Yôan UDAGAWA

—A Pioneer Scientist of Early 19th Century Feudalistic Japan—

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Preface

Until now the only biographical studies on Yôan UDAGAWA (1798–1846)[1] are a booklet[2] written by Yoshiaki YOSHIKAWA (1933) and a treatise[3] written by Gôichi FUJINAMI (1936). Though their publication date is fairly old, these two works have not yet been superseded by any biography of a later date with a broader view of Yôan's life. They have laid a valuable foundation in this specific field even if they have made limited use of historical materials and documents.

In the 1930's, the man who had particularly large collection of books and manuscripts by Yôan was, besides Gôichi FUJINAMI, Chibiki OKAMURA a scholar whose possessions included "*UDAGAWA YÔAN Jijo Nenpu*"[4] (Chronological Autobiography of Yôan UDAGAWA) which no doubt gives us the best although simple version of his life history. There are two versions of the original of this valuable material, both written in Chinese on 8–9 sheets of common Japanese paper. OKAMURA put them in order, added the correct punctuation to the text, and published it as a supplement to his book "*Kômô Bunka Shiwa*" (A Cultural History of Western People).

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[1] 宇田川榕菴 (緑舫). Biographical papers on Yôan UDAGAWA except the notes (2)-(4).

Suketoshi YAJIMA and Minoru TANAKA, "Meiji-zen Nihon Butsuri Kagaku Shi" (A History of Physics and Chemistry Prior to the Meiji Era in Japan) (1964) (J)=in Japanese.

Shôjirô MIZUTA, "A study of Yôan UDAGAWA (I)", *Kagakushi Kenkyû*, No. 14, p.p. 18–26 (1950) (J).

———, "A Study of Yôan UDAGAWA (II)", *ibid.*, No. 15, p.p. 18–28 (1950) (J).

Shôjirô MIZUTA and Tetsurô IKEDA, "A List of Yôan UDAGAWA's manuscripts", *Rangaku Shiryô Kenkyû-Kai Kenkyû Hôkoku*, No. 79 supplement (1961).

Tatsumasa DÔKE, "A Study of Yôan UDAGAWA (I)", *Kagakushi Shûkan*, No. 6, p.p. 95–109 (1971).

———, "Yôan UDAGAWA in the History of Western Learning", *Kikan Geijutsu*, No. 23, p.p. 88–106 (1972).

[2] Yoshiaki YOSHIKAWA, "UDAGAWA YÔAN, A Pioneer in Japanese Science" (1933) (J).

[3] Gôichi FUJINAMI, "UDAGAWA YÔAN," *Chûgai Iji Shinpô*, No. 1230, April 28 (1936) (J).

[4] Chibiki OKAMURA, "*UDAGAWA YÔAN Jijo Nenpu* (宇田川榕菴自敍年譜)", Kômô Bunka Shiwa (Sôgen-sha, 1953) (J). (→38).

FUJINAMI wrote the above treatise without having had any previous chance to look at the original materials possessed by OKAMURA including "*Jijo Nenpu*". He referred to OKAMURA's collection in his treatise and said that some day he would like to review the materials held by Mr. OKAMURA and, if necessary, revise his own work accordingly. He died, however, before having any chance to realize his wish. It will not reduce the significance of his work, therefore, if the present author points out several mistakes included in FUJINAMI's treatise that could be discovered only through collating it with Yôan's "*Jijo Nenpu*" and other manuscripts.

Today we do know that the most of Yôan's own manuscripts and other materials are held at the Ken-ken-sai Library of Takeda Chemical Industries, Ltd. and at the Waseda University Library, the former comprising the largest part of the FUJINAMI collection and the latter a large part of the OKAMURA collection. Some other works and manuscripts related to Yôan are also held at the National Diet Library and at the Tsuyama Local Museum, Tsuyama City.

The present author has been engaged on a biographical study of Yôan UDAGAWA referring to every document now available including UDAGAWA's own works and manuscripts, topped by "*Jijo Nenpu*", the treatises of YOSHIKAWA and FUJINAMI and many other studies of a later date. The following treatise should be regarded only as an introductory part of my accumulated studies. Its purpose is to provide a brief biography of Yôan based on the most accurate data now available and also hopefully to consider the meaning of his pioneering role and to make clear the position of Yôan's work in Japanese history, particularly in the history of Japanese natural science.

1

Yôan UDAGAWA (or Ryokubô),[1] a Dutch-school physician in early 19th century Japan, is recognized as a pioneer in the fields of modern chemistry and botany in Japan by virtue of his scientific writings represented by *Seimi Kaisô**

* *Seimi Kaisô* 舎密開宗; The author of this article would like to quote the following passage from Hideomi TSUGE's "*Historical Development of Science and Technology in Japan*" (1961), which is written in English and appears rather widely read among professional circles. In the chapter on physics and chemistry, TSUGE writes as follows; "HIROSE Genkyô (1821-70)[5] made a contribution to chemistry as well. His *Shami-Dokuhon*[6] (meaning a book on chemistry) and *Kagaku Shokyo*[7] (meaning the first step to chemistry) are the works of his activities in this science. At about the same time, in 1837, Udagawa Yôan (1798-1864) published the "*Shami Kaishu*" (Shami is transliterated from chemi). Thus in Japan, the study of chemistry at last became gradually active." (p.p. 81-82). (→79)

To the author's knowledge, however, there are at least three mistakes in this description. (1) The scholar who wrote "*Shami-dokuhon*" and *Kagaku Shokyo* was not Genkyô HIROSE but

[5] 広瀬元恭 (1821-1870).

[6] 「舎密読本」.

[7] 「化学初教」.

(Foundation of Chemistry), the first chemistry book ever written in Japan based on the Lavoisierian chemical system, *Shokugaku Keigen*** (Introduction to Botany), the first regular botany book written in Japan, and other outstanding academic works about Western medicine, pharmacology, zoology, history, geography, technology, music, mathematics and linguistics.

He was born in 1871 in Edo (now Tôkyo), the eldest son of Yôju EZAWA,[8] a Dutch-school physician employed by a local clan. At 13 years of age (in 1811) he was adopted by Genshin (Shinsai) UDAGAWA.[9] the head of the then most celebrated family of physicians, and later called himself Yôan or Ryokubô.[1]

2

Around 1811, the Dutch schools were undergoing a change. In 1774, thirty-seven years before, Dutch learning had its start in modern Japan, when Genpaku SUGITA,[10] Ryôtaku MAENO,[11] Jun'an NAKAGAWA[12] and other scholars published *Kaitai Shinsho*[13] (A New Book of Human Anatomy), an elucidative translation of *Tafel Anatomia*,[14] which introduced Western anatomy for the first time to Japan.

While desirous of more detailed information on foreign nations to sustain its own establishment, the Bakufu government did not want such information being propagated among the general public or even among the samurai. In spite of the government's strengthened control, it was impossible to keep from the Japanese people this knowledge of the Western world.

It was in these days when foreign ships began to visit Japanese ports fre-

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Kômin KAWAMOTO (1810–71).[15] (2) In the author's opinion, "*Shami Kaishû*" should be transcribed as *Seimi Kaisô*. Yôan himself wrote a phonetic transcription in *Kana* letters セイミ (read "seimi") at the side of 舎密 in his book. As for "Kaishû", we do not know for sure today how he pronounced the word 開宗. However, it is certain that according to Mannen UEDA's *Dai ji ten*[16] a most authoritative Japanese lexicon, the letter 宗 should be read normally as "sô", not "shû", except in a few rare cases. 開宗 should be read as *Kaisô* in all probability. (3) The above passage may give the reader an impression that "*Shami-Dokuhon*" and *Kagaku Shokyo* were written prior to "*Shami Kaishu*". The order was the reverse, however, and "*Shami-dokuhon*" should be transcribed as *Seimi-dokuhon*.

