



*Future  
Trends*



'18

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# 2018 Future Trends

## Executive Summary

To help courts think proactively about the future and strategic planning, the National Center for State Courts examined trends and potential disrupters across the spectrum of technology, politics, economics, and social demographics. While this is not intended to be an all-inclusive list, the following five topics are presented for consideration based on their potential to impact or disrupt society and the court community.

## Abstracts

### **Overuse of Antibiotics**

There are looming ramifications for the court system as common diseases become effectively untreatable as current medical practices allow for significant overuse of antibiotics. Russia is currently dealing with an untreatable form of tuberculosis, which can cause short prison sentences to effectively become death sentences.

### **Autonomous Vehicles**

With the inevitability of self-driving cars, state courts need to begin discussing the lost revenue from traditional drivers and how to determine appropriate fines and fees for autonomous vehicles. State courts will also need to discuss changes in workload and the possible creation of a new litigation type involving autonomous vehicles.

### **Talent War**

As Baby Boomers exit the workforce, and members of Gen X move up into vacated positions, the courts are neither attracting nor retaining Millennials in sufficient numbers to support a healthy future workforce. The number and length of court vacancies is rapidly increasing and potentially jeopardizing the court leadership and workforce of the future.

### **Genetic Editing (CRISPR Cas-9)**

CRISPR is making genetic modification more precise and affordable. The legal and ethical implications of CRISPR impact everything from food labeling to genetic information discrimination and privacy laws.

### **Nano Technology and the Internet of Nano Things (IoNT)**

The miniaturization and connected network of materials to a billionth of a meter opens applications in smart materials, molecular medicine, energy harvesting, and artificial intelligence. This also opens a multitude of security and privacy concerns, most of which are not fully understood.

## Table of Contents

Executive Summary .....	1
Abstracts .....	1
Overuse of Antibiotics .....	3
Autonomous Vehicles .....	5
Talent War .....	7
Genetic Editing (CRISPR Cas-9).....	10
Nano Technology and the Internet of Nano Things (IoNT) .....	14

## Overuse of Antibiotics

*There are looming ramifications for the court system as common diseases become effectively untreatable as current medical practices allow for significant overuse of antibiotics. Russia is currently dealing with an untreatable form of tuberculosis, which can cause short prison sentences to effectively become death sentences.*

The World Health Organization (WHO) released the following facts on February 5, 2018.<sup>1</sup>

- Antibiotic overuse and resistance is one of the biggest threats to global health and food security today.
- Antibiotic resistance can affect anyone, of any age, in any country.
- Antibiotic resistance occurs naturally, but overuse of antibiotics is accelerating the process.
- A growing number of infections—such as pneumonia, tuberculosis, gonorrhea, and salmonellosis—are becoming harder to treat as the antibiotics used to treat them become less effective.
- Antibiotic resistance leads to longer hospital stays, higher medical costs, and increased mortality.

The WHO makes it clear that antibiotic resistance is getting exponentially worse, and the public at large is largely oblivious to the risks. The U.S. Center for Disease Control (CDC) released reports and studies that concur with the views expressed by the WHO. They designated November 12-18, 2018 as U.S. Antibiotic Awareness Week.<sup>2</sup> It is an annual one-week observance to raise awareness of the threat of antibiotic resistance and the importance of prescribing and using antibiotics appropriately. This campaign is focused primarily at the medical community but does have a public component.

Antibiotic resistance is a public health problem that will impact the courts. Many people who enter the criminal court system are addicted to alcohol or drugs and are more likely to be infected with diseases like HIV/AIDS. The CDC reports the rate of HIV/AIDS infection among inmates in U.S. jails and prisons is five times greater than that of the general public.<sup>3</sup> That statistic is attributed to that segment of the population who engage in risky behaviors and generally fail to live a healthy lifestyle. It is logical to assume that as the antibiotic-resistance problem begins to manifest itself as difficult-to-treat or untreatable infections, at-risk populations will be affected at a rate greater than the general population.

Antibiotic-resistant diseases are already an epidemic in the prison systems of some countries. This is, in part, caused by the relatively poor health of the inmate population, and exacerbated by cramped or unsanitary living conditions. The tuberculosis outbreak in the Russian prison system

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<sup>1</sup> *Antibiotic Resistance*, World Health Organization, <http://www.who.int/en/news-room/fact-sheets/detail/antibiotic-resistance> (last visited July 13, 2018).

<sup>2</sup> *U.S. Antibiotic Awareness Week*, Centers for Disease Control and Prevention, <https://www.cdc.gov/antibiotic-use/week/index.html> (last visited July 13, 2018).

<sup>3</sup> *HIV Among Incarcerated Populations*, Centers for Disease Control and Prevention, <https://www.cdc.gov/hiv/group/correctional.html> (last visited July 13, 2018).

provides a current case study on the proliferation of antibiotic-resistant diseases in prisons. In the United States, tuberculosis was a significant health threat. However, antibiotics virtually eliminated the disease for the past 50 years in all but the most remote parts of the developing world. However, the disease must be treated with daily medication for a period of six to nine months. If the appropriate protocols are not followed and the medication regimen is interrupted, the disease may return in a form that is resistant to the initial antibiotic. If this process is repeated, eventually a form of the disease will emerge that is resistant to all available antibiotic treatments. This is the situation that Russian and to some extent Chinese prisons have experienced. The situation is so bad that many former Russian inmates have reported that surviving the Russian prison system without contracting a deadly disease is a miracle.<sup>4</sup>

It is likely antibiotic-resistant forms of serious, formerly treatable illnesses will begin to appear in the United States in the next five years, and the vanguard of the problem will be the jail/prison populations. This could have profound impacts on the criminal justice system—and state court systems. The costs associated with housing inmates will increase due to increased health-care costs. It will also affect the way inmates are housed. Currently, most prisons incorporate a “pod” system where 50-100 inmates are housed in close proximity. This allows for direct supervision by one staff member at a central station.<sup>5</sup> The inmates within a given pod are relatively free to move among one another. The proximity of inmates enables antibiotic-resistant diseases to flourish in this environment. Prisons may need to be redesigned to reduce the possibility of the transmission of diseases, which also increases cost.

