



## **HISTORY OF WESTERN SCIENCE & TECHNOLOGY**

*Daniele Macuglia (马大年); Graduate Course, 3 Credits.*

This document presents guidelines for preparing for the oral examination in this course.

Each week, students are required to develop presentations centered on a selected question from the designated sections. For the end-of-term oral examination, questions will be drawn from the following list. Due to the extensive variety of subjects covered in this course, it is imperative for students to regularly review and update their knowledge of the course materials, particularly after each session, to ensure they remain conversant with the course content.

The final oral examination, which is roughly an hour in duration, will encompass 4-5 questions covering various sections. Master's students are afforded the opportunity to choose their initial two questions from their preferred areas of study. Conversely, Ph.D. students will not be given the opportunity of selecting their initial questions and are expected to be prepared to engage in discussions encompassing all course themes.

*The following Chinese translations have been kindly curated by T.A. Lei Yu (雷煜) in 2024.*



## **SECTION 1: Ancient Greek World**

- (1) In what manner did the topographical and ecological characteristics of Hellas (ancient Greece) circa 6th to 5th century BCE shape the philosophical doctrines and speculations of the Pre-Socratic thinkers?

在公元前6至公元前5世纪，古希腊的地形与生态特征是如何塑造了前苏格拉底时期的思想家的哲学学说与思辨的？

- (2) To what extent did Thales of Miletus (circa 624–546 BCE), with his materialistic construal of natural phenomena and the notion of the autonomy of physis (nature), signify a shift from mythopoeic thought, thereby establishing a foundational framework for subsequent philosophic inquiry?

米利都的泰勒斯（约公元前624–546年）对自然现象进行了唯物主义的解释并提出了自然（physis）的自主性的概念，那么他在何种程度上可以被视为一个人们摆脱创造神话的思维（mythopoeic thought），并为之后的哲学研究建立基础框架的符号的？

- (3) How did the Platonic theory of eidē (forms) with its sharp distinction between the flux of the sensory realm and the immutable world of forms, influence the epistemological underpinnings of what constituted “scientific” knowledge in the context of Ancient Greek thought?

柏拉图的关于形式（eidē [forms]）的理论严格区分了感官世界的流变与不变的形式世界，那么柏拉图的这一理论是如何影响了古希腊思想语境下的“科学”知识的认识论基础的？

- (4) Analyze the synthesis of Platonic idealism and Aristotelian empiricism in shaping the trajectory of epistemological structures within the historical narrative of scientific thought, particularly in the Classical Greek era.

请分析柏拉图的理念论与亚里士多德的经验论在科学思想史中的融合，特别是在古典希腊时期，如何在科学思想的历史叙事中塑造了认识论结构的发展轨迹的。

- (5) In examining Aristotle’s (384–322 BCE) conceptual framework, provide a critical analysis of the distinctions and intersections between the domains of natural philosophy and metaphysics. How did this demarcation impact the methodologies and epistemological approaches within the ambit of ancient thought, as understood in a historical context?

请考察亚里士多德（公元前384–322年）的概念框架，并对自然哲学和形而上学领域之间的区别和交集进行批判性分析。请从历史语境下思考，这种划分方式是如何影响古代思想所具有的方法论和认识论方法的？



- (6) In Aristotelian philosophy, the concept of *kinesis* (motion) necessitates a continuous series of movers and moved objects. How did Aristotle resolve the dilemma of infinite regression in his argumentation for the “Unmoved Mover,” and how does this principle integrate into his broader cosmological schema?

在亚里士多德哲学中，运动（*kinesis*）概念需要有一系列的施动者和受动者。那么亚里士多德是如何在他对“不动的施动者”的论证中处理这一无限回溯难题的？这一原理是如何融入到亚里士多德的更广泛的宇宙学图景中的？

- (7) Considering the diametrically opposed views of Parmenides and Heraclitus on the essence of change, how did Zeno’s paradox, especially concerning motion and change, present a formidable challenge to conventional understandings, and what might an Aristotelian rebuttal to these paradoxes entail?

鉴于巴门尼德和赫拉克利特对变化的本质的截然不同看法，芝诺的悖论（尤其是关于运动和变化的悖论）对传统观念提出了怎样的重大挑战的？亚里士多德对这些悖论可能会怎样的反驳？

- (8) How did the epistemological discourses and polemics between the Sophists and Socratic philosophers, predominantly in the 5th century BCE, shape the development of critical and methodological thinking, which subsequently played a role in the development of scientific traditions?

公元前5世纪，智者学派和苏格拉底派哲学家之间进行的认识论方面的谈论和辩论促成了批判性和方法论思维的发展，这在之后的科学传统的发展中扮演了一定的角色。那么这一促成了批判性和方法论思维发展的过程是如何进行的？



## **SECTION 2: The Legacy of Greco-Roman and Islamic Thought**

- (1) In the intellectual milieu of the Roman Epoch, particularly during the 2nd century AD, how did Claudius Ptolemaeus (Ptolemy) and Galenus of Pergamon (Galen) epitomize both a continuity and a divergence from the Hellenic philosophical traditions established prior to their era?

在罗马时代的知识背景下，尤其是公元2世纪，克劳狄·托勒密和帕加马的盖伦如何体现了他们对先前希腊哲学传统的继承与偏离？

- (2) Ptolemy's corpus, notably in the domain of astronomy, laid the foundations for both Western and Islamic academia. In what ways did the exegesis and practical applications of his oeuvre exhibit variances across these two cultures during the subsequent centuries, and what historical or sociocultural factors engendered these divergences?

托勒密的著作，特别是天文学领域的著作，为西方和伊斯兰学术界奠定了基础。在随后的几个世纪中，这两种文化各自对托勒密的作品的评价和应用是如何展现出差异的，是什么历史或社会文化因素引发了这些分歧？

- (3) How did the concept of the equant resolve the discordance between the empirical observations of planetary motion and the entrenched Aristotelian cosmological postulate, which posits that celestial entities traverse in perfect circles at constant velocities?

亚里士多德的宇宙论认为天体以恒定速度沿着完美的圆周运行，那么等距点概念是如何解决对行星运动的经验观察与亚里士多德的这一根深蒂固的宇宙论观点之间的矛盾的呢？

- (4) While Galen, flourishing in the 2nd century AD, augmented the foundational tenets of the Hippocratic corpus concerning humoral theory, in what explicit manners did he refine or contest the earlier propositions of Hippocrates?

生活于公元2世纪的盖伦对希波克拉底著作中体液理论的基本信条进行了增补，那么他是如何详尽地对希波克拉底的更早提出的观点加以完善或予以质疑的呢？

- (5) Given that both Plato (c. 427–347 BCE) and Aristotle placed substantial emphasis on equilibrium and consonance—within the psyche and in nature, respectively—how might Galen's humoral theory be perceived as an integration of these philosophical doctrines in the medical sphere?

鉴于柏拉图（公元前427-347年）与亚里士多德分别在灵魂与本性方面着重强调了平衡与和谐，那么盖伦的体液理论是如何可以被视为这些哲学教义在医学领域的一种整合的呢？



- (6) How did the philosophical treatises of Islamic scholars during the Islamic Golden Age (8th to 14th centuries AD), especially in the fields of metaphysics and epistemology, contribute to or diverge from the classical Greek paradigms?

伊斯兰黄金时代（公元8至14世纪）的伊斯兰学者们的哲学论著——尤其是形而上学与认识论领域——是如何对希腊古典时期的范式做出贡献或背离这一范式的？

- (7) Ibn al-Haytham (Alhazen), venerated as the “progenitor of modern optics,” revolutionized the field with his work *Kitab al-Manazir (Book of Optics)* circa the 11th century. How did his treatise challenge the predominant Greco-Roman theories, and what was its impact on the formulation of the scientific method?

伊本·海扬（阿尔哈曾）被尊为“现代光学之父”，他于11世纪左右凭借其著作《光学之书》为光学领域带来了革命性的变化。他的这部著作是如何挑战了处于主导地位的古希腊-罗马时期的理论的？这部著作对科学方法的制定产生了怎样的影响？

- (8) Avicenna’s *Canon of Medicine*, a seminal text that became a standard reference in Europe for centuries, was a synthesis of Greco-Roman medical knowledge with Islamic scholarly traditions. How did this fusion influence the evolution of medical thought in both the Islamic world and medieval Europe during the early 2nd millennium, and what specific aspects of his work rendered it so enduring and influential?

阿维森纳《医典》是一部将希腊-罗马时期的医学知识与伊斯兰学术传统结合起来的并具有深远影响的著作，其在欧洲作为标准教科书的时间达数世纪。这种融合是如何影响了第二个千禧年早期的伊斯兰世界与中世纪欧洲的医学思想的演化的？《医典》的哪些方面使得它能够长久不衰并产生巨大的影响？



### **SECTION 3: The Development of Medieval Thought**

- (1) Examine the ramifications of the socio-political milieu during the Carolingian Renaissance, particularly under Charlemagne's dominion (c. 768–814), on the revitalization of scholastic pursuits. How did this era lay the groundwork for the resurgence of natural philosophy in Western Christendom?

请思考加洛林文艺复兴时——特别是查理大帝统治时期（约768–814年）——的社会-政治环境对学术复兴的影响。这一时期是如何为自然哲学在西部基督教世界的复苏奠定基础的？

- (2) Analyze the Byzantine Empire's diplomatic and cultural interchanges with Latin Europe during the early medieval epoch (c. 5th–10th centuries). In what ways did these interactions facilitate the conveyance and preservation of Hellenic and Roman intellectual heritage, and what were the primary challenges encountered by Western Europe in assimilating, translating, and diffusing this corpus of knowledge, as contrasted with Byzantine methodologies?

请对在中世纪早期（约公元5至10世纪）的拜占庭帝国与拉丁欧洲之间的外交互动与文化交流进行分析。这些交流是如何促进对希腊与罗马知识遗产的传递与保存的？相较于拜占庭学者所用的方法，西欧学者在吸收、翻译、传播这些知识资料时遇到的最主要的挑战是哪些？

- (3) Critically assess the significance of the translation movements, notably those centered in the House of Wisdom in Baghdad (9th–13th centuries) and the School of Translators in Toledo, Spain (12th–13th centuries), on the evolution of natural philosophy in Medieval Europe. Discuss the wider implications of this intercultural exchange of knowledge on the European intellectual tradition.

