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The Law of the Tetrapods

Henry T. Greely*

ABSTRACT

Should there be such a thing as “Technology Law”? This Article explores that question in two ways. It first looks at four substantive issues that appear across many different areas of technology law: privacy, security, property, and responsibility. It then examines five questions that frequently recur about how to regulate very different new technologies. These questions include which agency should regulate, whether regulation should focus on before or after marketing, what jurisdiction should regulate, how relevant new information will be gained and used, and how—politically—good regulation can be enacted. This Article concludes that it may make sense to develop a true field of “technology law.”

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I. INTRODUCTION

On November 4, 1995, the second day of a cyberlaw conference at the University of Chicago—about when most current first-year law students were being born—Judge Frank Easterbrook launched a new meme he called “the law of the horse.” According to his subsequent publication from the conference, he said:

“When he was dean of this law school, Gerhard Casper was proud that the University of Chicago did not offer a course in “The Law of the Horse.” He did not mean by this that Illinois specializes in grain rather than livestock. His point, rather, was that “Law and . . .” courses should be limited to subjects that could illuminate the entire law. Instead of offering courses suited to dilettantes, the University of Chicago offered courses in Law and Economics, and Law and Literature.”

Easterbrook dismissed cyberlaw as a field, arguing that the best way to learn about the law relevant to a specialized area, like cyberlaw or horses, is to study general principles through broad categories of law, like contracts, torts, and property.

The tag “the law of the horse” has dogged different versions of “law and technology” for the more than two decades since. This short Article tries to set out some ways in which the very different law and technology fields might, at the least, inform each other. And it proposes a different meme (one that will never be successful): The Law of the Tetrapods.

Tetrapoda is a superclass of the phylum Chordata and its subphylum Vertebrata. Its name comes from the Greek tetra (four) and pod (foot), and it includes all vertebrates except fish. Horses are tetrapods; dogs and cats are tetrapods; stegosaurs were tetrapods. But whales, seals, birds, humans, and snakes are also tetrapods—despite the fact that none of those organisms actually has four “feet.” They are all different, but they all have some things in common. Specifically, they have a common ancestor and some common “ways of being” that are associated with their genealogy.

Technology law is not one thing; it is many things. It is not a horse but rather a grouping that includes horses and lots of other animals (hence, “The Law of the Tetrapods,” not “The Law of the Tetrapod”). All fields of technology law are different, but, like tetrapods,
they have things in common that make it useful to think about them as a group. This Article is my effort to start thinking through some of the similarities among areas of technology law that might make “technology law” a useful approach instead of cyberlaw, artificial intelligence (AI) law, robot law, neurolaw, law and genetics, and so on. In it, I talk of two things: first, substantive issues that are common across many fields; and then, second, ubiquitous issues around how to regulate new technologies. This is an introductory foray, not much more than first musings on the topic. Do not expect completeness—but rather what I hope are some provocative examples.

II. SUBSTANTIVE ISSUES ARISING ACROSS TECHNOLOGIES

Many technology fields face similar problems in specific areas, and these areas can often be characterized by terms that are used in law. Many of these problems arise from the fact that most new technologies today have serious computing power at their silicon hearts (or brains). Consider four of them: privacy, security, property, and responsibility.

The shared privacy issues arise mainly because stored data, linked by the internet or other methods, are essential for many things that we want to do, from medical research to using cell phones, credit cards, and well beyond. Thousands of times a day, most of us leave little bits (and bytes) of data in various places. Each piece, by itself, may seem insignificant. But when assembled, they might suddenly become, like a jigsaw puzzle, a powerful picture. That meaning might reveal special, sensitive information, like the record of your drug addiction treatment or your mental health treatment. More often it will reveal boring, unimportant information, like how often you order pizza. But almost all of the new, cutting-edge technologies, and especially those developed by the biggest firms in our economy, need such stored and searchable data in order to work.