Judges are human beings and are aware of the collateral consequences of incarceration. If sending a criminal defendant to a correctional institution puts that person at risk of contracting a terminal illness, judges may be less likely to incarcerate individuals. This would likely mean alternative sanctions for criminal convictions would be in much greater demand, and the court would need to cover significant additional costs as these programs expand.

Finally, as antibiotic-resistant diseases become more prevalent in society, the public will consider this in their career choices. Jobs that isolate a person will become preferable. Courts by their very nature require employees to interact with the public, and this may make them a high-risk field of employment. This problem may get so bad that it causes the entire judiciary to reshape its business model to reduce direct human interaction. For additional reading, please see the benchbook prepared by the CCJ/COSCA Pandemic and Emergency Response Task Force, *Preparing for a Pandemic: An Emergency Response Benchbook and Operational Guidebook for State Court Judges and Administrators*.<sup>6</sup>

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<sup>4</sup> A. Sarang, L. Platt, I. Vyshemirskaya & T. Rhode, [Prisons as a Source of Tuberculosis in Russia](#), 12 INT’L J. PRISONER HEALTH 45-56 (2016).

<sup>5</sup> L. Woodruff, [The Evolution of Prison Design and the Rise of the Direct Supervision Model](#), Lexipol (last visited July 13, 2018).

<sup>6</sup> CONFERENCE OF CHIEF JUSTICES PANDEMIC TASK FORCE, [PREPARING FOR A PANDEMIC: AN EMERGENCY RESPONSE BENCHBOOK AND OPERATIONAL GUIDEBOOK FOR STATE COURT JUDGES AND ADMINISTRATORS](#) (2016).

## Autonomous Vehicles

*With the inevitability of self-driving cars, state courts need to begin discussing the lost revenue from traditional drivers and how to determine appropriate fines and fees for autonomous vehicles. State courts will also need to discuss changes in workload and the possible creation of a new litigation type involving autonomous vehicles.*

Nationwide, approximately 53 percent (44.9 million of 84.2 million) of new case filings were traffic matters in 2016.<sup>7</sup> So what will happen when autonomous vehicles—passenger cars and commercial vehicles capable of sensing the driving environment and navigating public roads and highways without the human drivers’ input—become a regular source of highway transportation? Many of our existing vehicles already have more autonomous features than we realize. It is predicted that as autonomous vehicles become more common, we will have fewer traffic accidents, fewer organs for transplants, and fewer traffic cases. The unintended consequences may be positive or negative depending on one’s perspective. The average age of a vehicle on the road in the United States is 11.6 years.<sup>8</sup> So, if only self-driving cars were sold starting tomorrow, it would be more than 11 years before half the fleet was self-driving.

State courts need to begin discussing the lost revenue from traditional drivers and how to determine appropriate fines and fees for autonomous vehicles. From the national conversation surrounding legal financial obligations and their impact on economically disadvantaged people, many states have already begun discussing alternative revenue sources. Arizona’s Task Force on Fair Justice for All began looking at ways to replace lost revenue from traffic cases and fines and fees arising out of them.<sup>9</sup> The task force acknowledged that new safety-equipped cars, self-driving cars, and new law enforcement techniques to control traffic (other than issuing citations) will reduce revenue from traffic cases. The Arizona Criminal Justice Commission agreed to establish a task force to explore these issues and make recommendations for alternative funding sources.

State courts will also need to discuss the change in workload and the possible creation of a new litigation type involving autonomous vehicles or sub-case categories, as well as the assignment of new caseweights for the existing felony, misdemeanor, infraction, civil, and juvenile litigation types.<sup>10</sup> Local courts may want to establish a specialty calendar to hear cases involving autonomous vehicles as these cases arise.

In addition to self-driving cars, the technology for other transportation innovations include flying taxis,<sup>11</sup> solar-powered roads that charge cars,<sup>12</sup> and “overhead pods” that can transport an

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<sup>7</sup> National Center for State Courts, [Court Statistics Project 2016](#).

<sup>8</sup> J. Walsworth, [Average Age of Vehicles on Road Hits 11.6 Years](#), AUTOMOTIVE NEWS (Nov. 22, 2016).

<sup>9</sup> JUSTICE FOR ALL: REPORT AND RECOMMENDATIONS OF THE TASK FORCE ON FAIR JUSTICE FOR ALL: COURT-ORDERED FINES, PENALTIES, FEES, AND PRETRIAL RELEASE POLICIES (2017).

<sup>10</sup> N. Le, *Autonomous Vehicles: Reimagining Traffic Court with Self-Driving Cars*, INSTITUTE FOR COURT MANAGEMENT (2018)(on file with the National Center for State Courts).

<sup>11</sup> B. Hanna, [Flying Taxis Could Be Coming to Texas Test Market by 2020](#), GOV’T. TECH. (Jan. 10, 2018).

