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In Search of Chinese Science

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One of my schoolmasters was fond of saying that there are only two worthwhile forms of worldly immortality: to get a poem in the *Oxford Book of English Verse*, or to have a mathematical theorem named after you. The British scholar Joseph Needham (1900–1995) was no better than a passable amateur poet, judging by the handful of verses in Simon Winchester's biography of him. He did have a scientific training, but it was in biochemistry, not math, so there is no Needham's Theorem, nor even a Needham Conjecture. He does, though, enjoy the rare distinction of having a Question named for him. Not a mere *question*, but a *Question*, one that has generated endless discussion and many theories.

The Man Who Loved China
By Simon Winchester
Harper ~ 2008 ~ 318 pp.
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Needham was an exceptionally brilliant man, whose scholarly career spanned two separate regions of human knowledge. How he got from the one region to the other, and what he accomplished—most especially in the second region—are fascinating to read about. Winchester's biography gives an excellent account of the man and his work. The Question turns up two-thirds of the way through, by which time Needham was a Cambridge don. He had conceived the idea of writing a book with the title *Science and Civilisation in China*. In May 1948, he accordingly submitted a proposal to Cambridge University Press. Winchester reproduces the first page of that proposal. The book is to be addressed, says Needham, "to all educated people… who are interested in the history of science, scientific thought, and technology, in relation to the general history of civilisation, and especially the comparative development of Asia and Europe." Then the Question, in two parts:

> Why did [Chinese] science always remain empirical, and restricted to theories of primitive or mediaeval type? What were the inhibiting factors in their civilisation which prevented the rise of modern science in Asia?

I shall take up the Question later. First, what was Needham's background, and what does this biographer have to tell us about Needham the man?

Joseph Needham's first career was as a biochemist, one of great distinction. He took his degree at Cambridge University in 1921, then joined the research team of Frederick Gowland Hopkins, co-discoverer of vitamins and the first ever professor of biochemistry at Cambridge. The young man blossomed at the university, taking up nudism, English folk dance, Christian socialism, and sex, all with unrestrained enthusiasm. In 1924 he contracted an "open" marriage with Dorothy Moyle, a fellow researcher at Hopkins's lab. They remained married until her death sixty-three years later.

A month after his marriage, Needham was awarded his doctorate and elected a fellow of his college, equivalent to tenure. He settled into academic life, in 1931 producing a three-volume work, *Chemical Embryology*, that was definitive in its tiny field.

In the late summer of 1937, Needham's life turned a crucial corner. A young Chinese woman, Lu Gwei-djen, arrived at Hopkins's institute to study, along with two other Chinese scientists. Needham and Lu quickly became lovers, with Dorothy's full knowledge and approval. It was inevitable that Needham, with his keen curiosity towards everything he encountered, would want to learn about China.

Working from Needham's diaries, Winchester reconstructs the key scene in some detail. Needham and his new mistress were both cigarette smokers. Lying in bed in his room one evening in February 1938, the two lovers lit up. Needham asked Lu to give him the Chinese word for "cigarette." She duly did so: it is *xiangyan*—"fragrant smoke." He then asked her to show him how the word is written. She wrote the two Chinese characters, and coached Needham through the writing of them.

> "It was very sudden," Gwei-djen remembered. "He said to me: I must learn this language—or bust!" She was to be his first teacher, he demanded, urgently. And she agreed, readily.

Thus Joseph Needham acquired what administrators at lonely outposts in the British Empire used to call a "sleeping dictionary." His keen intellect and capacity for hard mental work took care of the rest. Through 1938 and 1939 he studied hard, attaining spoken and written fluency. Lu drafted in the professor of Chinese at Cambridge as an assistant teacher. By the time Britain entered World War II, Needham was ready for a career in sinology.

While mastering Chinese, Needham remained a professor of biochemistry. In 1942, he published a major work, *Biochemistry and Morphogenesis*, that was a standard text in its field for twenty years. The man's energy was simply astonishing. Reports Winchester:

> He completed this book while he was still campaigning in England and lecturing in America for recognition of the plight of the Chinese, and at the same time was busy teaching his students, writing his half-crown monograph…on the history of a particular branch of English socialism, regularly giving morris dance performances, swimming naked, attending meetings of the Cambridge Communist Party, offering sermons from the pulpit at Thaxted Church, and living through the manifold complications of his peculiarly organized love life.