请批判性地评价翻译运动——尤其是以位于巴格达的智慧宫（9至13世纪）与位于西班牙托莱多的翻译学院（12至13世纪）为中心——对中世纪欧洲的自然哲学的发展的重要性。请探讨这些跨文化的知识交流对欧洲知识传统的更广泛的意义。

- (4) Elucidate the role of Albertus Magnus (c. 1200–1280) in melding the realms of magic and philosophy during the medieval era. How did his contributions shape the intellectual landscape of his time?

请阐述阿尔伯特斯·马格努斯（约1200–1280年）在将中世纪的魔法与哲学领域的融合方面所发挥的作用。他做出的贡献是如何塑造了他所处的时代的知识图景的？



- (5) Drawing upon seminal alchemical manuscripts and considering the broader socio-religious milieu of the Middle Ages, expound on the symbolic resonance of the Ouroboros in medieval alchemical lore. What does this symbol reveal about the alchemist's pursuit of spiritual and material transmutation?

请通过利用具有影响的炼金术手稿并思考中世纪的更为广泛的社会-宗教环境，阐述中世纪炼金术知识中的衔尾蛇在象征方面所具有的启发作用。就炼金术士对精神与物质的嬗变（transmutation在炼金术中特指贱金属变为金）而言，这一象征又揭示了哪些内容呢？

- (6) In the context of the pre-Socratic transition from mythos to logos in explicating the cosmos, how did medieval philosophers, exemplified by Thomas Aquinas (c. 1225–1274), reintegrate the divine into the comprehension of nature? Contrast their synthesis with earlier mythological paradigms.

前苏格拉底时代，对宇宙的解释经历了从运用神话到运用逻各斯的转变，以此为语境，请思考中世纪的哲学家——以托马斯·阿奎那（约1225–1274年）为例——是如何将神学内容重新融入到对自然的理解之中的？请将这些哲学家得出的融合成果与较早的神话范式进行比较。

- (7) Reflecting on the treatises of Roger Bacon (c. 1214–1294) and Thomas Aquinas, elucidate the divergent trajectories natural philosophy embarked upon in the medieval period. How did their distinct approaches shape the intellectual currents of their era?

通过思考罗吉尔·培根（约1214–1294年）与托马斯·阿奎那的著作，请阐述中世纪时期自然哲学所采取的不同发展路径。他们所采用的各不相同的方法是如何塑造他们所处时代的知识趋势的？



## SECTION 4: The Nexus of Renaissance Intellectualism

- (1) Amidst the emerging secular proclivities in the pedagogical landscape during the Renaissance what implications did this shift entail for societal perceptions regarding the study of the natural world and its theological interrelations?

随着在文艺复兴时期教育图景中逐渐出现了世俗倾向，这种转变对社会对自然世界的研究及后者与神学关系的看法有何影响？

- (2) Examine why Humanism is predominantly associated with Western Europe, particularly in the context of the Renaissance from the 13th to the 14th centuries. Compare this with the intellectual traditions of the Byzantine Empire, which persisted from the 4th to the 15th century, to assess whether a parallel or distinct form of Humanism existed within Byzantine culture.

请思考为何人文主义主要与西欧有着紧密的联系，尤其是在13至14世纪的文艺复兴语境下。请将西欧的人文主义与拜占庭帝国——存在时间为4至15世纪——的知识传统进行比较，并讨论在拜占庭文化中是否存在一个与其在形式上类似或不同的人文主义。

- (3) In the context of Giordano Bruno's work *De l'Infinito, Universo e Mondi* (1584), to what extent is his cosmological perspective emblematic of an integrated synthesis of Hermetic and Neoplatonic philosophies?

以焦尔达诺·布鲁诺的著作《论无限、宇宙与众世界》为语境，思考他的宇宙观在多大程度上是一种赫尔墨斯主义和新柏拉图主义哲学综合产物的象征。

- (4) With the discovery of the “Medicean stars” by Galileo in 1610 and the observed phases of Venus, how were these astronomical revelations instrumental in challenging the Ptolemaic geocentric model?

伽利略在1610年发现“美第奇星”和金星的相位变化，这些天文新发现是如何在对托勒密的地心说模型的挑战中起到关键作用的？

- (5) In the historiography of scientific thought, both the ancient Hellenic scholars and early modern savants such as Niccolò Tartaglia (1500–1557) and Christophorus Clavius (1538–1612) utilized mathematical principles to elucidate the mysteries of the natural world. Within this continuum, how did Galileo forge a distinctive paradigm in his synthesis of physics, astronomy, and mathematics? What aspects of his methodological approach or his empirical contributions demarcated his work as a seminal departure from the intellectual frameworks of his predecessors and contemporaries?

在科学思想的编史学中，古希腊与现代早期的学者——例如尼科洛·塔尔塔利亚（1500–1557）与克里斯托福鲁斯·克拉维乌斯（1538–1612）——都使用了数学原理来解释自然世界





的奥秘。在上述连续体的背景下，伽利略是如何在对物理学、天文学与数学的综合中创造出一个独特的范式的？伽利略的研究标志着他对前辈和同时代人的知识框架进行了一次深远影响的背离，那么是他的方法论途径或在经验论上的贡献的哪一方面实现了这一标志性的转变的？

- (6) Considering Galileo's role in challenging the geocentric model, should his approach be characterized predominantly as an exemplification of scientific skepticism, or rather as a form of denialism?

就伽利略在对地心模型的挑战中所发挥的作用而言，他的方法是应该被主要视为是科学怀疑主义的一种体现，还是一种形式的否认主义？

- (7) Both Johannes Kepler (1571–1630) and Galileo Galilei exhibited intellectual tendencies resonant with Neoplatonic thought. In what ways do their interpretations or applications of Neoplatonism diverge?

约翰内斯·开普勒（1571–1630）和伽利略·伽利雷的知识倾向都能让人联想到新柏拉图主义的思想。他们两人对新柏拉图主义的解释或应用所展现出的分歧之处有哪些？

- (8) Does Galileo's *Dialogue Concerning the Two Chief World Systems* (1632), through the discourses among Salviati, Sagredo, and Simplicio, serve as an exemplar of the Socratic method?

伽利略的《关于两大世界体系的对话》（1632）使用的是萨尔维阿蒂、沙格列陀与辛普里丘之间的谈话的方式，那么这部著作是否可称得上是一个苏格拉底式的方法的范例？

- (9) Given the technological constraints of the 16th century, in what manner did Tycho Brahe's (1546–1601) observational techniques and instruments facilitate his conclusion that the 1577 comet transcended lunar orbit, thereby challenging the Aristotelian doctrine of unalterable celestial spheres?

鉴于16世纪的技术限制，第谷·布拉赫（1546–1601）的观测技术和工具是如何帮助他得出1577年彗星穿过月球轨道的结论，从而挑战了亚里士多德关于固定不变的天球的学说的？

- (10) In what capacities did the Protestant Reformation influence the epistemological underpinnings and methodologies employed by natural philosophers of the period?

新教宗教改革对该时期的自然哲学家所采用的认识论基础与方法论产生了影响，宗教改革是如何做到这一点的？



- (11) How did Kepler's elucidation of elliptical orbits in *Astronomia Nova* (1609) represent a traumatic rupture in the intellectual fabric of the time, effectively dismantling the long-standing Aristotelian-Ptolemaic celestial-sphere model, and in what ways did this shift lay the groundwork for Sir Isaac Newton's (1642–1727) *Philosophiæ Naturalis Principia Mathematica* (1687)?

开普勒在《新天文学》（1609）中阐述了椭圆轨道，那么这一阐述是如何代表了当时知识结构中的一次剧烈的断裂，从而有效地瓦解了存在已久的亚里士多德-托勒密天球模型？这一转变又是如何为艾萨克·牛顿爵士（1642–1727）在《自然哲学的数学原理》（1687）中奠定了基础？



## **SECTION 5: Epistemological Shifts in Early Modern Science**

- (1) To what extent did the Scientific Revolution represent a radical epistemological rupture from preceding intellectual paradigms, as opposed to a gradual synthesis of antecedent scholastic traditions?

科学革命在多大程度上代表了一种在认识论上对先前的知识范式的彻底性断裂，而不是对早期学术传统的逐渐综合？

- (2) Considering the works of Francis Bacon (1561–1626) and René Descartes (1596–1650), critically evaluate the influence of their methodological divergences on the epistemic underpinnings of early modern scientific inquiry.

鉴于弗朗西斯·培根（1561–1626）和勒内·笛卡尔（1596–1650）的研究，批判性地评价他们方法论上的差异对早期现代科学探究的认识论基础的影响。

- (3) Examine the methodological disparities between the Baconian empiricism and Galilean experimentalism in their treatment of empirical data, and elucidate the implications of these differences for the scientific communities of their era.

思考培根的经验主义和伽利略的实验主义在处理经验数据方面的方法论差异，并阐明这些差异对当时的科学共同体的影响。

- (4) Examine the rise of mathematical practitioners in the 17th century and analyze how their emergence catalyzed the transformation of natural philosophy. Focus on the synergy between the increasing application of mathematical rigor and the evolving nature of philosophical inquiry during this period.

思考17世纪时数学实践者的兴起这一事件，并分析他们的兴起是如何促进了自然哲学的转变。请着重关注这一时期如下两者的协同作用：不断增长的对数学严谨性的应用，以及哲学研究所拥有的处于发展中的性质。

- (5) Analyze the initial reception within the medical community to William Harvey's (1578–1657) revolutionary findings on the circulatory system, detailing the key arguments and evidential breakthroughs that eventually led to the eclipse of the Galenic model.

请分析医学界对威廉·哈维（1578–1657）关于循环系统的革命性发现的最初反应，并详细说明最终导致盖伦模型被淘汰的关键论点和证据上的突破。



- (6) In light of Descartes' dualistic philosophy, explore how his vortex theory, positing a physical ether for planetary motion, contrasts with Newton's concept of an intangible gravitational force, and discuss the philosophical implications thereof.

