中國科學技術史

李約瑟著

SCIENCE AND CIVILISATION IN CHINA

BY

JOSEPH NEEDHAM, F.R.S., F.B.A.

SOMETIME MASTER OF GONVILLE AND CAIUS COLLEGE, CAMBRIDGE

FOREIGN MEMBER OF ACADEMIA SINICA

With the collaboration of

LU GWEI-DJEN, PH.D.

FELLOW EMERITUS OF ROBINSON COLLEGE, CAMBRIDGE

and a special contribution by

HUANG HSING-TSUNG, D. PHIL.

PROGRAM DIRECTOR

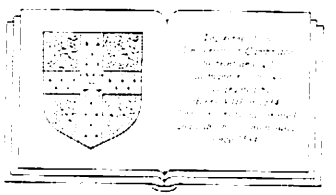
NATIONAL SCIENCE FOUNDATION

WASHINGTON, D.C.

VOLUME 6

BIOLOGY AND BIOLOGICAL TECHNOLOGY

PART I: BOTANY



CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE

NEW YORK PORT CHESTER

MELBOURNE SYDNEY

birds and beasts, plants and trees'. How could it be only their names with which they were acquainted? No, they deeply investigated them and earnestly sought out (their natures)—all are included in the 'investigation of things'.

Thus Neo-Confucianism brought philosophical justification for the botanical interests of scholars during the previous millennium and more, as well as for those who followed after.

The men of this school also showed on many occasions a vivid sense of unity with all other living things, while at the same time being able to distinguish well the levels of complexity and organisation. The following dialogue is reported of their greatest figure, Chu Hsi[1] (+1130 to +1200):[a]

Someone said: 'Birds and beasts, as well as men, all have perception and vitality (*chih chio*[2]), though with different degrees of penetration. Is there perception and vitality also in the vegetable kingdom?'

(The philosopher) answered: 'There is indeed. Take the case of a plant in a pot; when watered, its flowers shed forth glory; when pinched, it withers and droops. Can it be said to be without perception and vitality? Chou Tun-I[3][b] refrained from clearing away the grasses from in front of his window, because, he said, 'their vital force is very like my own'.[c] In this he attributed perception and vitality to plants. But the vitality of the animals is not on the same plane as man's vitality, nor is that of plants on the same level as that of animals.'[d]

Thus the evolutionary ascent through successive stages of integration was plainly implicit in Neo-Confucian thought. The same feeling for Nature is recorded of Chhêng Ming-Tao[6], the other great Chhêng brother (+1032 to +1085). Chang Hêng-Phu[7] tells us that

the steps leading up to Ming-Tao's library were thickly covered with grasses. When someone advised him to have it all cut, he said: 'No. I want always to be able to see the vital processes, the formative urges and the shaping forces of the natural world' (*tsao wu shêng i*[8]). He also bought a pond in which he kept small fish, and was always going to look at them. When asked why he kept them, he said: 'I like to watch the myriad things all satisfied with their existences' (*wan wu tzu tê i*[9]). Grasses and fishes of course everybody sees, but only Ming-Tao could (teach us to) see the life-principles in the grasses, and the life-satisfaction in the fish. That was no common seeing, but more like that of the impartial penetrating sun.[e]

And to take one last example, particularly relevant because the flowering parts of plants attracted botanical attention so early, there is a similar story about Chhêng I-Chhuan.[f]

[a] *Chu Tzu Chhüan Shu*, ch. 42, pp. 31*b* ff., tr. Bruce (1), p. 68, mod. auct.
[b] The founder of the Neo-Confucian school, +1017 to +1073.
[c] This report comes originally from *Honan Chhêng shih I Shu*, ch. 3, p. 2*a*, tr. Graham (1), p. 109, mod. auct. A note by the disciple Hsieh Liang-Tso[4] (d. +1121) adds that Chang Tsai[5] (+1020 to +1077) made a similar remark when watching a braying donkey.
[d] A full translation of the whole passage will be found in Vol. 2, p. 569.
[e] *Sung Yuan Hsüeh An*, ch. 14, p. 5*b* (p. 38), partial tr. Graham (1), p. 109, mod. auct.
[f] *I-Chhuan Wên Chi*, Suppl., ch. 1, p. 5*a*, tr. Graham (1), p. 110, mod. auct.

[1] 朱熹 [2] 知覺 [3] 周敦頤 [4] 謝良佐 [5] 張載
[6] 程明道 [7] 張橫渠 [8] 造物生意 [9] 萬物自得意

I-Chhuan came again with Chang Tzu-Chien[1] during the spring. Shao Yung[2][a] invited them to go for a walk with him on the Thien-mên road to look at the flowers. I-Chhuan declined, saying that he had never been in the habit of looking at flowers. Shao Yung replied: 'What harm could there be? All things have their ultimate patterns (*li*[3]). We look at flowers differently from ordinary people because we are trying to see into the mysteries of Nature's shaping forces.' I-Chhuan replied, 'In that case I shall be glad to accompany you'.

