also known as 3-D printing, in which machines build up new items one layer at a time. The Advanced Manufacturing Office suggested that additive manufacturing can reduce material needs and costs by up to **90 percent**. And instead of the replacement of worn-out items, their material can **simply be recycled** through a printer to return it to good-as-new condition using only 2 to 25 percent of the energy required to make new parts. 3-D printing on demand will also eliminate storage and inventory costs, and will significantly cut transportation costs. Nanomanufacturing—building atom-by-atom—will likely engender a **fourth industrial revolution** by spurring exponential economic growth while reducing human demands for material resources. Ward and company project that Australians will be using 250 percent more energy by 2100. Is there an upper limit to energy production that implies unsustainability? In their analysis, the ecological economists apparently assume that energy supplies are limited. Why this is not clear, unless their model **implicitly assumes** a growing **consumption** of fossil fuels (and even then, the world is not close to running out of those). But there is a source of energy that, for all practical purposes, is limitless and has few deleterious environmental effects: **nuclear power**. If demand for primary energy were to double by 2050, a back-of-the-envelope calculation finds that the **entire world's energy needs** could be supplied by 6,000 conventional nuclear power plants. The deployment of fast reactors would supply "renewable" energy for thousands of years

. The development of thorium reactors could also supply **thousands of years** of energy. And both could do so without harming the environment. (Waste heat at that scale would not be much of a problem.) Such power sources are in any relevant sense "decoupled" from the natural world, since their fuel cycles produce **little pollution**. Recall that GDP measures the monetary value of all finished goods and services. Finished goods will become a shrinking part of the world's economy as more people gain access to food, clothing, housing, transportation, and so forth. Already, services account for 80 percent of U.S. GDP and 80 percent of civilian employment. Instead of stuff, people will want to spend time creating and enjoying themselves. As technological progress enables economic growth, people will consume more pixels and less petroleum, more massages and less mortar, more handicrafts and less hardwood. Ultimately, Ward and his colleagues make the **same mistake as Malthus** and the Limits to Growth folks: They **extrapolate trends** without taking adequate account of human **ingenuity**. Will it be possible to grow the economy 7-fold over this century while reducing resource consumption and restoring the natural world? Yes.