Jessica Redmayne turns and waves to everyone with a great-to-see-you-all smile. Peter has a good view of her. It's not her. It's a bit like her.

Brutus: (*Abruptly.*) My title is *The Scientific Revolution in World History*—which, in fact, is the title of a book never written. Now I know what you are thinking? What is the Scientific Revolution? The Scientific Revolution with capital S and R is the transformation of pre-modern science to modern science—which is based on the scientific method and on strong societal support embodied in scientific institutions like universities, government laboratories, the Royal Society, national academies of science, corporate laboratories, and amateur scientific societies of all sorts. Modern science has been amazingly progressive and continues to expand our understanding of the universe and advance our very advanced modern technology. To say that the contemporary world would be very different intellectually and materially without modern science is to say the least.

Hereafter, I will usually just refer to modern science as science and pre-modern science as nature knowledge. Nature knowledge is a general category into which modern science and pre-modern science fall along with natural philosophy which will be mentioned in my lecture in good time.

I also have to make it clear that I am not an original researcher in the history of the Scientific Revolution. I have learnt what I know from original researchers. The main one being Floris Cohen whose book *How Modern Science Came Into the World*, published 2010, is the definitive history of the Scientific Revolution—at this present moment. In historical research, there is always more that can be done. Perhaps cliodynamics, which is history as a mathematical science, will one day give a quantitative understanding of the Scientific Revolution. My friend Winston, AKA Professor Lord Charlton-Jones, will touch on cliodynamics in tomorrow night's lecture.

By the by, Floris Cohen would be the first to say he was building on the historical research of a century and more.

When, where, why, and how the Scientific Revolution? When and where are clear enough. It happened essentially in the 17th century in Western Europe. The why and how is going to take some time to answer.

To begin, there are 7 essentials to having science, and so to having a scientific revolution. Note that when I pronounce scientific revolution with small s and r, I mean a hypothetical event, not the Scientific Revolution the historical event.

The first essential is that nature is understandable in an objective way. The corollary is that theories about nature that allow accurate predictions of how it behaves must exist. Finding and using those theories is science itself. The second essential is that humans be intellectually capable of science and we are. I have to add here something that is overwhelmingly well understood nowadays, but even a century ago was badly not understood, all human groups have the same distribution of intelligence. There is no scientific racialist component to the Scientific Revolution or anything else. So why the Scientific Revolution happened in Western Europe is not rooted in the special genetic makeup of Western Europeans. The third essential is that humans be curious about nature and how it works. And they are curious

though the amount of curiosity varies tremendously from person to person and also depends very strongly on the cultural context.

The fourth essential is you need information specialists. A scientific revolution will not happen in a hunter-gatherer society. So you need civilization in the sense of societies that live beyond subsistence, and so can have cities and knowledge specialists. Living beyond subsistence requires agriculture which I will touch on further below. The fifth essential is writing. There has to be a way of accurately transmitting intricate knowledge over generations.

The sixth essential is that there has to be a material benefit to acquiring nature knowledge and there is as is overwhelmingly understood nowadays. Curiosity is certainly sufficient for some individuals to study nature, but I think and will argue that for society to give continuous support for the pursuit of nature knowlege there has to be a material benefit. I will also argue that the material benefit had to be discovered. It is not obvious in the context of traditional societies which are all societies before the Scientific Revolution.

The seventh essential is having the scientific method. The short definition of the scientific method is the cycle of theorizing and experiment/observation for acquiring new nature knowledge. The scientific method in practice is very messy with all kinds complicated events that are sometimes common and sometimes not. However, the messiness doesn't change my view that short definition is the essence of the scientific method.

At this point, I'm going to distinguish the scientific method from the trial-and-error method. The two methods are very similar and there is no hard line between them, but they are distinct. The trial-and-error method does not aim at general nature knowledge. It just aims at solving particular problems. Humans have always used the trial-and-error method. In particular, craftsmen in traditional societies used the trial-and-error method all the time. And they made tremendous progress with it. They build the pyramids and the Roman aqueducts. They discovered gunpowder and invented printing. They built the outrigger canoes with which the Polynesians colonized the Pacific Ocean.

Of course, the trial-and-error method in technology has not gone away at all. It is still vital, but so is modern science. A pyramid without modern science, yes; a jet plane, no.

