

The Beginning of Scientific Sago Research: Abraham Steck's 1757 *De Sagu*

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Abstract Abraham Steck's dissertation entitled *De Sagu* was completed at the Faculty of Medicine in Bern, Switzerland in 1757. Not only is this the first known scientific book on the subject of sago, but apparently also the first scholarly book ever published on any aspect of the Palm family. Written in Latin, this 44-page dissertation is a rare book found in only a very few libraries in Europe and the United States. Steck presents a discussion of palm systematics in relation to the genus *Sagus* (= *Metroxylon*), as the palm was then known. *De Sagu* also provides interesting historical information about sago starch as a product in Europe in the early 18th Century. This article provides a free translation of the main points of *De Sagu*, with emphasis on starch extraction and utilization.

Key words: bread, flour, medicine, *Metroxylon*, palm

科学的サゴ研究の始まり：Abraham Steck's 1757 *De Sagu*

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要約 Abraham Steck によって書かれた *De Sagu* というタイトルの論文は、1757年、スイスのベルン大学医学部の学位論文として完成されたものである。これは、サゴヤシに関して知られている科学的な書物として初めてのものであるだけでなく、ヤシ科の植物に関して書かれた学術的な論文としては、初めて出版されたものである。ラテン語で書かれたこの44ページの論文は、ヨーロッパとアメリカの非常に少数の図書館でしか所蔵されておらず、きわめて珍しいものである。著者の Steck は、ヤシ科の分類法に関する議論を、サゴヤシ (*Metroxylon*) 属 (当時はこのように理解されていた) との関連で行っている。 *De Sagu* はまた、18世紀初頭のヨーロッパにおける、生産物としてのサゴ澱粉について興味深い歴史的情報を提供している。本報告は、*De Sagu* で書かれている中の主要な部分について、澱粉の抽出と利用方法について強調しながら、その意識を提供するものである。

キーワード: 医薬品, 小麦粉, パン, *Metroxylon*, ヤシ

Introduction

The earliest scientific study of sago and its commercial products is attributed to Abraham Steck in 1757. In that year he completed and published a dissertation on sago at the Faculty of Medicine in Bern, Switzerland. Steck was a botanist and physician, but details of his life and work are lacking,

despite attempts to obtain information from European libraries. According to an International Genealogical Index, an Abraham Steck born in Bern about 1730 appears to be the same person.

Steck's dissertation on sago was written in Latin, the scholarly language of the time. It is a short document

of 44 pages and is without question a rare book. Library research has identified only five original copies in collections in Europe and the United States. In addition, an original copy is in the private collection of the senior author, and its acquisition was the motivation to prepare this article. *De Sagu* has an added distinction for it also represents the first scholarly book that deals exclusively with palms.

De Sagu is recognized as an important source of early systematic information on sago and other palms. However, to our knowledge, its contents with regard to starch extraction and processing, and the introduction of sago starch as a commercial product into Europe, are not found in the general sago literature.

Following is a free translation of the main points of *De Sagu*, with an emphasis on the information it contains about starch extraction, utilization and commercialization. This article makes no pretense to be a definitive translation of Steck's dissertation. *De Sagu* is a challenge to translate, and some passages were beyond the translating and interpretative skills of the authors. Nevertheless, it is hoped that the contents of this article will provide sago researchers with the state of knowledge about sago in the middle of the 18th Century.

A few comments about the mechanics of the translation are in order. Translated text is presented in **bold** script to easily distinguish it from summarized material. *De Sagu* meets the minimum standard library length of 40 pages, to be considered a book; hence the major subdivisions are referred to as chapters. A considerable number of historical and other works are cited as information sources by Steck. However, the citations are incomplete, typically containing the author's name and title, both in abbreviated form, and a page number, but without a date or place of publication. It would require intensive research in a major library to determine the

full citations, a task that exceeds the scope of this article. Author names alone are retained in the translated text.

De Sagu is comprised of 33 mostly very short chapters designated by Roman numerals. Following are summary comments by chapter of material not presented in translation, and translated text having a direct bearing on sago utilization.