Sometimes, the outcome of such data analysis is a matter of life and death, such as a medical database that tells a pharmacist not to dispense a particular drug to you because of its potentially deadly interaction with another drug you are taking. Sometimes the outcomes are merely conveniences, like the transponders that pay your tolls on the highway or bridge. You could (in some places, at least) go through

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3. In some ways, this piece is vaguely related to an article I published about academic health law in 2006 as a result of a symposium at Wake Forest University, but that’s probably the last time I’ve tried thinking seriously about a “field” of law and what makes it useful to view it as a field. Henry T. Greely, Some Thoughts on Academic Health Law, 41 WAKE FOREST L. REV. 391 (2006).
the toll booths and pay actual money to a person. But you don’t want to. You could buy your coffee with cash (that you’ve withdrawn from a bank that will keep a record of the event), but a card or a payment app on a phone is easier. You could, in theory, even handwrite letters, possibly enclosing actual physical photographs—but apart from a few holdouts at the holidays, who does that?

Stored data are not forgotten. They are easily searched, easily compared, and easily stolen—all of the things that make them convenient and useful also make them easily misused—which is why much of technology law, and particularly technology law in today’s environment, has a privacy problem.4

Security is often confused with privacy. After all, a breach of database security is one very common way for privacy to be lost. But I mean it to be something slightly different here. Over a decade ago, some young doctors wondered about implantable defibrillators, small machines that can be used to shock the heart back into a good rhythm.5 The defibrillators came with little “controllers” that allowed them to be turned on and off and also to be tested to see if they could shock the patient’s heart. The researchers discovered that there was basically no security for these devices; someone with a controller for a particular brand of defibrillator could control any implanted defibrillator of that brand—and could, at least in theory, keep it on test mode long enough to kill the patient.6 This is the kind of “security” I mean here.

Hospitals have been blackmailed when hackers have broken into and “frozen” their computer databases, agreeing to release them—and to let the hospital function—only upon payment of a large sum of money.7 Hackers have shown that the automatic features on some cars can be used by third parties to make them stop, go, or turn off the road.8

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6. See id.


And how much would we pay to prevent someone from shutting down the electrical grid or turning off the safety controls at a nuclear reactor?

Property is a third area where new technologies often raise new legal questions. The old common law said, *cuius est solum, eius est usque ad coelum et ad inferos.* Roughly, this translates to “whoever owns land owns up to the heavens and down to hell.” Aviation established that this wasn’t exactly true: a landowner can’t stop planes from flying overhead, at least over some height. But what about drones, which can be more numerous, less traceable to their owners, less regulatable, and usually fly much lower than planes? We are still working on an answer. Likewise, Pokémon Go has raised questions about whether a virtual reality game can be held responsible for peoples’ trespasses on “real” (in two senses) property—or perhaps even on their “virtual property.”

Consider another example. In the United States, we generally do not own human bodies. Corpses are, at most, “quasi-property.” What about cell lines, body parts, human embryos, or DNA? We are still stumbling around toward answers, decades after the questions have become important. If technologies give rise to new “things” that for one reason or another aren’t very “thinglike,” or lead to new ways to invade old property, new legal questions can arise.

One of the most interesting—and perhaps most confusing—areas where new technologies might raise new questions of law deals with an intersecting set of questions around the meaning of

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life, of personhood, of agency (in the philosophical sense, not the legal one), and of responsibility. About sixty years ago, mechanical ventilators made it possible to keep human bodies alive after their brains were dead.¹³ This led to legal questions that we thought were solved about fifty years ago repeatedly coming back, possibly in ways stranger than fiction, such as head transplants (unlikely)¹⁴ or human brains kept alive outside their bodies (somewhat less unlikely).¹⁵ At what point of intellectual development does AI fairly raise the eternal question of Star Trek: The Next Generation’s android, Data—is Data a “machine” or a “person?” The same question may be asked, much sooner, not just of robots but of disembodied AI.¹⁶

Of course, law and technology intersect in many other ways. For instance, admissibility of scientific evidence, patent eligibility and validity, the limits of discovery in civil litigation—these are all areas where new technologies have consequences. The question for the law of tetrapods is not whether each of these examples, in different areas of law, has the same “law of the tetrapods” answer. They surely will not. Instead, the question is whether looking at the problems and solutions for some technologies can give us some useful insight in analyzing some of the others. English is not Italian, which is not Polish, which is not Farsi, which is not Bengali, but the fact that they are all Indo-European languages may make them a good source for mutual comparisons and insight.