Now the scientific method, unlike the obvious trial-and-error method, but like the material benefit of science, had to be discovered. It wasn't discovered all at once. The trial-and-error method shaded into the scientific method here and there in history and some people here and there practiced the scientific method. But as the dogma for doing science, it was only discovered with Scientific Revolution itself, one of whose two main ideological components is the scientific method itself—the other is the belief in the aforesaid material benefit of science.

Given my 7 essentials, why and how did the Scientific Revolution happen in history? Well, I think a scientific revolution could have happened as soon as there was writing which first appeared in a crude way in the civilizations of ancient Mesopotamia and ancient Egypt circa 3000 BCE: i.e., year 3000 before the Common

Era (i.e., CE) which started with the traditional birth year of Jesus. I say a scientific revolution could have happened, but it didn't happen because it was a very low probability event. It would have taken a fantastic band of geniuses to improve writing to full narrative capability, to have discovered the scientific method as a general rule, to have propagated it, and demonstrated the material benefit of science. There was no such fantastic band. In particular, I have to emphasize the scientific method is not obvious, the material benefit of nature knowledge is not obvious.

As history rolled on from the 3000 BCE, the probability of a scientific revolution increased until it started approaching 1 in Western Europe in the 17th century when the Scientific Revolution actually happened. Why increasing probability? Two primary reasons: one, advancing technology including agricultural technology and two, the accumulation of nature knowledge, but not at all in a continuous way and not always useful nature knowledge for a scientific revolution.

Why did advancing technology help? Most importantly, better agriculture could support more complex societies in which more sophisticated nature knowledge practitioners could flourish though certainly they mostly didn't do so. Another "importantly" is the development of better communication techniques, in particular printing. Printing allowed much cheaper, much more expanded, and much more correctable communication of text and also of diagrams. Communicating ideas, particularly nature knowledge ideas, was difficult in the manuscript age. Often not even preservation was achieved. Many of the works of ancient Greek nature knowledge were lost. I should note that printing though very, very useful to having a scientific revolution is not sufficient. The not sufficient fact is proven by the fact that printing was invented in China in the 7th century CE, but a scientific revolution did not occur in China then or later.

Also advancing technology presents a challenge to nature knowledge practitioners: the challenge of explanation and improvement. This challenge they largely ignored until the Scientific Revolution itself. Not absolutely entirely. One can point for example to Archimedes in the 3rd century BCE who, besides being arguably the greatest ancient Greek mathematician and having shouted "Eureka," was also noted as an inventor though most, perhaps all, inventions attributed to him are actually of uncertain origin.

Where did technology advance most rapidly? In Eurasia which, in fact, is the most important region for the eventual advent of the Scientific Revolution because of that fact of most rapidly advancing technology and where I will center almost all of the rest of my lecture.

Why did Eurasia have the most rapidly advancing technology? Well, as Jared Diamond argues in his famous book *Guns, Germs, and Steel*, published 1997, Eurasia just had the best suite of domesticatable plants and animals. In particular, Eurasia had oxen and horses, large powerful draft animals suitable for agriculture, transport, and industry, all of which helped support rapidly advancing technology by supporting complex society with many specialists including nature knowledge practitioners. This is a first reason for Eurasia having the most rapidly advancing

technology.

Note that the Eurasian domesticates could easily spread across Eurasia: no ocean barriers, few climate and disease barriers. They did not spread until after circa 1500 to the Americas or Australia and had only limited expansion in sub-Saharan Africa because of climate and disease barriers. They did spread in North Africa, but, from a human societal point of view, North Africa is part of Eurasia.

An important second reason is that Eurasia is all a connected landmass and that helps trade and migration both of which spread ideas just as it helps spread domesticates. An important third reason is that since Eurasia is the largest continent, it also had the largest number of technological innovations to spread because it had the largest number of inventors.

It should be emphasized that this spreading of technology was mostly not by books, obviously so for domesticates viewed as technology. The spreading was mostly by examples (including domesicates, of course), word of mouth, migration, and apprenticeship. These are the main means of technological transfer in traditional societies.

The advancement of technology in Eurasia is arguably continuous and cumulative. It's true that the advancement was often slow to the point of being unnoticeable to contemporaries, but we can see it in retrospect. Here the water mill was discovered in Classical Antiquity; there the padded horse collar was discovered in 5th-century-CE China. It's also true that some technologies could be lost in certain regions of Eurasia for a time. For example, some Roman building techniques were lost in the Western Europe in the Early Middle Ages circa 500 to 1000 CE. But if techniques were lost in some places in Eurasia, they were still known elsewhere in Eurasia and often spread back to where they were lost if they were not rediscovered or superseded in the meantime.