Translation and Comments

I-VI. General introductory information to the study.

VII-IX. Historical discussion of palms in general.

X. This chapter is the longest, extending over 14 pages. It comprises taxonomic descriptions of 11 palm genera. The genera Steck described along with notes of their current disposition were the subject of an article by Moore (1962), which was the basis for the proposal to conserve the genus *Metroxylon* versus *Sagus*. The proposal was approved (McVaugh 1968). Rauwerdink (1986) refers to Steck in his study of the genus *Metroxylon*.

XI. Discussion of Rumphius, and certain trees that do not appear to be palms.

XII. People exploit various species of palms. They break down the stem interior, reduce the pieces to powder, coagulate the powder into a paste with water, bake it over a fire and produce a type of bread for the sustenance of life.

Frequently in more recent times the writings of travelers recount that palm bread is prepared from a sort of white starch. That flour, from wherever it is obtained, they call *sago* and in this broad sense the meaning of the term *sago* embodies an amazing degree of confusion. This confusion is repeated by authors all the way up to Rumphius, concerning starch-yielding palms, with

many of the trees actually being widely different plants, which the authors claim to be one and the same, and which they have understood or seen to yield starch. This sago starch has nothing in common with Indian bread.

The ancient practice of making a type of bread from fruits of the date palm (*Phoenix dactylifera*) is mentioned.

XIII. Several trees are discussed as starch sources, but it is impossible to ascertain if the accounts refer to palms, or, where the term *palm* is used, to relate it to a modern palm genus or species.

The best and most copious sago is prepared from the genus of palms, which is called *Sagus*. The history of *Sagus* is almost entirely provided by Rumphius, whom therefore it is appropriate to follow.

XIV. More than a dozen historical sources are cited that detail sago use. Certain of the reports are erroneous, such as an account of the sago palm in Madagascar, where it does not occur naturally. Two clear references to sago are the following.

Pigafetta, who circumnavigated the earth in the early 16th Century, says that on the island of Gilolo (= Halmahara) in the Moluccas, bread is made out of the wood of some trees. A quantity of soft pith is cut, then ground to make bread, which for the most part is used by sailors and which they call *sago*. Clusius states that on the island of Ternate (in the Moluccas) all bread is made from a tree, which is cut into many pieces and separated, beaten with mallets made from thick canes, and from it they extract a sort of starch called *sago*. From the starch they make a white bread in the form of rectangular cakes, about the size of the palm of one's hand. The local people not only eat these cakes, but the great part they sell.

XV. The species of sago described by Rumphius are enumerated. It is stated that the species without spines yield the best starch.

The East Indians exploit the trees for more than merely sago. From the leaves (and trunk) they make dwellings, floorboards, boats, stools, tables and other traditional wood items. Fiber is extracted from the leaves and used to weave cloth.

XVI. **Species of sago grow throughout the Moluccas and archipelagoes of the East Indies. They occur in marsh lands in the lowlands and in moist patches on mountain slopes. Forests of these palms have an uninviting appearance and are called *lubo* or *latar* by local people. Upon reaching 30 years of age, the palm flowers, fruits mature and then it dies. Sago trees are propagated with fruits or by means of shoots that sprout copiously from the base.**

XVII. **Sago is prepared according to the following procedure. When the tree reaches maturity, so that its thicker leaves appear speckled with white powder, spines fall from the leaves, and it is robust enough to resist animals seeking the starch, then it produces the best starch. At that stage it is called *alaa-puti*. A tree cut before its growth terminates is considered immature, but if it is left until it puts forth a spadix, the tree yields a lesser quantity but thicker consistency starch. When the tree produces fruits, called *baboa*, it is clearly not suitable for starch. The following procedure is used to obtain sago from selected trees containing abundant and good-quality pith. First, a hole is bored into the stem and some pith extracted and examined. If it is inferior the hole is filled with clay and the tree allowed to continue to grow until a boring determines that the pith is suitable for making sago. When a positive result is achieved, the tree is felled by cutting it close to the root system. The trunk is cut into several sections, 6-7**