** *Shokugaku-Keigen* 植学啓原. Hideomi TSUGE refers to this book as "*Shokubutsu Keigen*" (*op. cit.*, p. 83 and index), which is an apparent mistake. (→77)

[8] 江沢養樹.

[9] 宇田川玄真 (榛斎) (1767–1832).

[10] 杉田玄白 (1733–1817).

[11] 前野良沢 (1723–1803).

[12] 中川淳庵 (1739–1786).

[13] 「解体新書」.

[14] J. A. Kulmus's "Ontleedkundige Tafelen" (Dutch version translated from German original by J. Dicten).

[15] 川本幸民 (1819–1870).

[16] 上田万年「大字典」.

quently, challenging the national policy of isolation by the Tokugawa Shogunate government. Accepting the proposal of Sakuzaemon (Kageyasu) TAKAHASHI,[17] an astronomical observer officer, the Shogunate government established, in May 1811, a new office, "Bansho Wage Goyô"[18] (Foreign Documents and Books Translation Bureau), at the Calendar Bureau of Asakusa Observatory in Edo. Sajûrô (Kokuri or Sadayoshi) BABA,[19] an interpreter working in Nagasaki, and Gentaku ÔTSUKI,[20] a noted Dutch-school physician, were attached to the new office. While translating foreign governments' documents as need arose, they also tried to use this opportunity to translate a Dutch version of Chomel's Encyclopedia[21] into Japanese, which began an encyclopedic Japanese collection known later as *Kôsei Shinpen*[22] (New Volumes for the Public Welfare). In 1813, Genshin UDAGAWA, and late in 1826, Yôan UDAGAWA, were also invited to work in this office as translators.

The UDAGAWA family,[23] with a long history in the medical profession, had been residing in Edo as the hereditary official Chinese-school physicians attached to the Tsuyama clan. The fifth family head Genzui (Kaien[24]) studied Dutch ideas under Gentaku OTSUKI, allegedly learned Alias Western medicine from Genpaku SUGITA and wrote *Seisetsu Naika Sen'yô*[25] (Selected Points of Western Theories on Internal Medicine) 18 vols., the first Japanese textbook on Western internal medicine. Succeeding him, the sixth family head, Genshin, translated as many as thirty anatomy books and published them in the form of an integrated abridged edition under the title of *Ihan Teikô*[26] (General Outline of Medical Precepts) accompanied by an illustrated supplement *Naishô Dôbanzu*[27] (Anatomical Atlases printed by Copper Plates). Then he published *Zôhojûtei Naika Sen'yô*[28] (*Naika Senyô*, revised and enlarged), a revised and enlarged edition of his father's translation on internal medicine, and also wrote *Oranda Yakkyô*[29] (Mirror of Dutch Medicines), the first standard Japanese book on Western pharmacology

[17] 高橋作左衛門 (景保) (1784-1829).

[18] 蕃書和解御用.

[19] 馬場佐十郎 (厳里, 貞由) (1787-1822).

[20] 大槻玄沢 (1757-1827).

[21] Noël Chomel: "Algemeen Huishoudelijk, Natuur-, Zedekundig en Kunst Woordenboek" (Translated by de Chalmot). Japanese translation was named "Kôsei Shinpen" and published in 1937.

[22] 「厚生新編」(1937).

[23] UDAGAWA's lineage; (I) Genchû (玄中)—(II) Gensen (玄仙)—(III) Genzui (Ensen) (玄随)—(IV) Genshuku (Kôto) (玄淑)—(V) Genzui (Kaien) (玄随)—(VI) Genshin (Shinsai) (玄真)—(VII) Yôan (榕菴)—(VIII) Kôsai (興斎).

[24] 宇田川玄随 (槐園) (1755-1797).

[25] 「西説内科撰要」.

[26] 「医範提綱」.

[27] 「内象銅版図」.

[28] 「増補重訂内科撰要」.

[29] 「和蘭薬鏡」.

translated from available Western books. He followed that up with *Shinteizôho Oranda Yakkyô*[30] (*Oranda Yakkyô*, Newly revised), *Ensei Ihô Meibutsu Kô*[31] (Treatise on Far Western Medicaments) and its *Hoi*[32] (Supplement) with the cooperation of his adopted son Yôan.

Genshin, born in Ise in the YASUOKA family, went to Edo to study medicine under Genzui UDAGAWA and learn the Dutch language under Gentaku OTSUKI. Though once adopted by Genpaku SUGITA, he was soon discharged "by reason of his prodigal way of living."[33] Then he assisted Sanpaku INAMURA[34] in compiling *Edo Halma*,[35] the first Dutch-Japanese dictionary ever produced in Japan. When Genzui died suddenly, leaving no heir, his friends attempted and succeeded in promoting Genshin as a successor to the famous UDAGAWA family.

3

It was Yôan, the seventh family head and the subject of the present study, who assisted his father in finishing *Ensei Ihô Meibutsu Kô* and yet independently went into various fields of modern basic science. He was brought up in the family of a local Dutch-school physician and adopted, when young, by the outstanding Dutch-school medical family of UDAGAWA. In short, his milieu was excellent. However, there is no evidence at all that he studied Dutch grammar as a boy or even after being adopted by Genshin. On the contrary, he was eager to learn the traditional Chinese philosophy of Confucianism so-called Kogaku-ha[36] and, of course, classical Chinese composition. Even in the field of medicine, young Yôan stuck mainly to classical Chinese work as he frankly confessed later in his autobiographical chronology *Jijo Nenpu*.

It is most unlikely that Genshin, a vigorous scholar, had never mentioned

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[30] 「新訂増補和蘭薬鏡」.

[31] 「遠西医方名物考」.

[32] 「遠西医方名物考補遺」.

[33] Genpaku SUGITA, "Rangaku Kotohajime" (→105).

[34] 稲村三伯 (later renamed Zuiô UNAGAMI 海上随鷗) (1759–1811).

[35] 「江戸ハルマ」.

[36] In the Edo period Confucian learning and morality were ostensibly respected as most authoritative. But this school of philosophy, conservative and unscientific, could not possibly keep a lasting hold on thinking men. It was next to impossible to keep a new attitude of mind from asserting itself. Discontent with Confucianism among Confucian scholars found expression in the views advanced in opposition to Chu Hsi's exposition. Such learned men as Sokô Yamaga (1622–1685), Jinsai Itô (1627–1705) and Sorai Ogyû (1666–1728) insisted that the real meaning of the teachings of Confucius and Mencius should be grasped by delving directly into the texts of the Chinese classics, instead of relying on the commentaries of Chu Hsi and Wang Yang-ming.

Theirs was the so-called Kogaku-ha or "Ancient school of philosophy" (Saburô IENAGA; "History of Japan", Japan Travel Bureau, Tourist Library Vol. 15, 1971, p. 165).

In the Edo period, most Dutch-school physicians learned the Chinese philosophy of Kogaku-ha's Confucianism.

to his promising son the treasure-house of knowledge on Dutch medicine accumlated so far. On the other hand, we have to realize that Japanese medical science at that time was not yet mature enough to utilize Dutch medicine in full, particularly in the field of clinical treatment. It was only natural for a young man aspiring to become a physician, especially a physician employed by a local clan, to study Chinese medicine.

