# Intellectual Property at the Science And Technology Frontier: AI, Biotechnology, and Quantum Computing

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Lecture Series: Day 1

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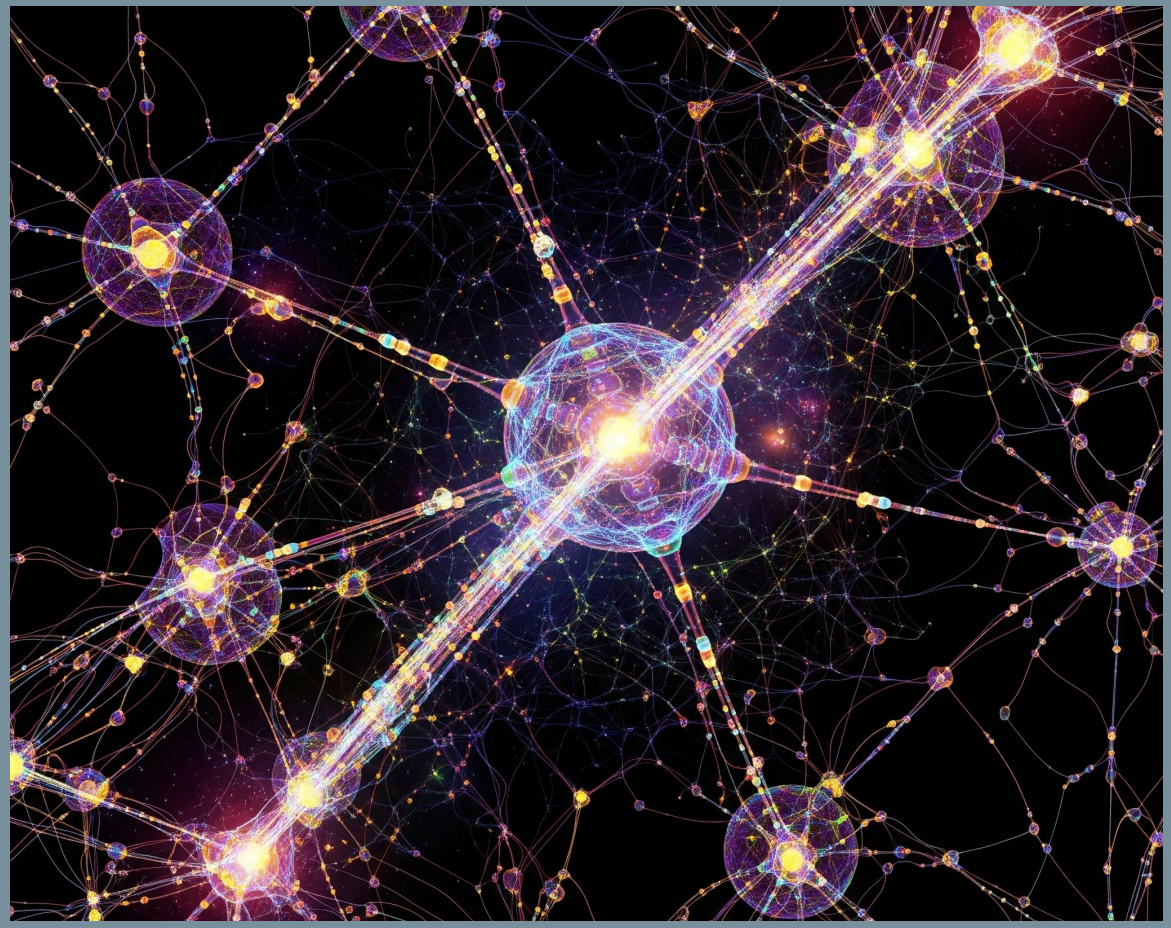
Lecture 1

- **The International Setting**
  - Intellectual property fundamentally a matter of national law
    - Constitutional systems typically require "transformation" of international rules into national rules to make them enforceable
    - Legislatures, executive administrative bodies and courts implement and refine rules
  - Two major sources of international rules: WIPO Administered Treaties and WTO TRIPS Agreement
  - Regional and bilateral IP agreements have been principal source of supplemental rules
  - International systems are "slow-moving" and follow IP law evolution within national systems

# Technological Advances Strain IP Systems

- Artificial Intelligence (AI), Biotechnology and Quantum Computing move into areas where rules developed for "classical" inventions raise challenges
- Patent, trade secret and copyright law are adapting within national legal systems
- Different legal systems will reach different conclusions, but business community is familiar with variations in national and regional rules
- A deeper question is what kinds of rules do we want or need?



