The
LINNEAN
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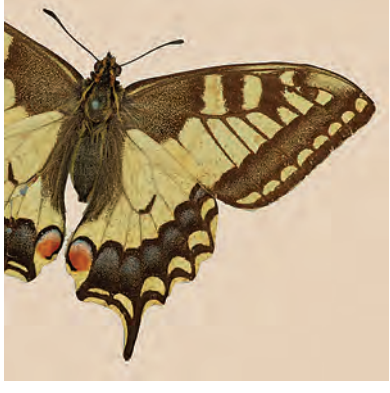
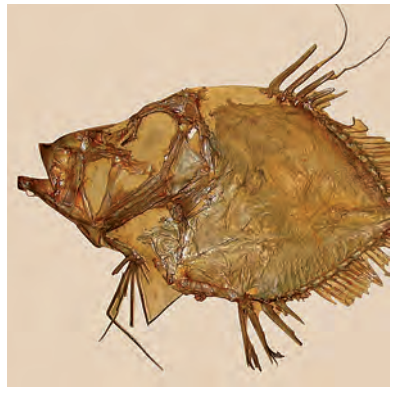
PATRON: HER MAJESTY THE QUEEN

The Linnaean Legacy





THE LINNEAN SPECIAL ISSUE NO. 8

A forum for natural history

THE LINNEAN SPECIAL ISSUE No. 8

The Linnaean Legacy: Three Centuries after his Birth

Part 1: Unlocking the Past
Part 2: Botanical Art in the Age of Linnaeus
Part 3: Today and the Future

edited by

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The Linnaean Legacy: Three Centuries after his Birth

Contents

Contents continued:

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Foreword

In 2007, the Tercentenary of the birth of Linnaeus was celebrated around the world – a fitting tribute to the man and his outstanding contributions to the scientific study of natural history, many of which are still especially relevant today. It was to be expected that the main concentration of celebrations, scientific meetings and excursions was to be found in Sweden and Britain. We are very pleased that, as a Society, under the expert guidance of our Tercentenary Coordinator, Jenny Edmonds, we were able to share in the organisation of many of these with Swedish colleagues. Those who attended the meetings and conferences were most fortunate to hear at first hand stimulating and significant papers.

In this volume we have brought together some of these papers, making them available to a wider readership. It must be said that in most cases it was not the original intention to publish them, but they were so well received that many of the authors graciously responded to my request for their contributions to be written up for this publication. Not only did they agree, but also delivered their manuscripts in good time, responding to the diligent encouragement of both Leonie Berwick (in London) and Annika Windahl Pontén (in Sweden). We are also greatly indebted to Mary Morris and Leonie for their hard work and skill in editing and producing this excellent and attractive supplement.

The grouping of the contributions used here is based on subject matter rather than their association with particular meetings. This has enabled us to include in appropriate places some additional individual papers of particular importance. Among these is the paper read in the Rooms of the Linnean Society by His Majesty the Emperor of Japan, an Honorary Member of the Linnean Society. We are also glad to have the Commemoration Speech given by Carl-Olof Jacobson, President of the Swedish Linnaeus Society, given in Uppsala Cathedral.

This supplement covers both historical and forward looking papers. It is the forward look based on such firm foundations that is so encouraging. Our thanks go to all of those who helped make the meetings possible, and for those who helped us to know more about Linnaeus – the man who saw everything.

DAVID F. CUTLER

President, Linnean Society of London

The Linnaean Legacy: Three Centuries after his Birth

Part 1: Unlocking the Past

Commemoration Speech

delivered at the Linnaeus Tercentenary Memorial, Uppsala Cathedral, May 23 2007

Carl-Olof Jacobson FLS

N. Rudbecksgatan 13, SE-752 36 Uppsala, Sweden

Sir, Court Physician and Knight of the Realm, our dear Carl Linnaeus:

As you no doubt are fully aware, your memory, on this day, 300 years after your birth, is the object of extensive celebrations across major parts of the world. *Et quis umquam dígnior fuit, qui ab ómnibus natiónibus concelebrarétur? Tu enim saeculis futuris demonstrasti, quantum sciéntia naturalis ad vitam humanam excoléndam*[1] *valéret. Hodie intelléximus omnem paene spem nostram in illa scientia naturali consístere. Nam sola illa cognitióne innixi genus humanum, immo totam rerum naturam, a periculis his tempóribus imminéntibus erúere póssumus*. (And who could be more deserving of this global attention than you? You have shown all subsequent generations of citizens of our planet how important an ordered knowledge of nature and all of its contexts is for the continued existence of humankind.)

Yes, you are indeed worthy of this multifaceted celebration, and so keenly has your presence been felt during this year that it seems natural to address you as if you were in fact here with us.

We have every reason to address you today about all the important projects you pursued during your work-laden but exciting life. You have rightly been called the Flower King, but we must bear in mind that your contributions span a much broader field than botany.

Both during your lifetime and to posterity, you became known above all as the great bringer of order to the three kingdoms of nature – the animal kingdom, the plant kingdom, and the mineral kingdom. All these years, we have retained your way of giving organisms genus names and species names. Your mind was also supremely attuned to understanding the contexts you perceived in nature. You were a pioneer in grasping the interdependence that characterises the relationships both between organisms and between them and their physical surroundings. You were sensitive to the sometimes delicate mechanisms in our surroundings, and you realised that we humans have a responsibility for the impact we have on nature. It is our hope that your thinking will guide more and more people on our planet. We also hope that your curiosity and boldness and your youthful frame of mind will inspire our young people today. The world is in great need of many, many people who experience the joy of discovery that you felt and who share your diligence.

[1] Cf. Verg. *Aen*. 6,663.

How many people have you inspired to study nature and the conditions for human survival on our planet, from the disciples you sent off to all corners of the world to the young people we now hope will emulate your zeal to research everything?
Nam sine ea curiositate naturali, qua in iuventute tua ardebas, nihil plane in rebus naturalibus indagándis efficere póssumus. Laudanda est illa curiósitas iuvenílis tua, laudanda etiam illa sapientía paene Salomónea senectútis tuae,[2] *cum discípulos tuos in omnes paene terras orbis terrarum mítteres*. (Without youthful exuberance, very little is accomplished on our earth. We therefore praise both your passion to discover, as a young man, and your wisdom in old age, when you sent off your disciples.)

Your enthusiasm and your stimulating way of teaching also made your lectures extremely entertaining to many people outside the Faculty of Medicine. Your idea to take your students out into nature to join you in examining organisms and minerals spawned a generation of kindred spirits, not least among future clergymen. They, in turn, conveyed your views of nature to the Swedes. If it is true, as people say, that we Swedes are especially fervent about being outdoors in our forests and fields, then there is a good case to be made that you are the source of that mindset. Or as you expressed it:

> *Aere delectaberis sereno tepidoque, solisque radios vernales excipias. In aere rusticano degas, ibique percurras*. (from *Diaeta Naturalis*, 1733)

We remain impressed by your unfailing efforts to improve the economy of our country and your certainty that our industries could clearly benefit from the application of scientific findings. Your reports to the Estates of the Realm from your journeys into the provinces testify to the fact that your scientific mind and disposition were matched by your eye for the practicalities of life. Your travelogues are, moreover, formulated in such a lucid and heart-felt manner that you can rightly be seen as a reformer of our language, and that, like Strindberg, Goethe, Rousseau, and others, we must count you among our foremost authors of the 18th century. Here is how Dag Hammarskjöld expressed his admiration for your language:

> With the innovative prowess of a poet, he expanded our capacity to catch and hold in the web of language the ephemeral experience of the moment.

In his speech as director to the official annual meeting of the Swedish Royal Academy of Sciences on the occasion of your anniversary 50 years ago, he expressed his admiration in the following way:

> An eminent scientist guided the author, but a great poet made the scientist privy to the inner sanctum of God.

Without your vivid descriptions of how our people lived in your day, how we were housed, how we ate, worked, and amused ourselves, we would be sorely lacking in knowledge of the roots of our present-day ethnography. Your depictions of folk costumes and work utensils are clearly marked by your scientific method for describing organisms, objects, and facts.

[2] Referens till Linnés verk *Senium Salomoneum.*

No speech addressed to you could avoid making some mention of your profession, that of a physician. You never forgot – nor do we wish to forget – that your efforts were largely directed toward providing human beings with a more secure life. After all, your academic knowledge of plants was fundamentally a quest for cures for human ailments. In your thoughts, all organisms served a specific purpose in the great commonality of nature. Scientists were bent on uncovering and exploiting the utility that nature's grand economic system had in store to make *us* hale and hardy. We often have occasion to recall your studies with immense gratitude. No small number of present-day pharmaceuticals can be traced to the suggestions and experiments set up by you and your disciples.

Dénique, Archiáter régie! Eques auráte! Memóriam tuam máxima pietáte, admiratióne summa nunc célebrat universus orbis erudítus, immo omnes gentes et nationes. Salve, máxime indagátor rerum naturálium! Vivit memoria tua, et vivet per saecula, et póstera laude semper recens crescet.[3] (So, dear court physician and knight of the realm: please understand that we commemorate your life today with such admiration! Please know that we are doing our best to carry on your vision of ultimately understanding the world and the mechanisms that govern nature and thereby our own conditions. **Hail, great scientist! Your memory shall live on!**)

Dixi

[3] Cf. Horatius, *Carmina* 3,30,7 f.

The Keen Eye: Linnaeus – The Man Who Saw Everything

Karin Berglund

Franckegatan 8, SE-431 34 Mölndal, Sweden

Ladies and gentlemen – firstly, I would like to declare that I am a journalist, not a scientist, and a gardener, rather than a botanist. I am going to offer you some very small glimpses of Linnaeus the man, and what sort of person he was.

As a passionate gardener you can look into the beautiful face of a flower and seemingly recognise yourself, at least, you can if you are a romantic like me. The magic aspect of gardening, for me, is very much about identification, the idea of belonging, and it is a pleasing feeling. To see one's self 'reflected' in something else; being part of creation, a cosmic revolution if you will, and in a sense the true idea of eternal life.

Linnaeus would have understood such a feeling. To him, every plant – and animal – had a specific 'personality', of which he has created delightful and living portraits. One gets the impression that he too looked a plant in the eye and saw himself.

Regarding the twin-flower *Linnaea borealis* ("my plant", as he called it) he wrote:

> A plant in Lapland – short, overlooked, and disregarded with only a brief time in bloom. This plant is named for Linnaeus, who is like it.

I must say I find this rather melodramatic. It is difficult to imagine Linnaeus as a small trailing thing on the floor of a dark wood. Indeed, he is more like a formidable tree, with many branches. Interestingly, he has also described himself this way.

A common theme throughout Linnaeus' texts is that he regards plants as being much like animals, without any serious differences between them. Man is also an animal; perhaps this is why we can 'find ourselves' in a plant. Linnaeus wrote that a plant is an animal turned upside down:

> The roots are their mouths
> the leaves, their wings
> and the flower is the naked love of the plant.

I have written a substantial and heavy book about Linnaeus, entitled *Thinking About Linnaeus, The Man Who Saw Everything*. It is beautifully bound with an extent of 400 pages, 40 per cent of which are illustrated. If Linnaeus had been able to see all of the pictures incorporated, he might have been envious. During his life he dreamed of being able to publish splendidly illustrated books, as was happening in places like England and Holland, but Sweden was a poor and remote country with no such possibilities and he could only include a small number of engravings, or in many cases none at all.

However, at Hammarby, his summer residence, he was compensated. The famous botanical painter Dionysius Ehret and other great artists sent Linnaeus beautiful prints

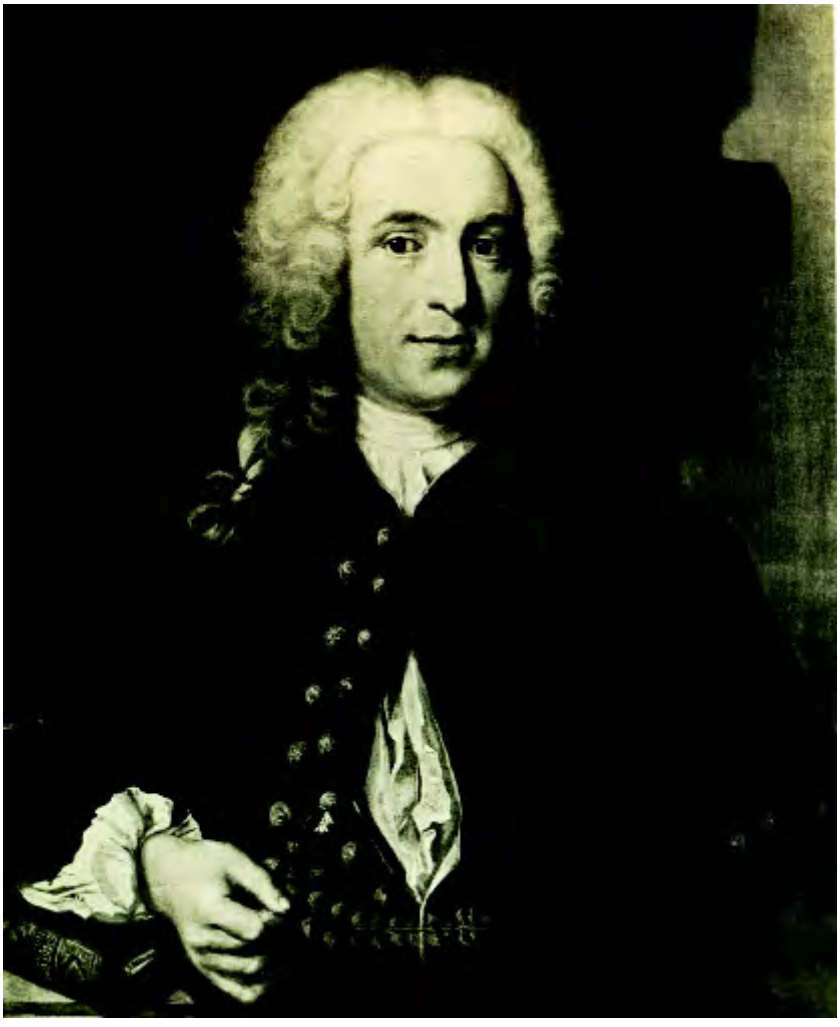


Figure 1. Wedding portrait of Linnaeus.

which he innovatively used as wallpaper in his bedroom and studio. He loved his magnificent wallpaper and proudly showed it to all of his visiting guests.

My own studio is not quite as gorgeous but I have two portraits of Linnaeus opposite my desk. One is a century-old monochrome reproduction of the famous wedding portrait (with the cardinal-red suit) painted by J.H. Scheffel in 1739 (Fig. 1). Printed beneath it are the words "Carl Linnaeus, 32 years". It is a fascinating portrait depicting great charisma and personal charm. The waistcoat is slightly unbuttoned, and a shirt of soft and flimsy material peeks through the gap. It looks almost as if he has just risen from the marriage-bed and without much ado has hastily buttoned up.

The portrait shows bright brown eyes, with eyebrows like a bird's wings, a noble nose and a big, beautiful mouth. Nonchalantly he leans his elbow against *Systema Naturae* (1735), the great work that had brought him to international recognition, about the sexual system of plants. Between his thumb and forefinger we can see his talisman;

a winding branch of his plant, *Linnaea borealis*. He shines with self-confidence, with a sheen of joy, as if he is a man who knows that the future belongs to him.

The other portrait in my office (Fig. 2) shows a much older Linnaeus. He is in the garden watering his hyacinths; he seems to be in another world. An old man who has forgotten the names he had given to all areas of creation. This man who had named 8,000 plants could not remember a single one in his final year. When he died in 1778 the study of natural history was no longer the science of the day, and the pinnacle of his career had long since passed.

He had decided on his funeral arrangements well before his death. His instructions were a little frightening:

Figure 2. Portrait of a much older Linnaeus watering his garden plants.

> Lay me in the coffin, unshaven, unclothed, dressed only in a sheet, and lock the coffin immediately so that no-one can see my misery.

Bitter, bitter. The warm and intense "summer-Linnaeus" had become an old and bitter "winter-Linnaeus" as Professor Gunnar Broberg has since put it. Linnaeus hated wintertime.

In the time between these two portraits he lived his scientific life; he wrote all of his epoch-making books, and he is still, after all these years, one of a few Swedes whose name is known to scientists all over the world. It was he who introduced the idea of a sexual system in the world of plants. It was also Linnaeus who furnished man with the scientific name *Homo sapiens*, and placed us beside the ape in his system. And he loved apes.

Linnaeus hated the towns, with their stench, dirt and diseases. In nature (that is, in the countryside), he commented that everything is so green and beautiful that you must be made of stone if you are not refreshed by it. When Linnaeus speaks of nature he does not mean epic forests or wilderness; his landscape was the cultivated scenery and light green woodland. For Linnaeus, nature was everything; it was as if this was where you would find God. He also counts the garden in his reference to 'nature':

> Why do all gardeners grow old and yet have beautiful skin, if not the plants refresh them? The scent of a beautiful flower can rejuvenate.