According to the above autobiographical chronology, he endeavored to promote his knowledge on Sino-Japanese medical herbs by wandering around hills and valleys, by observing and collecting herbs, and by joining group discussions to identify herbs referred to in the Dutch books. The group members included my father Genshin and noted herb scholars such as Gunpô HANADO[37] and Kan'en IWASAKI.[38] He would even "ask pharmacological questions to Dutch capitãos and ships' doctors at their lodging places in Edo, called Nagasakiya,[39] in attendance with my father Genshin," when these foreigners came up from Nagasaki to Edo castle to pay courtesy calls to the Shogunate government.

Yôan seems to learnt, during his wide-ranging education, that there were numerous medical herbs commonly used in Western countries but not available in Japan or China, and that there were also numerous herbs abundant in Japan or China but possibly effective only when used in the Western way. This may be the reason why he began to show interest in learning Dutch. However, his father did not allow him to learn Dutch at this stage, rejecting his proposal to do so (*Jijo Nenpu*). Genshin is said to have stressed that "the traditional academic approach in the UDAGAWA family is based in the main on learning classical Chinese composition. If you lacked the ability to compose a Chinese sentence, you cannot achieve medical learning either....But do not foget that translation is important work and worthy for a man to sacrifice his whole life to." This remark sounds conflicting, but since there was no reason that Genshin should have felt displeased with his son's new aspiration for learning Dutch, the above remark may be interpreted as a warning against a perfunctory and whimsical attitude toward Western knowledge. Yôan, however, did not change his mind and kept insisting that he start learning Dutch at once. His father eventually gave in and "made proper arrangements for me to study under Sajûro (Kokuri) BABA. It was quite impossible, my father said, to rob even a boy of his ambition" (*Jijo Nenpu*). Thus Yôan, by his own will, but equally influenced by the trends of his time, started learning Dutch under the best teacher then available using herb books as well as Dutch pharmacopoeia as textbooks. This was in 1814, when he was 16 years old.

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[37] 花戸群芳.

[38] 岩崎観園 (1786-1842).

[39] 長崎屋; Yôan met at this inn Hendrich Doeff (1814), Jan Cock Blomhoff and Classe Hagen (1818), J. C. Blomhoff (1822) and P. F. von Siebold and Johannes Keller (1826).

Sanjûro BABA possessed mastery of the Dutch language and had written several books in Dutch. He was also familiar with Russian and, beside translating poem of Romonosov[40] into Japanese, wrote a book on vaccination, *Tonka Hiketsu*[41] (How to Prevent Smallpox through Vaccination), translated from Russian. It was under the guidance of BABA, we may presume, that Yôan wrote *Roshia-ji On kô*[42] (A Treatise on Russian Letters and Sounds) which dealt with the Russian language. Then, Yôan met Shunsan YOSHIO,[43] a master of Dutch grammar, and learned Dutch from him. After BABA died fairly young, Yôan learned Dutch from Chûjirô YOSHIO,[44] who took the place of BABA at the Translation Bureau, as Yôan mentions in the above autobiography.

Thus, Yôan mastered the theoretical grammar and practical usage of Dutch very rapidly and when he was only 18 years old, he wrote *Kahi no Setsu* (an article on coffee, 1816)[45] and a few years later, *Engeris Sharien Kô* (A Study on the Epsom Salt in England 1819)[46] which surprised and pleased his father Genshin. Then came an article *Hange Itô Mukô Ron*[47] (A method of using the herbal plant *Pinellia ternata*, 1820) and among others a translation on the medical treatment of cholera (*Korea Morubusu Setsu*, 1822)[48] the latter being a hasty description of how to prevent the spread of cholera in the Nagasaki area at a time when nobody else knew how.

In 1822, he published a booklet *Seisetsu Botanika Kyô*[49] (Sutra of Botany) which occupied a most significant place in the historical development of natural science, particularly botany, in Japan.

As for foreign languages, he continued throughout his life to show a great interest not only in Dutch and Russian but also in English, and even in Latin and Greek. In the spring of the same year, 1822, he spent three nights aboard a British ship *Saracen* (which came to Uraga port) to study English, with the permission of Kageyasu TAKAHASHI.

In the autumn of the same year, 1822, he published *Ensei Ihô Meibutsu Kô*, 36 vols. A few years earlier, in 1817, he had accepted the post of physician to

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40 ROMONOSOV, Mikhail Vasilievich (1711–1765), a great Russian poet and scientist.

41 「遁花秘訣」.

42 「魯西亜字音考」.

43 吉雄俊三 (1787–1847). He learned Dutch under Gonnosuke YOSHIO, his uncle, and excelled at it. He obtained a post as a Dutch-school physician with the Owari clan, and wrote many books on Dutch grammar, astronomy, Western medicines and weather forecasting, *etc.* He died by accident in a fuluminating mercury explosion during experiments. Yoshiaki YOSHIKAWA; "Owari Kyôdo Bunka Ikagaku-shi Kô" p.p. 71–108 (1955).

44 吉雄忠次郎.

45 「哥非乙説」.

46 「諳厄利斯孚利塩考」.

47 「半夏為湯無効論」.

48 「虎列亜没爾爸斯説」. The Text of *Korea Morubus Setsu*; Boier's "*Cholea Morbus*".

49 「西説菩多尼訶経」.

the Tsuyama clan and in 1822 he married Seyo ADACHI[50] (a daughter of Chôshun ADACHI,[51] a physician of the Dutch school).

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In 1822, Yôan published *Seisetsu Botanika Kyô* which expounded the theory of Western botany using the special rhythmical scheme of Buddhist sutra recitations, perhaps translating from Chomel's Encyclopaedia. This was the first introduction of modern Western botanical ideas into Japan.

This pamphlet, consisting of only 75 lines of 17 Chinese characters, was significant in that it was the first botany book (if it can be called a book) ever published in Japan and, more important, it reflected his recognization of botany or botanical science as distinct from the herbal knowledge or herbalism (Honzô-gaku) which had been commonly practised in Japan until then.

Tomitarô MAKINO[52] and many other scholars have maintained that *Botanika Kyô* was the first book in Japan ever written about botany, but nobody has explained how Yôan came to know about botany.

Certainly Yôan must have come to know of botany as a field of Western scientific knowledge first when he read Chomel's Encyclopaedia. He wrote: "In 1817, I happened to read Chomel's book and learned of the existence of botany for the first time. Then I tried to learn more about this new field and later came to understand something of its significance." (*Jijo Nenpu*).

Yôan was wise enough to recognize that botany is more useful than traditional herbalism in medical treatment.

"Herbalism in China has been a field of practical knowledge dealing with minerals, animals and especially plants concerned only in determining which are beneficial and which harmful to man. But botany in the Western sense is a scientific field dealing with the identification of plants and the mechanism of their growth, flowering and development of fruits. Thus, botany is utterly different from herbalism." (*Shokugaku Dokugo*,[53] Confessions on Botany). In another book *Ensei Ihô Meibutsu Kô* (1822), he also referred to plants as one of the three fundamental groups on the earth, and even cited the name of Carl von Linné. "If you are unfamiliar with botany, you will be unable to understand the strange words and terms appearing in these Western pharmacology books.... Please read my latest work *Botanika Kyô* which deals with plant science in general."

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[50] 足立世瑛 (1808–1865).

[51] 足立長雋 (1776–1836).

[52] 牧野富太郎 (1862–1957), *Shokubutsu Kenkyû Zassi*, vol. 2, No. 5, p.p. 103–105 (1921).

[53] 「植学独語」. Ichirô YABE, "The study on *Shokugaku Dokugo* written by Yôan UDAGAWA", *Rangakushiryô Kenkyûkai Kenkyû-hôkoku*, No. 253, 1–9 (1971) (J).