This is one of those biographies that leave the reader feeling exhausted and ineffectual.

The opportunity to experience China firsthand came in early 1943, courtesy of the British government. A body called the Sino-British Science Co-operation Office had been attached to the British Embassy in Chungking, China's wartime capital. Needham was to go out there and see what could be done to help Chinese scientists.

Off Needham went, taking his limitless energies with him. During the next three years he traveled all over China, although Simon Winchester's claim of 30,000 miles should be taken with a grain of salt. His travels were organized in eleven separate expeditions, the primary purpose of each being to seek out Chinese scientists and hand-deliver any books or equipment they needed. Under the dire conditions of the war with Japan, China's experts were to be found in the oddest places: a team of biochemists deep in caves beneath Yunnan, physicists holed up in an ancient pagoda, statisticians at work in a Confucian temple.

Needham's travels in China generated a vast apocrypha, the stories—I have no idea how many of them were true—still eagerly being retailed around the School of Oriental and African Studies in London when I attended there in the early 1980s. I wish Simon Winchester had found space to include a few. A sample from the ones I heard, reproduced from memory: Needham and his party were traveling on horseback with guides through a remote, forested region. Suddenly they came up against another horseback party on the trail—led by a notorious local bandit, their terrified guides whispered. Needham dismounted, stepped in front of his party, up to the bandit leader's horse, and with his customary vigor executed an English folk dance. The bandit leader watched with interest. When Needham had finished, the bandit dismounted, stepped forward, and performed one of his own people's dances. The ice thus broken, everyone laughed and shook hands, and the two parties proceeded on their respective ways.

Needham returned from China in 1946 with a huge trove of knowledge. In his own notebooks he had recorded hundreds of observations of

Chinese craft and technology. He had also purchased trunks full of books dealing with the history of science in China, the foundation for Cambridge University's splendid East Asian science library.

That 1948 book proposal followed, and the *Science and Civilisation in China* project was under way. Output to date is twenty-four volumes, with three more in progress. Needham's own name is on fifteen of the volumes. Others were compiled by researchers, under his direction right up to his death in 1995.

Needham's postwar years were marred, however, by the shameful incident of the so-called International Science Commission (ISC), a communist front outfit set up in 1952 at the urging of China and North Korea to investigate allegations that the United States had used bacteriological agents in the Korean War, then well into its second year. Needham, a lifelong leftist, was easily duped into joining the Commission.

There followed one of those dismal charades in which foreign fellow-travelers with a strong prior inclination to let themselves be gulled were ushered around various Potemkin Village sites, in this case places supposed to have had infected insects or rodents air-dropped on them from American planes. Needham swallowed it all.

> He entirely trusted, he wrote, the dozens of Chinese scientists he interviewed on behalf of the commission—all of them were first-rate bacteriologists, and many were men and women he had known personally in the 1940s and could vouch for.

One marvels, not for the first time, at how easily a superlative intellect like Needham's can be taken in by a propaganda show. I have been to a couple of similar events myself, in China and communist Eastern Europe, and saw at once what was going on. In 1952, when the regime was new, the shows must have been even more amateurish. Winchester is, I think, too kind to Needham here, calling him "a victim of a very clever and adroitly organized campaign of disinformation" and "much more of a fool than a knave."

The fallout for Needham was dire. British troops were engaged in Korea as part of the United Nations forces. Over a thousand were killed in action, with corresponding numbers of wounded and missing. Needham was shunned by colleagues in Cambridge and blacklisted by the U.S. State Department. Even after the blacklisting was revoked in the 1970s he had difficulty getting U.S. visas.

Simon Winchester has unearthed a curious little back-story to the ISC fiasco from Soviet archives. The Commission's visit to China and North Korea took place in June and July of 1952. Stalin was already seventy-three, and showing every year of his age. He died in March 1953. The

furor over the ISC and its report was therefore taking place while the succession struggle in Moscow was first heating up, then being played out.