To ask that question, though, is not to answer it. In fact, does looking across similar questions in different areas of new technology help us glean new insights? That was the hope of my “Dogs and Cats” article last year.¹⁷ It is arguably one way to think about the work my colleague Mark Lemley has done with others on different effective


¹⁷. Last year, I published a little article looking at responsibility for creating or owning things that are uncontrollable and whose actions are unpredictable, turning from human neuroscience to robotics to genetically modified organisms—and dogs and cats. Henry T. Greely, Neuroscience, Artificial Intelligence, CRISPR — and Dogs and Cats, 51 U.C. DAVIS L. REV. 2303 (2018).
patent standards for different technologies under the same patent statute. I cannot easily come up with many other examples, although that may be because we do not have a field called “comparative technology law.” It may also be because those efforts will be difficult. They require nontrivial knowledge of not only two areas of technology law (and hence of the underlying technologies) but also of a traditional legal field.

Given the sociology of law schools, most law faculty working on one of the tetrapods will also teach at least one standard introductory law course—either a required course or an unrequired, but widely taken, class like Tax, Evidence, or Criminal Procedure. The problem may be finding someone with knowledge of two law and technology fields. For my University of California, Davis article, I happened to know a lot about law and neuroscience as well as about law and genetics. But even though both of those areas are within the general field of law and the biosciences, not that many scholars pursue both of them. In the section on robots and AI, I was only saved from my profound ignorance by the kindness of others.

To test this possible value of the law of the tetrapods, we could develop a “Journal of Comparative Technology Law.” Or we could host multitechnology conferences that explicitly set up panels to talk about, and compare, the effects of different technologies on an area of law. The excellent conference that gave rise to this symposium had one such panel on privacy, but even that ended up with three speakers on different questions—the Fourth Amendment, DNA searches, and corporate liability for breaches of privacy law—without really engaging (or being asked to engage) in the comparisons across technologies. Listeners, and presenters, might be inspired to try to make those connections on their own; but we should be able to do better, with conferences or projects that expressly aim to compare, say, privacy problems in different technologies, looking for commonalities, differences, and possible approaches to move between fields. Good assessments are likely to take several experts and perhaps a village—or at least a workshop.

20. These “others” are a friend, Professor Ryan Calo; speakers at a workshop at UCLA Law School’s PULSE center held for the purpose of comparing how law was interacting with neuroscience as well as robots and AI; and an excellent research assistant.
III. REGULATION AND REGULATORY STRATEGIES ACROSS THE TECHNOLOGIES

As discussed above, comparing these technology law tetrapods may or may not be a good source of useful insights. But the law of the tetrapods is certain to provide useful insights for a problem we face with all new technologies: How should we regulate them? Specifically, the regulatory approach encompasses at least five questions:

1. Who regulates?21
2. Using what kind of regulatory approach?
3. From what jurisdiction(s)?
4. Based on what knowledge of new developments?
5. From a political perspective, how do we get there from here?22

A. Who Regulates?

So, who regulates a new technology? I see four main possibilities: to find an existing regulatory system that fits it, find an existing regulatory system that it can be squeezed in (with or without statutory changes), create a new regulatory system, or decide that it needs no formal regulatory system.23

Sometimes an innovation will fit easily into an existing mechanism. When commercial aviation moved largely from propeller planes to jets, the Federal Aviation Administration (FAA) did not have to change radically to extend its sway over jets.24 As gene therapies finally began to prove themselves safe and effective, after nearly forty years of work, the Food and Drug Administration (FDA) had little difficulty fitting them into its existing regulatory mechanisms for drugs.

21. Note, this list does not include what might seem the essential first question: Should we regulate at all? That’s because a decision not to regulate is, to me, the same as an affirmative decision about one kind of regulation—(relatively) hands-off. “Nonregulation” is not an alternative to regulation but one form of it.

22. My former Stanford Law School colleague, now California Supreme Court Justice, Mariano-Florentino Cellar, has proposed—at least in one Stanford course—a different set of four questions. What are the reasons to regulate? What are the mechanisms (norms, common law, statutes, agencies)? To what use will the mechanisms be put (rules vs. standards)? And what are the institutional considerations (precedent, agency capacity, political economy, etc.)?

23. Of course, one might view the absence of a regulatory agency, with whatever “regulation” happens being implemented by, say, civil suits in court, as choosing an existing “regulatory nonagency.”

and biological products. The creation of new investment instruments has added to the workload of the Securities and Exchange Commission (SEC), to be sure, but financial innovation has not yet required the creation of a new agency.