思考笛卡尔的二元论哲学，探究其提出的涡旋理论——该理论提出了一种物质性的以太以解释行星的运动——与牛顿的无形引力概念的不同之处，并讨论其中的哲学意义。

- (7) Given Newton's gravitational theory's omission of a causal mechanism for attraction, discuss its influence on the philosophical discourses of the era, especially in relation to themes of determinism, causality, and the metaphysics of unseen forces.

鉴于牛顿的引力理论未能给予吸引作用的因果性机制，请讨论这一问题对当时的哲学讨论的影响，尤其是与不可见的力的决定论、因果性与形而上学等主题相关的讨论。

- (8) Examine the congruence or disparity between Newton's alchemical methodologies and the esoteric and metaphysical elements entrenched in the alchemical traditions of the medieval and Renaissance eras.

中世纪与文艺复兴时期的炼金术传统中存在着深奥与形而上学的成分，请思考这些成分与牛顿的炼金术方法之间有哪些一致与差异之处？

- (9) Contrast the experimental methodologies and philosophical ramifications of Robert Boyle's (1627–1691) and Evangelista Torricelli's (1608–1647) research, focusing on their contributions to the developing comprehension of vacuums and atmospheric pressure.

请比较罗伯特·波义耳（1627–1691）和埃万杰利斯塔·托里拆利（1608–1647）的研究所采用的实验方法论及这些研究的哲学影响，重点关注他们在处于发展中的对真空和大气压的理解方面所做的贡献。

- (10) Examine the historical philosophies foundational to the Royal Society and the *Académie des Sciences* in shaping their respective scientific methodologies, research priorities, and the strategies employed in the dissemination of knowledge.

英国皇家学会与法兰西科学院塑造了各自的科学方法论、研究重点以及用于传播知识的策略，请思考这两所科学院在这些活动中所依据的历史哲学基础是什么。



## **SECTION 6: Probing the Intellectual Landscape of the Enlightenment**

- (1) In the milieu of the Enlightenment (circa 1650–1800), to what extent did the mathematical praxes in physical sciences embody the epoch’s cardinal tenets like rationalism, empiricism, and the ethos of progress? Moreover, how did these methodologies either synergize with or contravene the societal and cultural fabric of this era?

在启蒙时代（大约1650–1800年）的背景下，物理科学中的数学实践在多大程度上体现了该时代的核心信条，如理性主义、经验主义和进步精神？此外，这些方法论是如何与这一时代的社会及文化结构产生协同作用或彼此抵触的？

- (2) The Enlightenment’s magnum opus, the *Encyclopédie* (first published in 1751), was a monumental endeavor to democratize knowledge, yet it encountered formidable censorship, mirroring the power dynamics of the era. Elaborate on the inferred nexus between the dissemination of knowledge and the structures of power, and discuss the *Encyclopédie*’s potential impact on ensuing socio-political upheavals, such as the French Revolution (1789–1799).

启蒙运动时期的巨作《百科全书》（首次出版于1751年）是一项旨在使知识民主化的壮举。然而《百科全书》遭遇了强有力的审查制度，从而反映出那个时代的权力动态。请详细阐述由上文指出的知识传播与权力结构之间的联系，并探讨《百科全书》对随后的社会政治动荡——如法国大革命（1789–1799年）——的潜在影响。

- (3) In the context of the Age of Reason, how did philosophers John Locke (1632–1704) and David Hume (1711–1776) address the issue of sensory experience reliability, and what philosophical conundrums emerge from their perspectives?

在理性时代的背景下，哲学家约翰·洛克（1632–1704）和大卫·休谟（1711–1776）是如何处理感官经验的可靠性问题的，此外有哪些哲学难题是自他们的观点中产生的？

- (4) Elucidate how Benjamin Franklin’s (1706–1790) kite experiment (conducted in 1752) augmented the understanding of electricity, and delineate its ramifications for the broader scientific community of the time.

请阐述本杰明·富兰克林（1706–1790）在1752年进行的风筝实验是如何增进了人们对电的理解，并概述其对当时更广泛的科学共同体的影响。



- (5) Assess the extent of inclusivity in the coffee house culture of the Enlightenment, particularly considering aspects of class, gender, and the diversity of viewpoints. How reflective was this milieu of the era's intellectual and social ethos?

请评价启蒙运动时期咖啡馆文化的包容性的程度，尤其要考虑到阶级、性别和观点多样性等方面。这种环境在多大程度上反映了该时代的知识和社会精神？

- (6) In the Enlightenment's scientific discourse, particularly against the backdrop of Newtonian physics, how does Immanuel Kant's (1724–1804) dichotomy between “phenomena” and “noumena” challenge contemporaneous scientific comprehension? Additionally, how does this distinction comment on the limitations of empirical science as per Kant's philosophy?

在启蒙时代的科学话语中，特别是在牛顿物理学的背景下，伊曼纽尔·康德（1724–1804）关于“现象”和“本体”的二分法是如何挑战当时人们对科学的理解的？此外，根据康德哲学，如果采用这种区分，那么该如何看待经验科学的局限性？

- (7) Discuss the role of colonial expansion in the Enlightenment era in sculpting the contents and organization of museum collections. How did these collections mirror and perpetuate the colonial ideologies of the time?

请讨论在启蒙运动时期，殖民扩张在制定博物馆藏品的内容与组织方式方面起到的作用。这些藏品是如何反映和保持当时的殖民意识形态的？

- (8) Examine the principal reservations articulated by contemporaries of Carl Linnaeus (1707–1778) regarding his taxonomic framework, and analyze what these critiques reveal about the nature of scientific discourse and the dominant intellectual values during the Enlightenment.

请思考卡尔·林奈（1707–1778）的同时代人对他的分类框架提出的主要的保留意见，并分析这些批评在关于启蒙运动时期科学讨论的性质以及主导的知识价值方面所揭示出的内容。

- (9) What factors precipitated the initial endorsement of the phlogiston theory, and how did subsequent research, particularly by Antoine Lavoisier (1743–1794), catalyze its decline?

是什么因素推动了人们对燃素说的最初的接受，此外，之后的研究——特别是由安托万·拉瓦锡（1743–1794）所进行的——是如何促成其衰落的？



## **SECTION 7: 19th Century Evolutionary Theories**

- (1) Analyze the intellectual upheaval instigated by the doctrine of uniformitarianism, as formulated by James Hutton (1726–1797) and later popularized by Charles Lyell (1797–1875). How did this theory challenge and eventually reshape the prevailing 19th-century geological paradigms, thereby indirectly exerting influence on contemporary biological theories, including those emerging in Darwinian thought?

均变论学说由詹姆斯·赫顿(1726–1797)阐述, 并随后为查尔斯·莱伊尔(1797–1875)所普及, 请对这一学说所引起的知识剧变进行分析。这一理论是如何挑战并最终重塑19世纪的主流地质学范式, 从而间接对当代生物学理论——包括达尔文思想中的新兴理论——产生影响的?

- (2) Contrast the role of empirical evidence in the formulation and acceptance of Charles Darwin's (1809–1882) theory of natural selection with that in Jean-Baptiste Lamarck's (1744–1829) theory of inheritance of acquired characteristics. How do these differing evidentiary bases reflect the scientific methodologies and philosophical inclinations of their respective eras?

无论是在查尔斯·达尔文(1809–1882)的自然选择理论的构想与人们对其的接受过程中, 还是在让-巴蒂斯特·拉马克(1744–1829)的获得性遗传理论中, 经验证据都发挥了作用, 请对上述两种理论中经验证据的作用进行比较。这两种不同的证据基础如何反映了各自时代的科学方法论和哲学倾向?

- (3) Delve into Darwin's methodological rigor in constructing his argument for natural selection. What specific empirical evidence did he gather during his expedition on the HMS Beagle (1831–1836) and in his subsequent research endeavors, which substantiated his theoretical framework? Provide illustrative examples.

请深入探讨达尔文在构建自然选择理论时所用的方法论的严谨性。达尔文乘坐贝格尔号所进行的考察探险(1831–1836)及之后的研究活动充实了他的理论框架, 那么在這些活动中达尔文收集了哪些具体的经验证据? 请提供说明性的例子。

- (4) Explore how Darwin's observations of interspecific variation among the finches of the Galápagos Islands during his voyage on the HMS Beagle informed his understanding of intraspecific variation within a single species. How did these observations become integral to his formulation of the theory of natural selection?

请探究达尔文在贝格尔号之旅期间对加拉帕戈斯群岛雀类种间变异的观察, 是如何影响他对单一物种内的种间变异的理解的。这些观察如何成为他在对自然选择理论的构想过程中的重要部分?



- (5) Scrutinize the aspects of Lamarckian evolutionary theory that were assimilated into Darwin's evolutionary framework, as well as those which he explicitly rejected. What were the implications of these choices for the broader development of evolutionary thought?

请仔细审视达尔文的进化论框架中吸收，以及明确抛弃了拉马克进化理论中的哪些方面。这些选择对进化思想的更广泛的发展有何影响？

- (6) Assess the implications of Darwin's lack of a comprehensive genetic framework within his theory of natural selection, and compare this to the reception of Lamarck's theory, which similarly lacked a genetic basis. How did this genetic lacuna shape the contemporary understanding and critique of their theories?

请对达尔文在其自然选择理论中缺乏全面的遗传学框架所带来的影响进行评价，并将其与拉马克的同样缺乏遗传基础的理论的接受情况进行比较。这种遗传学的如何塑造了当时人们对这些理论的理解和批判？

- (7) Discuss how Gregor Mendel's (1822–1884) rediscovered work, particularly his Law of Segregation and Law of Independent Assortment, provided a genetic basis that complemented Darwin's observations on natural selection. How did Mendel's laws, alongside the subsequent contributions by Hugo de Vries (1848–1935), particularly his mutation theory, bridge conceptual and empirical gaps in evolutionary biology?

请讨论格雷戈尔·孟德尔 (1822–1884) 的重新被发现的工作——尤其是他的分离定律和独立分配定律——如何为达尔文的自然选择观察提供了遗传学基础。孟德尔的定律与后来胡戈·德弗里斯 (1848–1935) 的贡献——特别是他在20世纪初提出的突变理论——如何为进化生物学中的概念与经验之间的隔阂架起桥梁的？

- (8) Critically assess Herbert Spencer's (1820–1903) adoption of the expression “survival of the fittest” within social and political discourses. To what extent can this be seen as a misapplication of scientific theory, and what are the historical examples that illustrate this phenomenon?