The Soviet archives make it clear that everything Needham saw was staged. After Stalin's death, however, the still-unstable Soviet leadership—probably Beria—decided that the germ warfare stories had done diplomatic damage to the U.S.S.R., since few in the West believed them, and those responsible for the deception should be disciplined. The Soviet ambassador to Pyongyang was recalled and prosecuted, and some lesser heads rolled—probably, given what we know of Beria, quite literally.

What then of the Question? Why did China not develop modern science? Needham himself seems never to have felt he'd gotten to the bottom of it. He tended to social and religious explanations. The scholar-bureaucrats who ran imperial China were educated in Confucianism, a doctrine so intensely concerned with human affairs, with statecraft and the cultivation of right conduct, that it had no room left for interest in the natural world. The principal outlet for the religious impulses of educated Chinese people was Buddhism, which regards the natural world as an illusion. Not much incentive for scientific inquiry there!

There was an alternative retreat in Taoism, Needham argued; but while not world-denying, Taoism was quietist and *action*-denying. The notion of exploiting nature for man's benefit is alien to the spirit of Taoism. The Taoists did, though, pick up monasticism from the Buddhists, and so they eventually came to preside over well-stocked libraries. They were also obsessed with the quest for personal immortality, which led them to quite a bit of dabbling in botany and alchemy in pursuit of elixirs. Needham considered Taoism to be the "source of intuitive scientific philosophy" in China.

A more popular approach to the Question has been political. Since the exertions of the First Emperor in the late third century B.C., China has been a unified state more often than not. There were many periods of division, but none of them produced a stable system of independent nation-states such as existed in Europe from the High Middle Ages onwards. It was the competition between Europe's nation-states that kept wits sharp and fresh insights valuable. So goes this line of argument (first voiced, so far as I know, by David Hume). The great unified despotic empires of the pre-industrial age were stagnant by contrast.

Political scientist Robert Wesson gave clear expression to this line of thought in his 1967 survey of those empires, *The Imperial Order*:

> The more efficient the empire, the more unimaginative and conventional are its people. Yet genius is always somewhat . . . maladjusted in terms of the mediocre milieu.

> In the great empire, moreover, the idealism that energizes genius is lost.... The sense and purposes of patriotism are missing in the universal state....
>
> Despotism, as de Tocqueville remarked, freezes the soul. The poor find it enough to keep alive, the educated show only a little less indifference and apathy, and all lose the capacity to wrestle with new thoughts.

Wesson put forward the late Roman and Byzantine empires as instances. He calls the latter "exceptionally uncreative," and points out that the Byzantine trading port of Galata, controlled by the Genoese, was by the end of the fourteenth century producing seven times as much revenue as Constantinople, the imperial capital. The parallel with Chinese treaty ports like Hong Kong is hard to miss.

Hard to miss, too, in memoirs of late Imperial China written by Westerners, is the theme of dreariness and dullness in Chinese life. Wesson again:

> European missionaries found much that was exasperating in the Chinese mentality: curiosity was blighted; horizons and interests were narrow and strictly bound by material concerns; an impoverished monotony was accepted as the natural condition of life; excuse and pretense covered anything; it was almost impossible to get a direct and factual answer to questions.

Marxists tried to root this political explanation in economic fundamentals—"modes of production." The most interesting of these attempts was Karl Wittfogel's theory of "hydraulic despotism"—the need for centralized power over large regions where rainfall was uncertain and great water-management projects needed to be organized. Wittfogel's ideas are not much regarded by political scientists nowadays, but his 1957 book *Oriental Despotism* gives a vivid picture of the stifling, soul-freezing monotony of life in the old bureaucratic-agricultural empires.

As opposed to these universalist theories, there are speculations that there is something particularly Asian behind the Needham Question. This bleeds over into the long-running debate about Asian creativity, which goes at least as far back as Ruth Benedict's classic 1946 study of the Japanese, *The Chrysanthemum and the Sword*.