<sup>12</sup> K. Leary, [China’s First Solar Highway Is Nearly Complete, May Soon Be Able to Charge Electric Cars](#), FUTURISM (Dec. 22, 2017).

individual without a road.<sup>13</sup> Whether these will become a reality or are just another invention or innovation that drops off the radar remains to be seen, but these changes in transportation technology will affect the courts in terms of numbers of cases and revenue. Cities and counties are already concerned about how they will replace gas taxes as cars become more efficient or move to electric power.<sup>14</sup> AARP reports that currently 94 percent of car accidents are caused by human error.<sup>15</sup> Even slight moves toward greater safety will affect these incidents. Not only will these autonomous vehicles be transporting us, but many claim they will be used to deliver goods. Again, a positive outcome is that a person could have medication delivered even when unable to leave the house. Negative outcomes may be lost jobs for taxi and truck drivers, which will affect tax revenue.<sup>16</sup>

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<sup>13</sup> C. Powers-Smith, [Company Pitches Overhead Pods to Massachusetts City as a Replacement for Cars](#), GOV'T. TECH. (Feb. 12, 2018).

<sup>14</sup> D. Vock, [With Gas Taxes in Peril, More States Study Alternatives](#), GOVERNING (Jan. 16, 2018).

<sup>15</sup> M. Saltzman, [Self-Driving Cars: Are We There Yet?](#), AARP (Feb. 7, 2018).

<sup>16</sup> G. Muthara, [New Driverless Vehicle May Soon Deliver Your Goods](#), AARP (Jan. 30, 2018).

## Talent War

*As Baby Boomers exit the workforce, and members of Gen X move up into vacated positions, the courts are neither attracting nor retaining Millennials in sufficient numbers to support a healthy future workforce. The number and length of court vacancies is rapidly increasing and potentially jeopardizing the court leadership and workforce of the future.*

The Great Recession held back the retirement dreams for many Baby Boomers and kept them in the workforce longer than many anticipated. But as the economy improves and retirement accounts recover, the dam holding Boomers in the workforce is ready to break. Who will replace them?

The court community is neither attracting nor retaining Millennials in proportional numbers to fill immediate job vacancies. Millennials, those born between 1980 and 1997, are not working in the courts in sufficient numbers to fill these vacancies. As Baby Boomers retire, they are replaced by Gen X workers (born between 1965-1980), but as the Gen X workers fill upward vacancies, there are not enough Millennials choosing to work or continuing to work within the court community to meet the lower-level vacancy demands. Without an appropriate representation of Millennials in lower- and mid-level positions, the courts will be hard-pressed to develop the court administration leaders of the future.

The table below compares the demographics working within the court community to the overall labor market.<sup>17</sup> Based on the methodology used to collect this data, it is plausible these data are skewed and falsely reflect an older court community than exists. However, this may be the best existing age data.

<b>Generations</b>	<b>% of working population as of 2015</b>	<b>% working in the courts as determined by Kiefer &amp; Knox (Winter 2017)</b>	<b>% working in the courts as determined by Kiefer &amp; Knox (Winter 2018)</b>
Boomers (1946-1964)	28.9	56	49
Gen X (1965-1980)	34.1	31	36
Millennials (1981-1997)	34.6	11	12

To measure the validity of the above data, we compared it to the 2016-2017 NCSC workforce age data. While the percentages differ slightly, the shape of the data is similar. The slightly higher representation of millennials (17 percent) could be attributed to NCSC's proximity to the William & Mary Law School and opportunities for interns. With that said, the NCSC Millennial representation is still half of the national workforce average of 34 percent.

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<sup>17</sup> P. Kiefer & P.Knox , *Future of the Courts*, Unpublished Survey Data (Feb. 2018)

## NCSC Demographics by Birth Year

Boomers (1946-1964)	48.3%
Gen X (1965-1980)	25.8%
Millennials (1981-1997)	17.2%

The data reflect a court community that is significantly older than national workforce demographics. This brings up several questions:

1. Why are Millennials not attracted to or retained within the courts?
2. Who is going to do the lower- and mid-level work in the future?
3. Can the court community compete in the war for talent?

The recovered economy also means the fight for top talent will be won by organizations who prepare to attract and retain the best and brightest by creating an organizational focus around:

- A compelling vision of the future
- Strong work/life balance
- High tolerance for change
- Trial-and-error approach to problem solving and change
- High level of technology integration
- Opportunities for growth and professional development
- Contribution to something greater than themselves

Demet, Lund, and Schninger (2016) echo the idea of intentionality: “Executives should carefully reassess the well-being of their organizations and, in many cases, adjust their leadership styles for the new context.”<sup>18</sup>

A more specific example of the challenge of attracting and retaining the necessary talent is provided by Judge Kelly Ryan, chief judge of Johnson County, Kansas.<sup>19</sup> During testimony to the Kansas legislature in 2018, Judge Ryan highlighted the following points:

1. In 2014 there were 245 applications for vacant court clerk/court officer positions. In 2017 there was the same number of vacancies, but only 35 applications. In 2016 and 2017 the average number of applicants per vacancy was only about 3.
2. The applicant pool was so poor they had to screen for basic typing skills. The applicants could use their thumbs to text but could not type.
3. Based on Web hits, the number of people looking at online ad postings went up, but applications went down.
4. Younger workers stay in the court system for a short time. The courts were once a career path; now they are a stepping stone.

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<sup>18</sup> A. De Smet, S. Lund & W. Schaninger, *Organizing for the Future*, MCKINSEY Q. (Jan. 2016).

<sup>19</sup> K. Ryan, [Testimony to the Kansas State Legislature Ways and Means Subcommittee on Social Services](#) (Feb. 13, 2018).

5. Pay for entry positions in the court are below the poverty level and hard to recruit. Average time to fill positions grows each year.
  - a. 2015 = 43 days
  - b. 2016 = 53 days
  - c. 2017 = 68 days (58 percent increase in two years)

The information does not paint a bright picture and compels the courts to ask some difficult questions:

1. Are the courts providing what attracts and retains Millennials?
2. Are the courts prepared for the current war for talent?
3. What is the impact if they fail to attract and retain an adequate future workforce?