This is how Linnaeus regards gardening in his early work, *Diaeta Naturalis* (started in 1733), "the natural diet".

Linnaeus was a physician. This is often forgotten for all of his work in botany. His professorship, his seat in Uppsala, was in medicine and botany, the two belonging together as most medicine was derived from the world of plants. His book *Diaeta Naturalis*, his 'lifestyle' book we would say today, is very amusing reading. He sounds like a message from the current social authorities. He is astonishingly modern.

Here are some of the lessons he taught his students: don't eat so much. Drink more water. Exercise, exercise, exercise. Fresh air; no alcohol; get enough sleep. Breast-feed the children; never beat them. Eat more fruit. Keep your brain active.

He warned against eating sugar but recommended a piece of chocolate if you felt a little low. Yes, I am sure you have heard that before.

Linnaeus is sometimes portrayed as a systematist, mad about figures and tables, an organiser with military ranks as a model. And yes of course, this is what gave him his international position, reputation and fame. But he was so much more. Even now, after more than 250 years, you can read his scientific texts with a delighted smile because of his unbelievable curiosity, his enthusiasm and astonishment over the richness and beauty of life. It is not for nothing that he is counted as one of the great Swedish authors of imaginative literature.

He sees everything – no detail is too small to be examined. For example, even as a mature man of 48, he was creeping down, as eager as a child, with lantern in hand to spy on the sleeping plants in his garden.

The story is as follows: Linnaeus had acquired some seeds of a small, exotic bird's foot trefoil and the plant had just started to flower in his botanical garden. He

was keen to show it to his gardener but when he was free in the evening they could not find the flower, it was no longer there. The next day it flowered as before, but again, when the gardener arrived in the evening it had disappeared. The same thing happened on the third day – by now, Linnaeus was almost mad with curiosity. He had to find the answer to this mystery. He eventually found the flower hidden behind three leaves. The leaves had placed themselves around the flower and formed a protective 'quilt'. The little bird's foot had fallen asleep and become invisible.

But Linnaeus would not have been Linnaeus if he had stopped there. He started to spy on the plants, curious about their secret nightlife. He studied 51 different specimens and found that many looked very different at night than during the day. He saw that they slept just like himself, and other animals. Of course he then went on to write a very scientific thesis about his experiments, with tables and figures of the sleeping plants, dull and correct.

However, in between you find amusing little pieces, for example:

> When the plants are young they are more addicted to sleep than later in life.

Linnaeus is often very funny. One of my favourites from among his books is *Flora Lapponica* (1737), his flora of Lapland. It is full of amusing stories. Here is only one example: In *Flora Lapponica*, Linnaeus describes several different fungi, including a special mushroom with a strong and pleasant smell. "When the young Lapps find it," he writes, "they pick it and place it just under the stomach, so that the wonderful smell will waft over and impress the women."

Up until this point everything is scientific and nothing particularly special. However, suddenly he comments:

> Oh, ridiculous Venus, you, who in other countries offer your help with coffee and chocolate, jams and bon bons…wines and lemonades, precious stones and pearls, gold and silver, silk and pomades, dancing and feasts…music and theatre. Here, you need only a dry mushroom.

Linnaeus was a marvellous teacher. He loved his topic and his students, and they were devoted to him. Teachers like Linnaeus could save the world, according to Paul Alan Cox in his introduction to the new English version of *Linnaei Philosophica Botanica*. With his enthusiasm he inspired his students to love life itself, and that this love could eventually move society in a better direction.

It has been said that Linnaeus among his students is one of the most striking cultural features of Swedish history. But of course there is also another side to this. Linnaeus was a man with at least two faces; among his students he was also a sovereign amidst his slaves. To be a 'Linnaean' was to be a member of a sect, with Linnaeus as the head priest. He preached his orthodox botany and expected his students to take his theories to the wider world as apostles, in the literal meaning of the word.

He loved his botanical garden; his academic garden – it was the apple of his eye. It was his classroom, his botanical dictionary and his joy. From the studio in his home he could look out over the garden. Early in the morning he would take his first tour around the plants in his nightcap and nightgown.

And like all gardeners throughout history he wanted people to see his 'paradise' when it flourished. "Come and see me," he wrote repeatedly to his dear friend Abraham

Bäck, who, like Linnaeus, was a personal physician at court.

I would like to finish with one of his most charming letters of invitation to Bäck:

> When my brother has left for Drottningholm [residence of the Queen], so you must come here to see the garden. I think it deserves to be seen for at least a couple of days. Whilst my brother is exploring the big world of Kings, then you must come to a little prince in the country of Flora. Let us retire in our nightgowns and close the front door, and talk about wonderful things.

Linnaeus: An 18th Century Background

Marie-Christine Skuncke

Swedish Collegium for Advanced Study, Thunbergsvägen 2, SE-752 38 Uppsala, Sweden

On 25 September 1759, the Swedish Royal Family visited the University of Uppsala: King Adolf Fredrik, Queen Lovisa Ulrika – the sister of Frederick the Great – Crown Prince Gustaf, a thirteen-year-old boy, and the little princess Sofia Albertina. They were received by the Vice-Chancellor who, that half-year, was none other than Professor Linnaeus. Today Linnaeus is remembered primarily as a scientist, but he was also a brilliant speaker. He delivered a grand speech to the royal visitors about the sciences, "vettenskaperna". The text was printed in large format (Fig. 1), with an ambitious layout reminiscent of poetry.

Linnaeus made two contentions in his speech: Sciences are useful and necessary in human society; enlightened rulers protect the sciences. Of course, this belonged to his role as Vice-Chancellor. If the present Vice-Chancellor of Uppsala University received representatives from the state authorities, he would be saying pretty much the same thing: 'Universities do useful work – we need economic support'. Nevertheless, this is an 18th century text which can tell us a good deal about Linnaeus and his time. Taking the speech as a starting-point, I shall attempt a brief introduction to Linnaeus' Swedish 18th century background.

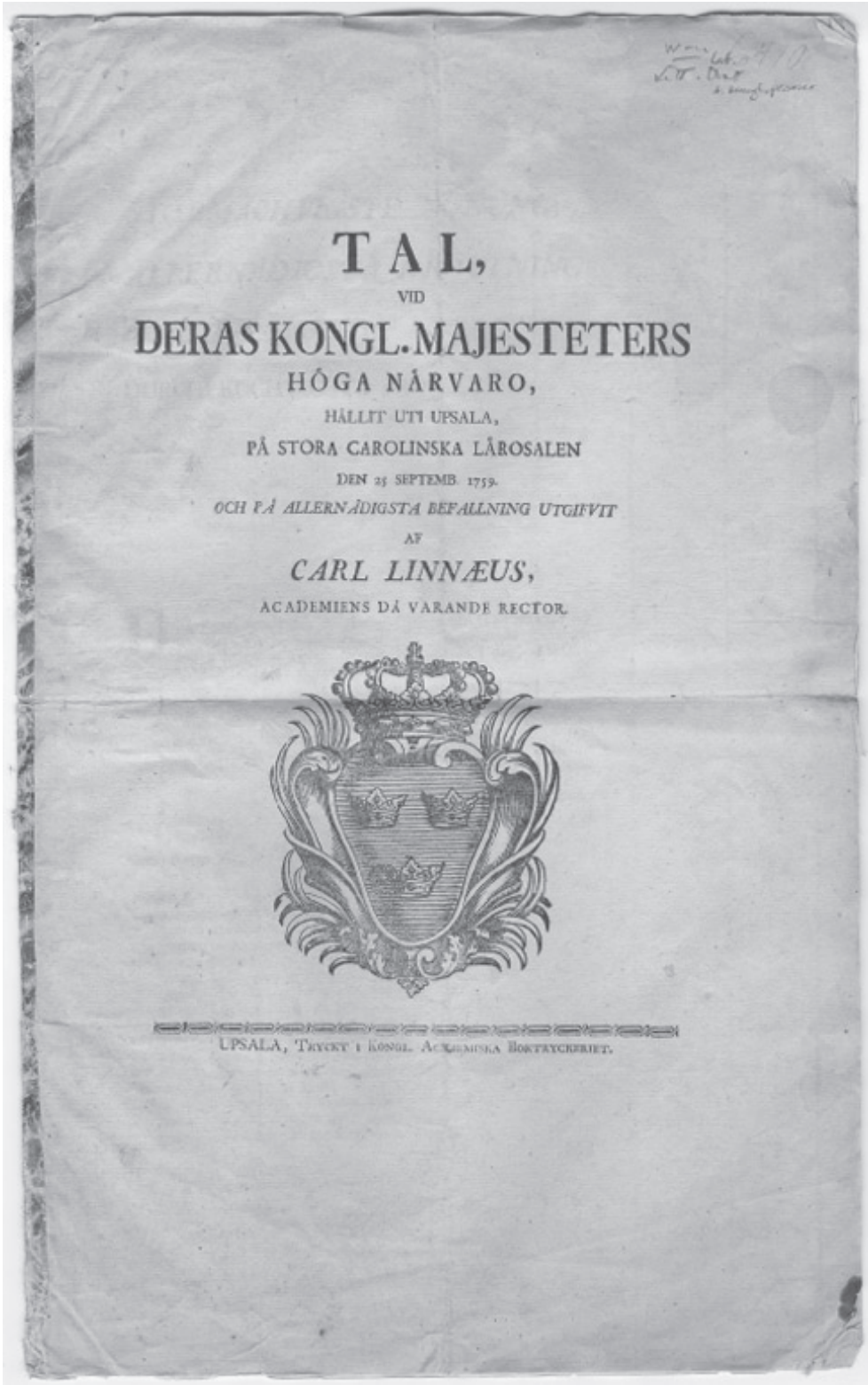
A belief in the sciences

Linnaeus' speech is a vindication of the sciences. A central image is that of light and darkness; sciences mean light, while lack of sciences means darkness:

> SCIENCES are a light, which is as little noticed by those that dwell in it, as it gleams splendidly for those that wander in darkness.
>
> (In Swedish: VETTENSKAPER äro ett ljus, som så litet märkes af dem däruti vistas, som det härligen glimmar för dem, som vandra i mörkret).

Linnaeus goes on to enumerate, in a series of parallel clauses, the benefits of the different sciences – Languages, Economics, History, Politics, Morals, Law, etc., 14 disciplines in all – and the negative consequences where sciences are absent. The parallel clauses are emphasised by the typographical layout.

Linnaeus' belief in the sciences was typical of the prevailing ideology in mid-18th century Sweden. A short background may be useful to readers not familiar with Swedish history. After the death of Charles XII, Sweden had lost its status as a great European power, yet this was a kingdom with an original political system. During the period known as the Age of Liberty (1720–1772), political power was concentrated in Parliament, the Diet or "Riksdag", whereas the king's power was strictly limited. Two parties, the Hats and the Caps, competed within the Riksdag, and in practice power rested with the ruling party. For several decades, from the late 1730s to the mid-1760s,



TAL,

VID

DERAS KONGL. MAJESTETERS

HÖGA NÄRVARO,

HÅLLIT UTI UPSALA,

PÅ STORA CAROLINSKA LÅROSALEN

DEN 25 SEPTEMB. 1759.

OCH PÅ ALLERNÅDIGSTA BEFALLNING UTGIFVIT

AF

CARL LINNÆUS,

ACADEMIENS DÅ VARANDE RECTOR.

UPSALA, Tryckt i Kongl. Academiska Boktryckeriet.

Figure 1. Two pages from Linnaeus' speech to the Royal Family 1759:
(a) the title-page above and (b) first page (right). The original format is large folio.

STORMÄCHTIGSTE KONUNG!

ALLERNÅDIGSTA DROTTNING!

DYRASTE ARFFURSTE!

DURCHLEUCHTIGSTA PRINTZESSA!

Detta Rum, ſom i dag uplyſes af EDRA MAJESTETERS hö-
ga närvaro, är det, ſom af våra Glorvördigſta Konungar
blifvit helgat åt *vettenſkaperna*, ſom ock ån i dag, af EDER
MAJESTÉT för *vettenſkaper* underhålles.

VETTENSKAPER äro ett ljus, ſom ſå litet märkes af dem dåruti
viſtas, ſom det härligen glimmar för dem, ſom vandra i mörkret.
En Menniſka, utan upfoſtran, lämnad ſig ſielf, liknar mer en
Markatta ån Guds beläte.
Ville Folkſlager, Barbarer och Hottentotter, ſkiljas ifrån oſs
endaſt med Vettenſkaper; likſom en äggig Sur-appel ſkiljes
ifrån en ſmakelig Renette, endaſt genom cultur.
Ja, genom vettenſkaper lyſer det minſta Förſtendömme i Tyſk-
land härligare, ån det ſtora Kejſaredömmet Mogol med alla
ſina ſkatter.

Vettenſkaper föra oſs till vördnad emot vår *Gud*.
till lydnad emot vår *Öfverhet*.
till kärlek emot vår *Näſta*.

Vettenſkaper uplyſa oſs i all vår lefnad; de lära oſs
genom *Språken*, at rikta oſs af andras åſkarenhet.
genom *Oeconomien*, at ſkaffa tillräckelig Närings fond.
genom *Hiſtorien*, at achta oſs för andras fehl.
genom *Politiquen*, at ſtyra och lefva lyckeligt.
genom *Moralen*, at lefva oſkyldigt och dygdigt.
genom *Lagfarenheten*, at lefva Lagbundit.
genom *Theologien*, at vandra Guds vägar.
genom *Aſtronomien*, at ſkönja Guds oändeliga macht.
genom *Naturkunnogheten*, at ſe Guds förträffliga inrättning.
genom *Phyſiquen*, at betiena oſs af Naturens lagar.
genom *Mathefin*, at förſtå vår egen ſtyrka.
genom *Pathologien*, at kienna våre egie ſvaga.
genom *Diæten*, at lefva nycktre och ſälle.
genom *Medicinen*, at appellera emot Döden.

Huru

the ruling party was that of the Hats – Linnaeus' party – which can be described as an alliance between big entrepreneurs and high-ranking civil servants.

For the Hat leaders, Sweden's future lay in developing science and technology in order to boost the country's economy, especially in manufacturing. The Hats promoted scientific research and launched new institutions. The Royal Academy of Sciences was created in Stockholm in 1739 just after the Hats had come to power, with the young Linnaeus as one of its founders. At the University of Uppsala, a chair of economics (*œconomia publica*) was established in 1741 with Anders Berch as its first holder. A national office for statistics, the first in Europe, was created in 1749: Tabellverket, the Office of Tables. As the Swedish historian of ideas Karin Johannisson has shown, the promoters of that office believed in the blessings of quantitative methods, "political arithmetic".

The mid-18th century was a period of strong institutional support for the sciences in Sweden, and it became a golden age for the natural sciences. Besides Linnaeus, we find names like Celsius, the well-known physicist, the astronomer Wargentin, the mineralogist Wallerius and others. As far as natural sciences are concerned, Sweden was far from peripheral; it belonged to the European forefront. In the Hats' programme, there was a strong economic component: the mercantilist principle to limit importation as much as possible in order to create a positive balance of trade. Hence a wish to substitute domestic products for expensive imports from abroad (this point has been stressed by Lisbet Koerner (Rausing) in her dissertation *Linnaeus: Nature and Nation*).

The travels of Linnaeus and his pupils were aimed at practical utility, at charting the natural resources of the Swedish realm – useful plants, animals and minerals. This is an important background to the Linnaean collections. Linnaeus' own travels in the Swedish provinces were commissioned in several cases by the Swedish authorities. When he set off on his journey to the island of Öland, he had an instruction from the Swedish Board of Manufacturers ordering him to look for, first, plants that could be used for dying (colours were needed for the new textile industry), second, types of clay that might be used to produce porcelain (and thus avoid the expensive import of porcelain from China), and third, medicinal plants. In the travels of Linnaeus' pupils and friends, we find the same utilitarian perspective; for instance the idea that foreign plants could be acclimatised in Sweden. Linnaeus had hopes of growing tea in Uppsala (again an expensive import). His friend Captain Ekeberg succeeded in bringing tea plants alive from China, but alas they did not survive the Uppsala climate. There was also an ambition to master production technologies, the secret of Chinese porcelain production for example.

In the Swedish Age of Liberty, one could say there was an alliance between science and business. Close ties developed between the Swedish Academy of Sciences and Linnaeus, on the one hand, and on the other the Swedish East India Company, with its director Magnus Lagerström a key player. The rule was adopted that chaplains on board the company's ships must have studied natural sciences, preferably with Linnaeus himself. This was the case with Pehr Osbeck and Olof Torén, gifted pupils of Linnaeus, who saw to it that they travelled to China with the Swedish East India Company. These chaplains on board the ships were botanists – both ministers of Christ and apostles of Linnaeus. Thus there was also an alliance between science and the Church.