That debate flared up rather interestingly in 2006 in the online journal *Evolutionary Psychology*. Satoshi Kanazawa of the London School of Economics butted heads with Geoffrey Miller of the University of New Mexico, Kanazawa arguing against Asian creativity (the first sub-heading in his paper is "Asians can't think"), Miller for it. Miller peers into the future and sees an enormous Asian brain bank riding atop newly vibrant economies, and believes that cultural factors

in the United States will stifle his academic discipline whereas it may have a better opportunity to flourish in East Asia, unhampered by religion, bioethics, or political correctness. Kanazawa, on the other hand, ripostes with tables showing the dismally small number of Asian Nobelists, complains of a high rate of plagiarism among his Asian students, and argues that "some combination of cultural, social, and institutional factors combine to stifle basic science in Asia." With unintentional hilarity, Miller earnestly responds that "Asian students' socialized conformity is fairly easy to overcome with explicit instructions to 'Be creative.'"

At the furthest limit of all these speculations is the biological hypothesis. *Homo sapiens*, like any other species with worldwide distribution, exhibits regional variations. There is no reason why the human personality should be exempt from this rule, with broad variations in attitudes or behavior perhaps arising as a result of slight differences in brain architecture or hormonal balances.

The late Daniel G. Freedman, a developmental psychologist, conducted a study in the late 1960s on the behavior of human newborns, working with his wife Nina Chinn (who is Chinese). They found significant differences between Chinese and Caucasian babies: "Caucasian babies cried more easily, and once started, they were harder to console. Chinese babies adapted to almost any position in which they were placed," and so forth. The babies were less than forty-eight hours old.

Unfortunately, speculation is still all we have by way of answers to the Needham Question. If the explanation lies in a lack of Asian creativity, with either biological or cultural origins, then something of the kind ought to show up in the psychometric data. Nothing does. In his counter-riposte to Satoshi Kanazawa in 2006, Geoffrey Miller offers such psychometric data as we have.

Miller assumes, as most researchers of the topic do, that creativity is some interaction between general intelligence, as measured by IQ, and "openness to experience"—one of the five dimensions in the currently favored Big Five model of human personality. (The other four are conscientiousness, extraversion, agreeability, and neuroticism, leading the model to be known by the acronym OCEAN.) Both IQ and openness are known from sibling studies to be considerably heritable. Both can be quantified by standardized tests.

Miller crunches the numbers and finds nothing statistically significant. He concludes:

> If Asians truly showed a "creativity problem," we might expect their average openness scores to be much lower than those of Americans. Instead, they are quite similar. . . . In no case does the

> Asian mean differ by more than 1/5 of a standard deviation from the U.S. sample.

The science here is unsettled. Not everyone even subscribes to the OCEAN model of personality, and there is a small but feisty rearguard action still being fought against the notion of general intelligence. The quantification of personality is dogged by problems of circularity in the testing process: the subjects must already be reasonably conscientious and agreeable. Cross-cultural comparisons are problematic, too, as the personality tests rely to some degree on the test-taker's perception of others' perception of him—very culture-dependent. Probably a couple of decades of hard work in neuroscience and genetics needs to be done before we shall be able to say anything dispositive about innate ethnic differences in mentation and personality, and even those answers may remain unsatisfyingly incomplete.

Cogent objections can be raised to the universalist theories, too. The Spanish were keen players of the European nation-state game from the thirteenth century on, yet they contributed almost nothing to the scientific revolution. The history of India is not unlike Europe's, with spells when different ethnicities, speaking quite different languages, held territory in competition with each other; yet no European-style awakening occurred, nor ever seemed likely to.

The ascription of Chinese scientific ingenuity to Taoism also needs much qualifying. The tremendous eleventh-century genius Shen Kuo, for example, was a perfect Confucian. Needham calls him "perhaps the most interesting character in all of Chinese scientific history." The great eighth-century astronomer Zhang Sui, who first described the proper motion of stars, was a Buddhist monk, and so on. (Buddhist monasteries, by the way, had libraries even better than the Taoists'.)