请批判性地评价赫伯特·斯宾塞 (1820–1903) 对“适者生存”这一词语在社会和政治话语中的使用。这在多大程度上可以被视为对科学理论的误用，并且有哪些历史上的例子可以说明这一现象？





## **SECTION 8: 19th-Century: Refuting Old Theories and Shaping Modern Science**

- (1) In the milieu of 19th-century scientific inquiry, how did the experimental endeavors of Louis Pasteur (1822–1895), particularly his seminal work on fermentation, serve as a crucial refutation of the long-entrenched doctrine of spontaneous generation, a belief prevailing since Aristotelian times? In light of Pasteur’s ostensibly limited investigational domain, what mechanisms enabled his research to profoundly destabilize this ancient theoretical construct?

在19世纪科学研究的背景下，路易·巴斯德（1822–1895）的实验，尤其是他在发酵领域的开创性工作，是如何对自然发生说——一种自亚里士多德时代以来盛行的观点——进行关键性地反驳的？鉴于巴斯德的研究领域从表面上看是有限的，是哪些机制使他的研究能够深刻动摇这一古老的理论？

- (2) To what degree did the germ theory of disease, emerging in the latter half of the 19th century, precipitate the obsolescence of the miasma theory and the concept of humoral imbalance, doctrines deeply rooted in Hippocratic and Galenic traditions? Was this transition wholly consummate, or did the ascendancy of the germ theory retain certain conceptual vestiges of its predecessors?

疾病的细菌理论兴起于19世纪下半叶，这一理论在多大程度上推动了瘴气理论与体液不平衡概念——这些学说深植于希波克拉底和盖伦传统——的淘汰？这一转变是否是完美无缺的，还是细菌理论所具有的优势保留了原有理论的某些概念方面的残余？

- (3) In the context of early 19th-century scientific discourse, how did the contemporaneous reception and critique of John Dalton’s (1766–1844) atomic theory and Johann Döbereiner’s (1780–1849) formulation of chemical “triads” exert influence on the trajectory and essence of ensuing scholarly pursuits in the realm of chemical classification?

在19世纪早期科学话语的背景下，当时人们对约翰·道尔顿（1766–1844）的原子理论和约翰·杜贝雷纳（1780–1849）所构想的化学“三元素组”的接受和批判，是如何影响随后的化学分类领域中的学术研究的研究路径和实质的？

- (4) Within the history of chemistry, evaluate the relative contributions of Lothar Meyer (1830–1895) vis-à-vis Dmitri Mendeleev (1834–1907) in the formulation of the periodic table. What factors underlie the more pronounced historical acclaim afforded to Mendeleev in this scientific narrative?

请在化学史的范围內，对比洛塔尔·迈尔（1830–1895）与德米特里·门捷列夫（1834–1907）两人在制定元素周期表方面的贡献，并对这些贡献做出评价。



- (5) In the evolution of modern organic chemistry, how did the repudiation of vitalism, a doctrine postulating a distinct life force beyond chemical and physical laws, reshape foundational tenets and methodological paradigms within the discipline?

在现代有机化学的发展进程中，对活力论——一种假设存在某种超脱于化学和物理定律的独特生命力的学说——的否定是如何重塑该学科的基本原则和方法论范式的？

- (6) Examine the scientific legacy of Friedrich August Kekulé (1829–1896), with an emphasis on his elucidation of molecular bonding in organic compounds. Specifically, analyze how his theories concerning carbon valency and the structure of benzene propelled advancements in both academic research and industrial chemical processes.

请思考弗里德里希·奥古斯特·凯库勒（1829–1896）的科学遗产，重点关注他对有机化合物中分子成键的阐释。更确切地说，请分析他关于碳价和苯的结构理论是如何推动学术研究和工业化学过程的进步的。



## **SECTION 9: The Pioneers of Electromagnetism**

- (1) How did Alessandro Volta's (1745–1827) contributions, notably the invention of the voltaic pile, precipitate a critical transformation in the understanding and application of electric potential, thereby influencing the trajectory of subsequent scientific endeavors in the domain of electromagnetism?

亚历山德罗·伏打（1745–1827）的贡献，尤其是伏打电堆的发明，是如何推动对电势的理解和应用的关键性转变，从而影响了之后电磁学领域的科学研究的路径的？

- (2) In what manner did the intellectual endeavors and theoretical progressions of Hans Christian Ørsted (1777–1851) and André-Marie Ampère (1775–1836) during the nascent years of the 19th century pose a challenge to, and expand upon, the Newtonian mechanistic paradigm prevalent in the domain of physics?

在19世纪初期，汉斯·克里斯蒂安·奥斯特（1777–1851）和安德烈·马里·安培（1775–1836）的知识探索与在理论上取得的进展，是如何对当时在物理学领域盛行的牛顿机械论范式提出挑战并加以详细阐述的？

- (3) Delve into the epistemological transformation engendered by Michael Faraday's (1791–1867) introduction of the concepts of field lines and magnetic fields, and how this stood in contrast to the Newtonian paradigm which primarily conceived forces in a distinct manner.

请思考迈克尔·法拉第（1791–1867）通过引入场线和磁场的概念所引发的认识论转变，以及这一转变与主要基于不同方式来对力进行构想的牛顿范式之间的差异之处。

- (4) Critically analyze the repercussions of the divergent methodologies employed by Ampère and Faraday in their scientific explorations – namely, Ampère's theoretical/mathematical approach versus Faraday's experimental/intuitive strategy – and their respective influences on the advancement of electromagnetism.

请批判性地分析安培和法拉第在科学探索中采用的不同方法论——即安培的理论/数学方法与法拉第的实验/直觉策略——所带来的结果，以及这两者各自对电磁学发展所产生的影响。

- (5) How did James Clerk Maxwell's (1831–1879) integration of the displacement current into Ampère's Law rectify the prevailing inconsistencies within the electromagnetic theory of his era, and what were the subsequent ramifications for the principle of charge conservation?

詹姆斯·克拉克·麦克斯韦（1831–1879）将位移电流整合进安培定律，这一举措是如何纠正了他所处的时代的电磁理论中存在的主要矛盾之处的？它在之后又对电荷守恒定律产生了哪些影响呢？



- (6) Maxwell's seminal work achieved a synthesis of electricity, magnetism, and optics, thereby revolutionizing contemporary scientific perceptions of physical forces. Investigate the repercussions of this unification on the philosophical viewpoints regarding nature prevalent during that epoch.

麦克斯韦的开创性工作实现了电、磁和光学的综合，从而彻底改变了当时的人们对物理力的科学理解。请探究这种统一对当时流行的关于自然的哲学观点所产生的影响。



## **SECTION 10: The Evolution of Thermodynamics and Atomic Theory (19th Century)**

- (1) In the context of the scientific discoveries of the early 19th century, particularly within the period surrounding Sadi Carnot's lifespan (1796–1832), how did his seminal work “Reflections on the Motive Power of Fire” serve as a catalyst for advancements in disciplines in and beyond thermodynamics, notwithstanding its initial underappreciation by his contemporaries?

在19世纪初科学发现的背景下，特别围绕萨迪·卡诺（1796–1832）在世时间的年代范围内，他的开创性著作《论火的动力》是如何成为促进热力学之内及之外的学科进步的催化剂的，尽管它最初未能被卡诺的同代人所重视？

- (2) In 1843, a crucial year for James Joule (1818–1889), his groundbreaking experiments on the mechanical equivalent of heat posed a formidable challenge to the prevailing caloric theory. What trajectory did the scientific community undertake in embracing this shift amidst the prevalent theoretical–experimental schism of that era?

1843年对詹姆斯·焦耳（1818–1889）来说是关键的一年，在这一年，他的关于热功当量的开创性实验对当时盛行的热质说提出了强有力的挑战。置身于那个时代普遍存在的理论-实验分歧中，科学共同体在接受这一转变时所采取是哪一种路径？

- (3) During the crucial decades of the 1860s and 1870s, how did James Clerk Maxwell (1831–1879) and Ludwig Boltzmann (1844–1906) revolutionize the kinetic theory, and in what ways did their pioneering contributions facilitate the integration of this theory into the domain of physical chemistry?

在1860年代和1870年代这关键的二十年里，詹姆斯·克拉克·麦克斯韦（1831–1879）和路德维希·玻尔兹曼（1844–1906）是如何使运动学理论发生革命性变化的？他们的开创性贡献又是如何促进这一理论被整合入物理化学领域的？

- (4) Reflect upon the collaborative endeavors in the development of statistical mechanics by Ludwig Boltzmann, Josiah Willard Gibbs (1839–1903), and their contemporaries. How did their collective and individual intellectual explorations contribute to the advancement of both physical chemistry and thermodynamics by bridging the microscopic behavior of particles with the macroscopic principles of thermodynamic laws?

请对路德维希·玻尔兹曼、乔赛亚·威拉德·吉布斯（1839–1903）及其同时代人在统计力学发展中所做的合作努力进行思考。他们的集体和个人智慧探索是如何通过将粒子的微观行为与热力学定律的宏观原理连接起来，从而促进物理化学与热力学的发展的？



- (5) During the waning years of the 19th century, Lord Kelvin (William Thomson, 1824–1907), known for his firm belief in classical physics and skepticism towards atomic theory, wielded significant influence. Analyze how his steadfast commitment to these principles impacted the scientific community's landscape and influenced the broader acceptance or rejection of atomic theories during that era.

在19世纪末期，坚定支持经典物理学且对原子理论持怀疑态度的开尔文勋爵（威廉·汤姆森，1824–1907）具有重要影响力。请分析他对这些原理的坚守如何既影响了当时的科学共同体的图景请思考，也影响了在该时期人们对原子理论的广泛接受与排斥。

- (6) Ponder upon Ernst Mach's (1838–1916) skepticism regarding the physical existence of atoms and his positivist philosophical stance. How did these convictions influence the discourse on atomic theory, and what impact did this have on the evolution of physical chemistry during his time?