It is typical of the Swedish 18th century that there existed, as a rule, no opposition between science and the official, Lutheran religion. On the contrary, the two went hand in hand. Swedish parish priests became involved in practical enlightenment work, for example encouraging peasants to inoculate their children against smallpox. For Linnaeus, the harmonious order that he uncovered in Creation proved the goodness of the Creator – the doctrine known as physico-theology. We find this in his speech from 1759, when he enumerates the benefits of the different sciences. Through astronomy, he says, we learn "to perceive God's infinite power" ("at skönja Guds oändeliga mackt"), and through natural science "to see God's magnificent order" ("at se Guds dråpeliga inrättning"). Linnaeus was not always an orthodox Christian in private, yet he was a deeply religious person, as the historian of science Tore Frängsmyr has recently stressed. In the 10th edition of the *Systema Naturae*, published in the same period as his royal speech (1758–59), the first pages are full of religious quotations praising the glory of the Lord. In one case, the words "Magnus est DEUS noster", "Great is our God", stand alone on the left-hand page, while the right-hand page gives details about the 10 editions of the *Systema Naturae*, as publicity for the work.

To sum up, one might say that the prevailing ideology among the Swedish elite in the mid-18th century was an optimistic belief in scientific progress, but at the same time a continued adherence to the Christian religion. If there was such a thing as a Swedish Enlightenment – this is a much debated point among Swedish 18th century scholars – it was a Christian, Protestant Enlightenment, very different from the anti-Christian Enlightenment of the French philosophers.

Linnaeus and languages

When Linnaeus addressed the Royal Family at Uppsala in 1759, the language situation was tricky. The king and queen were both German. For Queen Lovisa Ulrika, the most natural language would have been French, the international language of the aristocratic elite in Europe – but Linnaeus did not speak French. At the University of Uppsala, the normal language would have been Latin – but the Royal Family did not understand Latin. So Swedish was chosen as a compromise. Swedish, incidentally, was the first language of the crown prince, the future Gustaf III.

In his choice of languages, Latin versus Swedish, Linnaeus consciously targeted different audiences. Scientific works aimed at an international audience, and also at a Swedish academic audience, were written in Latin, or more accurately Neo-Latin. This was the case, for example, with the *Systema Naturae*. The list of editions just mentioned includes two editions published in Leiden, two in Halle, one in Leipzig and one in Paris, besides editions produced in Stockholm from Lars Salvius' publishing house. Latin was also the language that Linnaeus used in his correspondence with foreign scholars. Around half of the letters in the Linnaean Correspondence are written in Latin. Academic dissertations at Uppsala were normally also written in Latin.

Neo-Latin in the 18th century was not a dead and dusty language, but a living, flexible tool for scientific communication, as the studies of Latinists such as Hans Helander and Krister Östlund have shown. Linnaeus' Latin has been analysed in an article by Ann-Mari Jönsson, who works on the Linnaean Correspondence. The Latin in his letters is not always grammatically correct, especially when he writes in a hurry.

Yet his use of Latin is bold and creative – just think of the whole botanical nomenclature that he created! Ann-Mari Jönsson claims that Linnaeus owed his whole botanical career to the Latin language. There is something in this; if the *Systema Naturae* had been published in Swedish, it would not have reached beyond the borders of the Swedish realm.

On the other hand, works by Linnaeus aimed at a Swedish, not specifically academic, audience were written in Swedish. The Royal Academy of Sciences, of which Linnaeus was a founding member, systematically used Swedish in its publications in order to spread useful knowledge among the local elite in the Swedish kingdom. Linnaeus was a frequent contributor. For the same reason – spreading useful knowledge – the travel accounts of Linnaeus and his pupils were published in Swedish. As far as Linnaeus is concerned, this was not only useful knowledge but also highly enjoyable reading. He was a master of the Swedish language but he only had scant knowledge of other modern languages, for example, French, which in the 18th century was competing with Latin as an international scientific language.

Scientific careers

In Linnaeus' speech to the Royal Family, one of his contentions was that enlightened rulers protect the sciences. Linnaeus insists on the necessary material conditions if sciences are to flourish. The authorities should ensure that academic teachers get decent salaries, and that promising scholars have career prospects; promotion at universities should depend on scholarly qualifications, not on the number of years one has been employed. Linnaeus himself hardly set a good example in this respect. He secured for his own son the chair of botany and medicine at Uppsala, thus blocking the way to promotion for ambitious young scholars. As it happened, the younger Linnaeus died early, only five years after his father, but that could not be foreseen.

In a recent book on natural history and travel, the young historians Kenneth Nyberg and Hanna Hodacs explore the theme of scientific careers in 18th century Sweden. Kenneth Nyberg questions the image of Linnaeus' "apostles" sacrificing themselves for the sake of science and Linnaeus – an image largely created by Linnaeus himself. The travelling pupils, Nyberg claims, were young men at the beginning of their careers, and their travels to foreign lands were a stage in building a career. Some died on the journey, but others did succeed.

Kenneth Nyberg's results tally with my own current research on Carl Peter Thunberg, who visited the Cape, Java, Japan and Ceylon, and brought back to Europe huge collections of plants, animals, minerals, and also books, coins, maps and ethnographical objects. Thunberg obviously used his collections in order to promote his own career. He gave items to the influential Sir Joseph Banks in London, whom he visited on his way back from Japan. He donated his collection of precious Japanese coins to the Swedish king, Gustaf III (whom we have met in the introduction as a thirteen-year-old boy listening to Linnaeus' speech). He managed to succeed Linnaeus the younger as professor of medicine and botany at Uppsala in 1784, the same year that the Linnean collections were shipped to London. Thunberg's collections were there to fill the gap – he made a donation to the university in 1785. Thunberg held Linnaeus' chair at Uppsala for forty-four years, until his death in 1828.

Was Linnaeus a racist?

In Linnaeus' 1759 speech, we read the following lines:

> A Human Being, without education, left to himself, is more like a Guenon Monkey than the image of God.
>
> Wild Peoples, Barbarians and Hottentots, are distinct from us only through Sciences; just as a thorny, sour crab is distinct from a tasty reinette [a sort of apple] only through culture.
>
> (In Swedish: 'En Menniska, utan upfostran, lämnad sig sielf, liknar mer en Markatta än Guds beläte.
>
> Ville Folkslager, Barbarer och Hottentotter, skilljas ifrån oss endast med Vettenskaper; liksom en taggig Sur-appel skilljes ifrån en smakelig Renette, endast genom cultur').

Here the botanist is speaking: the sour, wild apple versus the tasty, cultivated apple. Cultivation, or culture, is an important image in the speech, besides the image of light and dark. What distinguishes modern Europeans from primitive peoples is education and culture.

In our day, Linnaeus and his pupils have come under attack from the post-colonial scholar Mary Louise Pratt in her book *Imperial Eyes* (1992) where she describes them as white, male, bourgeois, imperialist, racist Europeans. Was Linnaeus an imperialist and a racist? The question should be answered in a balanced way. With regard to the charge of imperialism, we should remember that Sweden, in the Age of Liberty, was a country without overseas colonies. The Swedish voyages to East India were a mercantile, not an imperial, project. Regarding the charge of racism, it is important to read Linnaeus' own texts. In the passage from the 1759 speech which I quoted above, Linnaeus asserts that civilised Europeans are superior to primitive peoples, and that their superiority resides in "culture". The decisive factor is "culture", not race. In this text, Linnaeus can be described as Eurocentric but not racist.

The *Systema Naturae* contains an anthropological discussion in Latin, which is not easy to interpret. I base my thoughts on the 10th edition from 1758–59, together with the comments of the historian of ideas Gunnar Broberg. Linnaeus does not use the word "race" – it was introduced by his French opponent Buffon. Instead, he distinguishes between five "varieties" of the species "*Homo sapiens*": the American, the European, the Asian, the African and the monstrous ("Monstrosus"). Linnaeus links geographical location – the four then-known continents – with physical and cultural characteristics. In the 10th edition, Linnaeus places the American before the European. On the other hand, the African comes lowest in the hierarchy of continents; he is described as "sly, lazy, careless" ("Vafer, segnis, negligens"). The Hottentots, whom Linnaeus mentioned in his speech to the Royal Family, are included in the category "monstrous", as they were supposed to have only one testicle. Classifications of this type could later be used for racist purposes, but that belongs to the 19th, not the 18th century. Linnaeus cannot be held responsible for the crimes of subsequent generations.

To conclude: Linnaeus was a Swede of the 18th century – the son of a country vicar, reconciling science and religion, intent on practical, economic utility; a master of the Swedish language; and, not least, a man who, with the help of the Neo-Latin language, placed Sweden on the international scientific map.

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What's more important, a good story or a true story? The merging of facts and fiction at Linnaeus' houses in Uppsala

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Museums know it, historic houses know it, churches know it and hotels know it. They know the importance of a good story to capture the imagination of the visitor. The tourist industry has become more and more dependent on narratives and storytelling. Houses and artefacts are not sufficient in themselves, they must be able to tell a story. If the story is bland, it can be spiced up. If the story isn't there at all, it can be created.

Uppsala University Art Collections are the trustees of around 500 objects that are in some way connected to Linnaeus and his family. These objects are kept at Hammarby, Linnaeus' country house outside Uppsala (Fig. 1), and they are thus part of a museum context as well as a tourist context. Some of these objects have the good fortune to have a provenance supported by inventories, passages in Linnaeus' rich correspondence or in his scientific work. Other objects are not so fortunate. But let us start with the lucky ones.

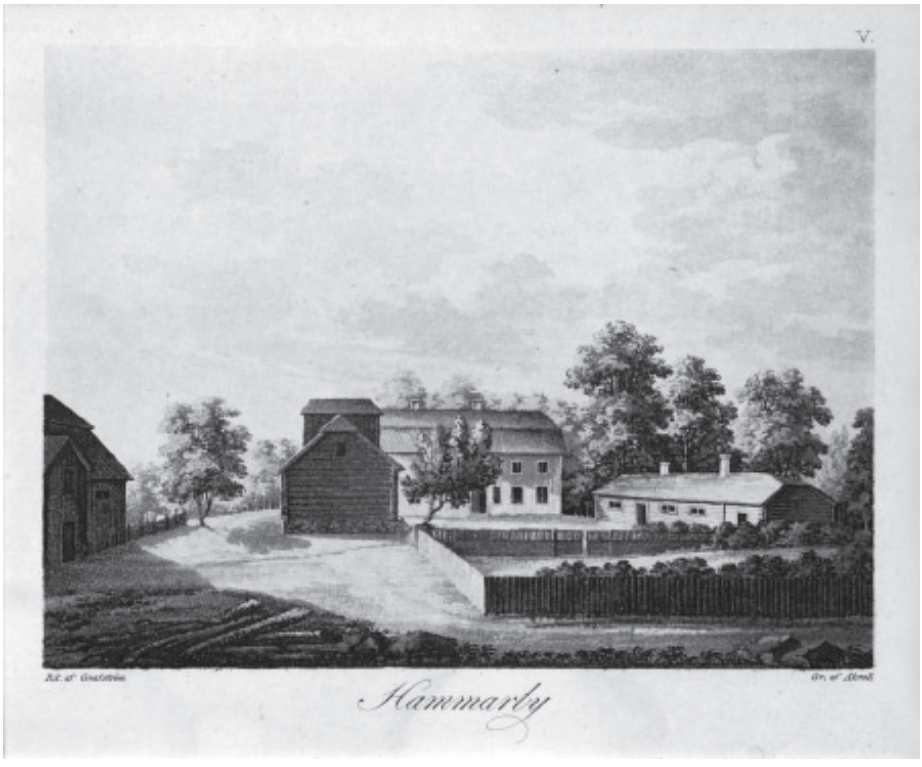

Figure 1. The Hammarby estate outside Uppsala was purchased by Carl Linnaeus in 1758. Engraving by F. Akrell. Uppsala University Art Collections/Hammarby.

Figure 2. Milk pitchers from the two tea sets decorated with *Linnaea borealis*. The tea sets were ordered on Linnaeus' account in Canton by Pehr Osbeck. © Uppsala University Art Collections/Hammarby.

For instance, take the two similar, but not identical, tea sets decorated with *Linnaea borealis*, commissioned by Linnaeus in China with the assistance of his disciple Pehr Osbeck who travelled with the Swedish East India Company to Canton (Fig. 2). The story of how the first commissioned tea set "was killed" – Osbeck's own words in a letter to Linnaeus – is well known and has captured the imagination of people for more than one reason. By saying that the tea set "was killed" it becomes almost human and subject to our feelings. Secondly, it was not "killed" on the long adventurous sea journey from Canton to Sweden but when travelling on land the relatively short trip from the harbour in Gothenburg to Uppsala – and, thirdly, it carries the symbol Linnaeus chose for himself – *Linnaea borealis*. All of this gives the tea set a special position among the many objects left by Linnaeus. The shipment of the second tea set has its own narrative. It is described in a letter prior to its commission: Osbeck tells Linnaeus that the advantage of a second commission is that the *Linnaea borealis* can be more accurately outlined and the colours improved upon. When comparing the two tea sets it is obvious that Osbeck was correct in that respect. The flower of the second shipment is more rose coloured than red and more sensitively drawn.

Another object with a splendid provenance is the oil painting of the monkey Grinn (Fig. 3) who is referred to by Linnaeus himself in a publication from the Royal Academy of Sciences. According to this, Grinn was a gift from the Swedish Queen Lovisa Ulrika in 1768. Furthermore, the text declares that the painting of Grinn was commissioned by the King Adolf Fredrik, and presented to Linnaeus. This little painting is thus a gem in more than one way. Not only is it a sweet, heart wrenching picture of an animal with a name and a charming punky sort of hairdo, it also has royal

Figure 3. This portrait of Grinn, a cotton-top tamarin, was painted by Gustaf Hassellius (1727–1775). © Uppsala University Art Collections/Hammarby.

connections and, furthermore, it was kept at the Botanical Garden, today the Linnaeus Garden, in Uppsala. The cotton-top tamarin is not the only animal depicted at Hammarby. Linnaeus' interest in animals is well documented. A person who surrounds himself with animals must have a good heart and this adds to the visitors' positive view of Linnaeus. The racoon Sjupp (Fig. 4) was a gift from King Adolf Fredrik and the stories surrounding this animal are many (and not always to Sjupp's advantage). Another engaging fact is that the raccoon was kept at the Linnaeus garden. In the following years live animals of various species, including monkeys, were kept at the garden. An old monkey's cage was found in the attic of the Orangery building in the garden. The cages can also be spotted on high poles in old engravings of the garden. It is tantalising to visualise Linnaeus' monkeys sitting up there, chained to poles, high above the ground.

Figure 4. A tinted drawing of a Raccoon, perhaps Sjupp. © Uppsala University Art Collections/ Hammerby.

Grinn and Sjupp *were* really kept by Linnaeus as pets and objects of study. Two other paintings of monkeys, now at Hammarby, are also part of the narrative surrounding Linnaeus and his unusual household animals (e.g. Fig. 5). They too are supposed to have been part of the menagerie kept at the Botanical garden but this is not in fact true. That narrative has been part of the Linnaeus tales since the beginning of the 20th century and it has moved from guide to guide and from book to book, without being questioned. Once something is set in print it also has a tendency to become tantamount to the truth. The truth this time however, is that the two paintings of live monkeys were used as models for the engravings included in a scientific work on animals that Linnaeus compiled for King Adolf Fredrik in 1754. This does not mean that the paintings are without interest, at least not for an art historian. From a Swedish point of view the artists involved in creating the illustrations for the book are highly interesting: Jean Eric Rehn and Olof von Dahlin. The first was a highly versatile artist involved in many high-ranking architectural and artistic projects in Sweden in the 18th century and the other a writer, publicist and historiographer. Both of them were very successful in their different fields but not famous for portraying monkeys! But of course for the average visitor to Hammarby the thought of the two monkeys roaming around in the garden is more pleasing than the fact that they were merely models for a scientific work on animals.

Linnaeus' doctoral (Fig. 6) hat is included in the inventory drawn up after the acquisition of Hammarby by the state in 1879. But in what sense is it Linnaeus' doctoral hat? Linnaeus passed his degree of Doctor of Medicine in Harderwyk in Holland. Did he receive the hat on that occasion? Probably not. The green colour of the hat has connections to the Faculty of Medicine in Uppsala and the fact that the hat is clad with silk indicates that it has been used on ceremonial or formal occasions. One must therefore

Figure 5. White-faced capuchin. An engraving based on this picture was included in the work *Museum S.R.M. Adolphi Friderici,* written by Carl Linnaeus and published in 1754.

draw the conclusion that Linnaeus used the hat in his role as conferrer at the conferment of doctoral degrees at Uppsala University. He acted in this role on no less than eight occasions. It is therefore not wrong to say that the hat is Linnaeus' doctoral hat but one

Figure 6. Linnaeus doctoral hat, a *tricorn*, clad with green silk.