feet in length, and then split lengthwise. Sitting astride the split trunk, a man uses a hoe, called a *nany*, fashioned from a cylinder of *Arundine bambos* L., to reduce the pith into shavings and separate it from the stem. The pith is broken down into small particles and ground into powder, placed in a deep vessel about 6 feet long, made from the thicker cortex of the *coeroerong* tree which is narrow at the top and broad at the bottom. At the widest portion a sack, called a *ranut*, made from a hairy sheath of dense Calappi (= coconut ?) leaves is placed. This sack is employed as a sieve, tied at the top and fastened to a rod above, but moveable below. The powder is collected in the vessel and vigorously stirred by hand with water, giving the mixture a milky appearance. The sieve is passed through the starchy water to capture fibers and larger pith particles, leaving the fine starch behind. The starchy water is directed into a channel that flows into a pot called a *praauw*. The starch settles to the bottom of the pot. After all the starch has been deposited, the water is poured out, either by tipping the vessel or through an opening in its upper part. The residue is dried to its whitest and finest state, and preserved in baskets of woven leaves that are called *sago manta*. Pith fibers left in the basket are called *ella* and used as pig feed.

XVIII. It is evident from the preceding chapter that the starch is a vegetable substance, formed in the pith within the trunks of sago trees. From there it is removed, placed in water and allowed to remain there until the starch separates.

XIX. It is evident that the nature of sago is starchy; within a month after its removal from the tree it decays. To conserve sago for a long time fermentation must be prevented by keeping the starch away from moisture. When the East Indians wish to preserve the starch, they mix it with a quantity of *battu papoudi*, which goes by

various names in different regions. The starch is placed in small storerooms or excavated *areis* and heated to a certain temperature. Starch subjected to these higher temperatures becomes dry and hard with a certain tenacity, and has a reddish color that fades away gradually upon becoming a very hard bread of various shapes depending upon how it is baked. On the island of Uliaffer, (*pisti*) bread loaves are four-sided, soft, less than a foot in width and with the thickness of a finger. Ten to as many as 25 of these loaves are tied together with string and customarily taken to towns and nearby small villages to sell.

Fresh sago is reduced to the form of a pap with the help of water. This pap is called *pappeda* or *zappia* and is agitated with a stick. This sticky substance is mixed with spices, lime juice and aromatic herbs and formed into little mounds that make a tasty food. Or, the pap can be baked as a bread, that in granular form is employed for medicinal use and sold to Europeans.

XX. Grains formed from *pappeda*, under the name of sago, have been brought to us. They are similar in shape and size to barley grains made in European mills. The *pappeda* grains, however, were of varying size indicating a lack of care in their preparation in the East Indies. The external color of the grains is golden white but when broken reveal a white pith of a hard consistency that has a firmness between the teeth and even under the pestle. It is crushed into smaller pieces with difficulty and has no taste whatever although a very slight odor is perceptible. The price of sago grains varies according to the length of time it is enclosed and carried in ships, to the extent we are able to ascertain that information. But time does not adversely affect the grains. If they are kept dry they can remain uncorrupted for several years. But if they are stored in a humid environment, they become covered with a sort of skin and spoil.

XXI. Sago grains differ from the typical bread grains in various respects, having diverse sizes, shapes and consistencies. This appears to be because they are not made directly from starch, but from *pappeda*. They appear more yellow in color than bread when baked hot, but they are more fragile than bread grains. But Rumphius states that the sago starch, baked thus over a large fire, becomes quite hard and brittle. There could be various reasons for the difference in grain size. One explanation is that larger quantities of round and poorly shaped globules can be heaped up for milling as compared to bread grains. Spherical sago cooked in water attains a taste similar to barley, but is more pleasing.