Sometimes, though, a new technology can fit into an old agency only with a lot of greasing, pushing, and even hammering. The FAA has not faced much of a hurdle in asserting that its statutory jurisdiction includes drones, but, for it and agencies in other countries, figuring out how to regulate millions of drones effectively for safety and privacy has proven difficult. The FDA has asserted its power to regulate human reproductive cloning, mitochondrial transfer, and human germline genomic editing by calling the modified human embryos “drugs” or “biological products,” but this is probably not what Congress had in mind in the 1938 Federal Food, Drug, and Cosmetics Act or the 1944 Public Health Service Amendments.

And sometimes nothing fits, even with a lot of grease. This happens when no existing agency or body has either plausible jurisdiction or expertise to regulate the new area. For example, Ryan


Calo has argued for a Federal Robotics Commission.29 In the 1910s and 1920s, there were no agencies available to deal with the new aviation or broadcast technologies. The precursors of the Federal Communications Commission (FCC)30 and the Federal Aviation Administration (FAA)31 had to be created, with some fits and starts. The Atomic Energy Commission (AEC) was created in 1946, largely for weapons development, but when civilian atomic energy was contemplated, Congress passed new legislation in 1954 to allow the AEC to govern commercial reactors—an industry that began with the Shippingport, Pennsylvania, reactor in 1957.32

If no specific agency regulates an area, as with robots or autonomous vehicles or AI or virtual reality or computer games, the courts and administrative agencies around the edges step in through existing common-law and statutory authorities—tort, contract, and maybe property law for the courts; false advertising statutes, for example, for administrative agencies like the Federal Trade Commission. Nothing is not regulated, even when some technologies are not regulated by dedicated agencies. The decision to avoid a dedicated agency is not just a decision against one kind of (expert) regulation, it is one in favor of another, more general, kind.

B. With What Style of Regulation?

The answer to “who regulates” may or may not fix the next important question: How to regulate? The United States uses a number of different approaches and myriad combinations of approaches.


31. The FAA dates its own history to 1926 when its (early) powers were given to the Commerce Department, although it went through various forms and names before becoming the Federal Aviation Agency in 1958, assigned to the newly created Department of Transportation and renamed the “Federal Aviation Administration” in 1967. See A Brief History of the FAA, supra note 24.

Sometimes an agency uses only one approach, but often an agency has different approaches in different contexts. Consider the following four approaches:

1. Requiring approval before marketing is allowed
2. Requiring advance notification of entering a market (usually with provisions for postmarket entry monitoring and the power of the agency to order the product or service withdrawn)
3. Authorizing the agency to order the product or service withdrawn from the market
4. Imposing postmarketing civil liability only

Ironically, my list excludes the most common and important kind of regulation from when I was a law student from 1974 to 1977. The “regulated industry” courses and casebooks of that day, and before, looked at industries like electricity, natural gas, water, railroads, aviation, trucking, and others—fields with entry and exit regulation and cost-based price controls. This model hasn’t entirely disappeared but is increasingly rare.

The FDA alone uses the first three mechanisms in different ways. Drugs, medical devices, biological products, and food and color additives are all (more or less) regulated using the first approach. These products cannot be marketed unless the FDA has approved (or, in some cases, “cleared”) them as at least “safe” and, in most of those cases, as “safe and effective.” This can be a multibillion-dollar expense for drugs or therapeutic biological products but is much less for most devices, food additives, or color additives. The FDA is not the only agency using this kind of regulation. A commercial jetliner cannot be sold or used in the United States without FAA approval. A car or truck cannot be sold without first proving to the federal (and in some cases, state) government that it complies with various environmental and safety requirements.

The FDA also uses the second approach. Sellers of dietary supplements do not have to prove that they are either safe or effective; they only have to provide some (albeit very weak) evidence that someone, somewhere, thought they might be effective, and they have to tell the FDA what they are making and where. The FDA has the power

to monitor their manufacturing plants to make sure they are complying with “good manufacturing practices.”

It also has the power to go to court to get a supplement withdrawn as unsafe.

The latter step is neither cheap nor easy for the FDA. For example, almost all makers of a supplement called ephedrine, a relative of amphetamines, agreed voluntarily to withdraw it from the market after some high-profile problems, including the death of Steve Bechler, a Baltimore Orioles pitcher. But not all did, so the FDA issued a final rule in April 2004 banning sales of the substance. One manufacturer objected and sued, winning in the district court but losing on appeal.