## Genetic Editing (CRISPR Cas-9)

*CRISPR is making genetic modification more precise and affordable. The legal and ethical implications of CRISPR impact everything from food labeling to genetic information discrimination and privacy laws.*

CRISPR is a family of DNA sequences found in the immune systems of numerous bacteria. Bacteria are constantly being attacked by viruses and other organisms, and when a bacterium neutralizes a threat, it stores some of the defeated organism's genetic material so that when a similar organism threatens the bacterium in the future, it can identify those threats based on the genetic material it has stored from previous encounters.

Once identified, the bacteria and its CRISPR-associated proteins split open the DNA of the threatening organism and remove the genetic material that makes it a threat. Basically, CRISPR looks for a target, which it identifies by looking at a cell's genetic code (its RNA), and then splits out the threatening piece of the cell's genetic code to neutralize it.

*What Does CRISPR Cas-9 Stand For?*

- CRISPR
  - Clustered
  - Regularly
  - Interspaced
  - Short
  - Palindromic
  - Repeats
- Cas-9
  - CRISPR
  - associated protein
  - 9—the protein that edits DNA (Cas-13 edits RNA)

*So Why Is this Useful?*

In 2012 scientists discovered that CRISPR will target any genetic material (any RNA) it has been fed as a target, not just a virus or another organically occurring threat to bacteria. In other words, scientists can create an artificial target of genetic material for a CRISPR-associated protein, which means that it can cut out (or splice in) any gene desired. The CRISPR process is much more precise than previous genetic modification, as well as much cheaper and much simpler. Genetic modification, which would have formerly cost thousands of dollars and taken scientists several weeks to complete, can now be done for under one hundred dollars in a matter of hours by a graduate student.

Having the ability to easily edit genetic material with CRISPR opens up a myriad of scientific possibilities. Right now, CRISPR is primarily used for genetic function mapping. In this process, scientists remove certain sections of DNA (down to an individual gene) and then observe the result to see what function or trait is affected. This process will likely greatly enhance our understanding

of the human genome and allow us to more fully understand what genes cause individual traits.<sup>20</sup> Scientists are in the early stages of using CRISPR to edit crops and to make them more nutritious, to remove allergens, and to improve their hardiness.<sup>21</sup> Researchers are also currently looking into ways that CRISPR might be harnessed to create more effective antibiotics and antivirals.

Other potential uses for CRISPR technology, which are still several years away from being viable on a widespread level, include finding a way to stop genetic diseases by altering the genes that cause them,<sup>22</sup> such as Huntington's disease and sickle-cell anemia.<sup>23</sup> As of 2018, many of these efforts are currently in early laboratory stages, but researchers in both the United States and China are seeking to begin CRISPR-centric clinical trials in 2018.<sup>24</sup> It may even be possible to alter the DNA of entire species by removing certain traits from animals and then using gene drive to spread that trait more quickly throughout populations of that species.<sup>25</sup> (Think: Removing the ability of mosquitoes to spread malaria.) However, scientists are still debating the ethics and researching the possible consequences of changing species like this. CRISPR may also eventually be combined with artificial intelligence to make it even more accurate. Microsoft is already testing the possibilities of this combination with two tools: Elevation and Azimuth.<sup>26</sup>

### *What Are the Roadblocks to Use of this Technology?*

The biggest potential roadblock for the widespread use of CRISPR is that the targeting technology of CRISPR is not perfect, and, occasionally, it will alter or cut DNA outside of the intended scope.<sup>27</sup> Scientists are currently working on ways to improve the accuracy of CRISPR, as well as ways to circumvent the problem by changing how the process works<sup>28</sup> or by editing other genetic material.<sup>29</sup> The pre-print version of a recent academic paper also suggests that some humans may have developed an immunity to CRISPR functionality, as CRISPR is derived from bacteria, some of which infect humans. As a result, the immune systems of some people may have encountered the bacteria before and developed a resistance to the proteins at the center of the functionality of CRISPR.<sup>30</sup> Finally, there are significant ethical considerations that come along with altering genetic material.<sup>31</sup>

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<sup>20</sup> H. Ledford, [CRISPR: Gene Editing Is Just the Beginning](#), NATURE INT'L. WKLY. J. SCI. (Mar. 7, 2016).

<sup>21</sup> A. Peters, [CRISPR Is Going to Revolutionize Our Food System-and Start a New War over GMOs](#), FAST COMPANY NEWSL.(Mar. 15, 2016).

<sup>22</sup> H. Ma et al., [Correction of a Pathogenic Gene Mutation in Human Embryos](#), 548 NATURE INT'L. J. SCI. (Aug. 24, 2017).

<sup>23</sup> N. Swaminathan, [Blood Diseases Could Show CRISPR's Potential as Therapy](#), WIRED (Nov. 28, 2016).

<sup>24</sup> E. Mullin, [CRISPR in 2018: Coming to a Human Near You](#), MIT TECH. REV. (Dec. 18, 2017).

<sup>25</sup> B. Plumer, ["Gene Drive." Learn the Term. Because It Could One Day Transform the World](#), VOX (June 12, 2016).

<sup>26</sup> J. Roach, [Researchers Use AI to Improve Accuracy of Gene Editing with CRISPR](#), AI BLOG (Jan. 10, 2018).

<sup>27</sup> S. Begley, [Do CRISPR Enthusiasts Have Their Head in the Sand about the Safety of Gene Editing?](#), STAT NEWS (July 18, 2016).

<sup>28</sup> N. M. Gaudelli et al., [Programmable Base Editing of A-T to G-C in Genomic DNA without DNA Cleavage](#), NATURE INT'L. J. SCI. (Oct. 25, 2017).