Figure 7. Photo of Linnaeus' workroom at Hammarby in the 1870s by the Uppsala photographer Emma Schenson. The walls are adorned with Plumier's uncoloured graphic prints. © Uppsala University Library.

should add that he used it as conferrer rather than when being awarded his degree.

The best preserved rooms at Hammarby are Linnaeus' work chamber (Fig. 7) and his bed chamber on the second floor. These two rooms were left more or less untouched after his death and were shown to visitors by his widow. Linnaeus' wife, Sara Elisabeth, used the house as a permanent residence after her husband's death since the Botanical house in Uppsala belonged to the university. The famous botanical plates that adorn the work chamber and bed chamber are actually fortunate to still be where they are. After Linnaeus' death his son wished to remove the engravings and replace them with something more up to date. His mother refused to comply and that is probably why we can still enjoy them today. Already in Linnaeus' lifetime visitors warned him that the valuable hand coloured engravings might come to harm as they were glued straight on to the bare timber walls. Linnaeus was well aware of the fact that the engravings were subject to various risks but he stated that they were to remain where they were for him to enjoy for as long as he lived.

Figure 8. Red cupboard in Linnaeus' work chamber from the late 18th century. © Uppsala University Art Collections/ Hammerby.

The hand coloured engravings used as wallpaper in Linnaeus' bed chamber are often referred to in books as "Ehret's plates", after the German botanical illustrator Georg Dionysius Ehret. The Swedish botanist Karin Martinsson has studied the engravings closely and determined that they are, in fact, taken from a number of botanical works

where Ehret is only one of several artists. Among them are engravings taken from Christoph Jacob Trew's *Plantae Selectae* and Philip Miller's *Figures of the most beautiful, useful and uncommon plants described in the Gardener's Dictionary* 1760 with Ehret as illustrator alongside John Miller. There are also a few plates by Carl Clerck from his work on butterflies, *Icones Insectorum Rariorum*. Naming the plates "Ehret's plates" is an unjust simplification of their more complex and interesting origins.

The engravings in the work chamber are all by the French monk and botanist Charles Plumier. Plumier made the drawings for the plates on a journey to the West Indies. The drawings were acquired by Linnaeus' friend Johannes Burman who wanted Linnaeus to see the engravings before they were published to make sure the designations given to the species were correct.

In an article in the Uppsala University Tercentenary book we have deliberately left out a piece of furniture that most visitors adore and which is repeatedly reproduced in books and magazines. It is the eye-catching red cupboard in Linnaeus' work chamber filled with pressed plants arranged according to Linnaeus' sexual system (Fig. 8). There is only one slight problem: the cupboard wasn't there in Linnaeus' lifetime. It has been examined by experts and although the wood is old it is thought to be from the very end of the 18th century. Is this important? I think it is. All the objects gathered at Hammarby are in the custody of the University Art Collections and they are thus part of research material belonging to the university. As in any other discipline of research we must have the same demand for accuracy and truth when presenting the property left by the Linnaeus family to the public.

Let us return to the monkey Grinn in his original setting on the wall covered with multicoloured engravings in Linnaeus' bed chamber. The spiky crown of white fur on the monkey's head – "the cotton top" of the cotton-top tamarin – is an important weapon in the struggle to catch the attention and imagination of the visitor today. Professor Tore Frängsmyr, former Hans Rausing Professor of History of Science wrote recently in one of the morning papers that "every jubilee has its own Linnaeus" meaning that every new generation of writers on Linnaeus interpret the man and the scientist in different ways. The same can be said for tourists and visitors to Hammarby and the Botanical house. Visitors pick and choose among the many objects left by Linnaeus and his family and the objects chosen differ from generation to generation. The monkey Grinn might not be considered interesting in a hundred years time or even twenty years time.

Let us move on to the Botanical house in the Linnaeus garden (Fig. 9). It was the home of the Professor of Medicine and Botany in Uppsala and it was originally built by Olaus Rudbeckius in 1693. It was rebuilt for Linnaeus in the 1740s according to plans drawn up by the famous Swedish architect Carl Hårleman. Or, at least, that is what it says in many, many books on the subject. There are in fact no written records whatsoever to support the claim that Hårleman was the architect. The house is clearly in the Hårleman tradition, the Botanical Garden was given a new layout according to plans by Hårleman and he was the architect behind several other building projects in Uppsala at the time. But it is also a fact that the architecture represented by Hårleman had a radical impact on *all* architecture of the time and the man himself worked in favour of architectural standardisation of official buildings. Linnaeus speaks in a letter of a plan

Figure 9. The Botanical house, today the Linnaeus Museum, was Carl Linnaeus' official residence from 1743. He lived here with his family until his death in 1778.

for the Botanical house drawn up by Hårleman's assistant Johan Christoffer Kjörner. That plan is lost and as long as no new records turn up, it would be safer to say that the Botanical house was rebuilt by an anonymous architect working in Hårleman's tradition. Hårleman is one of the most famous and best loved architects in Swedish history and he is associated with a romanticised century and with kings and queens promoting science, culture, refinement and education. It certainly isn't difficult to understand why people treasuring the memory of Carl Linnaeus wish to attach the name of Hårleman to the Botanical house. It makes it more important and its occupant accordingly so.

Finally, I think something must be said about the new wallpaper in the Botanical house (Fig. 10). The house was radically renovated and rebuilt in the 1930s after a thorough investigation into its history by antiquarians and art historians. Up to eight layers of paint were removed from the interior walls, secondary interior walls were removed, new fireplaces were installed *et cetera, et cetera*. This investigation revealed a host of unknown facts about the house in Linnaeus' days but it could, of course, never tell the whole story of what the house had looked like, how it was decorated or how it was furnished. There is, for example, no knowledge of what the interior walls actually looked like. Were they hung with wallpaper or with painted linen cloth nailed to wooden frames? Or were the walls merely plastered and painted? If there was wallpaper, was it monochrome, multicoloured or patterned? We simply don't know.

Figure 10. A sample of the Linnaeus Museum's newly produced wallpapers, crafted as in Linnaeus' days and inserted into the 18th century setting for the 300th anniversary of the birth of the scientist. © The Linnaeus Museum, Teddy Thörnlund.

Today the walls in the Botanical house are covered in new brightly coloured, patterned, hand painted and block printed wallpapers. The models have no connection with the Botanical house in Linnaeus' days. Instead, they are taken from Drottningholm Palace in Stockholm, the theatre at Drottningholm, the archives of the Stockholm City Museum, from Hammarby and from a neighbouring house in Uppsala from around 1810. Is this a problem? As long as guidebooks and guides are explicit and point out the fact that the various wallpapers are in fact reconstructions and representative of a time span of about 50 years *during* and *after* Linnaeus' life time, I think it is O.K. It is however not O.K to be vague on this point in an attempt to present a tale of an untouched 18th century house inhabited by one of our country's most illustrious scientists. As long as no facts are withheld, this new wallpaper can actually provide a piece of important information about the Botanical house, Hammarby and historic houses in general: the fact that time can't be halted, changes will inevitably occur over the years and will continue to do so. With this in mind the visitor can enjoy the houses occupied by Linnaeus and his family and be smitten by their robust charm, personal mix of styles and belongings acquired over a long period of time. A good story certainly makes life easier for the guides at Hammarby, but I'm sure Linnaeus would have opted for a true story if forced to choose.

Making Memorials: Early Celebrations of Linnaeus

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In 1807 the centenary of the birth of Linnaeus was celebrated. Previously, the marking of anniversaries had been a purely sacred phenomenon, due to the ecclesiastical tradition of jubilees. The anniversaries of Uppsala University's letter of privilege in 1477 had never been commemorated. Plans for a celebration were put off by King Gustaf III in 1777, since events from the time before the Reformation were not considered suitable for grand memorials.[1]

Not until later, during the late 19th century, did memorials of secular institutions or individual scientists become commonplace, and this was also the most intense time of monumental memorials. Thus, in 1807 the Linnaeus festivities were something new, a celebration focusing on science. Maybe this was the ground-breaking, first celebration of a scientist – although some sort of memorial was held in Leipzig in 1743, observing the bicentenary of Copernicus' death, and until this is properly studied we cannot know for certain.[2] The 1807 celebration was the first one in Sweden, and the first one in memory of Linnaeus.

Linnaean festivities soon grew into a special genre, held for instance in Russia, the U.S, the U.K. and Germany during the first half of the 19th century.[3] The memorials held in Uppsala and Växjö in 1807 contain elements which became typical for later celebrations:

1. Local or topographical aspects were emphasised, such as the old Botanical Garden and Hammarby, where Linnaeus had lived and worked. The new Botanical Garden and the building now called Linneanum were inaugurated in 1807, and kept their positions in later memorials.
2. Historical and genealogical aspects are evident. Production and exhibition of Linnaeus portraits, Linnaeus' daughters and their descendants (Linnaeus Jr. died in 1788 without an heir) were expected to arouse interest.
3. The Linnaean disciples are an important *lieu de memoire*, or site for memory: in 1807 several of the so-called apostles (who had travelled for Linnaeus) were still alive and partook actively in the celebrations. Disciples of the future were also saluted, e.g. the Småland Student Nation, to which Linnaeus had belonged, and youth-organisations for the study of science.
4. With the attention given to disciples there followed a closer attention to scientific aspects. The significance of Linnaeus was highlighted through donations to research, awards and appointments of honorary doctors. With these manifestations, the brilliance of Linnaeus reflected upon both his Alma Mater and the disciplines who received the grants.

The memory of Linnaeus was made part of new Royalist traditions, especially

Figure 1. Inauguration of the Linnaeus bust in Jardin de Plantes, Paris, in 1790. © Section for Maps and Pictures, Uppsala University Library.

since the Swedish crown, from 1810, was transferred to the Bernadottes. The memory was also used to strengthen patriotic feelings, and (after the World Wars) as a tool to promote internationalism or a rationalist, scientific policy for society.

The most conspicuous elements of the Linnaeus festivities are the visual ones. By no means unique for Linnaean celebrations, they show that such jubilees and memorials continued traditions such as academic ceremonial, coronations and ecclesiastical jubilees. The first Linnaeus memorial opened with an academic procession and held two festive banquets, symbolically demonstrating the University's social stance. Another visual component is evident in the Linnaeus tokens, which were produced already in 1807. Then engravings and medals were given away. Later, in the spirit of consumerism, all kinds of souvenirs were sold.

As a part of the 1807 celebrations, the Linneanum building was inaugurated in the Botanical Garden. The edifice had been initiated by King Gustaf III in 1787 and was in use already in 1805. Its name and neo-classical appearance disclose its monumental purpose, but it was also used for teaching, as official residence for the professor, and as a natural history museum.

Speeches were given on the occasion by two of Linnaeus' disciples, botany professor Carl Peter Thunberg, and the botany teacher Adam Afzelius. They both belonged to Uppsala University, which hosted the celebration but had not taken the initiative for the memorial. Thunberg, like Linnaeus himself in 1759, stressed the utility of science: natural history teaches us about God, Justice and Order, and how to heal mankind. Thunberg also praised the enlightened despot Gustaf III, for protecting the sciences.

The idea of celebrating the centenary of Linnaeus first appeared during the autumn of 1806. A collection appeal for a sculpture was announced, a sculpture which would be unveiled at a celebration in Växjö, the town where Linnaeus received his secondary education. The initiator, Sven Hedin, was a man of influence, Court Physician and member of the Academy of Science. Possibly, his energy prompted others to follow.

Some years earlier the botany teacher Afzelius had been asked to supervise a society of young botanists. Now he began to turn it into an educational institution

dedicated to the memory of Linnaeus. This, he hoped, would help his career, which apparently had come to a halt. In 1785 he had been appointed *botanices demonstrator*, i.e. assistant teacher to the botany professor. The professor, Thunberg, had held the office since the 1780s and had no intention of resigning. Afzelius hoped that his non-profit teaching of natural history would please the King so much he would be made professor without having to wait for an opportunity. In 1812 he finally was appointed professor *extra ordinem* in medicine and dietetics. Thunberg died in 1828. The Linnean chair of medicine and botany was transmitted, not to Afzelius who by then was 78, but to a much younger, promising, scientist, Göran Wahlenberg.

Figure 2. Copperplate of Jonas Forsslund's Linnaeus bust published by Smålands Student Nation in Uppsala, 1807. © Section for Maps and Pictures, Uppsala University Library.

Figure 3. Postcard of the Students' Spring Celebration in front of the Linneanum in the Botanical Garden in Uppsala, early 20th century.
© Section for Maps and Pictures, Uppsala University Library.

Figure 4. Johan Niclas Byström's statue of Linnaeus in Carrara marble, inaugurated in Linneanum 1829. Photograph taken by Emma Schenson around 1860.

In 1829 a statue was placed in the Linneanum. This statue resulted from an initiative of the student body, which also paraded and spoke on the occasion. The newly formed Student Choir sang of how Linnaeus, while still a young man, had lifted Nature's veil, describing the relationship between Scientist and Nature as a sort of marriage or romance. The Vice-Chancellor, historian and poet Erik Gustaf Geijer spoke of Linnaeus as a student, which he had been in 1729, one century ago. To the student body, which a decade later founded the Student Corps, the main point would have been the focus on the role of Youth, and claiming youth as an intellectual force to be reckoned with.

The bicentenary

The bicentenary of Linnaeus was celebrated in Sweden and abroad. The 1907 anniversary can be regarded as the culmination of the Linnaeus cult and of the intense period of celebratory memorials. The decades before and after 1900 display, on one hand, patriotic memorials and inaugurations: for example, in Sweden a National Day was introduced and different national museums were opened. On the other hand, the interest in Great Men and the celebration of Science blended in the Nobel Prize from

Figures 5 & 6. "Linnaeus", The Swedish Royal Academy 200 Years (1939).

Figure 7. "Linnaeus in Lappish Costume and Dutch Doctoral Cap", Linnean Journeys (1978). © Sweden Post Stamps.

1900, while interest in individuals also took the form of autograph collecting and a Swedish society for the history of individuals [*personhistoria*].

Of course, this was not a purely Swedish phenomenon. A fruitful comparison is that of the memorials of Charles Darwin, made the subject of a massive souvenir industry from the 1870s. Photographs and autographs were sold and Darwin's home became a tourist sight while Darwin was still alive and living in the house with his family. During this period, the Linnaean family home at Hammarby was taken over from the relatives by the Swedish state and Uppsala University, and made into a museum. At the centenary of Linnaeus' death in 1878 a strong interest in Linnaean biography, genealogy, portraits and manuscripts is evident. By the late 19th century "home" and "family" were viewed from a new perspective. Privacy of family life was regarded as almost sacrosanct, while at the same time the family life of the distinguished scientist or author became something highly fascinating.

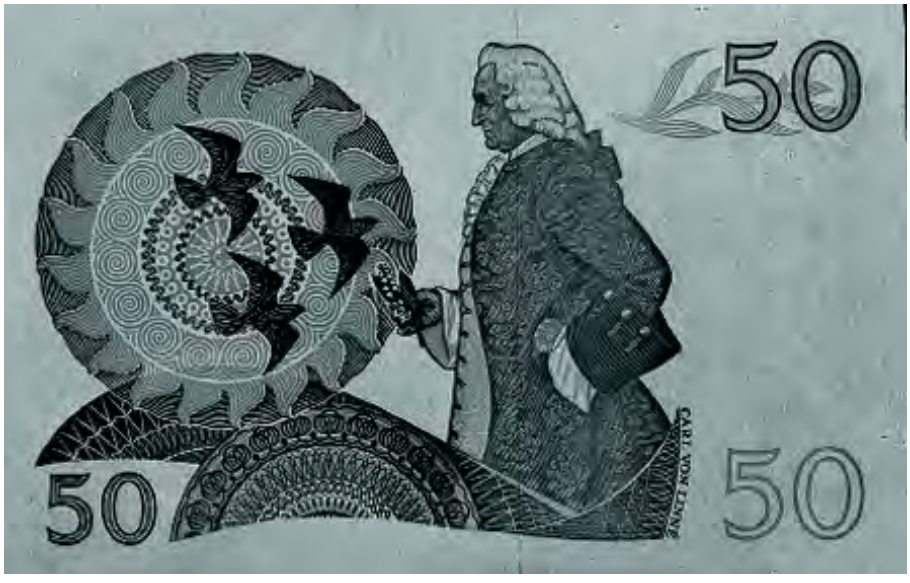

Figure 8. The back of the Swedish fifty crowns' bank-note with a picture of Linnaeus. In print from 1965 to 1990. © Sveriges Riksbank.

Figure 9. Æsculapius, Flora and Cupid wreathing the bust of Linnaeus. From *The Temple of Flora* (1799–1807), published by Robert John Thornton. © Uppsala University.