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The first large systematic work Yôan undertook was when he cooperated with his father in translating the Western pharmaceutical books cited above. At that time, every Dutch-school physician dealing with internal medicine experienced great difficulty in obtaining information on Western medicines. Father, (Genshin) and son (Yôan) started a joint project and in *Oranda Yakkyô* they compared Japanese-Chinese theories with Western ones relating to those herbs in daily use in Japan and China, and described the properties, shapes, advantages and uses ot such things as katsura (Japanese Judas tree) and dai-dai (bitter orange). In *Ensei Ihô Meibutsu Kô* (36 vols.) and its *Hoi* (Supplement) (9 vols.) they described the mineral and zoological remedies listed in the Dutch pharmacopeia and also the unidentified items of Japanese and Chinese origin. The first three volumes of *Oranda Yakkyô* were published as early as in 1819, but publication was suspended because of its inadequacy.

During 1828–1830 the whole 18 volumes of the newly revised and enlarged edition as supervised by Yôan came off the press. On the other hand, 36 volumes of *Ensei Ihô Meibutsu Kô* had been published earlier (1822) with the comment "Translated by Shinsai, supervised by Yôan," but its *Hoi* (Supplement) in 9 volumes appears to have gone to the press as late as 1835.

It must be noted that Vols. 7 to 9 of this Supplement (*Hoi*) were quite different from the other volumes. Entitled "*Genso-hen, Maki* 1–3" (On Chemical Elements, Vols. 1–3) they described the basic concepts of modern chemistry according to the systems established by A. L. Lavoisier. Yôan must have already concluded that in order to utilize Western medicines in Japan it was necessary to study modern natural science, chemistry in particular, as it constitutes the foundation of Western pharmacology. In *Ensei Ihô Meibutsu Kô Hoi* he stressed that "we shall be unable to master the elaborate process of preparing and producing medicines unless we *anatomize* (Yôan's word) the materials and even analyze their chemical elements."

Yôan at the same time continued to write and publish of his great works—*Shokugaku Keigen*, 3 vols. with illustrations (1835), *Dôgaku Keigen*[54] (Introduction to Zoology, 1835) and his masterpiece "*Seimi Kaisô*," 21 vols. (1837–47).

Why did Yôan translate foreign chemistry books into Japanese and write his own books on chemistry and publish them?

The reason, the author believes, is that he was so convinced of the significant role of chemistry in the practice of medicine.

In the preface of *Ensei Ihô Meibutsu Kô*, he wrote; "In the old days, a physician of the Western school used to mean a surgeon, because there were no such physicians in Japan who were not surgeons. My grandfather Genzui was

[54] 「動学啓原」. Masuzô Ueno "Yôan UDAGAWA's *Dôgaku Keigen-kô*", *Kagakushi Kenkyû*, No. 8, p.p. 18–26 (1944) (J).

the first man to believe in the significance of Western internal medicine and he expressed this belief by writing *Seisetsu Naika Sen'yô*, stressing in it the importance of Western internal medicine which had been developed from basic knowledge of the internal structures of the human body. Then, my father Genshin wrote *Ihan Teikô*, accompanied by an illustrated supplement showing the internal structures of human bodies. His books made a great contribution to medicine by conveying accurate knowledge on human internal structures and encouraging further study. But, unfortunately, the public does not know the methods for preparing effective medicines. So we, my father and I, have written this book, *Ensei Ihô Meibutsu Kô*."

So far, so good. But their joint description of chemistry was neither systematic nor, in the eyes of Yôan, adequate. This was why Yôan continued his studies and expressed his independent view in *Hoi* (1835) and in his *Seimi Kaisô*.

Thus, Yôan advanced his studies in chemistry. But his road in the period 1822 through 1835 was by no means smooth, as will be shown in the next section.

6

In 1828, the "Siebold Incident," the first in a series of suppressive actions taken by Bakufu against Dutch-school scholars, took place. In 1823 Phillip Franz von Siebold (1796–1866), a Dutch doctor, came to Nagasaki. He opened a private school called Narutaki-Juku to teach medicine and science to the young Japanese. Here many students snch as Ryôsai KÔNO,[55] Chôei TAKANO,[56] San'ei OZEKI,[57] Seikai TOTSUKA,[58] Keisuke ITÔ[59] and other's, gathered and learned science under the practical guidance of Siebold.

Also, Siebold studied Japan with the willing cooperation of these Japanese pupils.

Yôan wrote about Siebold as follows; "Siebold lost both his parents early in life, but he had a comprehensive knowledge of everything and was quite familiar with music. I learned much from him" (*Jijo-Nenpu*).

Yôan maintained friendly relations with Seikai TOTSUKA, Keisuke ITÔ and others, who were all pupils of Siebold. Siebold presented to Keisuke ITÔ Thurnberg's "*Flora Japonica*" and suggested that he translate it. Keisuke translated this book on Japanese flora and published it in 1829 under the title *Taisei-Honzô-Meiso*[60] (Western Botanical Nomenclature) 3 vols. with its supplement.

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[55] 高良斎 (1799–1846).
[56] 高野長英 (1804–1850).
[57] 小関三英 (1787–1839).
[58] 戸塚静海 (1799–1876).
[59] 伊藤圭介 (1803–1901).
[60] 「泰西本草名疏」.

Yôan had never been to Nagasaki. He met Siebold in Edo when Siebold came there in 1826 to visit the Shôgunate. They had friendly discussions about medicine, science and other subjects. Siebold was greatly surprised at Yôan's linguistic ability and good scientific knowledge. He is said to have referred to Yôan as "Our valuable friend, naturalist, and physician in Edo."[61]

Kageyasu TAKAHASHI, an official of the Bakufu and the head of the Translation Bureau, presented Siebold with a copy of the noted map of Japan compiled by Tadataka INÔ.[62] At that time, the transfer of such maps to foreigners had been strictly prohibited by the Bakufu. When the Bakufu discovered what TAKAHASHI had done,[63] Siebold and many others were arrested and Siebold was ordered to leave Japan at once. This is known as the "Siebold Incident."

Chûjirô YOSHIO, and official interpreter of the Bakufu and Yôan's teacher, was also arrested. Immediately, the work of the Bureau was suspended. On March 25, 1829, Yôan, Genshin and other members of the Bureau, worried and annoyed, sent a letter of appeal to the Bakufu, saying "We had been translating Chomel's Encyclopaedia. We have no connection with the men captured in the Siebold Incident—Kageyasu TAKAHASHI and the interpreters. We are innocent. Besides, we are confident that our translation is of great value to our country. Please let us resume this translation work at once."[64]

In 1829 Kagayasu TAKAHASHI died in prison. In 1830, the Translation Bureau was open again and work was resumed under a new head. But the iron hand of the Bakufu began to be felt more and more. Translation of Western books and meetings with the Dutch became more and more restricted.

7

In the spring of 1829, Yôan wrote to Keisuke ITÔ, "I am in good health and studying chemistry very hard, but I am greatly annoyed by the lack of chemistry books."[65] In 1829 (or 1830) he wrote another letter to him; "We don't see any Dutch people in Edo these days, so there is no chance at all to talk to them and obtain Dutch books."[66] In these letters, Yôan thanked Keisuke for his help in lending P. J. Kasteleijn's chemistry book, probably "Chemische en physische Oefeningen."

However, even under the strict control of the Bakufu government, Yôan never stopped translating works on Western botany and chemistry into Japanese

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[61] Syûzô KURE "Dr. Siebold," vol. 2, p. 162 (Heibonsha, 1968) (J).