Unlike the advancement of technology, the advancement of nature knowledge as aforesaid was not continuous at all. In fact, the history of nature knowledge in traditional societies can be characterized as consisting of relatively short golden ages and relatively long stagnations. Of course, in some traditional societies there was virtually no nature knowledge at all besides myth. At this point, I should clarify that when I say "nature knowledge," I mean general nature knowledge, not specialized nature knowledge. There is always lots of specialized nature knowledge in traditional societies. For example, hunter-gathers are usually experts in the special features of their environments.

What were the golden ages? They were periods of order a century or longer in a society in which there was continuous development of nature knowledge. Not all of this development can easily be classified as advancement, some of the development led nowhere. As for the stagnations, they were long periods of time in a society in which past achievements in nature knowledge were remembered to some extent in manuscripts and to some extent lost. How long were stagnations in a society? From of order a century up to all the time from the last golden age, whenever that was, to modern times—which we can say started with year 1900 as catch-all approximation. There were occasionally brilliant practitioners of nature knowledge

during stagnations, but they were relatively isolated figures.

To illustrate golden ages and stagnations, I will concentrate on those in western Eurasia since they were the most important ones. Certainly, golden ages happened in eastern Eurasia, in India and China, but they were less important in leading to the Scientific Revolution and I know less about them in any case. I should add that the Mayan civilization in the Americas must have had a golden age, at least in astronomy, and this is very interesting from the point of view of the history of science, but it added very little in itself to modern science.

The most important golden age of them all—except perhaps for the Renaissance golden age—was in ancient Greece circa 600 to 200 BCE. Why did the ancient Greek golden age happen? Ancient Greece circa 600 BCE was a pluralistic society politically, divided into many city-states, but relatively culturally homogeneous. It was already rich in art and poetry—but very definitely not yet rich in prose. It was able to defend itself against external societies and able to prey on them too. Greece's cultural and military strength made it a confident society, but it was also one that recognized it had a lot to learn from the more ancient societies to the east. In fact circa 600 BCE, Greece was still emerging from the Greek Dark Ages when literacy had vanished and history was mostly legend. Greece's pluralism, confidence, and openness to influences from elsewhere were all important in making it a society relatively open to innovations of all kinds.

Greece was also a society with a degree of freedom of speech and, in fact, its political life was strongly based on public argument and discussion even though most Greek city-states had only some elements of democracy and were not full democracies like Athens after circa 500 BCE. Note that Athens, though a full democracy, was quite unlike modern democracies in many respects—it had slavery and women were second-class citizens. Now if you can talk and argue politics freely, you can talk and argue anything freely—religion, sport—a lot of that—literature, art, philosophy, and nature knowledge which for long ages to come was part of philosophy. We consider Thales, who lived circa 625–546 BCE, the first philosopher and the first nature knowledge practitioner—he is a shadowy figure.

Why did nature knowledge in particular become of interest? General human curiosity and probably the random chance of a few especially interested individuals of genius in an environment of relatively free speech and openness. So a tradition of nature knowledge began circa 600 BCE with old Thales. Nature knowledge, in fact, eventually bifurcated into two branches: mathematical/empirical science and natural philosophy. The first branch, mathematical/empirical science, made progress in pure mathematics, in the physical sciences of statics and hydrostatics, in mathematical astronomy, and in medicine. Collectively, the achievements were wonderful compared to what had come before—which in some, but not all fields, was virtually nothing in recorded history—but are very small beer compared to what was achieved in the 17th century. The second branch, natural philosophy, developed qualitative, rational, but speculative, theories which offered rational explanations of nature. Those theories were mostly remembered into later times and provided useful starting points for early modern scientists in the Scientific Revolution. The

most fascinating of these theories was that of atoms, unobservably minute particles which provide the stable, but imperceptible, building blocks of reality. Now natural philosophy was based on reasoning from casual observations. There was virtually nothing like experiment or mathematical proof in natural philosophy.

