

## Nano Congress 2021: Nanotechnology and the law: 2021 - John McClellan Marshall - Fourteenth Judicial District of Texas, USA

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The history of technology in the past three hundred years has been one of major leaps forward, compared with the two thousand years or so that preceded them. In the 18th Century, the Agricultural Revolution changed the nature of farming throughout the world. Formerly, the "three field" system had been a dominant feature of agriculture, with the result that productivity was only two-thirds of what it might have been. The addition of fertilizers, irrigation, and upgraded equipment, such as steel plows, for everyday use meant that the "three field" system could be abandoned. It was, and it was replaced by a system that is much more recognizable in the modern day.

The Agricultural Revolution, once production exceeded immediate consumption levels, allowed for society to begin considering other aspects of the economy. The obvious choice was to look at industrial diversification beyond the "cottage industry" model. This became the Industrial Revolution of the 19th Century, though it actually had its roots in the 18th. When grist mills with wind and power looms with water power came into general use at that time, the stage was set for the Industrial Revolution to burst forth in the next century. Of course, it was not long before wind and water were replaced by the steam engine as a source of power. Once they became mobile for boats and railroads, steam engines rapidly dominated the ability of society to adapt to a wide range of environments that it could not have in earlier times. At the same time, industries such as steel, coal, and, later, oil supported this diversity well into the 20th Century. Ironically, it took two world wars to foster a shift from the "hard" Industrial Revolution to what might be termed the "soft" Industrial Revolution characterized by computers and circuit boards.

In reality, though, these were merely the foundation of what has been termed the Technological Revolution that began in the 1940's and has continued into the 21st Century. What is interesting about the Technological Revolution is the speed with which it has overtaken virtually all aspects of economic life, not just in the United States, but in the world at large. It is not merely that there are computers more powerful than the ones that sent Apollo to the Moon that one can carry in a pocket. It is the expansion of the variety of tasks to which those computers can be adapted that is significant. This has been accompanied by the consequent reduction of the need for individual human intervention in the operation of a given task. As a result, there is an almost imperceptible tension between the technological realities of daily life and the consideration of whether this is "good" or "bad". More precisely, this leads to the philosophical concept of cyberethics. This can be defined as "the relationship between the ethical and

legal systems that have been developed to serve humanity from ancient times to the present as expressed in our judicial process and the ability of computer-driven technology to operate outside those conventions with almost no limits."

What is not readily apparent to most observers is the direct impact on society and its structures this tension can produce. Perhaps the most obvious example is the law. The advance of technology from fingerprints composed of ink on paper to scanners that detect the minutest variations in a fingerprint is very well-known to the average person.

Another example of this problem and the technological and judicial evolution that it has impacted is the use of DNA evidence in criminal cases. From the discovery in 1953 of its double helix structure, the utility of DNA as a means of identification expanded through the remainder of the 20th Century. Criminal law kept pace with the technology in that defendants in rape cases particularly were subject to being identified through DNA left behind after the attack.

### Introduction

The number of men so convicted is not known for sure. What is known is that, as the technology for mapping the DNA improved, samples kept from many years earlier were re-examined and found not to belong to the person who was convicted. So scientifically and factually accurate was the DNA evidence thus adduced that by the end of the 20th Century many prisoners were exonerated and released by the advancement of technology in this area. For jurors and judges, likewise, the conclusiveness of DNA evidence became so pervasive that without it, the ability of the state to secure a conviction has been and is often severely crippled. This was in part a function of a television program dealing with violent crime known as "CSI", and the impact was "the CSI effect"; that led to the "no DNA" acquittals. On the civil side of the legal spectrum, the Technological Revolution has had a similar impact. For example, a digitally recorded document that was created four or five years ago may not be readable by the modern programming, even though 2+2 will continue to equal 4. Indeed, it may not be readable at all if the hardware or software to do so no longer exists. The most pedestrian example is the loss of numerous musical catalogues due to the absence of eight-track tape machines. In effect, that

evidence is "down the memory hole" and, for all practical purposes, simply does not exist.

Sometimes this situation arises as a result of the simply routine restructuring of computer systems as a part of good business management. The chart below, derived from a study of molecular biology, illustrates "oriented flow", in this case from the lower left to the upper right. The circle in the center, "The Cheese", represents the range of phenomena that normally can be perceived by human senses. These are sight, smell, sound, taste, touch, without technological augmentation.