[62] 伊能忠敬 (1745-1818).

[63] Kageyasu TAKAHASHI was confident that he gave the map to Siebold as an exchange of scientific knowledge, but, in the Bakufu government's eye, it was a dangerous military secret.

[64] Gôichi FUJINAMI, *Chûgai Iji Shinpô*,No. 1230, April 28, 1936, p.7.

[65] Yoshiaki YOSHIKAWA, "UDAGAWA YÔAN, A Pioneer in Japanese Science", p. 19. In my judgment, this letter was written in January 1829.

[66] Yoshiaki YOSHIKAWA, *ibid.*, p. 22. In my judgment, this letter was written in 1829 or 1830.

or writing chemical analyses of various spa waters of Japan.

The fact that he continued studying chemistry through these dark days can easily be proved by dating remarks in his manuscripts as follows;[67]

Mar. 1828: *Seimi ka Dai-ichi-sho, Tsuchi-Rui* (First Book of Chemistry on soils)[68]

Sep. 7, 1828: *Shinshû Suwa Onsen Shisetsu* (A report of chemical analysis at Suwa spa in Shinshû area)[69]

Mar. 5, 1829: *Atami Shisetsu* (Chemical analysis at Atami spa)[70]

Sep. 15, 1829: *Sakushû Yu-no-Sato Onsen Shisetsu* (Chemical analysis at Yu-no-Sato spa in Sakushû area)[71]

Aut. 1829: *Arima Onsen Shisetsu* (Chemical analysis at Arima spa)[72]

Aug. 5, 1830: *Dôsan Seimi-ka* (Chemistry of animal acids)[73]

Feb. 6, 1831: *Garuhani Erekiteru Zôsaku-ki* (A report on the generation of Galvanic electricity)[74]

Aug. 25, 1831: *Ka-Retsu-Taihyô* (A comparative table of Fahrenheit's thermo-scale with Réaumur's)[75]

Dec. 26, 1831: *Seimi-Shiyaku-Hen* (A List of chemical reagents).[76]

8

In 1833, he wrote *Shokugaku-Keigen*[77] (3 vols. with illustrations) and he published it in 1835. In its preface he admitted that he had compiled the book from various botanical theories appearing in Western books.

Shokugaku-Keigen describes (in Chinese composition form) the appearance, classification, anatomy and physiology of plants. The book attracts our attention

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[67] These manuscripts are in "Ken-Ken-Sai Library".

[68] 「舎密加第一書土類」.

[69] 「信州訪諏温泉試説」.

[70] 「熱海試説」.

[71] 「作州湯郷温泉試説」.

[72] 「有馬温泉試説」. Gôichi FUJINAMI "Yôan UDAGAWA's studies in spas", *Nihon Iji Shûhô*, No. 1732-5, p. 551-566 (1929).

[73] 「動酸舎密加」. The translation of a part of Lavoisier's *Traité de Chimie*.

[74] This is a report of experiments made by Yôan and his pupils.

[75] 「華列対表」.

[76] 「舎密試薬編」: Preparation of chemical reagents.

[77] 「植学啓原」. Ichirô YABE made a study of *Shokugaku Keigen*.

Ichirô YABE, "Yôan UDAGAWA's *Shokugaku Keigen* I" (J), *Rangaku Shiryô Kenkyû Kai Kenkyû-hôkoku*, No. 242, p.p. 1-8 (1971).

———, "The Translation of *Shokugaku Keigen* into spoken Japanese", *Musashi Daigaku Jinbun Gakkai Zassi*, vol. 3, No. 1, No. 3 (1971) (J).

———, "Yôan UDAGAWA and Linne's Classification", *Rangakushiryô Kenkyu-Kai Kenkyû-hôkoku*, No. 259, 7-9 (1972) (J).

———, "The Fermentation written in *Shokugaku Keigen*", *ibid.*, No. 260, 6-12 (1972) (J).

by the fact that its classification is based on the Linnean system.

The first volume deals with the forms and physiology of nutritive organs; roots, stems and leaves.

The second volume describes the forms and physiology of generative organs; flowers, fruits and seeds.

In the third volume he deals with plant chemistry, and he adds several colored botanical illustrations at the end of the book.

In the first part of *Shokugaku-Keigen*, he wrote as follows. "We can classify all natural material in the world into three categories; animal, plant and mineral, and corresponding to these three categories we have three sciences; zoology, botany and mineralogy.

With regard to these sciences, we consider that there exist three approaches for each; the first—natural history, the second—physics, and the third—chemistry, and of these chemistry forms the last and innermost core.

In another place (the preface), he stressed; "This is just an elementary book introducing natural historical botany, which forms a ladder leading to the upper floors of physical botany and chemical botany.

A good number of Japanese botanical terms used in this book were translated for the first time by Yôan and are widely used in Japan even today.

Yôan is also regarded as the first man to have introduced modern entomology into Japan by virtue of his manuscript *Konchû-Tsûron*[78] (Treatise on Entomology) (1828) which comprised a part of Chomel's Encyclopaedia. Then, in the same year, he started writing a zoological work, *Dogaku-Keigen*,[54] (1835) but this was never completed. Also in the same year, 1835, Yôan wrote *Ensei Ihô Meibutsu Kô Hoi*, an introduction to pure chemistry, and *Seimi Kaisô*, volumes 1, 2 and 3.

Yôan wrote in his *Jijo-Nenpu* as follows;

Oct. 1836: Block printers began to work on *Seimi Kaisô* (*S.K.*) vols. 1–3.
Mar. 1837: Printing blocks of *S. K.* vols. 1–3 completed.
Sep. 1837: Printing blocks of *S. K.* vols. 4–6 completed.
Jan. 1838: *S. K.* vols. 4–6 published.
Apr. 1838: Printing blocks of *S. K.* vols. 7–9 completed.
Jul. 1939: Printing blocks of *S. K.* vols. 10–12 completed.

Seimi Kaisô[79] 21 vols., allegedly a retranslation of the Dutch edition translated from the German version of Henry's *Elements of Experimental Chemistry* based

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[78] 「昆虫通論」.

[79] 「舎密開宗」; *Seimi Kaisô*. There are many papers on this written by Minoru TANAKA and Masao SAKAGUCHI as follows;

Minoru TANAKA, "The Chemical terms in *Seimi Kaisô*", Kagaku-Shugi Kôgyô. Vol. 6, No. 10 (1942) (J).

———, "The origin of knowledge of chemistry in Japan", *Nippon Rekishi*, No. 3 (1949) (J).

on Lavoisier's chemical views, is not a mere word-for-word translation but rather a compilation of Yôan's own opinions and conclusions obtained from a series of his own experiments, assisted by more than twenty Dutch books including Lavoisier's *Traité élémentaire de chimie*[80] (1789) (Dutch edition 1800). It may

———, "Hundert Jahre der Chemie in Japan, Studien über den Prozess der Verpflanzung und Selbständigung der Naturwissenschafte als wesentlicher Teil des Werdegangs modernen Japan (I)", *Japanese Studies in the History of Science*, No. 3, p.p. 89-107 (1964).

———, "Einige Probleme der Vorgeschichte der Chemie in Japan. Einführung und Aufnahme der modernen Materienbegriffe", *Japanese Studies in the History of Science*, No. 6, p.p. 96-114 (1967).

———, "Chemistry", *Nihon Kagaku-Gijutsu Shi* (1964) (J).

——— and Suketoshi YAJIMA, "Meiji-zen Nihon Butsuri Kagaku Shi" (1964) (J).