As aforesaid, the ancient Greek golden age of nature knowledge was circa 600 to 200 BCE. The time frame is long—except in the telescoping of history—but the achievements were made by very few creative nature knowledge practitioners in every generation. What was achieved in the golden age was remembered in manuscripts with only slow loss afterward.

Why did the ancient Greek golden age peter out circa 200 BCE? A fundamental cause—which needs its own explanation to be given in a moment—was that interest in the development of new nature knowledge was always weak. Thus, any random small weakening of interest could change continuous progress into sporadic progress or none at all—either of which is a stagnation. In ancient Greece circa 200 BCE, there was a weakening in interest and the ancient Greek stagnation began. After circa 200 BCE, there were isolated nature knowledge practitioners with great achievements—there often are in stagnations as aforementioned. The 2nd century CE even saw two great ancient Greek nature knowledge practitioners on the branch of mathematical/empirical science: the astronomer Ptolemy and the physician Galen. They would both become preeminent authorities in western Eurasia up until circa 1550 and even later in the minds of many.

Why was the interest in nature knowledge so weak in Classical Antiquity that continuous progress stopped and stagnation began? The nature knowledge practitioners didn't provide much material benefit to society. Some of the mathematical/empirical nature knowledge practitioners, like Archimedes, were inventors, but their inventions—real ones, not merely attributed ones—were mostly regarded just as novelties, not utilities. If these nature knowledge practitioners had demonstrated significant material benefit, there would have been societal support. Why didn't they provide much material benefit? The main reason is because they hadn't discovered the scientific method as a dogma although some practitioners, like Archimedes, used it, but without much advertisement.

As for the natural philosophers, they weren't interested in material benefit, but in rational theories which gave intellectual satisfaction for some people, themselves first of all. In fact, four distinct natural philosophies were developed—Platonic, Aristotelian, Stoic, and Epicurean. Each had their adherents among the educated classes—the people were mostly were unconcerned. Which of the four were right if any? The skeptics in Classical Antiquity denied that there was any way to know and they were right in their time. In our time, we can see that all four had useful scientific aspects, some of which can be classified as right. Now without natural philosophy developing into science, it had probably gone about as far as it could go in acquiring interesting/satisfying rational theories. Why didn't natural philosophy develop into science? By now you know my story: almost complete lack of the scientific method. Recall what I said earlier: the scientific method as a dogma has to be discovered.

The argument I have given for rise and fall of the ancient Greek golden age is similar to the arguments, *mutatis mutandis*, that could be given for other golden ages. I won't discuss all those other golden ages here—I will discuss a few more, more briefly, in a moment. But I must add that societal disruptions caused by famine, plague, and war in some combination can obviously have a negative effect on all intellectual pursuits by killing off some intellectuals—Archimedes may have been struck down by a Roman soldier—or more effectively by killing much of their societal support. Winston Charlton-Jones will say more about famine, plague, and war tomorrow night.

To indulge in if-history, what would have been needed to kick start a scientific revolution in Classical Antiquity. Perhaps a few more nature knowledge practitioners like Archimedes and a few prophets of the scientific method. But how many more is hard to say. Classical Antiquity wasn't lucky enough in having enough of those kind of individuals.

I also think that the invention of printing—for the reasons already discussed—would have strongly favored the start of a scientific revolution in Classical Antiquity. Why didn't Classical Antiquity invent printing? Probably the idea occurred occasionally to persons in Classical Antiquity and throughout the manuscript age in all societies, but these persons probably mostly dismissed it as being not worth the effort to turn the idea into reality. For examples of why not worth the effort, enslaved copyists were abundant in Classical Antiquity and in the mostly illiterate Early Medieval Europe, there wasn't much of a mass market. Those forgotten non-inventor idea-persons could probably not have envisioned the transformative effect printing can, but not necessarily does, have.

Now there were three more golden ages of nature knowledge in western Eurasia before the Scientific Revolution actually occurred. The first one was in early Medieval Islamic Society when it was cosmopolitan and open to non-Islamic learning. The scholars of that society, who were sometimes not Muslims themselves, learnt from Classical Antiquity and Indian society and made significant advances. But after 900 CE or so, stagnation happened.

Then in the 13th and 14th centuries in Western Europe, there was another golden age, the second of my three, stimulated by works from Classical Antiquity and Medieval Islamic Society. The most famous figures were Roger Bacon in 13th century England and Nicole Oresme in 14th century France. Stagnation for that Medieval European nature knowledge tradition followed after the death of Nicole Oresme.