# A Brief and General Refresher

- **Patents** are a form of government grant to inventors of entitlement to a bundle of rights, giving the inventor the right to prevent third parties from making, using, selling, offering for sale or importing for these purposes the invention. The invention is a product or process that is described in the patent and defined by the scope of its claims. The patent generally has a duration of 20 years from the filing of the patent application, though in some circumstances that term may be extended.
- The invention must constitute patentable subject matter. The invention must meet four criteria of patentability: that is, novelty or newness, utility or capability of industrial application, nonobviousness or involving an inventive step, and sufficiency of disclosure or enablement.
- A key benefit of patent protection is that it precludes a defense of "independent creation". The "first to file" wins, with a potential narrow exception for prior user rights.

- **Trade secret** is commercially valuable information not generally known in the industry that its owner has taken reasonable steps to protect. Trade secrets are of indefinite duration. They are protected as long as the owner maintains secrecy, or until a third party develops the information independently (including by reverse engineering).

# A Brief and General Refresher

- **Copyright** is granted to authors and artists to protect expressive works against unauthorized reproduction or distribution by third parties. Expressive works are broadly defined, and include such things as books, films, music recordings and computer software. Copyright does not extend to functional works or ideas. The TRIPS Agreement minimum term of copyright protection is the life of the author plus 50 years, though life plus 70 years is common.

- **Open Source m**eans that the developer of software or other product chooses to make it available to any third party wishing to use it, typically under established conditions. Open source products are typically protected by some form of IP, usually copyright. Patent “opening” typically accomplished by non-enforcement pledge, but may be accomplished through patent office royalty inscription. Conditions may include attribution of authorship, agreement to make add-on development available under the same (or other) conditions, or agreement to use only for noncommercial purposes. Open source is distinguished from "public domain". When technology is in the public domain it is freely available for anyone to use without condition.

# Patents and Artificial Intelligence

- **Inventorship**: The inventor is the person who conceived of the invention. There may be, and often is, more than one inventor named on a patent, and those individuals are co-inventors. It is important to distinguish “inventorship” from “ownership” of a patent. An inventor(s) can assign his or her interest to third-party, often a corporate employer, and in many countries the corporate employer may apply for the patent as “assignee”.
- The emergence of AI raised the question whether a “thinking machine” can be an inventor from the standpoint of patent law. This is a complex and multilayered issue, although the practical implications are not so clear.
- It is generally agreed that an AI does not have a legal personality and from that standpoint an AI cannot be the “owner” of a patent.
- While some argue that an AI does not have the capacity to autonomously invent in a way analogous to a human inventor, as time passes it becomes increasingly difficult to give credence to such argument.

# AI as Inventor

- What if Google's DeepMind identifies a protein structure, uses a computational method to find a particular chemical or biological agent that makes the proper binding connection to prevent a disease from emerging, and creates new drug? Is there some missing element of human sentience that distinguishes this creation from the creation of a human scientist?
- The principal issue identified by leading authorities is that precluding naming an AI as an inventor, particularly where it may be the sole inventor, is that it effectively requires a patent applicant to provide inaccurate information to the patent authority.
- The principal argument against AI inventorship appears to be that the patent system is intended to encourage invention by providing a financial reward through a right of exclusivity, and because an AI is not motivated by a financial reward, there is no need to grant a patent to an AI and suffer the economic impact of the exclusivity. But some enterprise must have invested in creating the AI, and that enterprise presumably requires some incentive for continuing its work.

# AI Inventorship

- **AI as coinventor:** To what extent are human inventors required to disclose the assistance of AI's in developing their creations? Is there some boundary or border that identifies a sufficient difference between using a computer as a computational tool -- which has been done routinely for decades -- and using a computer with AI capabilities that perform functions previously attributable to humans?
- So far patent offices and courts have not recognized AI's as inventors on patents, though they have permitted supplemental reference to the role of the AI in the specification. These decisions have principally been based on statutory language implying that legislators intended inventors to be human "individuals". See, e.g., *Thaler v. Vidal*, 43 F.4th 1207 (Fed. Cir. 2022). South Africa permitted an AI to be named as an inventor, but it does not engage in substantive review of patent applications.
- Patent offices around the world are engaged in review of rules applicable to AI inventorship, among other issues associated with patents and AI.