请思考恩斯特·马赫（1838–1916）对原子的物理学存在性的怀疑和他的实证主义哲学立场。马赫所持的这些他所深信不疑的观点是如何影响对原子理论的讨论的？此外，这对他所在的时代的物理化学的发展产生了怎样的影响？



## **SECTION 11: Advancements in Atomic and Radiation Physics**

- (1) Analyze the implications of the properties and phenomena of X-rays, as elucidated by Wilhelm Conrad Röntgen (1845–1923) and his successors, in relation to the atomic theory postulated by Dalton. Did these discoveries affirm, contradict, or augment Dalton’s theoretical framework?

联系道尔顿提出的原子论，请对由威廉·康拉德·伦琴（1845–1923）及其后继者所阐述的X射线的性质与现象的意义进行分析。这些发现是确认、反驳还是补充了道尔顿的理论架构？

- (2) In the context of late 19th-century, why did the observed characteristics of cathode rays and X-rays contribute to a revival of the corpuscular theory of light, a concept seemingly antiquated in the face of the then-dominant wave theory?

在19世纪末的背景下，为什么观测到的阴极射线和X射线的性质推动了光的微粒说——相对于当时占主导地位的波动说其可谓是一个陈旧的理论——的复兴？

- (3) Critically assess the methodological variances in the experimental approaches of Sir Joseph John Thomson (1856–1940) and Robert Andrews Millikan (1868–1953). How did these differences shape their individual contributions to the conceptualization of the electron?

请批判性地评价约瑟夫·约翰·汤姆森爵士（1856–1940）和罗伯特·安德鲁斯·密立根（1868–1953）在实验方法上的不同之处。这些差异如何影响了他们各自对电子理论的贡献？

- (4) In the field of radioactivity, position the empirical contributions of Marie Curie (1867–1934) and Pierre Curie (1859–1906), building upon the foundational work of Henri Becquerel (1852–1908), within the theoretical landscape of their time. How did their findings interact with contemporary theoretical predictions?

在放射性研究领域，玛丽·居里（1867–1934）和皮埃尔·居里（1859–1906）所做出的经验性贡献是建立在昂利·贝可勒尔（1852–1908）的基础性研究之上的，请将居里夫妇的经验性贡献置于当时的理论图景之中。他们的发现是如何与当时的理论预测互相影响的？

- (5) Examine the progressive theoretical advancements addressing the blackbody radiation dilemma, starting from Wilhelm Wien’s (1864–1928) Displacement Law, through the Rayleigh–Jeans Law formulated by Lord Rayleigh (1842–1919) and Sir James Jeans (1877–1946), to Max Planck’s (1858–1947) Law. How did these developments collectively resolve the ultraviolet catastrophe?



请思考旨在解决黑体辐射难题的理论方面的进展，从威廉·维恩（1864–1928）的位移定律出发，经由瑞利勋爵（1842–1919）和詹姆斯·金斯爵士（1877–1946）共同提出的瑞利-金斯定律，再到马克斯·普朗克（1858–1947）定律。这些进展是如何共同解决紫外灾难的？

- (6) Chart the evolutionary trajectory of atomic theory, beginning with Ernest Rutherford's (1871–1937) gold foil experiment, leading to his development of the orbital model, and culminating in the Rutherford–Bohr model of the atom advanced by Neil Bohr (1885–1962). Consider the historical and theoretical context of each stage in this evolutionary process.

请回溯原子理论的发展轨迹，从欧内斯特·卢瑟福（1871–1937）的金箔实验出发，到他对行星模型的发展，直至由尼尔斯·玻尔（1885–1962）提出的卢瑟福-玻尔原子模型标志着达到顶点。请探讨这个演化过程中，每个阶段的历史和理论语境。





## **SECTION 12: Exploring the Evolution of Light and Relativity**

- (1) In the context of 19th-century scientific inquiry, the measurement of the speed of light, an endeavor commenced in earnest by Armand Fizeau (1819–1896) and Léon Foucault (1819–1868), offered profound insights into light’s intrinsic nature. Specifically, how did the quantification of light’s velocity contribute to the debate between its wave-like properties, as posited by Christiaan Huygens (1629–1695), and its corpuscular characteristics, as theorized by Newton? This inquiry necessitates an examination of the aspects of light’s nature that could be illuminated by an understanding of its velocity.

在19世纪科学研究的背景下，由阿尔芒·菲佐（1819–1896）和莱昂·傅科（1819–1868）认真着手从事的一项活动——对光速的测量——向世人提供了关于光的本质的深刻见解。如果具体来看，光速的量化是如何导致了关于光的波动性——如克里斯蒂安·惠更斯（1629–1695）所提出——与微粒性——如牛顿所对其理论化——之间的争论的？这一探究需要考察光的性质中那些可以通过理解光速而得以被阐明的方面。

- (2) The late 19th and early 20th centuries witnessed a tumultuous era in the understanding of light’s nature, marked by a confluence of conflicting evidence. Analyze the impact of this evidence, considering the seminal contributions towards the wave theory by figures such as Thomas Young (1773–1829), Augustin-Jean Fresnel (1788–1827), Fizeau, and Foucault. Additionally, explore the particle-like evidence emanating from cathode and X-rays, juxtaposed against the implications of the Michelson–Morley experiment’s null result (1887), in shaping the scientific discourse.

就对光的性质的理解而言，19世纪末至20世纪初可谓是一个喧嚣的时期，其特点就是相互矛盾的证据在这一时期内交汇。请结合如托马斯·扬（1773–1829）、奥古斯丁·让·菲涅尔（1788–1827）、菲佐与傅科等人对光的波动理论所做的重大贡献，分析这些证据的影响。此外，请在科学话语的塑造方面，探究由阴极射线与X射线得出的光的微粒性的证据，并与迈克耳孙-莫雷实验的零结果（1887）的内在含义进行对比。

- (3) Albert Einstein (1879–1955), in his study of the photoelectric effect (published in 1905), forged a conceptual bridge between the wave theory and the corpuscular theory of light. Why is this study considered crucial in reconciling these historically divergent perspectives?

阿尔伯特·爱因斯坦（1879–1955）在其于1905年发表的关于光电效应的研究中，搭建了一条连接光的波动说与微粒说之间的概念桥梁。为什么这项研究被认为是在调和这两种在历史上就彼此矛盾的观点方面的关键？



- (4) The theoretical underpinnings of Einstein's conceptualization of the photon represented a fundamental shift in the scientific understanding of electromagnetic radiation. How did Einstein's photon theory both challenge and extend beyond Planck's initial hypothesis of energy quanta, particularly in terms of their implications for the wave-particle duality and the broader framework of quantum mechanics?

爱因斯坦对光子的概念化的理论基础代表了对电磁辐射科学理解的根本性转变。爱因斯坦的光子理论是如何挑战并超越普朗克最初的能量量子假设的，尤其是就它们所具有的对波粒二象性和量子力学的更广泛框架的意义而言？

- (5) The concept of "ether" underwent a significant transformation from its early mechanical interpretations, such as Descartes' vortices, to the 19th-century conceptualization of the "luminiferous ether." How does the persistence and evolution of the ether concept, despite its changing nature, illustrate the complex interplay between continuity and innovation in the history of scientific thought?

“以太”的概念经历了重大的转变：从早期的以笛卡尔的涡旋为代表的机械论解释，再到19世纪的“光以太”概念。尽管其性质不断变化，以太概念的长期存在和发展演进是如何说明了在科学思想史中连续性与创新之间的复杂相互作用的？

- (6) Einstein's theory of special relativity, introduced in 1905, posed a formidable challenge to the prevailing 19th-century conceptions of ether and absolute motion. How did this groundbreaking theory redefine these concepts, which had been widely accepted in the scientific community prior to 1905?

爱因斯坦在1905年提出的特殊相对论对19世纪普遍接受的以太和绝对运动的概念提出了巨大挑战。这一开创性理论是如何重新定义这些在1905年之前就已被科学共同体所广泛接受的概念的？

- (7) Contrast the implications of Galilean relativity with those of Einstein's special relativity, particularly in terms of their respective effects on the scientific understanding of time.

请将伽利略的相对性原理的含义与爱因斯坦的狭义相对论的含义进行比较，尤其是就这两者各自的对关于时间的科学理解的影响而言。

- (8) Discuss the logical and conceptual steps involved in transitioning from the equivalence principle to the notion of spacetime curvature in Einstein's theory of general relativity, introduced in 1915.

请讨论在爱因斯坦于1915年提出的广义相对论中的，从等效原理到时空曲率概念的转变所涉及到的逻辑和概念步骤。



### **SECTION 13: The Evolution of Biological Thought (Late 19th to Mid-20th Century)**

- (1) Delve into the socio-political and cultural currents that modulated the reception and repudiation of Neo-Lamarckism. Assess the zeitgeist of the late 19th and early 20th centuries that influenced this intellectual tide.

请对控制人们对新拉马克学说的接受与拒绝态度的社会政治与文化潮流进行探究。请评价19世纪末至20世纪初影响这一知识趋势的时代精神。

- (2) Within the paradigm of Neo-Darwinism, what empirical revelations or scientific advancements precipitated the recognition of its limitations? Elaborate on how these insights, emerging primarily in the early 20th century, sculpted the development of evolutionary biology.

在新达尔文主义范式内，是什么经验性发现或科学进展推动了对其局限性的认识？请详述这些主要诞生于20世纪初的洞见是如何塑造了进化生物学的发展过程的。

- (3) Examine the principal theoretical and methodological impediments encountered by the pioneers of the Modern Synthesis (circa 1930s and 1940s), and elucidate the strategies they employed to surmount these obstacles, thus forging a more comprehensive schema for interpreting evolutionary processes.

请思考现代综合论的先驱们（大约在1930年代和1940年代）遇到的主要的理论及方法论障碍，并阐述他们用于克服这些障碍，从而构建了一个用于解释进化过程的更全面的框架所用的策略。

- (4) Can you delineate the principal ideological dichotomies or discourses among the pioneers who contributed to the Modern Synthesis? Explore how these contentious issues were either reconciled or assimilated into the theoretical framework.

您能否就对现代综合论做出贡献的先驱者之间的主要的意识形态分歧或讨论进行阐述？请探究这些具有争议性的问题是如何获得调和或被吸收进理论框架的。

- (5) Analyze the tribulations confronted by William Bateson (1861–1926) in his endeavor to unify Mendelian genetics with evolutionary theory, amidst the then-dominant paradigm of “blending inheritance.” Reflect on the intellectual milieu of the early 20th century that framed this challenge.