Masao SAKAGUCHI, "On the Concept of Chemical Affinity in *Seimi Kaisô*", *Kagakushi Kenkyû*, No. 67, p.p. 113-120 (1963) (J).

———, "Studies on *Seimi Kaisô* II—the Original of Translation—", *ibid.*, No. 72, p.p. 145-151 (1964) (J).

———, "Studies on *Seimi Kaisô* III—Yôan UDAGAWA and European Chemical Atomism—", *ibid.*, No. 78, p.p. 49-53 (1966) (J).

———, "On the European Translations of Henry's Epitome of Chemistry and *Seimi-Kaisô*", *ibid.*, No. 80, p.p. 171-178 (1966) (J).

———, "On the Concept of Chemical Affinity in *Seimi Kaisô*" (II), *ibid.*, No. 83, p.p. 124-131 (1967) (J).

———, "On the Chemical Nomenclature in the *Seimi Kaisô*", *ibid.*, No. 85, p.p. 10-21 (1968) (J).

———, "On the Pharmaceutical Reference Books used by the Author of the *Seimi Kaisô*", *ibid.*, No. 86, p.p. 49-56 (1968) (J).

———, "Notes on the French Translation of W. Henry's Epitome of Chemistry", *ibid.*, No. 95, p.p. 139-150 (1970) (J).

———, "On the Mountain Measuring cited by Udagawa Yôan", *ibid.*, No. 96, p.p. 185-190 (1970) (J).

Several controversies are going on between M. TANAKA and M. SAKAGUCHI.

As regards the original of *Seimi Kaisô*, from which Yôan translated into Japanese, Minoru Tanaka has written. "Bisher wurde der originale Text als Ypey's *Sijstematisch Handboek der Scheikunde* (BHB) angenommen. Dr. M. Sakaguchi hat neulich durch Quellenuntersuchung gest gestellt, dass der originale Ypey's *Chemie voor Beginnende Liefhebbers* sein musste. Das erstere wurde, nach Dr. Sakaguchi, als Hilfsmaterial für die Ubersetzung benutzt, da es eine von Ypey vergrösserte Ausgabe des letzteren war. "Studien über Shêmi Kaisô" (Hitherto the original text was presumed to be Ypey's *Sijstematisch Handboek der Scheikunde* (BHB). However Sakaguchi showed later, based on his study of new materials, that this was not correct and the original text actually used was Ypey's *Chemie voor Beginnende Liefhebbers*. According to Sakaguchi, the former was an enlarged edition of the latter (enlarged by Ypey himself) and used as auxiliary material for translation. "Studies on *Seimi Kaisô*") *Kagakushi Kenkyû*, No. 72 (1964) und No. 73 (1965)", (Minoru TANAKA. "*Japanese Studies in the History of Science*", No. 6, p. 108 (1967)).

[80] A Dutch edition of A. L. Lavoisier's *Traité de Chimie* (1789); "*Grondbeginzelen der Scheikunde*" (1800).

Eikoh SHIMAO was recently made a study of the Japanese translation from Lavoisier's chemical terms by Yôan *etc.*

Eikoh SHIMAO, "Yôan UDAGAWA and Lavoisier's *Traité de Chimie*", Ed. by Takamichi ARISAKA, Nihon Yôgaku-shi no Kenkyû II, p.p. 245-279.

———, "The Establishment of Lavoisier's Chemical Nomenclature in Japan", *Kagakushi Kenkyû*, No. 100 p.p. 213-224 (1971) (J).

———, "The Reception of Lavoisier's Chemistry in Japan". *ISIS*, vol. 63, No. 218 p.p. 309-320 (1972).

be said that his attempt to transplant Lavoisier's chemical system into Japan, using many Japanese chemical terms invented by himself, was almost a success. Its "*Nai-hen*"[81] (Inter Part) chiefly treating inorganic and organic chemistry in 18 volumes and "*Ge-hen*"[82] (Outer Part) mainly dealing with analytical chemistry in 3 volumes were published over the period 1837 to 1847. Materials comprizing the Outer Part were derived from his own studies on chemical analysis and examination of the various spa. waters throughout Japan. The relevant data are presented in his manuscript *Onsen Shi-setsu*, (Chemical analyses at spas).

In the preface of *Seimi-Kaisô*, Yôan wrote as follows; "The original text is described in three parts. In the first part, the original author had written about the chemical elements and their compounds. In the second and third parts, the same author had written about the practical chemical analysis of substances (medicines, minerals, soils of rice fields, *etc.*) by means of chemical reagents. Thus, the second and third parts differ from the first, and accordingly the first part of my book was named *Nai-hen* (Inner Part) and the second and the third parts were named *Ge-hen* (Outer Part)"

"I presumed that the original text might be too profound and difficult for beginners, so I decided to write my own book *Seimi Kaisô* in more plain and accessible terms using in full the elucidative descriptions in simpler Western chemistry books. For this purpose, I also utilized my own chemical knowledge accumulated through various chemical experiments."

It may be presumed that his original intention was to digest and introduce the whole system of Western natural sciences, but later on he turned to the Western society itself where such systematic learning was fostered and developed. We can trace his views along this line in his works *Seiyô-kinen-Kô*[83] (A Historical Chronology of Western countries) (1838), *Oranda-Shi-Ryaku*[84] (A History and geography of Holland) (16 vols.) (1844–1845).

But these works were never published, with the exception of *Kaijô Hôjutsu Zensho*[85] (Complete Book of Maritime Gunnery, 1843) in which he worked as a cotranslator.

In 1839, the "Bansha no Goku"[86] incident took place. This incident, the second in a series of suppressive actions taken by the Bakufu against Dutch-school scholars, is now known to have been a frame-up by the conservative group in

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[81] 「内編」.

[82] 「外編」; No exact dates are available in his "*Jijo Nenpu*" to indicate when Yôan wrote and published *Seimi Kaisô Nai-hen*, vol. 14–18 and *Ge-hen* vol. 1–3.

Suketoshi YAJIMA has that, *Ge-hen* vol. 1–3 were published in 1847, one year after of death of Yôan (*Kagakushi Kenkyû*, No. 8, p. 58 (1944)).

[83] 「西洋紀年稿」.

[84] 「和蘭志略」.

[85] 「海上砲術全書」.

[86] 蛮社の獄.

the center of the Bakufu government. The result was the arrest of many leading Dutch-school scholars including Chôei TAKANO (a practicing physician), Kazan WATANABE[87] (a high official of the Odawara clan) and others, all on charge of allegedly stowing away to foreign countries. House searches revealed, it was said, documents criticizing the foreign policies of the Bakufu government. As a result, Kazan killed himself and Chôei was harassed and eventually took the same course. San'ei OZEKI, a translator of the Translation Bureau, was killed himself, too.

A man named Toraichi HANAI,[88] the bent informer in the incident, called himself a disciple of Yôan but we are still uncertain of the native of his involvement in the incident. On the other hand, Yôan, in 1842 (according to *Jijo Nenpu*), ordered Kôsai IINUMA,[89] his son adopted privately, to become a pupil of Gonsai ASAKA,[90] a leading scholar of Chu Hsi's Confucianism, which as the dominant sect of learning authorized by the government, opposed the Dutch-school learning absolutely. The present author presumes that this strange action might have been a step taken by Yôan to protect himself from any possible political suppression among the Dutch scholars in general. The truth, however, is not yet clear and must be left for further study.

Due to the abominable policy of the Bakufu to monopolize all advanced information from abroad, Yôan might have been keenly aware of the doomed cultural atmosphere surrounding him in those days. In fact, he lived through the "Siebold incident" (1828) and the "Bansha no Goku" incident (1839).