From the promulgation of the final rule banning ephedrine to the denial of review by the Supreme Court, the process took over three years of FDA time, budget, staff, and energy.

Yet another approach is to give a regulator the power to seize a product or order a recall. The FDA has that kind of authority over “facilities that manufacture, process, pack, or hold food that is intended for human or animal consumption in the United States,” except for retail establishments (e.g., grocery stores and restaurants) and farmers markets. Covered facilities must register with the FDA before they open, but they are not required to notify the FDA if they are producing a new product, such as a new flavor of Cheetos. Should the FDA—often through the efforts of the Centers for Disease Prevention and


Control—conclude that the product is hazardous, it can order the manufacturer to recall them, with judicial review as a possibility.\textsuperscript{42}

On the other hand, if you want to introduce a new computer game or program to the consumer or commercial market, you need no approval. A new version of Windows or iOS, or of Word or Excel, with a bad “bug” could cause massive harm around the world. But it is regulated only by private law sanctions. These include contract, product liability, or tort sanctions, although the firms’ liabilities will usually be limited by contracts, written by the firms for the firms, and typically requiring arbitration, not litigation. The common law, too, is a form of regulation—just perhaps a weaker one.

Another “regulatory” option could eschew any governmental involvement. Social and cultural norms, customs, or practices might be effective “regulators” even with no government enforcement. This method may well work better in small and homogenous communities; powerful, universally shared norms seem, for better or for worse, unlikely to succeed in the modern United States.\textsuperscript{43}

C. From What Jurisdiction(s)?

If we do choose to have a new regulatory regime for a new technology, as opposed to letting the existing civil law sanctions control, we will have to decide which jurisdiction will regulate. In the United States, that often comes down to a question of state versus federal governance. Before the New Deal, this would have been seen as a matter of the limits of the federal government’s powers under the Constitution. Federal regulatory authority was largely limited to interstate and international commerce, which mainly meant some steamboats, railroads, and eventually airplanes.\textsuperscript{44} The New Deal revolution, and the Supreme Court’s eventual acquiescence in it, greatly expanded the reach of the interstate commerce clause, so that ultimately a subsistence farmer could be reached by the federal government because his homegrown and home-used wheat displaced potential sales in interstate commerce.\textsuperscript{45}

\begin{itemize}
\item \textsuperscript{42} See U.S. Food & Drug Admin., Questions and Answers Regarding Mandatory Food Recalls: Guidance for Industry and FDA Staff (2018); Todd Garvey, Cong. Research Serv., R41546, A Brief Overview of Rulemaking and Judicial Review 13 (2017).
\item \textsuperscript{44} Lawrence M. Friedman & Grant M. Hayden, American Law: An Introduction 130 (Oxford Univ. Press 3rd ed. 2017).
\end{itemize}
In our era of greatly reduced constitutional limitations, how should we decide between state and federal regulation? On the side of state jurisdiction is the idea of states as, in Justice Brandeis’s famous concept, the laboratories of democracy.\textsuperscript{46}

This approach does have some problems.\textsuperscript{47} One is that industries can exploit state differences in a so-called race to the bottom.\textsuperscript{48} To attract businesses, jobs, and tax revenues, states will ease regulatory requirements to make firms happy. This is not just an industry issue—in the twentieth century, Nevada won the “race to the bottom” in divorce requirements.\textsuperscript{49} Arguably, this kind of a race to the bottom might be easier to create in a state-based regulatory system rather than a federal system, because one or a small number of firms might be able to exercise a stronger influence over the state legislature and the governor than over the whole country. Protecting against this kind of capture by diluting the power of interest groups through the sheer size and diversity of the Union was one of the arguments Madison used in \textit{The Federalist No. 10} in favor of a broader federation.\textsuperscript{50}