XXII. I do not venture to speculate when the East Indians began to make sago into grains, and when and in what manner sago first entered into trade with Europe. It appears likely to me that initially sago was employed primarily for medicinal purposes. The first people to use it in that way were the English. Cl. Malouin states that in 1729 sago was sold in London; Garcini reports its earliest use in France in 1740; and Trew asserts it was in general use in Germany in 1744. A year or two later the citizens of Strasburg began to use sago.

XXIII. It is evident from what has been presented that sago should correctly be considered a starch. It is indeed a vegetable product extracted from the pith, powdered, dried, thickened into a sticky substance by mixing with water; heated over a fire it expands in volume. It is suitable nourishment for people, but spoils and turns sour over time. Numerous experiments have been instituted to remedy the latter.

A pound of sago starch is ground and added to a larger quantity of water and heated to a moderate temperature. The starch collects together when

allowed to set for a period of time. The mixture emits an acid odor and the water is filled with numerous moldy particles. Another pound of sago to which I added bread yeast and water and heated to an appropriate temperature began to ferment. However, I was unable to capture any inflammable vapor from the fermented liquor, although the vapors had the odor of wine spirits.

XXIV. The difficulty of reducing sago to powder has already been stated. When sago is powdered it has a reddish-yellow color, and dissolves in hot water. When it is suspended in cold water and stirred, and allowed to settle, the mixture appears viscous. In that form the East Indians used *pappeda* to treat linen parchment and in bookmaking.

Fresh grains of sago, if they are poured into watery fluids, swell up, become transparent, impart to the same fluids their viscous nature; this varies according to the type of sago. Grains of sago cooked carefully with milk produces a pap that has to me an acceptable appearance and taste. It becomes more delicious if a spice or sugar is added. Trew recommends that before sago grains are used, they should be alternately exposed to and withdrawn from cooling for several days, so that they lose any undesirable flavor acquired through a sea voyage or aging. I have conducted experiments with grains that were at least four years old, having been long in transit to Europe. I subjected them to the foregoing procedure and obtained a product with no vestige of odor from the long transportation period. I took 1/2 ounce of grains with 12 ounces of milk and cooked the mixture gently for several hours and obtained a pap of the correct density. I also tried it in the manner sago is prepared in Lower Germany. That is I cooked 1/2 ounce of sago grains with 1 pound of noble wine for as long as I had done in the previous experiments. The sago took on a

beautiful, transparent, gelatinous appearance, in which the grains were dissolved, unlike in the previous cases. The same pottage had acquired the odor and flavor of must.

XXV. Alcohol is not effective in dissolving sago. It dissolves better in wine that is not alcoholic but that is partly oil and partly mucilaginous, and not in wines with vapors, because the salt it contains can more easily penetrate the globules than vapors of water or milk.

Further examinations of sago were undertaken. Two ounces of sago grains were placed in a retort vessel, set in a sand bath and placed over a flame and the temperature gradually raised to the highest degree. There was produced a gas that was evidently acidic, which appeared in the form of a white vapor, 11 drams in weight and a minute quantity of fiery red oil, and a black spongy residue of glowing charcoal. Reduced to ash by means of a stone it weighed hardly 30 grains. Furthermore, the ash exhibited no vestige of an alkaline salt; it dissolved in water. Under distillation an astonishing mass swelled up, impelled by the high heat, with a firm substance around it. This shows that an analysis of sago contains water, acid salt, oil and clay.

XXVI. I also investigated the effect of baking sago in an oven. I tried this in three ways. Sago was made into a paste with water; sago paste mixed with yeast and allowed to ferment and thereafter kneaded; and fermented with an equal amount of wheat flour. These were cooked in a baker's oven. The first exhibited a hard and heavy mass with a reddish crust. The second made a rather thin bread that was savory and black in color, similar to bread made from barley. The third bread was similar to the second, but became greatly compacted. What I observed is that these

breads prepared from sago, even after a long time, retained their firmness such as is preferred in fresh breads.