For some time, historians of science have studied the image, memory and celebration of famous scientists. Janet Browne, biographer of Darwin, claims that it should not be "discarded by historians merely as old-fashioned positivism, or as biographical whimsy, but rather instead could be regarded as a sociological phenomenon built into the heart of the scientific process – a phenomenon that is well worth our attention". [4]

Returning to May 1907, the town of Uppsala was adorned with flowers, plants and Swedish flags. Several members of the royal family attended the festivities. The University's ceremony took place in the University Auditorium. The following day a special Linnaeus conferment ceremony [*doktorspromotion*] was held in the Cathedral. The list of honorary doctors included German zoologist Ernst Haeckel, the English botanist Francis Darwin (son of Charles); the secretary of the Royal Society, Archibald Geikie; the secretary of the Linnean Society of London, Benjamin Daydon Jackson, and its former president, William Carruthers. However, the *doctores honoris causa* were mainly Swedish. The Swedish prince and artist Eugen was among those receiving

honorary doctorates, as was the author Selma Lagerlöf, the first female honorary doctor ever at Uppsala University.

When Ernst Haeckel, the "evolutionary biologist" and materialist, received his doctorate the audience applauded him, according to the newspapers – contrary to academic tradition, let alone regular behaviour in a church. Applause was repeated when prince Eugen and Selma Lagerlöf received their respective doctorates, in the latter case accompanied by a vigorous waving of handkerchiefs from the balcony, where the ladies sat.

The most important matter of the bicentenary seemed to be taking a stand pro or contra modern science, while promoting Linnaeus as a representative of either side of the issue. During the years around 1907 a flood of books and articles was published on the scientific status of the Linnaean perception of nature, as compared to modern botany, geology, zoology and medicine. The extreme opinions would be, on the one hand, that the Linnaean theories could not be considered exceptional, either in 1907 or during the 18th century. On the other hand, several authors claimed Linnaeus as the great predecessor in most fields, regardless of whether they had existed in his lifetime, such as evolutionary biology and bacteriology. [5]

After the World Wars, jubilant celebrations in the spirit of romantic nationalism were hardly ideal. This apparently did not stop the promotion of Linnaeus as a label for a new and modern Sweden. During the 1930s, 40s and 50s, Linnaeus was portrayed on chocolate bars, surrogate coffee, and stamps, and in 1965 he became the first non-royal person to appear on a bank-note. This happened to coincide with a time of inquiries about the Swedish constitution, which weakened the position of the monarch.

The Swedish Linnean Society, formed in 1917, celebrated its 50th anniversary in 1967. It was now stressed that Linnaeus had been subject to many different historical evaluations, and the exhibition was a determined attempt to turn away from both the stale patriotism and the romantic image of the floral prince to a supposedly realistic

Figure 10. Mr Flower Power, logotype of Linnaeus 2007 – the Swedish tercentenary celebration.

Figure 11. Wax sculpture of Linnaeus manufactured by Madame Tussaud's Ltd in 1966, picture taken in the Linnaeus Garden, Uppsala, in 1967. © Manuscripts and Music, Uppsala University Library.

view. Among other things, a wax sculpture in natural size had been manufactured by Madame Tussaud's Ltd.[6] In 1978 the bicentenary of Linnaeus' death was marked in Uppsala Cathedral by a commemorative service and a concert. The president of the Swedish Linnaeus Society (again) pointed out that Linnaeus was not an impeccable prince of flowers, but "in all his academic greatness", a human being with flaws and shortcomings.

The celebratory series of postage stamps did not focus on the person, but (rather characteristic for this period of society interest) on geographical images from the Linnaean journeys, although one portrait was among them. It claimed to depict Linnaeus in Lappish costume and a Dutch doctoral cap, although the headgear is neither doctoral nor Dutch, and not, as has been also claimed, a Lappish ladies' bonnet.

Conclusions

Since the late 18th century, the memory of Linnaeus has been evoked in support of political, scientific and cultural ideas. Shortly after Linnaeus' death, the crown expressed an interest in creating a Linnaeus memorial, by initiating the building of the Linneanum. Due to this, Uppsala University began using Linnaeus as a symbol of Sweden, the University, Science and the Future. When the time made it possible to mark the first centenary, private initiatives – mostly Sven Hedin's – strengthened such tendencies. The first memorial of Linnaeus included diverse goals and motives. Sven Hedin was lead by a genuine wish to make a tribute to his teacher and benefactor, while Adam Afzelius had career ambitions. Various projects directed attention towards Uppsala University, the landscape of Småland and the kingdom of Sweden. Later, students could celebrate Linnaeus in order to promote their own public position. By the turn of the century, nationalism and rural romanticism were jostling with the faith in scientific progress.

The 2007 tercentenary has not yet been made subject to historical research. It is important to continue the study of the images, interpretations and memorials of scientists like Linnaeus. He should not be made into a colonial racist, a green-wave ecologist, or a forerunner of DNA barcoding – out of respect for history, and for Linnaeus himself.

Footnotes

1. Carl Frängsmyr & Hanna Östholm, "En hoppets fest för vetenskaplig odling: Linné som festföremål, symbol och monument", *Låt inte råttor och mal förtära… Linnésamlingarna i Uppsala*, eds. Roland Moberg et al. with a summary in English (2007), pp. 4 ff., 15 f., 60 f. Johann Christoph Gottsched, *Gedächtnißrede auf den unsterblich verdienten Domherrn in Frauenberg Nicolaus Copernicus, als den Erfinder des wahren Weltbaues, welche in hoher Gegenwart zweyer Durchlaucht. Königl. Pohln. und Churfürstl. Sächsischer Prinzen auf der Universitätsbibliothek zu Leipzig ... und also zweyhundert Jahre nach seinem Tode gehalten* (1743).
2. Johann Christoph Gottsched, *Gedächtnißrede auf den unsterblich verdienten Domherrn in Frauenberg Nicolaus Copernicus, als den Erfinder des wahren Weltbaues, welche in hoher Gegenwart zweyer Durchlaucht. Königl. Pohln. und Churfürstl. Sächsischer Prinzen auf der Universitätsbibliothek zu Leipzig ... und also zweyhundert Jahre nach seinem Tode gehalten* (1743).
3. *Celebration at Flushing, Of the Birthday of Linnaeus, By the New York-Branch of the Linnaean Society at Paris, As Reported For the New York Stateman* (1824); Gotthelf Fischer von Waldheim, *Fête séculaire de Charles de Linné, célébrée par la Société Impériale des Naturalistes de Moscou le 24/12 Juin 1835* (1835); Samuel Farmer Jarvis, *An Address To the Citizens of Hartford, On the Birthday of Linnaeus: May 24th,1836 in Behalf of the Objects of the Natural History Society, Formed October 8th, 1835* (1836); K. F. P. von Martius, *Linné und der Zweifler: Ein Vortrag gehalten am Linnéus-Feste den 24. Mai 1838* (1839); K. F. P. von Martius, "Rede zum Linnäusfeste, in Ebenhausen bei München, gehalten 1842, 4. Juni", *Flora* 1842:25–26 (1842).
4. Janet Browne, *Science and Celebrity: Commemorating Charles Darwin*, The Hans Rausing Lecture 2004, Uppsala University, Salvia Småskrifter 5 (2005), p. 8.
5. *Carl von Linnés betydelse såsom naturforskare och läkare*, vols. 1–4, ed. Kungl. Vetenskapsakademien (1907); Wilhelm Junk, *Carl v. Linné und seine Bedeutung für die*

Bibliographie (1907); Hans Tedin, *Linné och jordbruket* (1907); K. A. Westling, *Linnés ställning till kristendomen: Några reflexioner med anledning av Linnés tvåhundraårsminne* (1907); Ernst Almquist, *Om Linné som hygieniker* (1908); L.A. Jägerskiöld, *Sveriges förste turist [Carl von Linné]* (1908); Edward Lee Greene, *Linnaeus as an Evolutionist* (1909); Ernst Almquist, *Linné und die Mikroorganismen* (1909); cf. Bengt Lidforss, "Carl von Linné: Föredrag på tvåhundraårsdagen av hans födelse", *Vetenskap och världsåskådning*, Samlade skrifter VII (2 ed.; Stockholm, 1917).

6. The quest to move away from the romantic and patriotic image of Linnaeus was shared by the Swedish historian of science Sten Lindroth, who wrote frequently on the theme in public press during the 50s and 60s, cf. *Dagens Nyheter* 4.12 1955.

The Origin of and the Philosophy behind Linnaeus' Sexual System

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Today Carolus Linnaeus is primarily remembered as a taxonomist. More specifically his memory is associated with the Latin binominal names that are still in use when we want to designate an organism – be it an animal or a plant. Also in his own eyes he was the great taxonomist and he proudly stated *Deus creavit, Linnaeus disposuit* – God created, Linnaeus ordered.

Linnaeus' career was unusually consequent. Already as a young school student in the little cathedral town of Växjö in southern Sweden, he seems to have made up his mind to catalogue every organism in the world – and first of all the plants. He had found his mission and he accomplished it. In Växjö Linnaeus had been lucky to meet with an understanding teacher – Johan Rothman. Rothman was a physician, and a capable botanist. Furthermore, he was very well informed about the latest ideas within botany and put the most recent botanical literature under his pupil's eyes.

Among these books was Valentini's *Historia Plantarum*, an introduction to the botanical taxonomy presented by Joseph Pitton de Tournefort. In the history of botanical classification Tournefort is well-known for his interest in the concept of *genus*. Tournefort brought together several similar species in a genus that he tried to define as exactly as possible. Linnaeus eagerly picked up Tournefort's idea and the genus concept remained central in his taxonomy throughout his life.

Rothman also showed Linnaeus Sebastian Vaillant's *Sermo de structura florum*. Vaillant was an early advocate of the idea that not only animals but even plants reproduced sexually. The botanically interested young man was immediately attracted by this theory and a few years later he used the sexual parts of the flowers – the stamens and the pistils – as the basis for his classification of the plants. All plants were grouped together in 24 classes, defined by the number and arrangement of the stamens. Within each class, the plants were sorted in different orders depending on the number of pistils. For instance the Iris, which has three stamens and one pistil belonged to the order *Monogynia* in the class *Triandria*.

This so-called "sexual system" proved itself very convenient. Not only could it be used to organise all those plants already known to the botanists and herbalists of the time but all new plants that were brought home to Europe from foreign continents could find their place in Linnaeus' system. In Linnaeus' time, when new organisms were constantly being discovered, this openness proved invaluable.

But let us have a closer look at Linnaeus' achievement. In the 18th century – just as today – taxonomy had two different objectives: first, it should offer a way of identifying, defining and naming the organisms. Second, the classification of the

organisms should reveal some kind of natural order. Precisely as the modern taxonomists do, Linnaeus tried to present a "natural system". Nowadays the taxonomists try to trace the course of evolution through millions of years and group the various organisms according to their descent and how they are related to each other. To Linnaeus a natural system was something quite different. As did most 18th century naturalists, Linnaeus believed in a divine creation. To him the most natural taxonomy was the one that best reflected God's ideas, when He created the world.

As long as it concerned the first of these objects – identifying and naming the organisms – Linnaeus was remarkably successful. He could feel content with himself – and so he certainly did. When it came to finding out "the order of Nature", however, he was less convinced that he had found the solution. Already in the first edition of *Systema Naturae* (1735) he complains about the fact that the "sexual system" was hardly a "natural system". In the future, he writes, he will endeavour to construct and publish a much better and more "natural" system.

Before I discuss Linnaeus searching for a natural system, I should like to comment a little upon his identification and naming of the organisms. Partly inspired by the famous Dutch physician Herman Boerhaave, Linnaeus was a dedicated advocate of Descartes' ideas. Like this 17th century philosopher he was convinced that naturalists should strive to use characters that could be measured, weighed or counted. From this point of view the number of stamens and pistils was perfect and Linnaeus used these characters to define his classes and orders. Similarly, the different genera within the classes and orders were defined by obvious and visible attributes.

Linnaeus' Cartesian conviction also meant that he avoided using invisible characteristics, *e.g.* the "virtues" – that is the medical properties or purported medical properties – of the plants when classifying them. By doing so he broke with an old tradition. For instance, John Gerard in his famous *Herbal*, first published in 1597, tended to group the plants according to their usefulness in the kitchen or as pharmaceuticals. When Linnaeus discarded this type of characteristic it was an important step towards modern biological classification.

I cannot avoid pointing out that Linnaeus' stubborn sticking to distinct, visible and preferably measurable attributes also had another and more radical consequence. As is well known, Linnaeus was the first biologist to include us, humans (*Homo sapiens*), in the order *Primates* under the class of Mammals (*Mammalia*). His grounds for taking this step were very simple. Ever since Aristotle, man had been considered the only animal that was endowed with reason – that is the capacity of rational thinking. Most pre-Linnaean naturalists had used this capacity as a taxonomic character and thus had sorted out humans as the only rational animal. This done, they could start to classify the "ordinary animals". Linnaeus simply noted that the rational mind was not visible; it could not be weighed or measured, and consequently it could not be used as a taxonomic character. And if he ignored reason, he could note that the anatomical similarities between monkeys, apes and humans were so important that they ought to be grouped together as primates. However, it is important to observe that Linnaeus did not deny that humans had a soul or a rational mind – nor did he imagine that man descended from the apes. He only adhered to his principles: invisible characters should not be used for classification.

Linnaeus' most important innovation was probably the use of binominal names. Generally Linnaeus presented elaborate arguments for his different innovations. However, he had little to say about the binominal names. Probably he simply found the long Latin phrase-names that had been used previously too inconvenient. Typically enough, the first place where he made use of the binominal names was in an index. In 1741 Linnaeus visited Öland and Gotland, the two limestone islands in the Baltic that have a very special flora, and some years later (1745) he reported his observations. In the index to this book he has listed his botanical findings. The plants are ordered in concordance with the sexual system and each species is presented under its generic name with a discriminating species epithet.

It appears as if Linnaeus gradually became more and more convinced that the binominal names were extremely convenient and eight years later he was ready to introduce them on the international arena. In his *Species Plantarum* (1753) Linnaeus used this convenient invention throughout the text and this work, consequently, forms the basis of all modern botanical nomenclature.

Apart from being short, the binominal names had another advantage. The old phrase names were supposed to describe each species so that it could be discriminated from all other species. However, when a new species – closely related to one previously described – was discovered, these phrase-names often had to be changed. The binominal names, however, could be kept constant. When a new species was discovered, just a new name had to be invented. Moreover, different authors had often used different phrases to describe the same species. In an early pamphlet Linnaeus had argued that the same phrase-names should be used by all authors. However, his colleagues had not always complied with this piece of good advice, and the nomenclature remained heterogeneous. Thus, it is hardly astonishing that Linnaeus' binominal names immediately became very popular.

As long as it concerned the first objective of taxonomy, namely to offer a method of identifying and naming the various organisms, Linnaeus' system was very successful. However, when it came to finding a natural system, he had less success. Already in the first edition of *Systema Naturae* (1735) he had pointed out that the sexual system was not a "natural system", and he had frequent opportunities to note that the classes he had constructed were often very heterogeneous. One example would be the class *Diandria*, where Linnaeus collected all plants with two stamens. This class contained one single species of grass, *Anthoxanthum odoratum* (Sweet Vernal-grass) whereas most other species of grass were to be found in the class *Triandria*, containing plants that have three stamens. To offer another example, the class *Octandria* was very heterogenous, containing plants that we now refer to families as different as *Onagraceae*, *Ericaceae* and *Polygonaceae*, and individual species like *Adoxa moschatellina* (moschatel) and *Paris quadrifolia* (Herb Paris).

Throughout his life Linnaeus tried to order plants and other organisms in a way that reflected the order of God's creation. There is, however, good evidence that he was not satisfied. Just let me give you one example: in the second edition of his *Flora Suecica* (1755) – Swedish flora – he presented the amphibious bistort *Polygonum amphibium*, nowadays often *Persicaria amphibia*, under the class *Octandria*, where it was grouped together with other species within the genus *Polygonum*. However, in

his description of the amphibious bistort *Polygonum amphibium*, he starts by telling us that this species has five stamens. How could he be so inconsistent that he placed a plant that has five stamens in the class *Octandria* – defined by having eight stamens? Ten years earlier, in the first edition of *Flora Suecica* (1745) *Polygonum amphibium* is properly placed in the class *Pentandria* – plants with five stamens. However, in the second edition Linnaeus has changed his mind and classified this plant in *Octandria*. The reason is probably that he has noted that the various species within his genus *Polygonum* have much in common and thus ought to be brought together. Consequently he was prepared to break with his own system and put *Polygonum amphibium* in the same class as the other species within this genus, which often have eight stamens.