But another problem with action at the state level is efficiency. The proliferation of differing state-level regulations could cause chaos at a national scale. Fifty states with fifty different requirements for,

\begin{footnotes}
\item[46.] New State Ice Co. v. Liebmann, 285 U.S. 262, 311 (1932).
\item[47.] Another term for laboratories of democracy, with less happy connotations, is Mao Tse Tung’s short-lived injunction to “let a hundred flowers bloom.” See, e.g., Gilbert King, \textit{The Silence that Preceded China’s Great Leap into Famine}, SMITHSONIAN.COM (Sept. 26, 2012), https://www.smithsonianmag.com/history/the-silence-that-preceded-chinas-great-leap-into-famine-51898077/ [https://perma.cc/LA8T-9P2F].
\item[48.] The term seems to come from Justice Brandeis just a year after his praise of federalism in his “laboratories of democracy” quotation. In his dissent from a majority opinion finding a Florida statute limiting chain stores a violation of the due process clause, he wrote:

\begin{quote}
The removal by the leading industrial states of the limitations upon the size and powers of business corporations appears to have been due, not to their conviction that maintenance of the restrictions was undesirable in itself, but to the conviction that it was futile to insist upon them; because local restriction would be circumvented by foreign incorporation. Indeed, local restriction seemed worse than futile. Lesser States, eager for the revenue derived from the traffic in charters, had removed safeguards from their own incorporation laws. Companies were early formed to provide charters for corporations in states where the cost was lowest and the laws least restrictive. The states joined in advertising their wares. The race was one not of diligence but of laxity. Incorporation under such laws was possible; and the great industrial States yielded in order not to lose wholly the prospect of the revenue and the control incident to domestic incorporation.
\end{quote}

\item[50.] \textit{The Federalist No. 10} (James Madison).
\end{footnotes}
say, refrigerator energy-saving provisions, mandatory employee benefits, or compulsory labels for genetically modified organisms would be extremely inconvenient for manufacturers or employers and, in the long run, for consumers and employees. So, in each of the three examples listed above, federal legislation preempts inconsistent state laws, allowing industries to meet one uniform standard throughout the country.51

What works best between state and federal power is a complicated and difficult question. It takes on another harder dimension when regulation needs to transcend national borders. Uniform and effective international regulation is hard to achieve. International agreements are difficult to negotiate and, even if negotiated, may well move to the least common denominator, in either power or in specificity. A vague international requirement may well, in effect, be no requirement at all. And even if the parties have beaten the odds by carefully negotiating strong language, national enforcement of that treaty language may be hard, because some countries will have weak regulatory structures, or will be particularly susceptible to corruption, or will see sub-rosa violation of the international norm as in their best interest.

Some new technologies are likely to push this problem to an extreme—especially technologies that have the potential to spread everywhere in the world. We already see this with the internet where various national laws on, say, depicting Nazi regalia,52 or providing a “right to be forgotten,”53 or even China’s efforts at preventing “antisocial” messages through its Great Firewall54 are proving hard to enforce.

Now think about the potential global reach of new reproductive technologies (banned in one country, but available through reproductive tourism elsewhere),55 gene drive mosquitos (which will neither see nor heed national boundaries),56 or one nation’s effort to

52. See Yahoo!, Inc. v. La Ligue Contre Le Racisme, 433 F.3d 1199, 1202 (9th Cir. 2006).
53. See Garcia v. Google, Inc., 786 F.3d 733, 745 (9th Cir. 2015).
55. See I. GLENN COHEN, PATIENTS WITH PASSPORTS: MEDICAL TOURISM, LAW, AND ETHICS 388 (2014).
push back global warming by injecting sulfate particles into the upper atmosphere.\textsuperscript{57} How can we deal with those?

One offbeat option to consider is nongovernmental guidelines, or a mix of governmental and nongovernmental solutions. Professional organizations might be able to take a lead. Human subjects research has highly similar regulation across most of the world thanks, in large part, to the international Declaration of Helsinki, first adopted in 1964 and from time to time amended by the nongovernmental World Medical Association.\textsuperscript{58} Similarly, human embryonic stem cell research is almost universally governed by the US National Academy of Sciences' completely voluntary 2005 Guidelines for Human Embryonic Stem Cell Research.\textsuperscript{59} These guidelines, subsequently adopted with only minor modifications by the (voluntary) scientific organization, the International Society for Stem Cell Research, are followed almost everywhere in spite of being legally required almost nowhere.\textsuperscript{60}

\textit{D. Based on What Knowledge?}

Regulatory schemes for new technologies face another problem: no one really knows what’s going on. Few people understand how the new technology works, and no one can be confident they know how, or even whether, it will end up being used. This is a problem for setting up a regulatory regime, and it continues to be a problem for running one. Even finding out how widely a technology has been adopted can be a problem—much less understanding its risks and benefits.