In the light of these glimpses one can see something of the background, explicit or implicit, which made Confucian scholars feel authorised to probe into the strange plants of outlying regions or the problematical plants to which the men of old had alluded. What they wrote about these things constitutes two special genres of botanical literature, and we shall now describe the books or tractates which dealt with the south, those regions which most fascinated the Chinese as they moved outwards to fill the geo-political *oikumene* of their culture. But first a few words must be said about the historical course of this southern penetration. We have had occasion to speak of this several times already during the preceding volumes.[b]

(i) *The exploration of the borderlands*

During the Warring States period the whole region of what is now south China and Vietnam was occupied by tribal peoples known as the Hundred Yüeh (Pai Yüeh[4]). In the east there were the Tung Yüeh[5] of Chekiang and Chiangsu, who had attained the status of a princedom, the Yüeh State, from about −400 onwards. Most of Fukien (Min) was the area of the Min Yüeh[6] people, while to the south in Kuangtung, Kuangsi and Annam there were the many groups of the Nan Yüeh[7]. These had relations especially close with the State of Chhu[8], which acted as an intermediary for their tropical and sub-tropical products, so it was natural enough that after the fall of this State to the first emperor, Chhin Shih Huang Ti, in −223, the conquering organisation of Chhin sought to annex the regions which had been providing such valuables as rhinoceros horns, ivory, jade and pearls, to say nothing of desirable plant products like bananas and lichis. As soon as the country was unified, then, in −221, a great expeditionary force passed southwards between the peaks of the Nan Ling[9] range to subjugate the Yüeh. It took some seven years, and in the course of it a great technical achievement happened, the construction of the most ancient transport contour canal in any civilisation. Started in −219, this was the design of the engineer Shih Lu[10], who united the upper waters of a northward-flowing river with those of a southward-flowing one, with the result that an unending stream of barges with army supplies

[a] One of the earlier of the Neo-Confucian school, +1011 to +1077. But he stood rather aside from their main line of development; cf. Vol. 2, pp. 455 ff. We have had occasion to discuss some of his ideas on p. 305 above.
[b] E.g., Vol. 1, p. 101. On the general subject of trade and expansion in Han China there are now books by Yü Ying-Shih (1) and Wiens (3).

[1] 張子堅 [2] 邵雍 [3] 理 [4] 百越 [5] 東越
[6] 閩越 [7] 南越 [8] 楚 [9] 南嶺 [10] 史祿

could reach the neighbourhood of Canton from as far north as the Yellow River.[a] In −214 three regular commanderies were established, including what is now northern and central Vietnam.

But the Chhin dynasty came suddenly to an end, and during the confusion preceding the inauguration of the Han, Southern Yüeh had peace and even independence under the rule of an official who had been appointed from the north, Chao Tho[1]. After −202 the Han emperors desired to reabsorb these southern regions, so Wên Ti sent as an envoy Lu Chia[2] on two occasions, first in −196 and then again around −179, but these visits did not obtain immediate results. It was not until sixty years after his death, and some twenty-five after that of Chao Tho, that the forests and ricefields of Nan Yüeh re-entered the Chinese empire following vigorous action in −111, naval as well as military, by Han Wu Ti.[b] All the south was now divided into nine commanderies, making together Chiao-chou[3], under a Governor of Chiao-chih[4]. During the commotions of the time of Wang Mang at the beginning of the era, and those still greater upheavals which terminated the Han, the southern regions (Ling-Nan[5]) generally enjoyed considerable tranquillity under a number of enlightened officials, some of whom, like Shih Hsieh[6], proclaimed a temporary independence. But in +211 he submitted to Sun Chhüan[7], soon to be the ruler of the State of Wu in the Three Kingdoms from +221 onwards. He used to send him, says the *San Kuo Chih*,[c]

a variety of perfumes, several thousands of pieces of fine *ko*[8] grass-cloth,[d] brilliant pearls, large cowrie-shells, green glass,[e] caerulean jadeite, tortoise-shell, rhinoceros (horns), ivory and other precious things; together with strange products and rare fruits, bananas, coconuts, longans and the like. Every year there came these gifts, and sometimes he presented several hundred horses as well.

Shih Hsieh lived to be ninety, dying in +226. During the course of his long and successful governorship he had welcomed to the peaceful south many scholars from the north who sought new homes and new employments far from the tumults of their own provinces. Such people began to take great interest in the natural products and industries of Nan Yüeh.