One result of his efforts to find a "natural system" was *Philosophia Botanica* (1751), where he presented 63 "natural orders", which to some extent correspond to modern plant families. We also know that he lectured about what he called his "natural system". The German botanist P.D. Giseke spent the summer of 1771 at Hammarby where he took part in the private lectures given by the aging professor. More than twenty years later (1792) he related what Linnaeus had to say about the natural relationship between plants. Giseke's pamphlet contains a map that was inspired by Linnaeus' teachings. Here the "natural orders of plants" were represented by circles of different sizes – the larger the circle, the greater the number of plants within the "natural order" in question. Further, those circles that were placed close to one another contained plants that Linnaeus considered similar in one respect or another. Giseke has even indicated some names of plant genera that Linnaeus wanted to put at the borderline between some of his "natural plant orders". For instance, according to Giseke, Linnaeus had put ferns and palms close to one another because both had fronds. Where these two circles touched each other, but among the ferns, he had placed the two cycad genera *Cycas* and *Zamia*.

Linnaeus often expressed a rather static view of nature. For instance, in the introduction to the first edition of *Systema Naturae* (1735) one could read: "Since there are no new species; since like always produce like offspring" it is necessary that each species takes its origin in "some Almighty and All-knowing Being, namely *God* whose work is called *Creation*". In the same text he also wrote: "If we regard the work of God, it will be shown convincingly enough to everyone that each living being stems from an egg, and that every egg gives new life to an offspring that resembles the parents to the highest degree. Consequently, no new species will now originate". The young son of a priest from the province of Småland had no doubts. Nothing had ever changed since the Creation.

However, a few years later Linnaeus' view of nature was challenged. In the late summer of 1742 a student named Siöberg was botanising in Roslagen, east of Uppsala. There he found a plant that he did not recognise, so he brought it back to Uppsala where it came under the eyes of Linnaeus. Linnaeus became puzzled. In most respects the plant resembled a yellow toadflax (*Linaria vulgaris*), but the flowers did not look the way they usually did. A normal toadflax flower resembles a snapdragon, it is bilaterally symmetrical – zygomorphic as botanists say – with a big yellow dented lip and a spur protruding backwards. The new plant however had radially symmetrical

flowers; they could be described as a tube with five lobes spreading out at the top and five spurs protruding in different directions at the bottom. In *Flora Suecica* the yellow toadflax is placed within the class *Didynamia*, that is plants having four stamens where two are longer and two shorter. The new plant, however, had five stamens, all of the same length, and consequently should have been attributed to another class, *Pentandria*. It was, Linnaeus wrote, "like a cow having given birth to a calf with a wolf's head".

Linnaeus' conception of the world threatened to collapse. According to his own principles, he ought to establish a new species or even a new genus. But, he did not. Linnaeus was always reluctant to raise varieties to the level of species, and instead of presenting the peculiar yellow toadflax as a new, previously unknown species, it became the subject of a special investigation in the little pamphlet *De Peloria* (1744) – About Peloria. The name Linnaeus gave his find is telling: the term *Peloria* comes from the Greek word for monster. Today we know that the aberrant yellow toadflax was the result of a so-called mutation, an irregular variation of one gene. But Linnaeus knew nothing about genes and mutations. Instead he presented the hypothesis that the *Peloria* had arisen from the cross-fertilisation of the common toadflax with some other plant.

This radical idea contradicted much of what Linnaeus had taken for granted earlier in life. But the notion of new forms developing from old forms that cross-bred with each other was gradually assuming an ever more important place in his natural philosophy, and in a publication called *Plantae Hybridae* (1751) – Plant Hybrids – he presented an entire list of plants that he supposed could have originated in this way. He even went so far as to imagine that the Creator's work had ended when he had formed the genera, or perhaps even at the level of the orders. Later, the original forms that God had created had spontaneously blended with one another and given rise to the different genera and species.

Linnaeus even presented a detailed theory about the effects of cross-breeding. The plants, he thought with reference to the Italian 16th century botanist Andrea Cesalpino, consisted of bark and pith – these words must not be understood in the sense of modern plant anatomy. Linnaeus associated the pith with the female organ, the pistil and the bark with male stamens. When pollen from one plant fertilised the pistil of another, "pith" and "bark" were thus combined in a new way.

Towards the end of Linnaeus' life, his perception of nature was less static than it had been earlier. Certainly he still held to his belief in God the Creator, but he had abandoned the idea that every species had been conceived at the moment of creation and that no changes had occurred thereafter. While in the earlier editions of *Systema Naturae* he determined that there were as many species as God had originally created, he cancelled this statement in the later editions of the same book. Perhaps God did not even have a finger in the new hybrid species being created. In some of his late publications Linnaeus talked about "nature" or even "chance" having taken over.

Of course the theories of this Swedish 18th century botanist do not stand up to modern inspection, but still the ability to make such a radical revision of the very basic assumptions of his taxonomy testifies to the greatness of Linnaeus as a researcher. Perhaps it is also worth pointing out that modern botanists are also of the opinion that new plant species can rather often arise from two species cross-fertilising each other.

The dream of finding the divinely given order of plants runs like a red thread through all of Linnaeus' achievements. Some of his most prominent theoretical contributions were made when he tried to understand how God had arranged his Creation. Nowadays it is common to put science and faith in opposition to one another, and there is no denying that the advocates of science have had to battle intolerant religious authorities. Remarkably enough, the debate that followed in the wake of Darwin's evolutionary theories is still going on. But in the case of Linnaeus the conflict between faith and science was not as clear-cut, and when he sought "the natural system" he was driven by a combination of scientific curiosity and religious fervor to understand God's creation. Consequently, Linnaeus was not torn between religious piety and scientific knowledge. On the contrary, to him science was a way of paying homage to the Creator.

Linnaeus' Sexual System and Flowering Plant Phylogeny

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This year we celebrate the tercentenary of the birth of Carl Linnaeus. He brought order to the knowledge of plants and animals by arranging all known species in encyclopaedic works. He established a nomenclatural system for plants and animals still in use. He proposed a system of plants, the sexual system, based on the number and arrangement of male and female organs in the flowers. With the anniversary, the life and work of Linnaeus has come into focus. There is a great interest in information as to what extent his classification of plants actually corresponds to what we know today about plant relationships. His sexual system has long ago been replaced by "natural" or phylogenetic systems of flowering plants. There has never been a comprehensive comparison of the sexual system with modern plant classification. Here, I have made such a comparison between the sexual system in Linnaeus' principal work *Species Plantarum* (Linnaeus 1753) and the currently used APG-system of flowering plants (APG 2003) (Fig. 1).

Linnaeus' sexual system is an artificial system in the sense that it is constructed by first choosing a number of key characters and then sorting the species according to these key characters. In this case, the key characters comprise the number and arrangement of stamens and pistils in the flowers. Linnaeus observed that these characters are stable and very rarely subject to variation within the species. He was

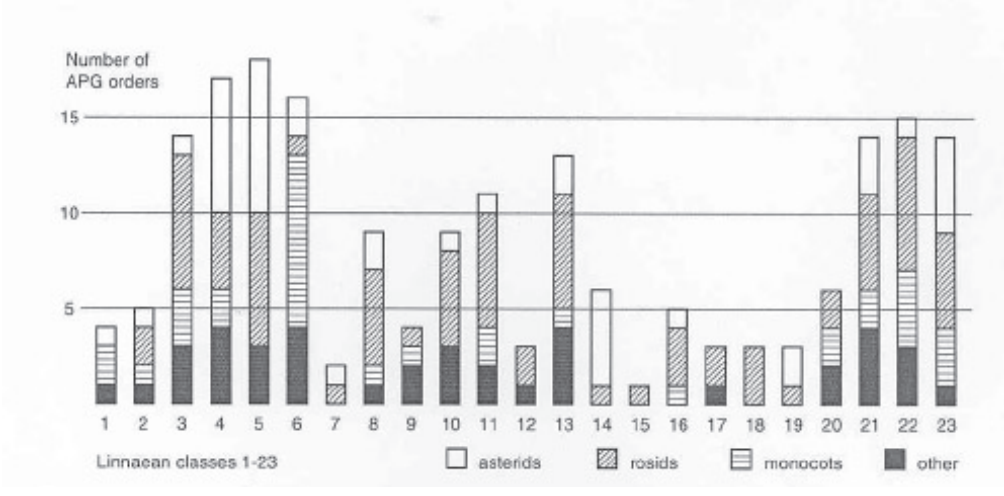

Figure 1. The number of APG-orders in current classification (y-axis) represented in each of the 23 flowering plant classes of Linnaeus.

well aware that his system was in some sense artificial. He also presented fragments of a natural system, where plants also similar in many other characters were classified together, but he never completed it and instead returned to his sexual system.

The sexual system comprises 24 classes, 23 of which contain the flowering plants (Table 1), with stamens and pistils. Most of the classes are defined by the number (1–12 or many) and arrangement of the stamens (1–12 or many, evenly arranged or in groups, equally or unequally long, free or fused). Some classes are also defined by the arrangement of the stamens in relation to the pistils (free or fused with the pistils, in different flowers, on different plants). Some of these stamen and pistil arrangements are very rare, e.g. seven stamens (class Heptandria), and thus comprise very few species, others are common, e.g. five stamens (class Pentandria) which characterise thousands of species.

The currently most used classification of flowering plants is the APG-system, an ordinal classification for the families of flowering plants, proposed by an international group of plant systematists known as the Angiosperm Phylogeny Group (APG 2003). The APG-system is based on comprehensive phylogenies of flowering plants, reconstructed by analysis of extensive DNA sequence data. Due to the increasing amount of sequence data, flowering plant phylogeny is today known in considerable detail and with great certainty. We thus know how flowering plants evolved and how they are related to each other, the basis for what may be called a natural classification.

Table 1. Linnaeus' sexual system, classes 1–23.

1	Monandria
2	Diandria
3	Triandria
4	Tetrandria
5	Pentandria
6	Hexandria
7	Heptandria
8	Octandria
9	Enneandria
10	Decandria
11	Dodecandria
12	Icosandria
13	Polyandria
14	Didymania
15	Tetradynamia
16	Monadelphia
17	Diadelphia
18	Polyadelphia
19	Syngenesia
20	Gynandria
21	Monoecia
22	Dioecia
23	Polygamia

About 250,000 species of flowering plants have been described. In the APG-system they are classified in 453 families and these families are classified in 45 orders. Most of the species and many of the families, including those of six of the 45 orders, were not known at the time of Linnaeus. Families and orders in the APG-system are arranged in ten larger informal groups representing major branches in the flowering plant phylogenetic tree. Three such groups are the monocots (e.g. lilies, orchids, grasses, palms), the rosids (e.g. roses, legumes, birches, maples, and numerous other herbaceous and woody plants), and the asterids (e.g. asters, sunflowers, bluebells, primroses, and numerous other mostly herbaceous plants). Each of these three groups comprises between one third and one quarter of all flowering plants. Magnolias and water lilies are examples of plants that do not belong to any of these three groups.

In the mid-18th century, when Linnaeus published *Species Plantarum* (Linnaeus 1753) with a complete list of all known species of flowering plants, about 7,000 species were known. Linnaeus classified all these species into over 1,000 genera and 23 classes (e.g. sunflower in the genus *Helianthus* in the class Syngenesia). I have

examined all these genera and classified them according to order and major group (monocots, rosids, asterids) in the APG-system (2003) (e.g. sunflower in the order Asterales in the asterids).

Figure 1 displays the numbers of APG-orders represented within the classes of the sexual system. Furthermore, for each class it is shown how many of these orders belong to the monocots, the rosids, and the asterids. The latter three groups represent major branches of the flowering plant phylogenetic tree and hence groups of entirely unrelated plants (except in the sense that they are all flowering plants). All classes except one, number 15 Tetradynamia, comprise groups of unrelated plants. Not surprisingly, the sexual system does not display what we know today about plant interrelationships. The class Tetradynamia is characterised by two short and four long stamens and it comprises what we know today as the family Brassicaceae with cabbage, cauliflower, broccoli, mustard, etc. Class 18 Polyadelphia is characterised by stamens arranged in groups and it comprises only rosids, however several families are not closely related to each other.

As is evident from this analysis there is little correspondence between the sexual system and the APG-system. This does not mean that the sexual system has been useless or misleading. As an artificial system, it was well chosen and at the time when it was introduced by Linnaeus, it formed the basis for much intensified research and increased knowledge of plants.

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Science or poetry? Vernacular plant names and binary nomenclature in Sweden around 1900

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Around the turn of the 20th century, a battle raged through the nation about the jurisdiction over Swedish plant names. University botanists, pedagogues, linguists, agricultural scientists and seed inspectors published their views in heated articles on the necessity – or uselessness – of vernacular names in general, the appropriateness of specific names, and above all, who should have the privilege of determining these names, and for what purposes.

This paper examines how questions such as these were used to stake out scientific and pedagogic territories in Sweden a century ago and how nomenclature became a means of discussing the role of botany, and science in general, in education, agriculture, and among the general public. Although this brief episode from the history of plant nomenclature primarily concerns vernacular names, it nevertheless concerns aspects that are central to most kinds of terminological considerations: authority and communication.

Linnaeus, Fries, and early attempts to collect and standardise plant names

Linnaeus' influence on the ideas and practices of developing a national standard for vernacular nomenclature was profound, and in several ways it mirrors the importance of Linnaean binary nomenclature for the standardisation of communication in biology. Many historians of science have pointed out that the participants of "the Botanic Republic" in the 18th century – to use Linnaeus' own term – and the users of the scientific information produced, were a much more extensive group of people than the small number of academic botanists in 18th century Europe (Koerner 1995, Stafleu 1971). The Linnaean system was designed to be accessible to people with only a rudimentary knowledge of plants and science. Armed only with a copy of one of Linnaeus' own handbooks (originally written in simple Latin but inviting local editions and translations into the vernacular), anyone should be able to identify any plant in the system. By establishing a channel of communication between establishment botanists and clergymen, farmers, even women, Linnaeus wanted to disseminate his own findings. At the same time, and in line with the mercantilist politics of the period, the knowledge of the common people could be made accessible to the Swedish state by clothing it in scientific terms.

In his eagerness to harvest the wisdom of the people, Linnaeus also took a keen interest in vernacular names of plants and animals. He constructed new Swedish names for economically important groups of plants such as grasses – most plants, of course, lacked species-names in the modern sense. But he also tried to document ideas about plant uses and characteristics hidden in the rich variety of regional names. Thus, for

Linnaeus and his contemporaries, vernacular nomenclature as well as the Latin system filled important functions in the communication of botanical and economic information between different groups.

The triumphal progress of binary nomenclature through the scientific world also had an impact on vernacular nomenclature. In 1792, Samuel Liljeblad published a flora where many genera had been given Swedish names in direct accordance with their Latin designations: for instance, yew was called "Tax" after the Latin *Taxus*, and *Solanum tuberosum* was given the semi-Swedish designation "Potates-Solan" (Liljeblad 1792). Many botanists resisted these attempts to bring vernacular names in line with the Latin ones (Nathorst 1903–4, Lyttkens 1904–15). Elias Fries, professor of botany in Uppsala 1834–1859 and a participant in the Romantic movement, considered plant names to be expressions of the "innate appreciation of nature" of the Swedish people, and was reluctant to force the diversity of the vernacular into the straitjacket of systematics (Fries 1852a, 1852b). However, he also regretted the confusion created by the variety of regional names, and worked on a critical dictionary of plant names where the folk names were to be brought to a gentle consensus (Fries 1880).

Educational reforms and horticulture

Traditionally, the role of science in Swedish curricula was insignificant but, towards the end of the 19th century, science gained space both in the elementary schools and in the higher education system. Compulsory Latin was abolished in the universities, leading to a stronger focus on science in secondary schools; and in the elementary schools science was considered an excellent subject in which to practice the teachings of the current pedagogical fashion, object lessons. The new teaching colleges and the private girls' schools were hothouses of pedagogical reform, and the growing flora of semi-vocational secondary schools of agriculture and forestry were central to the expanding, and diversifying, educational system (Beckman 1999, Florin & Johansson 1993, Sörensen 1942).

Although science education took many forms in these different contexts, botany was central to them all. It was the only science subject that elementary school children were certain to encounter, and floristic studies remained at the heart of botanical education. Learning species was compulsory in elementary schools, and the secondary school boys were expected to compile substantial herbaria. Plant collecting united the old system of learning-by-rote and the new ideals of excursions and learning through direct contact with the objects of study (Jonsell & Hultgård 1999).

With the development of national curricula, educators argued for the necessity of national textbooks and floras, instead of the local floras used in the secondary schools. As the Latin bias of higher education weakened and the educational system itself was branching out in new directions, voices were raised for the compilation of a national guide to Swedish plants using *Swedish* names. They argued that botany was a central element of civic education and should be available to all, regardless of their knowledge of Latin (Arnell 1904, Fries 1852b, Johansson 1901, Neuman 1903, Wintzell 1903).