Limited sources of information exacerbate this problem. Often information will come mostly from people involved in the technology day to day, and these people will usually be genuinely enthusiastic, as early adopters often are, as well as financially interested in its success. Their glasses are rose-tinted. The views of extreme optimists will be balanced by those of extreme pessimists who are afraid a technology will cause the destruction of the earth, the end of humanity, or at least the fall of civilization as we know it. From in vitro fertilization to video

\textsuperscript{57} See Oliver Morton, \textit{The Planet Remade: How Geoengineering Could Change the World} 149, 366 (2015) (discussing the release of sulfate particles as a form of geoengineering and how the use of geoengineering could lead to international conflicts).


\textsuperscript{60} Id. at 47-49.
games to genetically modified food to AI, the concerns of extreme pessimists have been loud, whether or not any information supports them. In many cases, the new technologies will face established rival technologies with their own entrenched interests in slowing or preventing the rise of the new approach. These interests will be wearing glasses that are dark—very dark.

So without an existing infrastructure to acquire good data and with those interested in the new technology possibly distributed at the extremes of an optimism-pessimism spectrum, how does one decide how to regulate appropriately? Care must be taken at all stages to avoid an irrational or just plain unworkable result. The problem may be as much in the regulation leaping ahead of the science as falling behind. For example, when the birth of Dolly the sheep was announced in February 1997, the world (or at least the headline writers) seemed to jump immediately to dystopias of armies of cloned warrior slaves (humans, not sheep). The British, however, quickly (and smugly) announced that they had already foreseen the problem and solved it. In their 1990 regulations implementing the Human Fertilisation and Embryology Act, they had a section banning human cloning. The problem was that their ban only specifically addressed one possible cloning technology—one that was not used to create Dolly. Getting too far out ahead of new technologies can be a game of whack-a-mole that wastes policy makers’ time and energy and—more importantly—exhausts any members of the public who want to be engaged.

E. And How Do You Get There from Here?

The last problem is, to me, in many ways the most interesting. Let’s assume that you have devised a good regulatory scheme for a new technology. How do you get it adopted, especially in the light of ignorance (some genuine and some feigned) and entrenched interests?

Sometimes it is relatively easy. For some of the new biomedical technologies, the FDA has clear or plausible jurisdiction and a great deal of experience in how to proceed. It may merely need to be given time and space to figure out an approach without premature interference from Congress. It is currently grappling with problems on

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62. Human Fertilisation and Embryology Act 1990, c. 37, § 3(3)(d) (Eng.).
the edges of its jurisdiction from new technologies, from the use of artificial intelligence in health care to various kinds of wellness apps.\textsuperscript{64}

Other times, it is harder. When the first genetically modified crops approached the market in the mid-1980s, the seed firms involved wanted to be able to sell them but also wanted some government blessing. Several agencies had some plausible connection to some of the uses of these crops, from the Environmental Protection Agency’s control over pesticides under the wonderfully named “Federal Insecticide, Fungicide, and Rodenticide Act” (FIFRA) to the US Department of Agriculture’s Animal and Plant Health Inspection Service (APHIS) to the FDA’s regulation of food additives.\textsuperscript{65} The Reagan administration adopted the Coordinated Framework for Regulation of Biotechnology in 1986, later updated in 1992 and 2017, which parcelled out regulatory authority among those agencies based on existing statutory authority and other grounds.\textsuperscript{66} The problem is that none of the statutes involved had been passed in light of genetic modification. Many, like the Federal Food, Drug, and Cosmetic Act of 1938, had been passed before genetic engineering was even conceived.\textsuperscript{67} Thus, the statutes did not fit the problems very well.

They fit well enough, at least for a while, but now have begun to fall apart in light of new genetic modification technologies like Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR).\textsuperscript{68} Why did the Reagan administration not get a new “GM Crops Act” passed in 1986, giving existing agencies clear or well-tailored authority? And why haven’t the Bush, Clinton, Bush, Obama, and Trump administrations, in the subsequent thirty-three years, done so?


\textsuperscript{66} Id. at 70.

\textsuperscript{67} Id. at 27–66.