请分析在当时处于主导地位的“混合遗传”范式背景下，威廉·贝特森（1861–1926）在努力将孟德尔遗传学与进化理论统一时所面临的困难。请思考塑造出这一挑战的20世纪早期的知识环境。



- (6) Investigate the assimilation and enduring influence of Sewall Wright's (1889–1988) concepts of genetic drift and the adaptive landscape within contemporary evolutionary thought. Assess how these ideas have been integrated and their sustained impact.

请对休厄尔·赖特（1889–1988）的遗传漂变与适应性地形这两个概念在当时的进化思想中的吸收情况及持久影响进行考察。请就这些观点被整合的方式以及它们所产生的持久影响进行评价。

- (7) Discuss how J.B.S. Haldane's (1892–1964) contentious views on eugenics and advocacy for state-regulated selective breeding influenced the ethical discourse and public perception of his contributions to the Modern Synthesis. Discuss the intersection of his scientific work and socio-political ideologies within the context of the early to mid-20th century.

请讨论J.B.S. 霍尔丹（1892–1964）关于优生学的争议性观点，以及他对国家调控的选择育种的支持是如何影响了伦理学话语及公众对他在现代综合论方面所做的贡献的观点的。请讨论在20世纪早期至中期的背景下，他的科学研究与社会-政治意识形态的交汇之处。



## **SECTION 14: The Epochs of Quantum Mechanics and Particle Physics**

- (1) In the continuum of light's dualistic nature, postulated by Einstein through his explication of the photoelectric effect, how did Louis de Broglie (1892–1987) augment the discourse with his novel perspective on wave-particle duality?

在爱因斯坦通过解释光电效应所提出的光的二元性质连续体中，路易·德布罗意（1892–1987）是如何用他关于波粒二象性的新视角来补充这一讨论的？

- (2) Amidst the intellectual ferment of early 20th-century physics, how did the prevailing zeitgeist shape Erwin Schrödinger's (1887–1961) formulation of wave mechanics, particularly when juxtaposed with Werner Heisenberg's (1901–1976) matrix mechanics?

在20世纪初物理学知识蓬勃发展的进程中，当时的盛行的时代精神是如何影响了埃尔温·薛定谔（1887–1961）对波动力学的构想，尤其是在与维尔纳·海森堡（1901–1976）的矩阵力学对比时？

- (3) Contemplating the shift from Schrödinger's deterministic wave mechanics to Max Born's (1882–1970) probabilistic interpretation, how did this transition refine and evolve the understanding of quantum mechanics?

思考从薛定谔的确定性波动力学到马克斯·玻恩(1882–1970)的概率诠释的转变，请回答这一转变是如何完善与发展了人们对量子力学的理解的？

- (4) In the milieu of the Copenhagen interpretation, did the concept of "wave function collapse" resolve the quantum measurement problem? What were the historical ramifications and intellectual challenges posed by this concept?

在哥本哈根诠释的背景下，“波函数坍缩”的概念是否解决了量子测量问题？这一概念所带来的历史影响以及知识挑战是什么？

- (5) In the historical evolution of quantum mechanics, what role did the phenomena of superposition and entanglement play, particularly in light of seminal thought experiments like Schrödinger's cat?

在量子力学的历史发展过程中，叠加与纠缠现象所起到的作用是什么，尤其是鉴于诸如薛定谔的猫的重要思想实验？



- (6) How did Bohr's concept of complementarity, interlacing with the observer effect, contribute to the nascent understanding of quantum mechanics in its early years?

玻尔的互补概念是如何在与观察者效应交织后，就人们对量子力学的早期理解做出了怎样的贡献？

- (7) Contrast the methodological and interpretative approaches in Rutherford's 1917 experiment leading to the proton's identification and James Chadwick's (1891–1974) 1932 discovery of the neutron.

请比较卢瑟福在1917年进行的发现质子的实验，与詹姆斯·查德威克(1891–1974)在1932年对中子的发现中的用到的方法论及解释方法。

- (8) Explore the historical significance of the Paul Dirac (1902–1984) equation in amalgamating quantum mechanics with the special theory of relativity.

请探究保罗·狄拉克（1902–1984）方程在融合量子力学与狭义相对论方面的历史重要性。

- (9) Analyze the profound philosophical ramifications of Dirac's prescience in predicting antimatter and Carl Anderson's (1905–1991) subsequent empirical discovery, particularly regarding conceptions of reality.

请分析狄拉克预测反物质的存在的先见之明，以及卡尔·安德森(1905–1991)在随后的经验发现所具有的深远的哲学影响，尤其是在关于现实的概念方面。

- (10) Discuss the evolution and influence of the concept of non-locality and the breach of Bell inequalities, framed by the 1935 Einstein-Podolsky-Rosen paradox (EPR paradox) and John Bell's (1928–1990) 1964 analysis, on the philosophical and theoretical landscape of quantum mechanics.

非定域性概念以及贝尔不等式的违反分别由在1935年提出的爱因斯坦-波多尔斯基-罗森佯谬（EPR佯谬）与约翰·贝尔（1928–1990）在1964年的分析所构想出，请讨论非定域性概念与贝尔不等式的违反的发展过程，以及它们对量子力学的哲学与理论图景的影响。

- (11) How does the EPR paradox challenge or affirm diverse interpretations of quantum mechanics, including the Copenhagen, Many-Worlds, and pilot-wave theories in their philosophical construction of reality?

量子力学的诠释包括哥本哈根诠释、多世界诠释与导波理论等，那么EPR佯谬是如何在这些诠释对现实的哲学构建方面挑战或确认这些不同的诠释的？



- (12) What specific advancements and new theoretical domains in physics were catalyzed by Richard Feynman's (1918–1988) Path Integral Formulation?

理查德·费曼（1918–1988）的路径积分表述促成了物理学中哪些特定的研究进展以及新的理论领域？

- (13) Examine the contribution of Tsung-Dao Lee (born 1926) and Chen-Ning Yang's (born 1922) discovery of parity violation in 1956, and its experimental confirmation by Chien-Shiung Wu (1912–1997), to the formulation of electroweak theory.

李政道（1926年生）和杨振宁（1922年生）在1956年发现宇称不守恒，吴健雄（1912–1997）对其进行了实验验证，请分析他们的研究工作对电弱理论的阐述的贡献。

- (14) Reflect upon the unification of the electromagnetic and weak forces into the electroweak theory in the late 1960s and the subsequent establishment of quantum chromodynamics as the theory of the strong force in the 1970s, and its transformative impact on particle physics.

请对以下内容进行思考：在20世纪60年代末电磁力与弱相互作用力被统一成为电弱理论；随后在70年代，作为强相互作用力理论的量子色动力学的建立，及其对粒子物理学产生的变革性的影响。

- (15) Analyze the progression from the initial quark model, as proposed by Murray Gell-Mann (1929–2019) and George Zweig (born 1937) in 1964, to the consolidation of the Standard Model in the 1970s, highlighting the key experimental and theoretical developments during this period.

请对从默里·盖尔曼（1929–2019）和乔治·茨威格（1937年生）在1964年提出最初的夸克模型，到70年代标准模型的确立这一过程进行分析，着重关注这一时期的关键性的实验的和理论的发展。



## **SECTION 15: World War II Era: Pioneers, Ethics, and Global Impact**

- (1) Delving into the history of nuclear physics, the groundbreaking experiment that unveiled nuclear fission stands as a subject of intense scrutiny, especially when viewed through the lens of Enrico Fermi's (1901–1954) preceding contributions. In what manner can we contextualize the empirical evidence that underpinned this discovery, particularly in light of Fermi's earlier advancements within this domain?

如果对核物理学的历史加以研究，尤其是当通过恩里科·费米（1901–1954）的早期贡献的视角来对其加以看待的话，我们就会认识到揭示了核裂变现象的开创性实验是受到密切关注的话题。我们如何能够对作为这一发现的基础的经验证据置于历史语境中，尤其是根据费米此前在该领域取得的进展？

- (2) Considering the historical debate surrounding Werner Heisenberg and his colleagues' involvement in Nazi Germany's nuclear program, assess the extent to which their scientific actions and decisions either facilitated or hindered the Third Reich's pursuit of nuclear weaponry, with particular emphasis on exploring instances of potential deliberate impedance.

鉴于对维尔纳·海森堡及其同僚参与纳粹德国核计划一事所引发的历史争论，请评价在多大程度上他们的科学行动和决策促进或阻碍了第三帝国研制核武器的努力，着重探寻潜在的蓄意阻挠行为的例子。

- (3) Elucidate the role of Fermi as a model of scientific leadership and methodology during the inception and operational phase of Chicago Pile-1. How did his approach reflect the synthesis of scientific innovation, the exigencies of wartime, and ethical deliberations within the ambit of the Manhattan Project?

在芝加哥一号堆的开始与运行阶段，费米所担任的角色是科学领导和方法论的典范，请对费米的这一角色进行阐述。他的方法是如何反映了曼哈顿计划所涉及的对科学创新、战时需求和道德考虑的全面的？

- (4) What was the functional and administrative significance of the Los Alamos National Laboratory in its role as the crucial nexus of the Manhattan Project, and in what ways did its structural and cultural dynamics contribute to the realization of the Trinity Test?

作为曼哈顿计划的关键枢纽，洛斯阿拉莫斯国家实验室在工作和管理方面的重要性是什么？其结构和文化动态如何促成了三位一体试验的实现？





- (5) Discuss the moral quandary confronted by eminent physicists, notably J. Robert Oppenheimer (1904–1967), in the ambit of the Manhattan Project. In what manner did these savants negotiate the dichotomy between their intellectual aspirations and the ominous ramifications of their nuclear research, particularly in light of the project’s potential to engender catastrophic outcomes?

请对参与曼哈顿计划的杰出物理学家，尤其是J. 罗伯特·奥本海默（1904–1967）所面临的道德困境进行讨论。这些学者如何处理他们的智力追求与其核研究所产生的不祥后果之间的对立性的，特别是鉴于该计划具有可能引发灾难性后果的潜在性？

- (6) Explore the roles and impacts of women and ethnic minorities in the Manhattan Project, highlighting the intricate interplay of gender and racial dynamics within the scientific community and the broader societal constructs of the mid-20th century. Assess how these elements were intertwined and how they influenced both the scientific discourse and the social landscape during the mid-20th century.