A new golden age, the third one of my three—hard on the heels of the second—began in Western Europe in the 15th century: i.e., in Renaissance Europe. Why so soon after the last golden age in Western Europe? I think it is likely that technology and accumulated nature knowledge had reached such a level in Renaissance Europe that the probability of a new golden was just quite high in general. And that probability was increasing because of the continuing technological advance (to which the ending Medieval European golden age was not important) and the onset of Renaissance humanism.

The new technological advance that was most important was the invention of printing circa 1450 by Johannes Gutenberg—a person with technical skill in metalworking needed for making movable type and the vision of the utility of printing. As mentioned earlier, printing was invented much earlier in China in the 7th century CE which was long before Johannes Gutenberg. The early printing in China was woodblock printing, not movable-type printing—which I usually just call printing without qualification. However, movable-type printing was invented there in the 11th century and in Korea in the 13th century. But movable-type printing is, in fact, not very efficient for Chinese because of its thousands of characters and does not seem to have added much extra stimulation beyond woodblock printing in China.

By the way, woodblock printing spread from eastern Eurasia to western Eurasia, but Gutenberg's invention of movable-type printing seems to be independent.

An interesting question at this point is why didn't printing have the transformative effect in eastern Eurasia that it did at a much later date in Western Europe. It seems likely that part of the answer is control by authorities in suppressing innovations in thought. In eastern Eurasia, this was probably more effective than in Western Europe. One cannot say that eastern Eurasian societies, China being much the most important, were absolute monolithic controlled societies, but in general they were closer to that than Western Europe. How was the control by authorities implemented in regard to printing? Well, everyone must agree that the invention of printing necessitates censorship and that's how. However, in the multiple jurisdictions of Western Europe, it was possible to evade censorship and outright suppression of one's scurrilous tripe by moving elsewhere.

Now why did Renaissance humanism help start a new golden age? But before answering that question another question: What was Renaissance humanism? It was an intense study of Classical Antiquity, particularly its literary works. Of course, the study of Classical Antiquity had been ongoing throughout the Middle Ages in Western Europe. But it was accelerating from the late 14th century on and, in particular, there was a new desire to understand Classical Antiquity on its own terms and not through the filter of Medieval conceptions. Most of Renaissance humanism was not about nature knowledge, but some important nature knowledge practitioners participated. They wanted to fully recover the achievements of ancient Greek nature knowledge as well as retain the achievements of Medieval Islamic and Medieval European nature knowledge. And they did make a substantial recovery and that indeed helped start a new golden age and that was the help of Renaissance humanism to that new golden age.

Actually, Renaissance Europe was in some key respects like ancient Greece at the dawn of its golden age of nature knowledge. Both were politically pluralistic societies, but with a strong degree of cultural unity. Both were relatively self-confident, but aware that they had much to learn from the others—in the case of Renaissance Europe, the others were the ancient Greeks themselves and the ancient Romans too, of course. And both Renaissance Europe and ancient Greece had

a considerable degree of intellectual freedom. Medieval and Renaissance Roman Catholicism, within certain dogmatic bounds, actually did allow considerable intellectual freedom and certain political jurisdictions did not object to that freedom either. And like the ancient Greeks, the Renaissance intellectuals liked to talk about all kinds of things: literature, art, politics, and nature knowledge. So I would argue that the two golden ages, ancient Greek and Renaissance, had similar foundations.

The Renaissance golden age continued through the 16th century and showed no obvious signs of stagnation. The nature knowledge practitioners began to be aware that they had not only recovered ancient Greek nature knowledge, but were beginning to surpass it, particularly in mathematics, astronomy, medicine, and geography. In geography, the oceanic voyages by Columbus, Magellan, etc. made it very clear that the ancient Greeks had been outdated.

One must say that only some nature knowledge practitioners thought that they had surpassed the ancient Greeks. There were many conservative nature knowledge practitioners who continued to think that at least everything important was found by the ancient Greeks, particularly Aristotle. The influence of the dyed-in-wool-Aristotelians, who were often university professors, only died out slowly with time. Hereafter, when I say nature knowledge practitioners, I usually only mean the progressive ones.