Lecture 2

# AI and Inventive Step or Non-Obviousness

- **Novelty** and **inventive step** are related criteria of patentability. Novelty asks the question whether an invention has previously been made public and become part of prior art, anticipating an invention. As a doctrinal matter, in order for novelty to be defeated there must be a single piece of prior art anticipating each element of the claimed invention. This becomes a more complex exercise with respect to AI, because AI inventors may seek patents on fairly general claims and disclosure, which will make it difficult to precisely determine whether a prior AI patented invention or public disclosure has anticipated a subsequent AI invention.

- The more interesting set of issues is raised with respect to **inventive step**, that is, the distance between the claimed invention and the prior art, and whether the difference would be obvious to a person reasonably skilled in the art.

- We have historically compared humans to each other: whether an invention by one human should have been obvious to another "reasonably skilled" human? But what if AI's solve technical problems more easily than humans. Should the human inventor be compared to the reasonably skilled AI? Should AI intelligence be "off-limits" as a comparator? Should an AI inventor be compared to a human, or to a reasonably skilled AI? The time may not be so distant when everything a human invents will have been obvious to an AI. See Ryan Abbott, **Everything is Obvious**, 66 UCLA. L. Rev. 2 (2019).

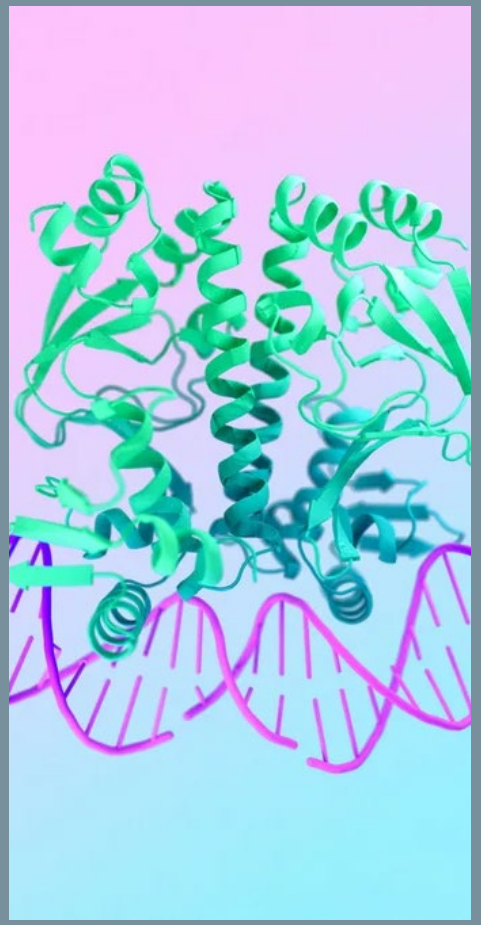
# AI, Enablement and Disclosure

- The patent bargain is that the inventor is awarded a period of market exclusivity in exchange for disclosing his or her invention to the public. The disclosure must: (a) enable a third party to replicate the invention without “undue experimentation”, and; (b) show that the inventor was in possession of the invention at the time of the patent application.
    - There are various complex doctrines surrounding the requirements of disclosure, including requirements applicable to the drafting of claims. Special rules apply to so-called “means plus function” claiming which may be relevant to AI inventions.
- AI is primarily a software program, though because certain AI’s require extraordinary computational capacity, an AI invention may well encompass a hardware component (see discussion of Nvidia).
- Software developers ultimately overcame the problem of disclosing source code by providing more general descriptions of the function and methods of operation of programs, including flowcharts and diagrams, without the details of source code. “Means plus function” claiming is a possibility, but because in the United States the scope of the means plus function patent is limited to what is embodied in the specification, this creates potential problems as programs evolve.

# DeepMind and Nvidia

- It appears that DeepMind has relied on method patenting of processes used to predict folded protein structures based on amino acid sequences. They refer to multiple techniques for creating predictions based on a variety of factors, such as atomic structure, and using various algorithmic methodologies, including (but not limited to) neural networks. The processes are repeated or “iterative”, with qualitative scores for outputs that are then reprocessed to refine results, ultimately selecting a preferred predictive model. See, e.g., WO 2020/058174 A1. So far it appears that a limited number of patents have been granted, suggesting that patent offices are proceeding cautiously on applications, at least in the US and Europe.