请在曼哈顿计划中的女性及少数族裔的角色与影响进行探索，着重强调20世纪中期的科学共同体中的性别和种族动态的复杂相互作用，以及更广泛的社会观念。请评价这些要素是如何紧密连接在一起的，它们又是如何影响了20世纪中期的科学话语与社会图景的。

- (7) The moral dilemmas faced by figures such as Leo Szilard (1898–1964) stand out, particularly their resolute advocacy for the prudent use of atomic weaponry. Elaborate on how these scientists’ ethical considerations left a mark on the postbellum discourse concerning nuclear morality and arms control, shaping the philosophical and ethical landscape of the era.

莱奥·齐拉（1898–1964）等人面临的道德困境非常突出，尤其是因为他们坚定倡导谨慎地使用核武器。请详细阐述这些科学家的道德考虑如何影响了战后关于核道德与军备控制的讨论，从而塑造了那个时代的哲学与伦理图景的。

- (8) Explore the historical context of string theory, particularly in its relation to the pursuit of Grand Unified Theories (GUTs) and the Theory of Everything (ToE) in theoretical physics. How did string theory emerge as a candidate for unifying the fundamental forces and particles, and what were the key challenges and breakthroughs in its early development in seeking to fulfill these ambitious scientific goals?

请探究弦理论的历史背景，尤其是它与对理论物理中的大统一理论和万有理论的研究的关系。弦理论是如何作为统一基本力和粒子的候选者而问世的？此外，在弦理论的早期发展中，为实现这些雄心勃勃的科学目标，该理论经历了哪些重要的挑战和突破？



## SECTION 16: Transforming Genetics

- (1) In what manner did the seminal discovery of nuclein by Friedrich Miescher (1844–1895) in the year 1869 lay the foundational groundwork for the subsequent identification of deoxyribonucleic acid (DNA) as the quintessential genetic material? Moreover, what array of factors precipitated the initial underestimation of its paramount significance within the framework of genetic theory?

弗里德里希·米舍（1844–1895）于1869年发现了核素，他的这项开创性的发现是如何为之后将脱氧核糖核酸（DNA）认定为重要遗传物质这一过程奠定基础的？此外，哪些因素导致了这一发现的在遗传理论框架内的重要性最初被低估？

- (2) How did the investigative endeavors of Hermann Muller (1890–1967), particularly his experiments with *Drosophila melanogaster* in the decades of the 1920s and 1930s, challenge and subsequently alter the prevailing paradigms of genes and heredity within the scientific community of the era?

赫尔曼·马勒（1890–1967）的研究工作，尤其是他在20世纪20至30年代对果蝇的实验是如何挑战并随后改变当时科学共同体中关于基因和遗传的主流范式的？

- (3) In the historical and scientific context of the mid-twentieth century, specifically the year 1944, how can we critically evaluate the Avery-MacLeod-McCarty experiment, particularly in terms of its role in shifting the scientific consensus from a protein-centric to a DNA-centric understanding of genetic information? Additionally, what were the underlying reasons for the initial skepticism towards embracing DNA as the fundamental carrier of genetic information?

在20世纪中期，特别是1944年的历史和科学语境下，我们如何批判性地评价埃弗里-麦克劳德-麦卡蒂实验，尤其是就这一方面而言：该实验在将科学共识从以蛋白质为中心理解遗传信息转变为以DNA为中心这一过程中所发挥的作用？此外，人们最初对于将DNA作为遗传信息的基本载体这一观点持怀疑态度的根本原因是什么？

- (4) Considering the significant implications of the Avery-MacLeod-McCarty experiment, which had already robustly implicated DNA as the genetic material, what is the importance of the Hershey-Chase experiment? What novel insights did this subsequent experiment contribute, thereby affirming its relevance in spite of the preceding findings?

埃弗里-麦克劳德-麦卡蒂实验已经有力地表明了DNA是遗传物质，鉴于这个实验所具有的重大意义，赫尔希-蔡斯实验的重要性又在哪里？这一后续实验贡献了哪些新颖的见解，从而在尽管已有之前的实验，但还是能证明其具本身有意义？



- (5) In what capacity did Linus Pauling (1901–1994), particularly through his erroneous triple-helix model of DNA, impel further investigations into the structure of DNA?

莱纳斯·鲍林（1901–1994）是如何推动对DNA结构的进一步研究的，尤其是通过其错误的DNA三螺旋模型？

- (6) To what extent did the hypothesis-driven approach employed by James Watson (born 1928) and Francis Crick (1916–2004) facilitate their rapid conceptualization of the double helix structure of DNA, in contrast to an experimental or data-driven methodology?

詹姆斯·沃森（生于1928年）和弗朗西斯·克里克（1916–2004）采用的假设驱动方法是不同于实验或数据驱动方法的，那么他们所采用的假设驱动方法在多大程度上促进了他们对DNA双螺旋结构的快速概念化的？

- (7) How can one analyze the ethical and professional circumstances surrounding Rosalind Franklin's (1920–1958) contributions to the elucidation of DNA's structure, particularly in light of the broader scientific and gender dynamics of the time?

罗莎琳德·富兰克林（1920–1958）对DNA结构的阐明做出了贡献，那么如何分析她做出这一贡献时所处的伦理与职业环境，尤其是鉴于当时更广泛的科学和性别动态？

- (8) In what ways did the revelation of DNA's molecular structure transform the genetic foundations of the Modern Synthesis, and what were the ramifications of this discovery for the Synthesis's theories of mutation and natural selection?

对DNA分子结构的揭示是如何改变现代综合理论的遗传基础的？这一发现对综合理论的突变理论和自然选择理论又有什么影响？

- (9) From the perspective of Paul Feyerabend's (1924–1994) philosophy of science, specifically his notion of "methodological anarchism," how can the discovery and subsequent research of DNA be interpreted as an illustration or refutation of this concept?

从保罗·费耶阿本德（1924–1994）的科学哲学观点，尤其是他的“方法论无政府主义”概念来看，DNA的发现及随后对其的研究是如何能够被解释为对这一概念的例证或反驳的？



## **SECTION 17: The Cold War**

- (1) In what manner did the “Sputnik Crisis” (1957) impinge upon the philosophical ethos and ethical considerations governing scientific research and development during this epoch? Elaborate on the multifaceted repercussions of this crisis within the landscape of scientific morality and intellectual inquiry during the the Cold War (circa 1947–1991).

1957年发生的“斯普特尼克危机”是如何影响那个时代中，作为科学研究与发展的准则的哲学精神和伦理考虑的？请详细阐述这场危机在冷战时期（大约1947–1991年间）的科学道德和知识研究图景中的多方面影响。

- (2) Delve into the interplay between the geopolitical tensions characteristic of the Cold War era and the scientific ventures undertaken during the International Geophysical Year (IGY, 1957–1958). In your perspective, did the IGY serve primarily as a conduit for ameliorating the Cold War frictions through scholarly cooperation, or did it, perhaps inadvertently, exacerbate the geopolitical rivalries?

冷战时期的特点之一就是地缘政治紧张局势，请对这种紧张局势与国际地球物理年（IGY, 1957–1958年）期间的科学事业之间的相互作用进行探究。在你看来，国际地球物理年主要是发挥了通过学术合作来缓解冷战紧张关系的渠道作用，还是可能无意中加剧了地缘政治对抗？

- (3) During the Cold War, a retrospective examination of Alfred Wegener’s (1880–1930) Continental Drift hypothesis, first proposed in the early 20th century, gains significance in understanding the evolution of scientific thought amidst geopolitical tensions. What were the primary inadequacies in Wegener’s theory, and how did the scientific milieu of his time, later influenced by Cold War dynamics, contribute to its initial dismissal and eventual re-evaluation?

在冷战期间，回顾性地审视阿尔弗雷德·魏格纳（1880–1930）在20世纪初提出的大陆漂移说，对于理解地缘政治紧张局势中科学思想的演变具有重要意义。魏格纳理论的主要不足之处是什么？此外，他所处时代的科学环境，以及后来冷战动态的影响是如何导致了该理论最初被否定而在最后被重新评价？

- (4) Examine the contribution of the IGY to the shift from the Continental Drift theory to the widespread acceptance of Plate Tectonics. Frame the technological and methodological advancements emergent during the IGY that were instrumental in this scientific transition.

国际地球物理年推动了从对大陆漂移说的支持向对板块构造说的广泛接受这一转变，请对这一推动作用进行思考。请指出在国际地球物理年期间出现的，并对上述科学转变起到重要作用的技术与方法论进展。



- (5) What epistemic transformations, both in technological instrumentation and theoretical constructs, were imperative for Edwin Hubble's (1889–1953) redshift observations to engender a recalibration of cosmological discourse?

埃德温·哈勃（1889–1953）的红移观测引发了对宇宙学话语的重新校准，那么从技术手段与理论概念这两方面来看，哈勃的这项观测所需要的认识论转变是什么？

- (6) Analyze the dialectics of scientific beliefs in maintaining the Steady State theory post-Hubble. What ideological, philosophical, or paradigmatic commitments buttressed its tenability despite empirical contradictions?

请对后哈勃时期用于维持稳恒态理论的科学信念辩证法进行分析。有哪些来自意识形态、哲学或范式方面的支持因素支撑着稳恒态理论的可信性，尽管其与经验相矛盾？

- (7) Examine the reinvigoration of Einstein's cosmological constant in contemporary cosmology and its implications for our understanding of "scientific error" from a historical and philosophical perspective.

请思考爱因斯坦的宇宙学常数在当代宇宙学中的复兴，及其对我们从历史和哲学视角理解“科学错误”所具有的意义。

- (8) In what ways did the discovery of the cosmic microwave background radiation reformulate the hermeneutics of cosmological data? Integrate notions of "observational adequacy" and "theory-ladenness" in your analysis.