XXVII. Based upon the reports and experimentation reported above, some conclusions can be drawn. All the authors consulted agree that the East Indians use sago for food and that there are no doubts about its quality. Starchy substances are very suitable for human nutrition. Not only has it been said since ancient times that cereal grains, roots and leguminous plants have been employed for food, but in our times as well maize, rice, tubers and so on. It is a mistake, therefore, to reject sago, which has been shown to compare well as a starch source. Sago supplies nutrition to humans but this nutrition is weak and poor and insufficient for the robust. Sago is less viscid than all other kinds of starch. I conclude that sago by itself is a weak and poor nutrition for the human body. Experiments conducted by Rumphius showed that excessive consumption of sago leads to a swelling of the body, causing dropsy and other maladies.

XXVIII. It is evident from the preceding chapter that the use of sago is less salutary for healthy and strong people, unless it is taken in combination with other general foods that offer better nutrition. But to those people who are weaker it is devoid of all wholesome quality. Seba commends it for the first light nutrition for infants, to be given with food, as the best accommodated by delicate bodies. It also possesses a thickness that is too much for the strength of the stomach that delights in wheat. I do not see that sago cooked with milk exhibits a pap that is appropriate nutrition for infants. Because sago is thin it exhibits optimum alimentation only for those people who on account of debilitating illness are not able to easily digest solid food. The English were the first to make use of it for people suffering from tuberculosis. Sago is

used not only as a strengthening food for people debilitated through illness, but also is administered as a medicine. Given its inherent viscosity it prevails over irritation, that sustains and increases fever, so that it is moderated and assuaged. Moreover it reportedly makes a coating so that no further decay of the lungs occurs.

XXIX. Those knowledgeable of medical precepts are likely to conclude that sago will supply nutrition to all those who suffer from high fevers originating from ulcers in any part of the body. It will also help to sustain the lives of those who languish from unexplained exanthematic, inflammatory, malign or intermittent fevers; those suffering from severe hemorrhages or those who are wounded. Sago facilitates digestion and firm nutrition and it overcomes all bitterness, produces hot acid and thus overcomes alkali and it relaxes the thick strictures of blood vessels. Sago is seen to exhibit medicinal power in sicknesses.

XXX. From the fact that when sago is agitated with a liquid it becomes thick, it is seen that it may be administered with the greatest success to those sick people in whom relaxation and softening is indicated. I will not propose to administer sago with success to all, especially those having ailments with bitter fluids in the throat or lungs. Salmo writes about the successful application for treating diarrhea. It is also beneficial for those in an advanced state of kidney dysfunction and also for those suffering from rheumatism or arthritis. It is demonstrated without difficulty that sago is an antispasmodic anodyne, possessing cooling as well as other attributes.

XXXI. I do not intend to exclude the external benefits of sago, which experience shows to be shared with all forms of starch. There is no doubt that it is recommended for all those illnesses in which the external application of starch by a

medical expert has positive benefit. I will refrain from enumerating the cases in which sago is suitable. Innumerable factors spare me such labor. Outstanding among these are accounts of surgery, therapy and the benefits of *Materia Medica*. The careful reader should distinguish from the forms under which sago can be used, as summarized in Chapter XXIV. These external uses can be applied to all starches and most barley-like grains, as well as sago.

XXXII. Using the example of sago, medical experts say that all new medications are unwisely disdained because today we are weighed down by the number of medicaments, written accounts of medicines and the pharmacopeias. But for all that, new treatments should never be disdained, as medical experts certainly argue. A medical expert is entirely to blame for neglecting to try some remedies, because while there are several superfluous medicines, it has not at all been established which ones are superfluous. A medical doctor who is preoccupied with anything but the furtherance and exercise of the growth of the practice of medicine is unworthy of the name.

XXXIII. From the foregoing information regarding the qualities of sago, I have also gathered together its possible abuses and harms. I have cautioned that sago itself does not provide sufficient nutrition for a healthy body. Those who rely solely on sago for nutrition will incur illness. In bringing this discourse on sago to an end, I will be satisfied if I have provided some knowledge about sago to the reader and aroused a desire in our people for the best food and medicine.

