Assignment01- Reflection

1. Awad distinguishes between different “types” of AI. What classification scheme does the paper use and why do these types matter for scientific research?
    - Within the article, Awad distinguishes the different types of AI according to their role in the scientific process. The types of AI are broken down into 7 categories (based on Section 1)
        1. Predictive AI: forecasting and modeling outcomes from data
        2. Descriptive AI: pattern discovery and extracting knowledge from data
        3. Generative AI: produces new content/hypothesis statements
        4. Optimization AI: improves experimental design and decision-making
        5. Causal/Explainable AI: uncovering cause/effect relationships and improving based on the way the AI can interpret
        6. Privacy-Aware AI: secure research
        7. Meta-scientific AI: automating the scientific discovery process
- These types of AI matter for scientific research since they overall clarify how AI contributes to scientific discovery and how we can use it either as an assistance, an engine that comes up with new hypotheses, or more. The influence of AI can forever change the way we do research.

2. Does Awad make a clear distinction between AI as a tool and AI as a scientific collaborator? If so, what are the differences, and what are some examples given to support the differences? Do these examples suggest a real shift in how science is conducted, or mostly an extension of existing methods?
    - Yes, there is a very clear distinction between AI as a tool and AI as a scientific collaborator. When discussing AI as a tool that supports scientific workflows, Awad provides examples such as predictive models for climate forecasting, AlphaFold, which helps with protein structure predictions, and more. While AI as a scientific collaborator functions as an epistemic agent, basically a system that participates in generating knowledge itself. Examples include meta scientific AI systems that generate different types of hypotheses, LLM simulating social behaviors, and how AI can identify new relationships. There is a shift present with these observations, which showcases that AI systems are now blurring this hypothetical line between tool and collaborator. This shift now causes talk about how to restructure the research process.

3. What are some limitations or risks of using AI in science? How do these relate to issues such as interpretability, bias, reproducibility, or theory formation?
    - One limitation that Awad talks about is called “Black Box” problems. This is where deep learning systems produce accurate outputs without good/understandable reasoning. This challenges the usual notion that comes with the research process, such as scientific explanation, peer-reviewed papers, and overall trust in the findings of the data. Another limitation that was brought up was bias. LLMs have encoded societal biases such as race, gender stereotypes, etc. Bias in scientific studies is super harmful and can affect the way we make policies, prioritize research, and interpret the data. There was also mention surrounding the fact that AI systems can hallucinate information and generate incorrect results, which seem correct, and overall have very weak reliability that is needed in scientific research. Lastly, when talking about theory formation, AI functions on pattern recognition versus theory. This shifts the perspective from science to correlation and overall produces ideas that are difficult to understand theoretically.

4. According to Awad’s arguments, is AI more likely to *accelerate* scientific discovery or to *reshape* the scientific method itself? Do you agree or disagree
    - Awad does both within this paper. AI will reshape the scientific method due to the way that it can accelerate discovery as well as help improve things like protein modeling, gene recognition, and more. There is also mention that AI will restructure scientific reasoning by helping the process of generating hypothesis statements, and coming up with new knowledge. My evaluation of this after reading this paper is that I agree with the opinions being shared. AI is already changing the trajectory of how we function in our everyday lives, it's not all that surprising that it will change the way we do research as well. Being in Biology right now, we are learning about the ethical implications of AI within the lab and how it can be used to help find patterns such as breast cancer, gene mutations, and more that would have taken months for a human to do. However, there is this uneasiness with it due to how unreliable the current models are. However, in spaces/ occupations where there is high computational input that is needed, it is very easy to understand how AI can and is already influencing how we frame our questions and how we think theoretically.