宇宙微波背景辐射的发现是如何对宇宙学数据的阐释进行重新表述的？请将“观察充分性”与“理论负载性”等概念加入进你的分析中。

- (9) Deconstruct how the Big Bang and Steady State theories mirrored or contradicted the ideological ethos of the Cold War, specifically in relation to Western liberal individualism and Soviet dialectical materialism.

请分析大爆炸理论与稳恒态理论是如何反应或抵触冷战的意识形态精神的，请特别结合西方自由个人主义和苏联辩证唯物主义来进行分析。

- (10) Explore the ethical dimensions surrounding the translocation and assimilation of German scientists into Soviet and American space programs during the Space Race. Concentrate on how this integration mirrored and was influenced by the broader Cold War tensions and ideologies.



太空竞赛期间，一些德国科学家被转移或吸收进苏联与美国的航天计划中，请就这一问题所涉及的伦理方面进行探究。请重点关注这种吸收行为如何反映了更广泛的冷战紧张局势和意识形态，以及是如何受到后者的影响的。

- (11) In the historical trajectory of the Cold War, the advent of communication satellites stands as a technoscientific milestone, encapsulating the complex interplay between technological innovation and societal structures. How can one analyze the extent to which the concepts of “technological determinism” and “social constructivism” are applicable in understanding the development, deployment, and cultural integration of these orbital communicators during this era of geopolitical tension?

在冷战的历史轨迹中，通信卫星的出现标志着技术科学的一个里程碑，其本身概括了技术创新与社会结构之间复杂的相互作用。如何分析在这个地缘政治紧张时期，“技术决定论”和“社会建构论”等理论在理解这些轨道通信装置的发展、部署和文化整合方面的适用的程度？



## **SECTION 18: Computational Milestones**

- (1) How did Alan Turing's (1912–1954) conceptual schema of the Turing Machine demarcate the theoretical boundaries of computational capability, thereby influencing the nascent architectural paradigms of early computational systems?

艾伦·图灵（1912–1954）的图灵机的概念纲要是如何界定计算能力的理论边界，并因此影响了早期计算系统的初步概念结构范式的？

- (2) In considering the Turing Machine as the “genetic code” of computing, to what extent does this metaphor aptly encapsulate its seminal role in the historical and theoretical evolution of computational science and praxis?

鉴于有人将图灵机视为计算的“遗传密码”，这一比喻在多大程度上恰当地概括了图灵机在计算科学与实践的历史与理论发展中具有的开创性角色？

- (3) Investigate the limitations posed by vacuum tube technology in early digital computing exemplars.

请考察早期电子计算模型中真空管技术所带来的局限性。

- (4) Originating from the Jacquard loom and evolving into a primary medium for early computer programming, punched cards bridged mechanization and computation. Reflect on this transition: how did punched cards, with their unique constraints and capabilities, shape the foundational philosophies and practical methodologies of early computer programming and data processing?

起源于雅卡尔织机并发展成为早期计算机编程的主要媒介，穿孔卡片成为了连接机械化和计算之间的一座桥梁。请对这一转变进行思考：具有独特的局限性和能力的穿孔卡片，是如何塑造了早期计算机编程和数据处理的基本原理和实践方法论的？

- (5) In the post-World War II era, specifically 1947, the groundbreaking advent of the transistor by William Bradford Shockley (1910–1989), John Bardeen (1908–1991), and Walter Houser Brattain (1902–1987) marked a crucial moment. How did this innovation vividly demonstrate the superiorities of digital computing over its analog predecessor, within both technological and historical frameworks?

在第二次世界大战后，特别是1947年，威廉·布拉德福德·肖克利（1910–1989）、约翰·巴丁（1908–1991）和沃尔特·豪泽·布拉顿（1902–1987）制造出晶体管这一突破性的事件标志着一个关键时刻的到来。这项创新是如何在技术与历史框架下，生动地展现出数字计算相较于原有的模拟计算所拥有的优势的？



- (6) In the realm of computational theory and practice, how did John von Neumann's (1903–1957) seminal report, "First Draft of a Report on the EDVAC" (1945), transformed the conceptual and architectural underpinnings of early computer design? Furthermore, critically assess the extent to which von Neumann's insights and proposals in this report presaged and shaped the future trajectory of computer science, both in theoretical constructs and practical implementations.

在计算理论与实践领域中，约翰·冯·诺伊曼（1903-1957）的开创性报告《EDVAC报告书的第一份草案》（1945年）是如何改变了早期计算机设计的概念与逻辑架构基础的？此外，请批判性地评价冯·诺伊曼在该报告中的洞见和计划在多大程度上预测并塑造了计算机科学的未来发展路径的，无论是理论概念方面还是实际执行方面。

- (7) Discuss the sociotechnical evolution from tailor-made, general-purpose computer systems like ENIAC to the commercial production epitomized by UNIVAC in 1951.

请对以ENIAC为例的定制、通用计算机系统到以诞生于1951年的UNIVAC为代表的商业化产品的社会技术发展进行讨论。

- (8) In the context of the UNIVAC's landmark success in forecasting the outcome of the 1952 U.S. presidential election, how did this event reconfigure societal perceptions and scholarly discourse regarding the utility of computer technology in socio-political analysis?

在UNIVAC对1952年美国总统选举结果的预测取得具有划时代意义的成功的背景下，这一事件是如何改变涉及计算机技术在社会政治分析中的应用这一问题的社会观念和学术话语？

- (9) How did the advent and progression of molecular-simulation techniques, particularly since the first successful molecular dynamics simulation of liquid argon in 1957 by Berni Alder (1925–2020) and Thomas Wainwright (1927–2007), challenge and expand the theoretical boundaries of quantum mechanics and statistical mechanics?

分子模拟技术的出现和发展，尤其是自伯尼·奥尔德（1925–2020）托马斯·温赖特（1927–2007）于1957年首次成功对液氩进行分子动力学模拟以后，是如何挑战及扩展了量子力学与统计力学的理论边界的？

- (10) Contrast the Metropolis Monte Carlo method, developed by Nicholas Metropolis (1915–1999) et al. in 1953, with molecular dynamics, focusing on their methodological differences, theoretical frameworks, and practical implications in statistical mechanics and thermodynamics. How did the scientific and historical context of the mid-20th century shape the formulation and adoption of these techniques in simulating the microcosmic behaviors of matter?





请将由尼古拉斯·米特罗波利斯（1915–1999）等人开发的米特罗波利斯-蒙特卡罗方法与分子动力学进行比较，注重关注它们的方法论差异、理论框架以及在统计力学与热力学中的实用性内涵。就模拟物质的微观行为方面而言，20世纪中叶的科学和历史背景是如何影响对这些技术的阐述与采用的？



## **SECTION 19: Biotechnology & Nanotechnology**

- (1) In what manner did the seminal discovery of DNA's double helix structure catalyze the trajectory of genetic testing? Moreover, discuss the key ethical, legal, and societal quandaries that have arisen in the wake of these technologies.

对DNA双螺旋结构的具有深远影响的发现如何促成了基因检测的发展？此外，请就在这些技术出现之后接踵而至的主要伦理、法律和社会困境进行讨论。

- (2) The year 1983 stands as a key moment due to Kary Mullis' (1944–2019) pioneering development of Polymerase Chain Reaction (PCR). How did this innovation revolutionize genetic research and precipitate early interdisciplinary influences on other scientific domains?

由于凯利·穆利斯（1944–2019）开创性地发展了聚合酶链式反应（PCR），1983年成为了具有重要意义时刻。这项创新是如何在遗传学研究引发革命性变革，并对其他科学领域产生早期的跨学科影响的？

- (3) Chart the historical progression of personalized medicine from its conceptual inception to its pragmatic application, particularly in the aftermath of the Human Genome Project. What were the principal obstacles encountered in integrating genomics with clinical practice?

请描绘出个性化医疗从概念创立到实际应用的历史进程，特别是在人类基因组计划完成之后。在将基因组学与临床实践整合过程中，人们遇到的主要困难是什么？

- (4) Examine the evolution of gene therapy, tracing its journey from theoretical concepts to real-world treatments, with a particular emphasis on the conceptual and technological innovations that facilitated this transition.

请考察基因治疗的发展过程，追溯其从理论概念到现实世界治疗的发展路径，着重强调促进这一转变的概念与技术创新。

- (5) Delving into the synergy between genetics and advanced technologies, explore how fields like computer science and nanotechnology have revolutionized genetic testing and gene therapy since the late 20th century, with a specific focus on the integration of computational algorithms and nano-scale engineering in these domains.

请考察遗传学与先进技术之间的协同作用，并探究自20世纪末以来计算机科学和纳米技术等领域是如何彻底改变基因检测和基因治疗的，着重关注计算算法和纳米尺度工程在这些领域的整合。



- (6) In reviewing Feynman's visionary 1959 lecture "There's Plenty of Room at the Bottom," how would you characterize the veracity and influence of his foresights on the development of nanotechnology?

在回顾费曼在1959年发表的富有远见的演讲《在底部还有很大空间》时，您如何描述他对纳米技术发展的预见所具有的准确性和影响力？

- (7) Place the 1985 discovery of fullerenes within the extensive framework of theoretical chemistry and molecular physics. Examine whether prior theoretical frameworks or experimental investigations hinted at the potential existence of fullerenes, or if this discovery emerged as a remarkable and unforeseen development in the scientific field.

请将在1985年对富勒烯的发现置于理论化学与分子物理学的广泛框架中。请探究之前的理论框架或实验研究是否暗示了可能存在富勒烯，或者说这项发现是否是作为科学领域中一项引人注目且意料之外的发展而问世的？

- (8) Critically discuss the historical and scientific journey from the development of carbon fibers to the advent of carbon nanotubes. How does this narrative intertwine with broader scientific advancements and theoretical insights?

请批判性地讨论从碳纤维的发展到碳纳米管的出现这一段历史与科学旅程。这一叙事是如何与更广泛的科学进步和理论洞见交织在一起的？

- (9) Since the isolation of graphene in 2004, its path from theory to application has been both complex and intriguing. Evaluate this development, particularly the challenges and advancements in harnessing graphene's theoretical properties for practical uses.

自从石墨烯于2004年被分离以来，其从理论到应用的发展路径可谓既复杂又引人入胜。请对这一发展过程，尤其是在利用石墨烯的理论性质以实现其实际应用的过程中遇到的挑战与取得的进展进行评价。