<sup>29</sup> D. B. T. Cox et al., [RNA Editing with CRISPR-Cas 13](#), 358 SCI. (Nov. 24, 2017).

<sup>30</sup> S. Zhang, [You May Already Be Immune to CRISPR](#), ATLANTIC (Jan. 9, 2018).

<sup>31</sup> [What Are the Ethical Concern about Genome Editing?](#), National Human Genome Research Institute: Genome Editing (last visited July 13, 2018).

## *How Might CRISPR Interact with the Law?*

With a wide array of potential medical, industrial, and technological uses, there are many points at which CRISPR may interact with the law. The first intersection may occur with the Genetic Information Nondiscrimination Act of 2008 (or GINA).<sup>32</sup> This law prohibits discrimination of individuals based on genetic information in the fields of employment or health insurance. As genetic therapy becomes more common, the availability of genetic information may become more common, and thus the potential to misuse it may increase. GINA is a federal law, but many states also have their own genetic privacy laws, too.<sup>33</sup>

Second, although there is a litany of evidence to suggest that genetically modified foods are no more dangerous to consume than organically grown foods,<sup>34</sup> there are some nationwide requirements for labeling genetically modified food,<sup>35</sup> and some localities in the United States have even banned genetically modified food altogether.<sup>36</sup> Using CRISPR on food sources certainly falls under the broad category of genetic engineering, but there is some question about whether the technology falls under the reporting requirements of the existing standards.

Many debates about genetic diseases and genetic editing carry with them a strong set of ethical and moral considerations, which receive a high degree of public scrutiny. For example, the state of Ohio recently passed a bill to ban abortion in cases where the fetus has been diagnosed with Down's Syndrome (though the bill was ruled to be unconstitutional before it could take effect).<sup>37</sup> CRISPR also theoretically makes the concept of "designer babies" possible,<sup>38</sup> though there seems to be a consensus in the scientific community that genetic modification should focus on preventing disease and disability.<sup>39</sup> Whenever genetic editing of embryos becomes possible, however, there will likely be many policy debates and many new laws (and likely litigation over that legislation) governing the scope of the technology.

Finally, many in the intelligence community think that genetic editing has the potential to become a biological weapon threat. Former Director of National Intelligence James Clapper put genetic editing onto a list of potential "weapons of mass destruction and proliferation" in 2016.<sup>40</sup> The Pentagon and other government agencies have been studying the potential to create biological weapons by CRISPR and other genetic modification tools for years.<sup>41</sup> As the technology proliferates and becomes cheaper,<sup>42</sup> the potential for misuse on a scale that would require a legal

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<sup>32</sup> Pub. L. 110-233, 122 Stat. 881.

<sup>33</sup> [State Genetic Summary Table on Privacy Laws](#), National Conference of State Legislatures (last visited July 13, 2018).

<sup>34</sup> B. Plumer, [5 Big Takeaways from the Most Thorough Review of GMOs Yet](#), VOX (May 18, 2016).

<sup>35</sup> [Labeling of Foods Derived from Genetically Engineered Plants](#), U.S. Food and Drug Administration (last visited July 13, 2018); for context, see D. Charles, [Congress Just Passed a GMO Labeling Bill. Nobody's Super Happy About It](#), NATIONAL PUBLIC RADIO (July 14, 2016).

<sup>36</sup> E. Lau & M. Lee, [California County Breaks Ground with Biotech Ban](#), DAILY HERALD (Mar. 8, 2004).

<sup>37</sup> L. del Valle, [Ohio Judge Blocks Legislation Preventing Abortions in Down Syndrome Cases](#), CNN (Mar. 14, 2018).

<sup>38</sup> A. Salkever, [When Baby Genes Are for Sale, the Rich Will Pay](#), FORTUNE (Oct. 23, 2017).

<sup>39</sup> [News Release](#), National Academies of Sciences Engineering Medicine (Feb. 14, 2017).

<sup>40</sup> A. Regalado, [Top U.S. Intelligence Official Calls Gene Editing a WMD Threat](#), MIT TECH. REV. (Feb. 9, 2016).

<sup>41</sup> E. Niiler, [The Pentagon Ponders the Threat of Synthetic Bioweapons](#), WIRED (July 10, 2017).

<sup>42</sup> A. Tarantola, [I Played God with the Odin's DIY CRISPR Kit](#), ENGADGET (June 30, 2016).

response also increases. CRISPR technology shows great potential for improving quality of life for many people, from making better food and drugs to possibly curing genetic diseases, but it also opens many uncertain rabbit holes of technology and will likely spur both passionate policy debates and related litigation.

## Nano Technology and the Internet of Nano Things (IoNT)

*The miniaturization and connected network of materials to a billionth of a meter opens applications in smart materials, molecular medicine, energy harvesting, and artificial intelligence. This also opens a multitude of security and privacy concerns, most of which are not fully understood.*

Technology is now ready to be implemented in humans for a wide range of uses: security access, payments, biometric tracking, health monitoring, and things we have not yet thought of. For example, microchips are already being implanted, voluntarily, in many employees for convenience, entry access, opening doors, unlocking and starting cars, and charging to company vending.<sup>43</sup>

But we are just scratching at the surface of what this technology can do for convenience.<sup>44</sup> For example, microchips could:

- Replace the corporate ID
- Replace keys, wallets, or the need to remember passwords
- Track vitals in athletes
- Store health records and emergency information
- Track work flow
- Connect to financial accounts to pay at market or gas pump

What are the pros and cons of embedded microchip technology?