The achievements of the nature knowledge practitioners were applauded by many elements in Renaissance society—including the nature knowledge practitioners themselves—and so they gained support in one fashion or another, material and moral. This, of course, furthered their work. Also the idea began to grow that pursuing novel nature knowledge would lead to material benefit even if the actual achieved material benefit was very modest. The idea of material benefit was particularly true in medicine, in mathematics needed for navigation and military applications, and in astronomy for astrology. Astrology was considered a very useful science in Renaissance Europe—it evaporated as a science in the 17th century, and I won't mention it again.

What caused the transition from the Renaissance golden age to the Scientific Revolution? The discovery of the scientific method and the material benefit of nature knowledge as dogmas. It is impossible to specify single moments for these discoveries. However, I think most historians of science would agree that the work of three contemporaries, Galileo, Johannes Kepler, and Francis Bacon, constitute those discoveries. The three contemporaries all made their mark in the period circa 1590 to 1640.

I'm not going to detail the personal achievements of Galileo, Johannes Kepler, and Francis Bacon. I will say that Galileo and Kepler made impressive advances in astronomy and physics—Kepler in mathematics too. Impressive not just to fellow nature knowledge practitioners, but to the general public. Neither of them ever gave a succinct statement of the scientific method, but their work and writings exemplified it. In fact, we can talk of them as scientists and what they did as science without anachronism. Actually, this is true to one degree or another for many earlier nature knowledge practitioners of the Renaissance golden age. It has

to be added that Kepler had an inclination to natural philosophy in the sense of ancient Greek natural philosophy. He was very much a transitional figure, looking forward, but also far, far back to Pythagoras and Plato.

Galileo and Kepler also both propounded the material benefit as well as the intellectual benefit of nature knowledge. They made a start at providing it too. Galileo with his physics that became a starting point for scientific engineering. Kepler with his improved astronomical methods for navigation and timekeeping. By the way, Galileo was quite conscious of the challenge of technology to nature knowledge practitioners that been for so long almost completely ignored. Kepler was probably not as conscious as Galileo.

Francis Bacon had a different role. As a practicing scientist, he was negligible and his own methodology for doing science was not very fruitful. His importance is as a prophet in his published writings of the material benefit of science and of the benefit of experimentation in science. He was strongly impressed by the useful inventions of recent centuries, particularly, gunpowder, the compass, and printing. He was hardly the first to emphasize these three, of course. Bacon's influence was strongest in England, naturally enough, but even there it was not immediately felt. However, eventually, it was felt and spread abroad to join up with the influences of Galileo, Kepler, and many others.

Now I can say, finally, that I've explained to some adequacy the why and the how of the Scientific Revolution's beginning in the early 17th century in Western Europe.

You are thankful, I'm sure, that our night is too short for me to detail the progress of the Scientific Revolution through the 17th century. I will say that science itself progressed rapidly. The material benefit very much more slowly. It's true to say that the belief in the material benefit was sustained for a century or so more by insight—true vision—rather than by realization.

Before I conclude, I will indulge again in a little if-history. Could the Scientific Revolution have been avoided in Western Europe in 17th century? For example, would the elimination of Galileo, Kepler, and Francis Bacon have turned it off? I think not. Other persons of similar genius, perhaps a little later would have filled their roles in history. The nature knowledge and technological progress of 16th century Western Europe just seems too robust to have been stopped by the random appearance or non-appearance of particular geniuses.

Could some societal change have stopped the Scientific Revolution? I think it's a possibility. Say that the Holy Roman Emperor Charles V had succeeded in conquering Western Europe to such an extent that he could have imposed an extreme Counter-Reformation control on the intellectual life of Western Europe with the Inquisition everywhere. Perhaps that would have suppressed intellectual advance for a long time and ended the Renaissance golden age before it accelerated into the Scientific Revolution. Another possibility is that the wars of religion could have grown even more destructive than they were. Instead of a Thirty Years' War in Germany, a hundred years' war throughout Western Europe wreaking havoc and eliminating the societal support for nature knowledge practitioners and sometimes

their being. An endless war with no scientific revolution in sight.

So in my view, it is possible that some relatively random major event could have stopped the Scientific Revolution in Western Europe in the 17th century. But I think a scientific revolution would have happened later somewhere in Eurasia or maybe in Eurasian colonies in the Americas. Nature knowledge would have continued to advance and spread intermittently. Technological progress would have continued and spread more continuously. New golden ages would have come and, maybe after some decades or centuries, one would have ignited a scientific revolution and changed the world.