- Nvidia’s patent strategy is not directed solely or principally at hardware, but also at the software that integrates the hardware functions and the networking functions of the AI systems it enables. At the technology frontier of AI, Nvidia uses a hardware/software model and corresponding patents. A critical issue confronting potential Nvidia competitors is that they not only need to design around or avoid one type of patent, that is, those addressing hardware, but the fact that the hardware does not function without the associated software, and unless both can be designed around, it is very difficult to challenge Nvidia’s position on the market.



# The Black Box Problem

- AI developers sometimes state that they cannot explain how their systems reach their results - AIs surprise their developers
- While inventors are required to disclose information sufficient to permit third parties to re-create their inventions without "undue experimentation", they are not required to explain "why" their invention works. Scientists routinely use genetic engineering to create new biological substances, or even "new" animals (e.g., the Harvard mouse), but they do not need to explain "why" biological inventions function as they do. Harvard does not know how to "build" a “Harvard mouse”.
- Is it therefore adequate for an AI patent application to state that initiating certain functions on a computing machine generates results, without explaining why it generates those results? The AI makes connections through a process that the human does not understand. Would it perhaps be necessary for the inventor to show that repeated use of the AI to address the same problem reaches the same or a similar result? Should there be a test of accuracy or validation? Is it sufficient to describe a process "using a neural network" to generate results?

# Utility

- Patented inventions are required to demonstrate a specific and credible utility, or to make a sound prediction regarding such utility (or capability of industrial application).
- An AI standing on its own would presumably be useful because it serves a practical purpose in problem solving, generating content, or performing other functions.
- In areas such as materials science and biotechnology, AIs may be capable of generating large numbers of predictive models of new materials, molecules or protein structures, but without having determined that they are functionally useful. This may present a barrier to patentability absent further development and testing to demonstrate usefulness.
- A classic patent law issue: at what point along the research and development spectrum should patents be granted? Too early may block competitive research. Too late may inhibit research expenditure.
- Discussed further along with biotechnology

# AI as Patentable Subject Matter

- In order to secure patent protection, an invention must encompass “patentable subject matter”. Patent systems generally exclude certain subject matter from patentability either expressly by statute, or through judicial decision.
- In the United States, exclusions from subject matter patentability are generally the product of judicial decision by the US Supreme Court. The Supreme Court has referred to “abstract ideas”, “laws of nature” and “natural phenomenon” as excluded. Most recently, the Supreme Court has articulated what is today referred to as the “Alice-Mayo” two step test for patentable subject matter. In the first step, the court determines whether the claimed subject matter comes within one of the articulated exclusions. If it does not, then it is patentable subject matter. If it falls within one of the exclusions, the second step asks whether there has been a sufficient “transformation” of the otherwise excluded subject matter to allow patentability. The Supreme Court has not provided material guidance on what constitutes sufficient transformation, leaving this for a case by case inquiry.

# Transformation

- The Federal Circuit has addressed the issue of transformation in the case of development of network models through algorithmic use of large language model data sets. See *Recentive Analytics, Inc. v. Fox Corp*., 134 F.4th 1205 (Fed. Cir. 2025). The Court held that the idea of using a dataset compiled and updated by a large language model with a generic AI algorithm for analyzing and proposing a network structure was an abstract idea, and this abstract idea was not transformed by specifying a particular end use (in this case for scheduling broadcasts of sporting events). Notably the patentee in this case did not claim to have invented a large language model, or an algorithmic AI process, but only claimed applying those in a particular context. The Court noted a long line of decisions that it was not sufficient to say, “take this abstract idea and apply it”.
- The Federal Circuit decision was limited to its context, and it was not making a general statement regarding the patentability of large language models and their training.

# The 1980s All Over Again

- In the 1980s, patents were largely set aside in the software industry for reasons not dissimilar to those confronting the AI sector. If a developer submitted the source code, and a patent application may require two or three years before it is approved, the subject matter of the patent might be obsolete by the time the patent is granted. Would the alternative of describing the function of the computer program along with a structural diagram or flowcharts be acceptable to patent offices because, at the least, of limitations on patenting of abstract ideas. The main challenge was the dynamic nature of the software industry, such that attempting to patent a fixed formulation of the patented technology would potentially leave the software developer vulnerable to third parties making modifications to the program.
- The alternative well-known story is that computer software developers relied instead on copyright which because of its automaticity would adapt to changes in source code contemporaneously with the developer. This did not solve all problems. Was object code capable of copyright protection? If the source code involved an algorithm, was that a non-copyrightable idea based on the idea-expression dichotomy? Eventually these issues were sorted, although issues continue arise in litigation.
- Eventually the patent re-emerged!