<b>Pros</b>	<b>Cons</b>
Unpowered and do not transmit further than 12 inches	Cannot be turned off or left behind like other card chips
Less trackable than the cell phone we all carry and not much different from corporate access key cards already used by many companies	Currently chips are not regulated or controlled
Compatible with MRI machines and do not set off airport detectors	
Can be reprogrammed while implanted	Susceptible to malware
Reduce hacking risk, by requiring second factor such as iris or finger print scan with RFID	
Privacy issues are no different from those already present from credit cards and cell phones; not a huge leap from having the tech in our pockets to under our skin	Can be cloned

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<sup>43</sup> Y. Grauer, [A Practical Guide to Microchip Implants](#), ARS TECHNICA (Jan. 3, 2018).

<sup>44</sup> *Id.*

RFID already used in inventory control, shipping, baggage handling	Limited upside beyond access convenience
Easy to embed; like a piercing (size of grain of rice)	
Useful military health information	
Minimal risk of loss	Hard to replace if access needs change

It is estimated that 50,000–100,000 people already have chips, but this number is likely to grow exponentially.<sup>45</sup>

*The Next Step: The Internet of Things and the Internet of Nano Things (IoT, IoNT)*

The Internet of Things (IoT) is an array of inexpensive microsensors and microprocessors with tiny power supplies and wireless antennas that allow ordinarily inanimate objects to interact/communicate with each other via the Internet.<sup>46</sup> Thermostats, door locks, and embedded pet trackers make up the IoT. New IoT devices are announced almost daily, and analysts predict there will be 30 billion devices online by 2020.<sup>47</sup> These range from the smart house that unlocks the front door when a security camera recognizes the home owner via facial recognition to an implanted glucose monitor that not only automatically adjusts insulin levels, but automatically alerts care givers if blood sugar reaches a dangerous level.<sup>48</sup>

The real breakthrough is the oncoming Internet of Nano Things (IoNT), where sensors miniaturized to millimeters, microns, and nano-scales can circulate within living bodies or be incorporated into the molecular fabric of materials.<sup>49</sup> Nano technology is the science of working with particles that are one billionth of a meter. This is the dawn of smart materials and true molecular medicine and impacts everything from the military to electronics, cosmetics, medicine, and genetics.<sup>50</sup>

This also raises significant challenges in privacy, safety, and security. For example, nano-sensors introduced into the body, deliberately or inadvertently, could provoke immune reactions or be used to transmit surveillance information.<sup>51</sup> Think about the human eye and ear being used as a camera and microphone to transmit information without the use of any wearable device.

Intrabody nano-networks could be used for remote health care and even DNA-level alterations to treat or even prevent disease. The interconnected nano-office would could keep track of the location, use, and status of all belongings in an integrated and effortless way. When embedded in

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<sup>45</sup> *Id.*

<sup>46</sup> A. Nayyar, V., Puri, & D-N. Le, *Internet of Nano Things (IoNT): Next Evolutionary Step in Nanotechnology*, 7 NANOSCIENCE & NANOTECHNOLOGY 4-8 (2017).

<sup>47</sup> J. Garcia-Martinez, *The Internet of Things Goes Nano*, SCI. AM. (June 23, 2016).

<sup>48</sup> I. Akylidiz & J. M. Jornet, *The Internet of Nano-Things*, IEEE WIRELESS COMM. (Dec. 2010).

<sup>49</sup> G. MARX, 21 TRENDS FOR THE 21ST CENTURY: OUT OF THE TRENCHES AND INTO THE FUTURE (Education Week Press 2014).

<sup>50</sup> *Id.*

<sup>51</sup> Garcia-Martinez, *supra* note 46.

materials, nano-sensors could not only monitor vibrational, mechanical, and EM energy, but also harvest it from the environment as an ultra-low power sensor.<sup>52</sup>

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<sup>52</sup> Akyildiz & Jornet, *supra* note 47.

# Future Trends

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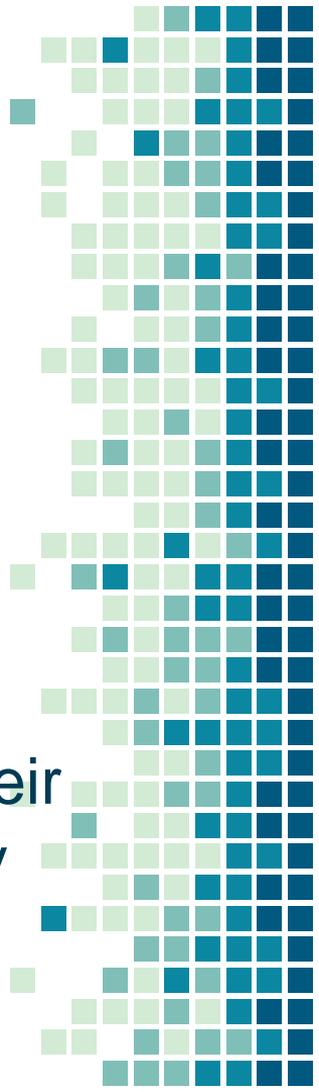
*Exploring topics that impact the courts*





# About Futures

The National Center for State Courts looked at technology, politics, economics and social demographics and selected five topics for consideration due to their ability to impact or disrupt society and the court community.





*“ The world is changing exponentially...  
and the status quo has become a  
one-way ticket to obsolescence. In a  
fast-changing world, unless we stay  
ahead of the curve, we can expect  
whole companies, industries and  
some other institutions to disappear*

**Gary Marx**; “21 Trends for the 21<sup>st</sup> Century” (2014)

1.