\textsuperscript{68} Id.
Probably for two reasons. First, the existing scheme worked well enough—and getting a good bill through Congress seemed extremely difficult. The US Congress finds it easy to block new legislation and regulatory actions; getting it to adopt new ones is much, much harder.

One key term from above is “a good bill.” Incumbents may try to stifle a new industry; the first new entrants may try to capture the regulation to protect themselves from subsequent innovation; various environmental, labor, business, or ideological groups may take an interest. Getting any bill passed is hard, especially given the ease of blocking legislation in Congress. Getting a good bill passed is well-nigh impossible.

How does sweeping legislation get passed in Congress? In general, one of two things happen. One way is when stakeholders recognize that an area, like a new technology, has a strong need for new legislation. Aided by influential legislators, the stakeholders work, often for years, to craft a compromise that is sufficiently acceptable to those involved (in light of their individual powers) to get passed. The Genetic Information Nondiscrimination Act, passed in 2008 after thirteen years (and a change in party control of the House of Representatives), is an example of this kind of legislation. Recent patent reforms have also been limited in scope because two of the biggest interest groups, information technologies and biopharma, have not been able to reach agreement on some big areas, which were therefore avoided in the eventual statutes.

The other way is to have a crisis. The USA PATRIOT Act (the world’s worst acronym, “Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001”) was a hurried response to the attacks of September 11, bundling together a host of previously floated ideas, most of which had nothing to do with using hijacked commercial jets as, in effect, cruise missiles. Many of the FDA’s important bills have been responses to crises arising from death and disability from harmful drugs or medical devices. It seems perverse to wish for a disaster in order to get a regulatory scheme; but it would be a mistake not to be prepared with a good regulatory scheme to stick in when disaster strikes and “don’t just stand there, pass something,” becomes the cry on Capitol Hill.

69. Sonia M. Suter, GINA at 10 Years: The Battle Over 'Genetic Information' Continues in Court, 5 J.L. & BIOSCI. 495, 496 (2018).
This issue in particular can benefit from paying attention to history—and not just recent history. New technologies have been prompting new regulatory schemes for most of the history of the United States. The nineteenth century saw the spread of canals as well as the invention and widespread use of steam boats, railroads, telegraphs, telephones, and electricity, among others. The twentieth century saw automobiles, airplanes, radio and television, nuclear energy, and the modern pharmaceutical and biotech industries. The twenty-first century is already seeing the rise of the (earlier invented) internet, genome editing, blockchain, AI, autonomous vehicles, and whatever else. Those past episodes may help teach us what to look forward to, and how to move forward, in the future. *Plus ça change, plus c'est la même chose:* “The more things change, the more they stay the same.”

IV. CONCLUSION

When Frank Easterbrook spoke about “the law of the horse” in 1995, Gerhard Casper had been Stanford’s ninth president for three years. Casper had been my law school colleague (in theory) and next-door neighbor (in reality and in reality). He is still fairly active in Stanford affairs and probably still doesn’t like “the law of the horse.”

In 1995, Easterbrook was an active, and not that new, member of the US Court of Appeals for the Seventh Circuit, having been appointed from the University of Chicago faculty in 1985. He remains an active member (not a “senior judge”) on that court at the age of seventy. I suspect he probably still does not like “the law of the horse” and will not like “the law of the tetrapods.”

However, like Easterbrook, cyberlaw has not retired—it is still around and active. It is the subject of a variety of casebooks, featuring the nouns *cyberlaw, computer law, internet law,* and so forth. It is the subject of many seminars and a few classes, as well as a major subject in many “technology law” (often mainly cyberlaw and patent law) journals. It hasn’t replaced contracts, torts, criminal law, or property as required classes in the first-year law school curriculum, but it is changing those mainstream classes. Click-through consent, courtesy of cyberlaw, is changing contracts. Pokémon Go is changing property law. E-discovery is changing civil procedure (at least in reality, if not in every first-year Civil Procedure course.)

Tetrapods Law? Not yet and, under that name, I am quite confident, never. But a more general “technology law” field, with

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72 He stopped being my next-door neighbor when his successor, John Hennessy, moved into the president’s house in 2000.
courses, journals, scholars, and conferences—and one that doesn’t just take the lazy definition of “technology” as “information technology”? I have hopes, but we will see.