Alongside textbooks and fieldguides, horticulture was an important arena for the collection and dissemination of plant names. Vernacular as well as scientific nomenclature was distributed through journals, manuals and seed catalogues; for instance, the

horticultural literature was one of the most important fora for the dissemination of Linnaean nomenclature in 18th century England (Stafleu 1971). Market gardens advertised the latest plants and varieties under a variety of designations, and Swedish botanists and linguists were particularly concerned over the import of German names through the lively exchange with German breeders. As Elias Fries put it: "In the old days, the German Kräuterbucher were the worst enemies of our native plant names; today, many prefer the gaudy denominations of the seed catalogues of German Gärtner over our old, decent, Swedish names" (Fries 1880).

"Normalförteckningen" – The Standard List

With the academisation of agriculture during the 19th century, the fields of agriculture, horticulture and education were brought into even closer correlation. In 1894, the National Board of Agriculture published the spark that was to set fire to the botanical world: a Standard List of Swedish plant names, to be used in agricultural education and seed testing. The purpose was twofold: to provide nomenclatural uniformity in the Latin-free schools of agriculture and forestry as well as in state elementary schools, and to facilitate communication between farmers and agricultural officials (Normalförteckning öfver svenska växtnamn 1894).

The principle behind the Standard List was described by its creators as "popularly scientific", in contrast to both "purely scientific" nomenclature and "naive folk names". In the popular imagination objects lacking natural relations were grouped together, and thus naive folk names – though beautiful and evocative – could serve little pedagogical purpose. Purely scientific nomenclature, on the other hand, depended on minute differences between species, difficult to distinguish for the common people and subject to constant re-evaluation from the scientists. More importantly, Latin names lacked any connection to "popular sentiment" (Fries 1852b).

But "popularly scientific" nomenclature would unite the advantages of these two systems. It would be popular in the sense of using the appeal of the vernacular, and glossing over esoteric classificatory distinctions. But it would also be scientific, because it would apply scientific principles to vernacular names: it would use the system of binary nomenclature.

Every vernacular name should consist of two parts, a stem and a prefix, with the stem signifying the genus and the prefix the species. Thus, the names of sunflowers and Jerusalem artichokes (in Swedish "jordärtskockor") should reflect the fact that they belonged to the same genus *Helianthus*, and accordingly sunflowers – whose Swedish name "solrosor", "sunroses", might delude the ignorant into supposing them to be related to actual roses – should be known as "sunchokes" ("solskockor") (Laurell 1904a).

Whose authority?

The Standard List caused pandemonium in the botanical world. "Who" – in the words of one combatant – "has the right to create new plant names?" (Lyttkens 1904–15) On the face of it, anyone who demonstrated "that good taste, that fresh simplicity and clear appreciation of nature which are evident in all those who live in close proximity with nature" (Lindman 1903). But in actual fact, the Standard List was interpreted as a blatant attempt to encroach on the authority of the metropolitan botanical establishment.

Reactions to the List reflect academic politics of the time. University botanists in general, and members of the Academy of Sciences in particular, were surely the only ones competent to judge the propriety of plant names, and wanted to disqualify all agricultural scientists from discussing nomenclature (Nathorst 1903–4, Nathorst 1905).

The debate reflects the diversification of botanical research at the turn of the 20th century. The academic agricultural establishment was developing an independent institutional structure, increasingly separate from the old universities and academies alike (Mårald 2000). With educational institutions, research stations and an academy of their own, agricultural scientists were confident that they could establish autonomous scientific standards, as well. The "popularly scientific" nomenclature of the Standard List expressed a view of the uses and requirements of botany and of botany education that was related to, but not dependent on, the Academy of Sciences and the state secondary schools. The Academy of Sciences did not have the monopoly of scientific knowledge, as one of the creators of the list explained to a critic who had questioned the genus concept of the Standard List:

> What is a genus? Well, if Professor N. himself could answer this deceptively simple question, he would undoubtedly do a great service to science: because no one has yet managed to provide an objective and universal basis for the division into genera. The current confusion in this issue is proof of that. In fact, therefore the 'popularly scientific' systematics should be as scientifically justified as the "purely scientific"! (Laurell 1904b)

Communication and continuity

The heat of the debate notwithstanding, the academic botanists might still have shrugged off this challenge to their authority – after all, most people who mattered never used vernacular names at all. But soon after the publication of the Standard List, its names began to find their way into textbooks intended for ordinary elementary and secondary schools. This implied that the ways of communicating botanical information were changing, not only in agricultural contexts but in the whole of the botanical world, from rural children making their first acquaintance with science in school to students preparing for university entrance. This triggered a new surge of opposition to the Standard List from establishment botanists. They painted a very bleak picture of the consequences of the new names, not only in the schools but for the Swedish people.

From a scientific perspective, the new names generated a flawed understanding of the relationships between natural objects, as the popular genera were not quite the same as the purely scientific ones. Simultaneously they suffered from one of the most serious problems of scientific nomenclature in that any changes in taxonomy would either disrupt the careful correspondence between Latin and Swedish nomenclature, or subject the latter to the same instability as the former. Moreover, the new, unnatural names would destroy the deep connection between country people and nature mediated through those vernacular plant names which – in the words of one German commentator

> had been used for centuries and were profoundly tied to the thoughts and feelings of the people (Meigen 1898).

Thus, a form of "poetry of the people" would be lost – and with it, an important source of botanical information (Fries 1843, Fries 1852b).

The importance of nomenclature for communication in science was a central – and controversial – issue among botanists at the turn of the 20th century, when alternative standards were being proposed in different national and scientific contexts (Nicolson 1991). But outside academic circles, names were equally, if not more, important: among those users and producers of botanical knowledge whom we might call amateurs (Alberti 2001, Keeney 1992, Kohlstedt 1976). If the ability to correctly name plants was necessary for communication between academic botanists, it often embodied the total knowledge of amateurs. Historian of science Anne Secord has vividly described the meetings of artisan botanists in Lancashire in the mid-19th century, where the highlight was the collective naming of the weekly harvest of plants (Secord 1994). Knowledge of the names of plants was the link between artisan botanists and those academic botanists who – through them – gained access to rare specimens, habitats and localities and other kinds of botanical information in exchange for recognition. Names were the currency in this scientific economy. As one of the harshest critics of the Standard List wrote:

> Swedish plant names have a justified claim of belonging to the nation, the people, the public, and not just a small clique of botanists, not to mention of elementary botany teachers (Lindman 1904).

And though many amateur botanists had no Latin, their knowledge of plants was transmitted to the academic world through their scientifically literate colleagues. A new system of nomenclature, such as the Standard List, could upset the delicate balance between different users and producers of botanical knowledge. The apparent – but false! – scientific standard of the List might make people abandon any ambition to learn Latin, and the lack of stability of the system might endanger communication even more. Loss of poetry entailed loss of feeling, of interest, and thus, of future information.

The active role of amateurs in the question of Swedish botanical nomenclature should not be over-emphasised. In Sweden, the debate over the Standard List was dominated by academic botanists, agricultural scientists, and educators. But although amateurs had no independent voice, their function as recipients, users, and potential producers of botanical knowledge was central to the discussion, which was an extension to wider contexts of the anxiety among scientists concerning stability and communication across national and professional boundaries. And as we have seen, metropolitan botanists and agricultural scientists expressed different ideas about how these boundaries should be negotiated (Gieryn 1999).

The passionate concern for ancient Swedish plant names reflects scientific and institutional changes in the years around 1900. With the differentiation of botanical research and the expansion of the systems of education, the relations between what we might call citizens and guest workers in the republic of science were changing. Nomenclatural reform – already proving both troublesome and necessary among professional botanists – had ambiguous implications for these relations (McOuat 2001). On the one hand, standardised vernacular nomenclature could facilitate communication with, and between, school children and students from different school systems and different parts of the country. Even some of the opponents of the Standard List admitted that a national standard of nomenclature could be useful in some contexts. On the other hand, the Standard List posed a threat to time-honoured channels of information.

If Latin was displaced in lower education, the number of people who could communicate directly with academic botanists declined. And if the people were deprived of their local names – those names which, in the national romantic spirit of the times, were understood to forge strong emotional links between Swedish souls and Swedish nature – they might lose their interest in botany. Thus, the academic world would be deprived of regeneration, of an enthusiastic audience, and of that knowledge which might lie hidden in the depths of the popular imagination and which botanists ever since Linnaeus had attempted to collect. Vernacular as well as Latin names could work as currency across boundaries, but if these names were re-negotiated quickly and one-sidedly, they might lose their meaning and capacity to travel through different contexts (Star & Griesemer 1989).

Conclusion

I have described the struggle over the plant names as the efforts of different groups to gain authority through control of botany education, where plant names served as a medium for scientific ideas. Crucial to the issue is the diversity of interests manifested in the debate: the commercial concerns of horticulturalists, the romantic purism of linguists and botanists, the pedagogical anxiety expressed by representatives of different branches of botanical research. But behind these conflicts lay the recognition that scientific work is not an isolated activity. It was dependent on that same public from whose ranks academic botany would be replenished; whose various interests in plants supported teachers, writers, and breeders; and whose knowledge of the living environment might provide nuggets of interest to the academic botanists. And in this delicate system of exchange, plant names were important mediators. This was expressed very clearly in 1904 by one of the participants in the name wars:

> The confusion concerning the Swedish plant names which has hitherto prevailed, has constituted an abyss between the botanists and the Swedish public, which has made practically impossible any sympathetic, informed, collaboration between them; circumstances which have been highly detrimental to *both* parties (Arnell 1904).

Thirty years later, the Standard List was reprinted, again under the aegis of the National Board of Agriculture. A number of its suggestions – even names which were almost universally condemned in 1894 – are now regarded as the established and correct names of plants. The most important effect of the Standard List was thus that it established the idea that standardised vernacular names were necessary. In the late 20th century a new national checklist was launched, this time sanctioned by the Swedish Botanical Society (Karlsson 1982, 1997). Again, its purpose is to facilitate communication between people who lack specialised knowledge of either botany or Latin, and it argues for the value of the stability and the poetry of Swedish plant names, though at the cost of the diversity of regional names and with a slight partiality for binary names (Karlsson 1983, Fries 1994). In this respect, if not in others, its affiliation with the Standard List shines through. And today, there are other similar projects under way: in order to stimulate public interest in the study of insects, entomologists are compiling a list of Swedish names for all species of scarab beetle found in this country – most of which, of course, have never had vernacular names (Forshage 2000). The appeal of the perceived popularity, poetry, and stability of vernacular names evidently reaches far beyond century-old plant name wars.

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Apollos of Systematic Botany

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Introduction: Linnaeus as Apollo

Hortus Cliffortianus (Linnaeus, 1738) is doubtless the most beautifully executed publication by Linnaeus, written during his formative visit to the Netherlands from 1735–1738 and illustrated by the great artists Ehret and Wandelaar. Its frontispiece is full of symbolism and shows Apollo, the god of archery, medicine, prophecy, poetry, and music, removing the clouds of darkness and ignorance from above the earth goddess Cybele, while treading on the dragon of falsehood. The goddess is offered plants from all corners of the earth, while Clifford's banana tree (*Musa cliffortiana*), brought into fruit by Linnaeus and Clifford's gardener, hovers in the background. Inspired by a serious analysis by Callmer & Gertz (1954), both Wilfred Blunt and William L. Stearn believed that the Apollo, handsomely potrayed by the Dutch painter and engraver Jan Wandelaar, is none other than the young Carolus Linnaeus himself. Comparisons of most portraits of Linnaeus show little resemblance to the engraving, however, but do show very little, or even less, resemblance among themselves – making it understandable why Linnaeus himself was not very pleased with the likeness of most of his portraits (Blunt, 1971). There is, however, a remarkable facial resemblance with the mezzotint of Linnaeus in Lapland costume, made after the famous painting by M. Hoffmann, who also illustrated the *Musa Cliffortiana* coffee table book by Linnaeus (1736, 2007) in the same year that he was cataloguing Clifford's immense botanical collections and

Figure 1. Linnaeus as Apollo. Left: Linnaeus in Lapland costume. Mezzotint after the portrait by M. Hoffmann (detail); Right: Apollo in the frontispiece of *Hortus Cliffortianus.*

library. Especially the nose, eyes, lips, and somewhat androgynous impression of the face, are similar (Fig. 1). Whether this is a real indication that the young Linnaeus actually "stood" for Wandelaar to have him portrayed in this heroic fashion will remain a speculative and rather romantic hypothesis, but for the sake of this paper, let us assume he did. Linnaeus was after all not averse to some hyperbole when it comes to his own importance, and he certainly earns the title "*Apollo of Systematic Botany*" for all his contributions to the classification, understanding, and naming of the world of plants.

Linnaeus' sojourn in the Netherlands from 1735 to 1738 launched his scientific career and apollonian status. As documented in great detail by an often overlooked thesis by Boerman (1953), Linnaeus just followed a general pattern when he travelled from Sweden to the Netherlands to further his academic career. Most Swedes before him with any academic ambitions in medicine had done so, including his own mentor, Rudbeck the younger, because Sweden simply lacked a decent medical faculty well into the 18th century, whereas Leiden University, with the world famous Herman Boerhaave (1668–1738) and other eminent earlier and contemporary scientists in its service, was a Mecca in this respect. Comparatively easy, and above all very affordable Doctor's titles could, moreover, be had at the university of Harderwijk – Boerhaave and Rudbeck also had them.

For Linnaeus, the naturalist, the Low Countries had many additional attractions – especially the world class collections of exotic plants and other naturalia – brought together as a by-product of the successful spice trade of the Dutch East India Company (VOC). From 1602 onwards their apothecaries and surgeons had been instructed to "bring along branchlets with their leaves, laid between paper…" (i.e. herbarium specimens) of anything that could be of interest not only for the spice trade but for any other use in medicine, horticulture, etc., thanks to an instruction drafted by none other than that early Apollo of Systematic Botany, Carolus Clusius (1526–1609) – the great European traveller and scientist who had crowned his career with the first directorship (*hortus praefectus*) of the Leiden Botanical Garden from 1593–1598 (Baas, 2002). Private and university gardens, orangeries, and hothouses in Holland were overflowing with exotic plants never before seen at such high latitudes. Great servants of the VOC, although self-professed amateurs of botany, such as H.A. van Reede tot Drakestein and G.E. Rumphius had been instrumental in writing the first ever large scale tropical floras, especially documenting the medicinal potential of the plants of the Malabar Coast of India and the Moluccas, respectively. Although the manuscript for Rumphius' *Herbarium Amboinensis* was still unpublished during Linnaeus' visit, he would soon learn about it, because his Amsterdam host, Johannes Burman, was in the process of meticulously editing it for posthumous publication. Herbarium collections had also accrued, most notably the large collections from Ceylon, by Paul Hermann. Leonard Rauwolf's herbarium, perhaps the most famous of the 16th century was collected in Asia Minor, the Middle East and southern Europe and had been acquired by Leiden University. It provided the materials for a *Flora Orientalis* by Johan Gronovius, Linnaeus' first real sponsor. Holland was, moreover, an international centre for publication, with numerous excellent printers and publishers with well-oiled distribution systems for marketing their products. For Linnaeus this was of great importance

because in his luggage he carried a number of manuscripts in various stages of completion. These could see the light in the Low Countries and spread his fame accordingly.

In summary, our young Apollo could look forward to extending his network of learned collagues (an ambition clearly articulated in his notorious interview with the *Hamburger Anzeiger*, given en route from Sweden to the Netherlands), find plenty of living and preserved biological collections to study, and publishers galore who might be persuaded to print his work. In addition to the compulsory publication of his Doctoral thesis, on malaria in the marshy Uppsala region, less than two weeks after his arrival in Harderwijk, Linnaeus would publish no less than 10 significant works during his three-year stay in Holland.

He was very lucky to find two enthusiastic supporters in Leiden only a few weeks after his arrival: Johan Gronovius and the Scotsman Isaac Lawson were so impressed by his tabular, 14 pp., representation of the order in nature, in his *Systema Naturae*, that they arranged for its immediate publication by the well-known printer Theodoor Haak. *Systema Naturae*, including the sexual system for the classification of plants, would impress the entire scientific establishment and develop during Linnaeus' lifetime through 12 editions into a true compendium of the living and mineral world covering over 2,300 pages. In the following years Linnaeus' output in the Netherlands was also quite impressive. In 1736 *Bibliotheca Botanica*, *Fundamenta Botanica*, and *Musa Cliffortiana* were published; in 1737 *Critica Botanica*, *Flora Lapponica*, and *Genera Plantarum* followed, while in 1738, during his last half year in Holland *Hortus Cliffortianus*, and *Classes Plantarum* saw the light of day. In between all this, Linnaeus completed a systematic treatment of the Fishes started by his late friend Peter Artedi. Many of these books were not only innovative and full of accurate observation, they also foreshadowed all the important works with which Linnaeus was to enrich biological science during the rest of his life: *Systema Naturae* remained the "Ariadne's thread" of all his endeavours, with 12 later editions, as mentioned above; *Bibliotheca Botanica, Critica Botanica*, and *Fundamenta Botanica* would be synthesised and augmented in his immensely influential *Philosophia Botanica* of 1751 and *Genera Plantarum* would go through six editions. When Linnaeus returned to Sweden, Holland had offered all that he could have hoped from it: sponsorship, scientific reputation, and a bookshelf full of his own publications – but then our Apollo had also given his host country and the whole scientific world a great deal in return.