A different take on possible religious causes is offered by some Christian apologists, who argue that the concept of nature formed by the Greeks, then carried forward and developed by the medieval Scholastics, prepared the way for the scientific method. This argument is historically and philosophically plausible, although complicated by the fact that several of the founders of modern science were, with varying degrees of explicitness, rebelling against the Church. It also has to be explained why science came up precisely as medieval Christian dogmatism was ebbing, and mainly in those northern European nations where it was ebbing fastest.

There have been other non-Marxist explanations on offer, too. Kenneth Pomeranz, in his 2001 book *The Great Divergence*, argued that favorable access to key resources—English coal, the products of the New World—made all the difference, allowing northern Europe, but

not East Asia, to escape from the Malthusian trap. Gregory Clark's 2007 book *A Farewell to Alms* looked to biology. In Britain, but not elsewhere, Clark argues, the middle and upper classes simply had more children than the poor. Their bourgeois values and dispositions thus came to dominate society—"survival of the richest." Jared Diamond of *Guns, Germs, and Steel* fame has suggested that gaps in civilizational achievement are due to agricultural resources, climate, and other environmental factors. This works for Africa and the Americas, but not really for East Asia, whose geography is too similar to Europe's, even including a self-consciously distinct and quarrelsome group of offshore islands with atrocious weather.

Perhaps all these deterministic schemes are misplaced. Perhaps the scientific revolution might, like a lightning strike, have happened at any time, anywhere with a good base of technology to work from; and that then, once it had happened anywhere, everyone else would quickly be far behind the curve, leading to speculations three or four centuries later about why it had not happened in *their* neck of the woods.

Present-day Chinese tend to blame the Manchus, a primitive Siberian people who seized the empire in 1644 and ruled it until 1911. This is implausible, as the curves for innovation and creativity were plainly turning down at least a century before the Manchus showed up—and this in the Ming, an entirely Chinese dynasty.

In any case, the Manchus, having no ideas of their own, quickly sinified themselves. The second Manchu emperor, Kangxi, who ruled for sixty years, was very diligent in this regard, and worked hard to recruit Chinese scholars into the imperial administration. The fashion for blaming the Manchus is in fact just another outgrowth of the regrettable impulse to assert Chinese race-nationalism into every area of the human sciences.

Joseph Needham, his wife, and his mistress all lived to great ages. Dorothy was the first to go, in 1987, aged ninety-two. Two years later Needham married Lu Gwei-djen, his mistress of fifty-two years. Lu died after a fall two years later, at eighty-seven. Needham himself had Parkinson's disease by this point, but he continued work on his tremendous project almost to the end, dying in March 1995, aged ninety-four.

The Needham Question remains wide open. Simon Winchester takes a brief canter through it in the epilogue of his book, without coming down in favor of any one theory. He ends optimistically:

> It seems abundantly clear that creativity, true inventiveness, is starting to flow in China once again, with the new prosperity of the country.... Nowadays, in every field...the new China is

> entering a time of intense activity and entrepreneurial energy.

While present-day China certainly presents a refreshing contrast to the lunacy and obscurantism of the Mao era, the Chairman's portrait still looks down from Heavenly Peace Gate, across the square from his hideous, grandiose mausoleum. Chinese scientists not involved in the big, no-expense-spared military and national-prestige projects still grumble that they can't get funding, that politics bedevils the labs and lecture halls, that their students just want to make money, and that the People's Republic remains at its core an authoritarian Leninist state intolerant of doctrinal deviation.

"Scientific revolutions happen by challenging the established paradigms," observes Satoshi Kanazawa, channeling Thomas Kuhn. "No conformists have ever brought about a scientific revolution." For insight into the current Chinese state's attitude toward nonconformists, I recommend a viewing of the recent National People's Congress, the delegates seated in precise ranks and files, wearing identical dark suits, applauding robotically and turning pages in unison as the "leaders" of China drone through two-hour speeches filled with dry-as-dust subacademic politico-babble. The word "creativity" does *not* leap to mind.

It would be interesting to know what Joseph Needham would have made of the new China, with its heroic materialism, its teeming commercialism, its bumptious militarism, and its sinister, vengeful race-nationalism. Probably he would have deplored much of it, while reminding us that at least Chinese scientists no longer have to work in caves and derelict pagodas.

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