# Overuse of Antibiotics

Insight into health and population outcomes



# World Health Organization “WHO” information about antibiotic overuse & resistance in 2018

- Significant threat to global health, food security, and development today
- Affect anyone, of any age, in any country
- Occurs naturally, but misuse of antibiotics accelerates the process
- Pneumonia, tuberculosis, gonorrhea, and salmonellosis – are harder to treat as antibiotics become less effective
- Leads to longer hospital stays, higher medical costs and increased mortality

# IMPACTS

## One

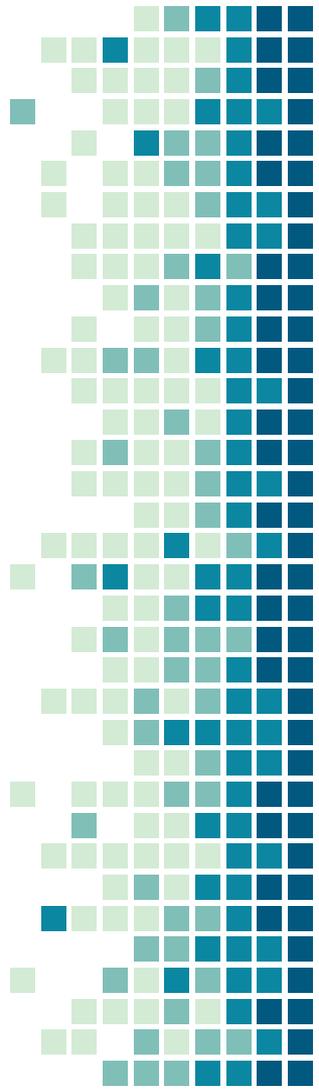
Sentencing and incarceration decisions influenced

## Two

Increased health issues for criminal defendants (many already have issues from IV drug use)

## Three

Court employee exposure





2.

# Autonomous Vehicles

Self-driving transport & delivery



“ *What kind of insurance ought a selfdriving car to have? If it goes wrong, who's liable?* ”

**Margareta Drzeniek Hanouz**

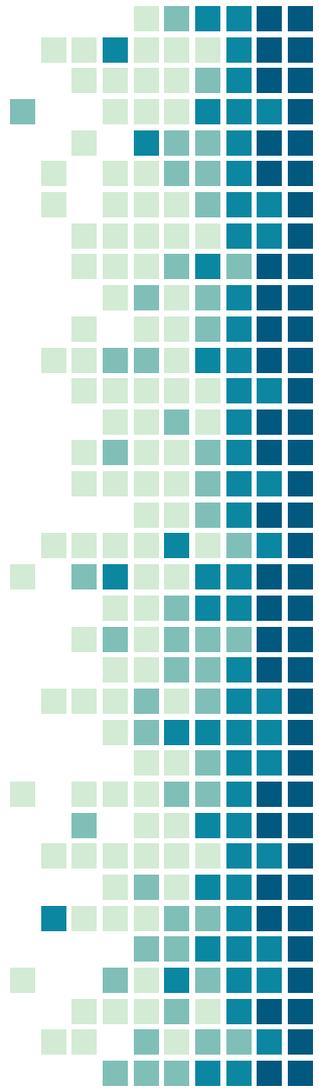
co-author of the World Economic Forum *The Global Competitiveness Report 2017*

53% or 44.9M

New case filings were traffic matters (Court Statistics Project, 2016)

92% of car crashes

Are attributed to the driver (NHTSA Traffic Safety Facts, February 2015)



# Court Impacts



3.

# Talent War?

Employment and staffing trends



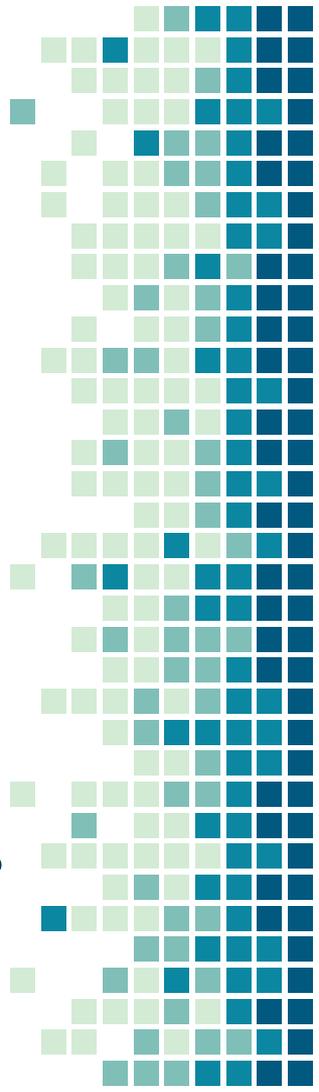
““ *A perfect storm of events is exerting tremendous pressure on the court workforce*

# U.S. Age Demographics vs. Court Age Demographics

Generations	% of working population <i>as of 2015</i>	% working in the Courts <i>*as of 2015</i>
Boomers (1946 - 1964) 54-73	28.9	56
Gen X (1965 - 1980) 38-53	34.1	31
Millennials (1981 - 1997) 21-37	34.6	11

# The Data Suggests

- Courts not attracting or retaining Millennials... Why?
- Courts remain Baby Boomer heavy (nearly 50% of court employees)
- Boomers will be quickly retiring, opening opportunities for Gen X
- Not enough Millennials to back fill the Gen X openings
- Number and length of **vacancies** rapidly increasing
- This problem is negatively impacting the court workforce
- Why are the courts not attracting and retaining Millennials?
- What are we doing about it?



4.