Under his successor, Lü Tai[9], Chinese exploratory curiosity pushed out still further towards the Indian culture-area. Between +226 and +230 Lü sent two famous envoys, Chu Ying[10] and Khang Thai[11], to visit the countries of Champa (Lin-I[12]) and Cambodia (Fu-Nan[13]), and so such kingdoms began to pay tribute to the state of Wu.[f] Both of these men wrote books on their experiences, but these

[a] See Vol. 4, pt 3, pp. 299 ff. [b] See Vol. 4, pt 3, p. 441.
[c] Ch. 49, p. 11*a*, tr. auct., adjuv. Li Hui-Lin (12).
[d] This was the cloth woven from the fibres of the leguminous vine *Pueraria thunbergiana* (R 406); cf. pp. 86, 340 above.
[e] This could well have been something imported from Europe and passed on. Cf. Vol. 1, p. 200.
[f] Cf. *San Kuo Chih*, ch. 60, p. 9*a*.

[1] 趙佗 [2] 陸賈 [3] 交州 [4] 交趾 [5] 嶺南
[6] 士燮 [7] 孫權 [8] 葛 [9] 呂岱 [10] 朱應
[11] 康泰 [12] 林邑 [13] 扶南

are extant now only in the form of quotations in later works. Chu Ying was the author of the *Fu-Nan I Wu Chih*[1] (Record of the Strange Things in Cambodia); Khang Thai had two titles to his name, the *Fu-Nan Chuan*[2] (Record of Cambodia) and the *Wu Shih Wai Kuo Chuan*[3] (Record of Foreign Countries in the time of the State of Wu), but they may have been the same book. It is certain that both of these writers had something to say of the plants, trees and animals characteristic of these strange countries, but the fragments left have little of this now. In +280 the empire was re-united under the Chin,[a] and the Nan-Yüeh lands down to the middle of Vietnam were once more within the boundaries. A succession of able and benevolent governors, first Thao Huang[4] from +271, and then Wu Yen[5] from +301, gave peace and good administration to the south. We need not pursue further the fluctuating fortunes of Chiao-chou and the two Kuang provnces,[b] because the time of Wu Yen was precisely that of the greatest type-specimen of books on tropical botany, as we shall see in a moment.

We are now to look at the whole succession of writings about the southern regions,[c] a succession which may go back as far as the −2nd century, if the *Nan Yüeh Hsing Chi*[6] (Records of Travels in Southern Yüeh) was genuinely the work of Lu Chia[7] (p. 111 above). Without dispute he was down there, and the book would have been written about −175, but then it may well have become rare by Chin times and lost altogether thereafter. Equally enigmatic is the second account, the celebrated *Lin-I Chi*[8] (Records of the Champa Kingdom); if Tungfang Shuo[9] was really the author of the first version he probably penned it around −100. In any case, it must have been remodelled a good deal later on, not reaching its present form before the latter part of the +5th century. If the following passage on the betel-nut palm, *Areca catechu*, was contained already in the original version, it must be one of the oldest botanical descriptions of southern plants which have come down to us. The *Lin-I Chi* says:[d]

The areca tree (*ping lang shu*[10])[e] is about ten feet in circumference[f] and more than a hundred feet high. Its bark resembles that of the *chhing thung*[11] tree,[g] and it has joints or

[a] The first reign-year of the first Chin emperor dated from +265, but the State of Wu was not absorbed until just after +277.
[b] There is a wealth of Chinese secondary sources condensing the history of these times, e.g. Thang Chhang-Ju (1); Hsü Tê-Lin (1); Li Ssu-Mien (1, 2); Wang Chung-Lo (2); Li Chien-Nung (3, 4).
[c] These have been touched upon before, especially in the geographical Section 22 (Vol. 3, p. 510), where we had some discussion of the literature on southern regions and foreign countries. Among other surveys of this genre, that of Schafer (16), pp. 147 ff. is worthy of note, though it accordance with its design it concentrates mainly on writings of the Thang period.
[d] As cited in the +1647 edition of the *Shuo Fu*, ch. 62, tr. Aurousseau (4), p. 15, eng. mod. auct. The parallel passage in the *Nan Fang Tshao Mu Chuang* has been translated by Li Hui-Lin (12).
[e] We have said something of the betel complex already on p. 384 above.
[f] Aurousseau suspected that the text had originally 'one foot'.
[g] I.e. *Sterculia platanifolia* = *Firmiana simplex* (R 272), the *wu thung*[12], often called the phoenix tree.

[1] 扶南異物志 [2] 扶南傳 [3] 吳時外國傳 [4] 陶璜 [5] 吾粲
[6] 南越行紀 [7] 陸賈 [8] 林邑記 [9] 東方朔 [10] 槟榔樹
[11] 青桐 [12] 梧桐