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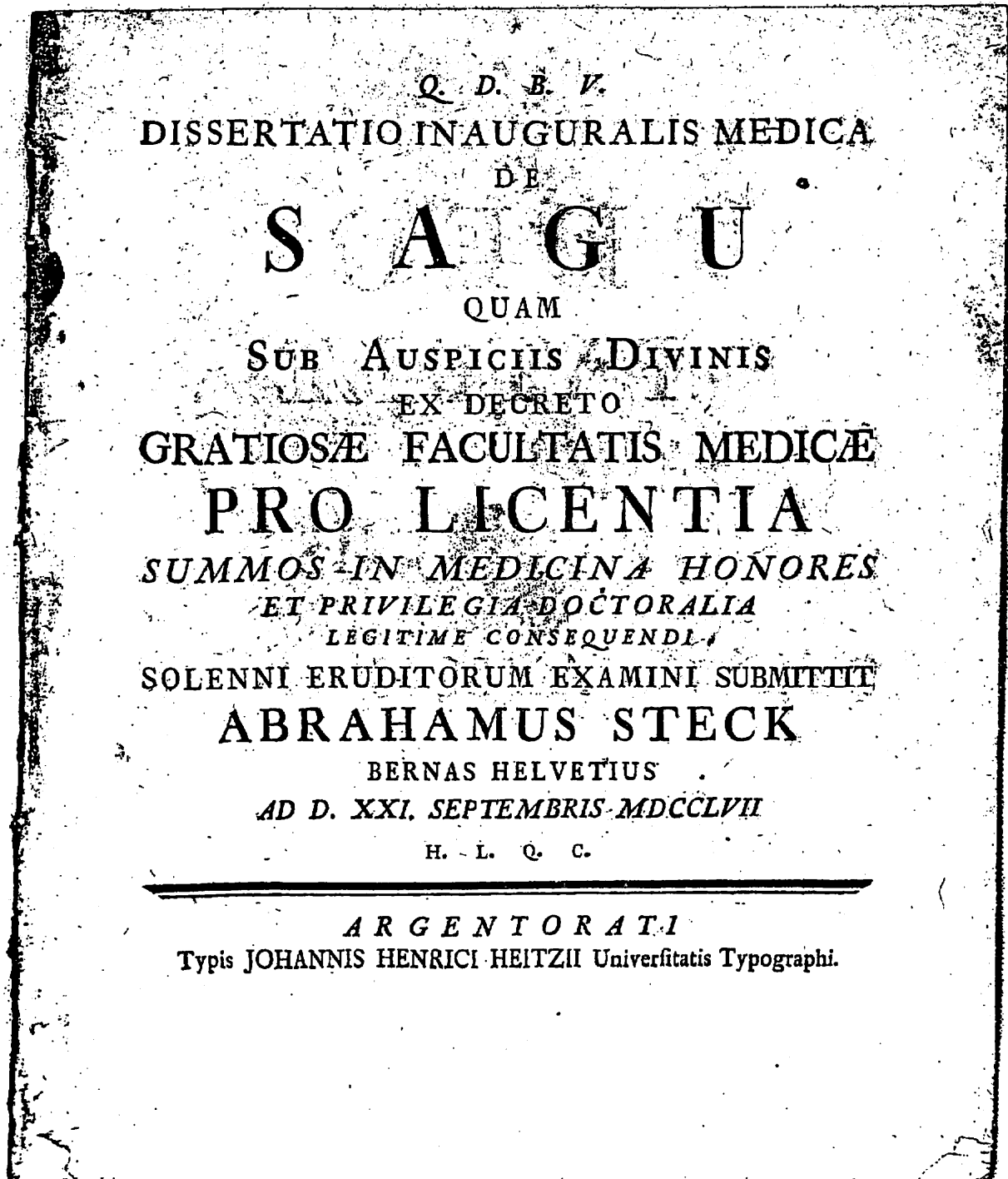


Figure 1 Reproduction of the cover of *De Sagu*.