Both incidents brought not only a most severe control over the Dutch-school activities but also a total prohibition against Western cultural knowledge applying to every strata of Japanese people including the samurai (except for a specific elite group).

9

Yôan died on June 22, 1846, at the age of 48. Yôan must have continued writing the manuscript of his life's work *Seimi Kaisô* and of his other works including *Oranda Shi Ryaku* till the days just before his death. This is undeniable, because the author has discovered evidence in the manuscript[91] of *Seimi Kaisô Ge-hen*, which contains the following remarks giving definite dates when each volume had been finished.

> "*Seimi Kaisô Ge-hen*, Vol. 1. Manuscript finished on January 26 in the year of *Mizunoto-U*."[92]

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[87] 渡辺崋山 (1793-1841).
[88] 花井虎一.
[89] 飯沼興斎 (1821-1887).
[90] 安積艮斎 (1791-1860).
[91] These are in Ken-Ken-Sai Library.
[92] 癸卯.

"ditto. Vol. 2. Manuscript finished on January 30."

"ditto. Vol. 3. Manuscript finished in the early part of February in the year of *U*."

The year of *Mizunoto-U* or the year of *U* can be estimated as the year 1843 or around then.

"ditto. Vol. 2. Proofreading finished in August in the year of *Mi*"[93]

"ditto. Vol. 3. Proofreading finished in early August in the year of *Mi*."

The year of *Mi* is probably the year 1845.

This means that Yôan completed the manuscripts of *Seimi Kaisô Ge-hen*, Vols. 1 through 3, in August one year preceding his death (June 22, 1846). These manuscripts and the published texts correspond almost prefectly.

Furthermore, the present author was able to confirm the existence of nearly-completed manuscripts[91] of *Seimi Kaisô Ge-hen*, Vols. 4–6, with no date, treating minerals and metals, in contrast with the foregoing volumes 1–3 where only mineral water was treated. The author also has discovered a brief synopsis of the manuscripts[91] for Vol. 7 and later volumes, also with no date, treating methods of applying chemistry to industry agriculture. Unfortunately they were left unfinished and therefore unpublished.

Yôan wrote in the preface of *Seimi Kaisô* that he had intended to treat the foundation of chemistry in *Nai-hen* or Inter Part and its application to production techniques in *Ge-hen* or Outer Part. We can see his original intention in the work of his last days.

Besides these manuscripts related to chemistry, there are many other drafts written by him on Western medicine, pharmacology, geography, history, music,[94] painting, mathematics and linguistics. There is even a dramatic work and a rubbed copy book[95] of coins of various countries all showing his wide-ranging interest in everything around him.

In Tama Cemetery, a vast common graveyard located at the western suburbs of bustling Tokyo, I found that there were two moss-covered tombstones[96] for the eternal residence of Yôan. Under one tombstone, he is laid beside his grandfather Genzui and his father Genshin. Under the other, he is lying in peace beside his wife. "Yôjuin ryokubô shôyô koji,"[97] his posthumous Buddhist name, is clearly inscribed on these tombstones.

Conclusion

His great achievement may be summarized as follows; In the isolated

[93] 巳.

[94] 「大西楽律考」 (*Taisei Gaku-ritsu Kô*) (A Study of Western Music).

[95] 「西洋宝貨鑑」 (*Seiyô Hô-ka Kan*) (A Collection of Prints of Western Coins).

[96] Tatsumasa DÔKE, "Two Tombs of Yôan UDAGAWA", *Shizen*, vol. 27, No. 12, p.p. 82–88 (1972) (J).

[97] 榕樹院緑舫逍遙居士.

atmosphere of feudal Japanese society in the latter part of the 18th and early 19th centuries, Yôan, starting from actual medical practices, (1) came to know of the existence of Western learning, zoology, botany and chemistry, which comprised independent but interrelated fields of modern natural science and was able to recognize their social significance; and more than that (2) he read numerous Western books, carried out observations and experiments based on his reading, studied, translated and published in Japanese these modern European systematic works on botany and chemistry.

Let us introduce two chronological flow charts that indicate the gradual development of Yôan's learning and writing during his lifetime. The first chart outlines the subjects of his studies while the second one highlights the various pioneering academic milestones on the road which led to his own translation work as its final stage.

Chart I

(1) Learning Chinese classics.→
(2) Learning Chinese medicine.→
(3) Learning and studies on Chinese-Japanese and Western herbs.→
(4) Learning the Dutch language.→
(5) Learning, studies, translations, and publishing of Dutch-school medicines.→
(6) Learning, studies, translation and publishing of botany, zoology and chemistry.→
(6′) Learning, studies and writing on Western languages, geography, history, music, gunnery and technology, *etc.*

Chart II

(1) Learning Chinese medicine and Western surgery.→
(1′) Learning the Dutch language.→
(2) Learning, studies, translation and publishing of Western anatomy; Genpaku SUGITA and others, "*Kaitai Shinsho*" (1774).→
(2′) Publishing of a textbook of the Dutch language; Gentaku OTSUKI "*Rangaku Kaitei*"[98] (An Introduction to Dutch Learning) (1781).→
(3) Learning, studies and publishing of Western internal medicine; Genzui UDAGAWA, "*Seisetsu Naika Sen'yô*" (1793–).→
(3′) Publishing of Dutch-Japanese Dictionary; Sanpaku INAMURA and Genshin YASUOKA, "Edo Halma" (1796).→
(4) Learning, studies, writing and publishing of Western medicines; Genshin UDAGAWA and Yôan UDAGAWA, "*Ensei Ihô Meibutsu Kô*" (1822), "*Shintei-zôho Oranda Yakkyo*" (1828).→
(4′) Learning and writing textbooks of Dutch grammer by Gonnosuke YOSHIO and Shunsan YOSHIO.→
(5) Learning, studies, translation and publishing of natural sciences (botany and chemistry): Yôan UDAGAWA, "*Shokugaku Keigen*" (1834), "*Seimi Kaisô*" (1837).

According to his own writing, he read Chomel's Encyclopaedia in 1817, at the age of 19, and came to know of the existence of botany. He was wise enough to distinguish botany from the traditional herbal knowledge and therapies. He

[98] 「蘭学楷梯」.

was able to detect that the former was in pursuit of the theoretical basis of growth, florescence and fructification of plants while the latter was interested only in the practical effectiveness of plants applied as medicines. Then he stressed the significance and necessity of systematic approaches to nature as represented in botany, zoology and chemistry because, however futile and impractical they may have appeared at first, they would in the long run contribute vastly to the progress of medical treatments.

It is undeniable that what drove Yôan to his assiduous academic studies was, in addition to his passion as a physician to save his patients' lives, his impulse to seek further knowledge when he encountered modern natural sciences in the form of botany and chemistry.

His endeavors seem to have ended in vain. He died even before his masterwork "*Seimi Kaisô*" was published in full. Many his writings, including those on Western geography, history and music, never went to press. Nevertheless we must remember that nothing could halt the development of natural science in Japan, with Yôan as one of its pioneers, though he himself could not overcome, due to the severe oppression by the government, the limitations of his scientific work, which remained basically within the frame work of the Lavoisierian system. It required ten years and Kômin KAWAMOTO,[10] Yôan's successor in Dutch learning, to introduce Dalton's atomistic chemical theories into Japan.[99]

Nobody should understimate the role which Yôan played in these critical days before the dawn of modern Japan. He was certainly a pioneer who promoted the advance of our country by learning, digesting and publishing, all of his own volition, western natural sciences (chemistry and biology in particular) in a feudal society under the oppressive control of the Tokugawa government.