# Genetic Editing & CRISPR Cas-9

Gene alteration, removal, and replacement



# The Term

Clustered Regularly Interspaced Short

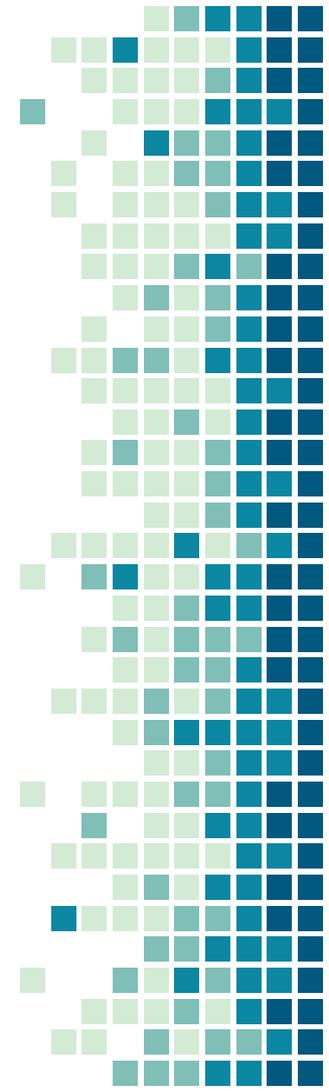
Palindromic Repeats (CRISPR)

CRISPR associated protein 9 is the protein

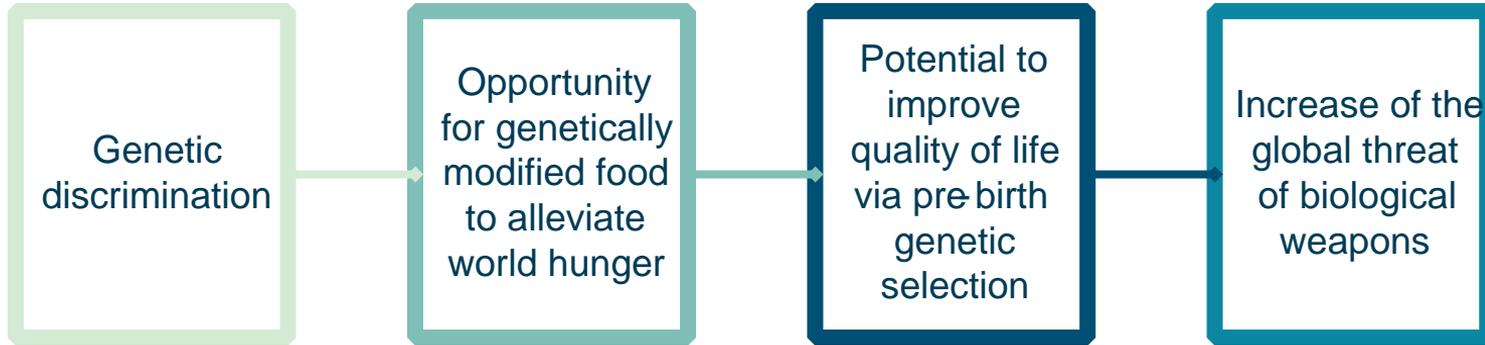
that edits the gene (Cas9)

# What can we do with it?

- Allows scientists to cut out or splice in any gene desired;
- Reduces genetic modification from weeks and \$1Ks to hours and less than \$100;
- **Cost effective** method to edit crops, remove allergens & make species more hardy;
- Can stop genetic disease;
- Alter traits in animals (i.e. remove the ability of mosquitos to spread malaria);
- Can be used to create designer babies (i.e. gender selection, eye color, etc.);



# Moral & Ethical Impacts



5.

# Nano Technology

The Internet of Nano Things (IoNT)

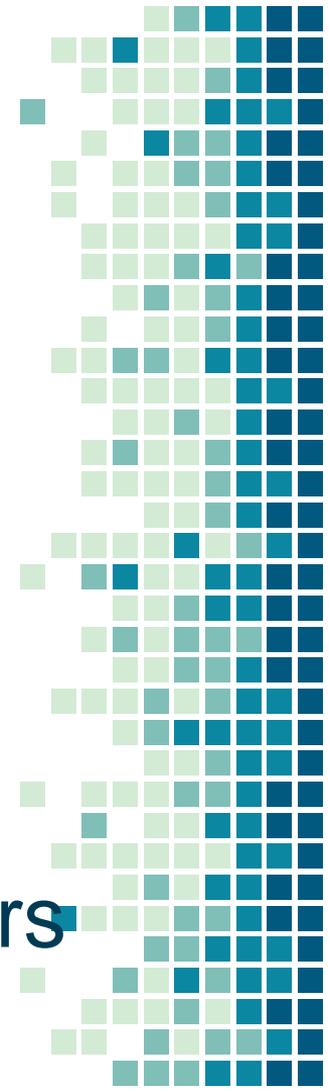


# 30 Billion

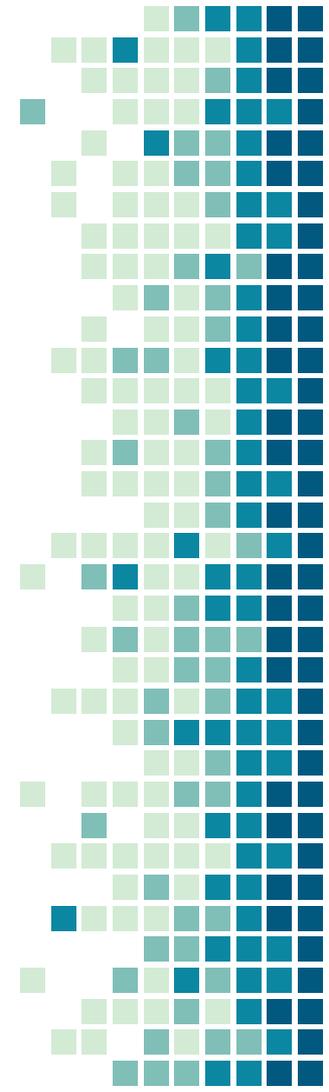
devices online by 2020

# 1 Billionth

of a meter for miniaturized nanosensors



# Technology Impacts



# THANK YOU

Please direct any  
questions or  
information requests to:

Knowledge@NCSC.org | 757.259.7591