Without his endeavors, our progress in medical treatment and general production might have been much retarded, and the health and living conditions of the Japanese people might have remained much lower and poorer for a long time.

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[99] As for the transplantation of the chemical atomic theory a short note may be added.

Rinsô AOCHI described in his *Kikai-Kanran*,[105] presumably the first book on physics in premodern Japan, a simple explanation of physical phenomena based on the corpuscular theory, but not the chemical atomic theory. Even in the *Seimi Kaisô* of UDAGAWA according to M. Tanaka, there is seen no definite description of chemical atomic theory, although it contains in a volume on organic chemistry some numerical data of weight composition by number "*a-ryô*" ("*a*" may be an abridgement of "atomen" and "*ryô*" means quantity). The latter is considered by M. Sakaguchi to form the first description of chemical atomic theory in Japan (*Kagakushi Kenkyû*, No. 72, p.p. 151–156 (1964)).

Tanaka considers that chemical atomism was first introduced by Kômin KAWAMOTO, who translated in 1856 a Dutch book on chemistry, Fritz Meyer's *Gronden der Krijgskundige Scheikunde voor de Kadetten der Artillerie Ingeniur en Genie* (Berda, 1840). The translated book *Heika-Sudoku Seimi-Shingen*,[111] which was distributed in the form of a manuscript, contains a table of atomic weights and simple stoichiometric calculations. (*Japanese Studies in the History of Science*, No. 6, p.p. 96–114 (1967)).

A Short Biographical Chronology of Yôan UDAGAWA

		1774	Genpaku SUGITA, Ryôtaku MAENO and others published *Kaitai Shinsho*[13]
		1777	Ryôtaku MAENO wrote *Kanrei Higen*[100] (My Small Views on the World).
		1781	Gentaku ÔTSUKI wrote a textbook on the Dutch language *Rangaku-Kaitei*.[98]
		1786	Gentaku OTSUKI opened his private school of Dutch medicine called *Shirandô*.[101]
		1792	Genzui UDAGAWA wrote *Seisetsu Naika Sen'yô*,[25] 18 vols. (and started publication in 1793).
		1796	Sanpaku INAMURA published a Dutch-Japanese dictionary; *Edo Halma*.
		1797	Genzui UDAGAWA died.
1798	Born in Edo, the eldest son of Yôju EZAWA.	1798	Genshin YASUOKA succeeded Genzui as the head of the UDAGAWA family, and called himself Genshin UDAGAWA. Tadao SHIZUKI wrote *Rekishô Shinsho*. (New Book on Astronomy) vol. 1.[102]
		1805	Genshin UDAGAWA published *Ihan Teikô*.[26]
		1808	Genshin UDAGAWA published an illustrated volume titled *Naishô Dôbanzu*[27] as a supplement to *Ihan Teikô*.
1811	Was adopted by Genshin as the heir of the UDAGAWA family.	1811	The Shogunate government established the Translation Bureau of Foreign Documents and Books.[18]
1815	Learned Dutch under Sajûro BABA.	1815	Genpaku SUGITA wrote *Rangaku Kotohajime*[103] (The Origins of Dutch-school Learning in Japan).
1816	Learned Dutch under Shunsan YOSHIO. Wrote *Kahi no Setsu*.[45]		
1817	Obtained the position of physician with the Tsuyama clan. Read Noël Chomel's *Woordenboek* and found out about the scientific field called "botany".		
1819	Wrote an article *Engeris Sharien Kô*.[46]		
1822	Published *Seisetsu Botanika Kyô*,[49] 1 vol. Genshin and Yôan published *Ensei Ihô Meibutsu Kô*,[31] 38 vols. Married with Seyo ADACHI.	1822	Genshin published *Zôho-jûtei Naika Sen'yô*,[28] 18 vols.
1823	Learned Dutch under Chûjirô YOSHIO.	1823	P. F. von Siebold came to Nagasaki.

[100] 「管蠡秘言」. Katumi IWASAKI, "Maeno Ranka" supplement, p.p. 521-571 (1938).

[101] 芝蘭堂.

[102] 志筑忠雄 (1760-1806) 「暦象新書」. First published book of the Western astronomical physics in Japan.

[103] 「蘭学事始」.

1826 Met P. F. von Siebold in Edo. Was invited to work in the Translation Bureau of Foreign Documents and Books as a translator.

1826 Chôei TAKANO started his translation of *Scheikunde*.[104]

1827 Keisuke ITÔ learned under Yôan.
Rinsô AOCHI published *Kikai Kanran*[105] (Overall View of the Atomosphere).

1828 Went to Tsuyama with his master and on his way home visited Keisuke ITÔ at Owari (Nagoya).
Translated a chapter of Chomel's *Woordenboek* and wrote *Konchû-Tsûron*.[78]
Revised and enlarged his father's work, and published *Shintei-zôho Oranda Yakkyô*, 18 vols.[30]
Wrote *Seimika Dai-Ichi-Sho, Tsuchi-Rui*.[68]
Began to apply chemical analysis to the hot waters of Japanese spas, and wrote *Suwa Onsen Shi-setsu*,[69] *etc.*

1828 "Siebold Incident" took place.

1829 Keisuke ITÔ published *Taisei Honzô Meiso*.[60]

1830 Wrote *Dôsan Seimika*.[73]

1832 Inherited UDAGAWA family's properties as his father Genshin retired.
Wrote *Seimi Shiyaku Hen*.[76]
Wrote *Shokugaku Keigen* (and published it in 1834).

1832 Chôei TAKANO published the first Western physiology book, *Igen Sûyô*[106] (Essence of Medical Principles).

1833 Genboku ITÔ opened his private school of Dutch medicine called *Shôsen-Dô*.[107]

1834 Genshin and Yôan's *Ensei Ihô Meibutsu Kô Hoi*[31] was published.

1834 Genshin UDAGAWA died at the age of 65.

1837 *Seimi Kaisô Nai-hen*. vols. 1-3 was published.

1838 Yôan's real father Yôju EZAWA died.
Kôan OGATA opened his private school of Dutch medicine called *Teki Juku*.[108]

1839 Wrote *Seiyô Kinen-Kô*.[83]

1839 "Bansha no Goku Incident" took place.

1843 Yôan and others wrote *Kaijô Hôjutsu Zensho*.[85]

1845 Wrote *Oranda-Shi-Ryaku*.[84]

1846 Died at the age of 48.

1847 Yôan's *Seimi Kaisô, Ge-hen* (3 vols.)

1847 Kôan OGATA wrote the first Western

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[104] These manuscripts of Chôei's have been lost.

[105] 青地林宗 (1775-1833)「気海観瀾」. The first book on modern physics published in Japan.

[106]「医原枢要」: The first book on modern physiology published in Japan.

[107] 象仙堂.

[108] 適塾: In this private school Yukichi FUKUZAWA, Keisuke ÔTORI and many others learned under Kôan OGATA.

was published.

pathology book, *Byôgaku Tsûron*[109] (Introduction to the Study of Illness).

1851 Kômin KAWAMOTO wrote *Kikai Kanran Kôgi* 15 vols.[110] (A Wide Construction on Overall View of the Atomosphere).

1856 Kômin KAWAMOTO wrote *Heika-Sudoku Seimi-Shingen*[111] (True chemistry for a Military Scientist).

1860–61 Kômin KAWAMOTO wrote *Kagaku Shinsho*[112] (3 vols.) (A New Book of Chemistry).

[109] 緒方洪菴 (1810–1863)「病学通論」. The first book on modern pathology published in Japan.

[110]「気海観瀾広義」.

[111]「兵家須読舎密真言」.

[112]「化学新書」.