Apollos of Flora writing

Linnaeus himself rightfully attached great value to Floras. He wrote no less than three floras: *Flora Lapponica* (1727), *Flora Suedica* (1745) and *Flora Zeylanica* (1747), and it can be argued that his *Species Plantarum* (1753) was a first comprehensive Flora of the World, although this starting point of botanical nomenclature certainly did not fulfill *all* the criteria that Linnaeus himself included in his definition of the products of flora writers. In aphorism 16 of *Philosophia Botanica* (Linnaeus 1751) Linnaeus has it that "the compilers of Floras list the vegetables that grow naturally in any particular place – systematic, with location, soil quality, time and vernacular names".

The subsequent history of flora writing is tremendously rich (cf. Frodin 2001), and owes much to regional and national Apollos of Botany. Here I will just dwell on some selected Apollos of *Malesian* Botany. As in other tropical regions, the first incentives for botanical stock taking in the Linnaean sense came from the colonial powers, in this case Great Britain and The Netherlands. Van Steenis (1979) has documented the stumbling and often ill-fated beginnings of botanical exploration in the Malesia (the botanical province including the nation states of Indonesia, Malaysia, the Philippines, Brunei, Singapore, Papua New Guinea, and East Timor): late 18th and early 19th century attempts to even start on floras of Java and Peninsular Malaysia were seriously delayed. Linnaeus' own unfaithful disciple, Solander, never published his observations on 338 species from Java made in 1770 – his manuscript is still shelved in the British Museum; Thomas Horsfield's account of Javanese plants had to wait for about 40 years until it was finally published decades later by Bennet & Brown (1838–1852). C.L. Blume (1796–1862), a great botanist of Apollonian ambition started on a beautiful *Flora Javae* project, as well as the serial publication *Rumphia* to contain monographic studies of the Flora and Vegetation of the Dutch Indies, but did not come even close to completion of a Flora of Java.

C.G.G.J. (Kees) van Steenis (1901–1986) certainly had the apollonian vision, drive, and perseverence when he founded the immense *Flora Malesiana* Project in the forties of the last century. This was the first scientific inventory of all flowering plants and ferns of a biogeographically delimited region, based on a critical taxonomy (requiring semi-monographic studies of all genera and families), with information on ecology, uses, anatomy, chemistry and vernacular names added. Van Steenis was not only a very hard working botanist, he was also a talented organiser and for the task of writing *Flora Malesiana*, at the time estimated to contain 25,000 species of higher plants, he had engaged the support of a small team of full time collaborators (later incorporated into the Rijksherbarium staff in Leiden) and a network of numerous volunteer specialists from all over the world. The original work plan reckoned that 25 years would be enough to complete the task. It must have been a great disappointment for him that, towards the end of his life, about 40 years into the project, only about 10% of the flora had been published and that there was a slowing down in contributions from his own staff and international network of volunteers. Later attempts by his successors at Leiden and in the region itself, through the *Flora Malesiana* Foundation, to revitalise this megaproject have only partly been successful, and in its current format there is no prospect of finishing the entire flora, now estimated to include 40,000 species of flowering plants and ferns, within the next 100 years. In my opinion this does not mean that Van Steenis does not deserve to be ranked as a great Apollo of Systematic Botany. His personal contributions on the biogeography, vegetation science and ecology of the Malesian lowland and mountain floras alone earn him this title, but it illustrates a very general problem that most flora projects covering over 15,000 species seem to have been facing in the tropics. Flora projects covering more species are simply too large for single individuals, or even for institutions or consortia, to oversee, and too long-lasting to maintain momentum and funding. *Flora Malesiana* (like *Flora Neoptropica* and the various supranational Floras of Tropical Africa) moreover faces the problem that it covers several nation states, which always complicates funding and long-term

cooperation. Therefore, the scientifically founded ideal of writing large supranational, critical (!) floras seems to remain utopian for the time being. For the Malesian region there are two encouraging and inspiring alternatives, involving one historical and one modern Apollo of Systematic Botany and their teams of contributing taxonomists. In

Figure 2. Apollos of Malesian Botany. Top left: C.L. Blume; Bottom left: C.G.G.J. (Kees) van Steenis and his wife Rietje van Steenis-Kruseman; Top right: J.D. Hooker; Bottom right: E. Soepadmo.

the 19th century, Peninsular Malaysia belonged to British India, and Joseph D. Hooker´s *Flora of British India*, covering about 14,000 species, was published by the then Director of Kew and his staff in precisely 25 years from 1872–1897. The very rich Tree Flora of Sabah and Sarawak, the Malaysian parts of Borneo, are currently the subject of a critical flora project under the inspiring leadership of E. Soepadmo. In his earlier career Soepadmo contributed the Fagaceae and Ulmaceae treatments to *Flora Malesiana*, and all signs are positive that this 10,000 tree species tree flora of North Borneo will be completed well within 25 years (Soepadmo *et al.* 1996–2007), and a new comprehensive flora of Peninsular Malaysia has now been embarked on using the same successful formula. Although volunteer or hired taxonomists from the former colonial powers still contribute significantly to these national floras, their success and momentum owes much to the fact that they are entirely driven as projects of great national interest to the nation state of Malaysia.

From the above it seems totally unrealistic to discuss the Flora of the World as a viable proposition. Nevertheless that is precisely what we have been discussing since the initiative of the Royal Botanic Gardens Kew, a number of major herbaria and natural history museums together called for a new *Species Plantarum* project in 1990, soon to be followed by what seemed a more realistic Global Plant Checklist (under the auspices of the specially founded (in 1991) International Organisation of Plant Information, IOPI) and the launching of the first volumes of *Species Planarum: Flora of the World* (Orchard, 1990). Despite all the best intentions the World Flora and related projects have not come very far about 15 years after their original inception. The Global Plant checklist seems to be an exception thanks to Global Plant Conservation Strategy of the Convention of Biological Diversity, that has targeted the checklist as an urgent tool to underpin the conservation goal of the Convention to stop further species loss by 2010 (see *http://www.plantlife.org.uk/international/plantlife-policies-strategies-gspc.html*). Here one could be cynical, were it not that in the years that institutional support for the global plant species checklist was dismal, one single-minded Apollo of Checklist Botany, Rafaël Govaerts, industriously continued to contribute to a world checklist single-handedly (e.g. Govaerts 1996). On a plant genus basis one must also hail the encyclopedic successes of J.C. Willis and Airy Shaw in producing subsequent editions of Willis' Dictionary of Flowering Plants and Ferns (1897–1973), continued as the much more encompassing, and truly apollonian Plant-Book by David J. Mabberley (1987, 1998, 2008).

Nowadays of course we all cherish the hope that, through information technology and web-based international taxonomic cooperation, the completion of a Flora of the World is a realistic possibility. DNA-barcoding could help circumvent the tedium of constructing poorly functioning dichotomous, synoptic or interactive computer-assisted identification keys. I am convinced that all these dreams can only aspire to the much required scientific standard if revisionary taxonomy and the delimitation of new species – which is *absolutely needed* to make IT applications and Barcoding work – is given much more in the way of "contact hours" between the taxonomists and their plants in the field and in the herbarium. A good alpha taxonomist can deal with about 500–1,000 species in a life time if he or she works (semi-) monographically on a limited number of families and revisits their taxonomy from time to time throughout his career. The work

of Sir Ghillean Prance comes to mind; he combined and combines a very rich career in administration, conservation and ethnobotany with world class taxonomic contributions on Chrysobalanaceae and Lecythidaceae and Proteaceae. Of the former family he even contributed a definitive treatment for the abortive Flora of the World series (Prance & Sothers, 2003). Other very industrious taxonomists such as Herman Sleumer (Ericaceae, Flacouriaceae s.l., Icacinaceae, Myrsinaceae) and Bernard Verdcourt (multiple families, especially from Tropical Africa) come to mind. With the estimates for total numbers of Flowering Plants and Ferns having risen from about 8,000 in Linnaeus' *Species Plantarum* to 240,000–320,000 today the world would need not more than 600 active taxonomists – all true Apollos of Botany – and the total world flora could be critically revised every 40–50 years.

From this perspective there would be no shortage of taxonomists: the International Association of Plant Taxonomists alone numbers well over 1,500 members, and many current taxonomists are not even IAPT members (cf. staff listings in *Index Herbarorium*). To make an army of 600 taxonomists all over the world work together in a complementary as well as synergistic fashion would require the vision and authority of a new Linnaeus indeed! Yet this is desperately needed, because all great schemes need a sound alpha-taxonomy as the underpinning basis: from the resolution of the Tree of Life down to its terminal twigs, the Encyclopedia of Life, the use of DNA Barcoding in identification, and for better implementation of Conservation Strategies, to the use of wild relatives in genetic improvement of cultivars. One should shout it from the roof-tops as a paraphrase of the American election campaign: *It´s the Taxonomy Stupid*!

Apollos of the Natural System

Although Linnaeus' sexual system of plant classification was highly artificial, the quest by Linnaeus for a natural system was, in my opinion, very real, never mind that it was in his time constrained by a solid creationist framework. Aphorisms in *Philosophia Botanica* (1751) that "Nature does not make leaps", that "the true beginning and end of botany is the natural system", and that the system of classification is "Ariadne's thread of botany" all testify to this. Moreover, Linnaeus himself did recognise that apart from sexual organs all other plant attributes should be taken into account to arrive at a natural system. Linnaeus' recognition that all species descend from the sexual union of a male and female parent was again a prerequisite for that later Apollo of Evolutionary Biology, Charles Darwin, to recognise the patterns of sexual selection. From the first publication of *Systema Naturae* in 1735 to the latest update of that tremendously useful APG website maintained by Peter Stevens there is no shortage of Apollos of Systematic Botany who have proposed numerous improvements to the classification of flowering plants and ferns. I shall not name them here, but limit myself to the contributions of systematic plant anatomy to these classifications. I owe this to my own specialisation, but I also think it is necessary to recognise that the role of attributes from vegetative anatomy as phylogenetic and diagnostic markers has not always received the limelight it deserves.

Although all microscopists since Malpighi, Grew and Van Leeuwenhoek have contributed to comparative and thus systematic plant anatomy, the true founder and

Figure 3. Apollos of Systematic Plant Anatomy. Top left: L. Radlekofer; Top right: H.H. Solereder; Bottom left: C.R. Metcalfe and his wife Gwen; Bottom right: I.W. Bailey. (The first three by courtesy of the Hunt Library).

Apollo of systematic plant anatomy was Ludwig Radlkofer (1829–1927). As monographer of the tropical woody family of the Sapindaceae he consistently included especially leaf anatomical features in his descriptions and generic and species delimitation. In 1883 he gave an historical address to the Royal Academy of Bavaria in which he unfolded his vision for systematic botany, with the famous predication that "the next hundred years belong to the anatomical method". His dedication to that anatomical method is apparent from a personal letter dated 2 September 1920, in the archives of the National Herbarium of the Netherlands: while offering condolences to Mrs. Koorders in Bogor with the demise of her botanist husband, he requests her to

take a thumb-nail size leaf sample from a certain herbarium specimen so that he can verify its identity. His impact on systematic botany would be especially important through his pupil Hans Solereder (1869–1920) who wrote the encyclopedic "*Systematische Anatomie der Dikotyledonen*" (1899 & 1906) being a compilation and synthesis of all that was known on vegetative plant anatomy to date, and much of the information coming from PhD theses from the Radlkofer/Solereder school. An additional series on the "*Systematische Anatomie der Monokotyledonen*" was far advanced before Solereder's untimely death. Much of the anatomical information was assimilated in Engler & Prantl's second edition of the *Natuerliche Pflanzenfamilien*.

The translation at Kew of Solereder's *magnum opus* by L.A. Boodle and F.E. Fritsch heralded the era of systematic anatomy in the English speaking world. It was Charles Russel Metcalfe (1904–1991) who, as a young Keeper of the Jodrell Laboratory in Kew, approached Laurence Chalk, wood anatomist at the Imperial Forestry Institute in Oxford, in the 1930s to embark on a completely updated and expanded version, resulting in the two-volume bible "*Anatomy of the Dicotyledons*" first published in 1950. With true Apollonian drive Metcalfe continued with a series on the *Anatomy of Monocotyledons*, and revisited the Dicots with a much expanded second edition from 1979 onwards. Both the Monocot Series and the second Edition Series of the "*Anatomy of the Dicotyledons*" are still being continued. *Anatomy of the Dicotyledons* has been intensively data-mined for wood anatomical databases (cf. *http://insidewood.lib.ncsu.edu*) and by great pre-APG systematists like Dahlgren, Thorne, Cronquist and Takhtajan, and post-APG there has been recognition by DNA systematists that anatomical patterns contain significant phylogenetic signals, especially at higher taxonomic levels, supporting many of the "unexpected" outcomes of the phylogenetic DNA analyses.

My final Apollo, Irving Widmore Bailey (1884–1967) from Harvard added great *insight* into anatomical diversity by recognising functional, developmental, and evolutionary patterns (Bailey & Tupper, 1918; Bailey, 1954). As a consummate microscopist he ranks easily as the most innovative plant anatomist of the 20th century, correctly modelling the ultrastructure of the woody cell wall as well as uncovering the major evolutionary trends in xylem anatomy and fathoming the powerful phylogenetic signals contained in vestured pits. Current ecophyletic wood anatomy research by authors like Sherwin Carlquist, Pieter Baas, Steven Jansen, Frederic Lens and Elisabeth Wheeler gratefully builds on the foundations laid by this great Apollo of comparative plant anatomy.

Epilogue

The use of one metaphoric Apollo from a 1738 frontispiece to revisit some aspects of the history of systematic botany carries the danger of turning the subject into a caricature. Above all I have tried to illustrate how some individuals with great vision, drive and talent developed our subject into the modern discipline it is today. Individualism often going hand in hand with a large and self-confident ego, is, however, only one side of the coin: most of the selected Apollo's were also great team workers who nurtured large networks of colleagues and disciples – Linnaeus himself was a good example of this. The great breakthroughs in DNA phylogeny and taxonomy from the early '90s

onwards were only possible thanks to the excellent team spirit of all the Apollos united in the Angiosperm Phylogeny Group (APG 1998). So let us hope for a future chorus of numerous Apollos both in alpha taxonomy and phylogenomic systematics to further our discipline!

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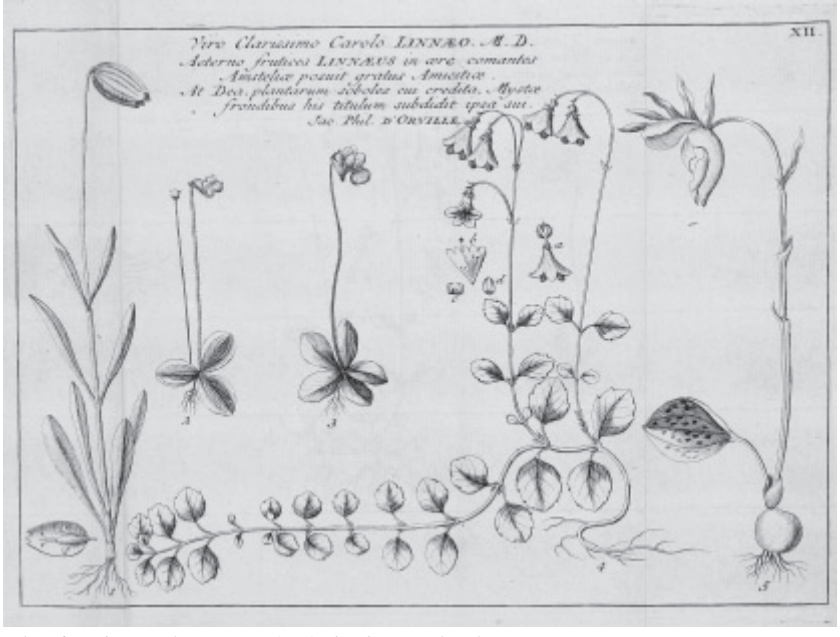
The Linnaean Legacy: Three Centuries after his Birth

Part 2: Botanical Art in the Age of Linnaeus



Tab. 12 from Linnaeus' *Flora Lapponica* (1737): Fig. 4 is *Linnaea borealis*.

Linnaeus' use of illustrations in his naming of plants

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It is an interesting fact that Linnaeus' own, numerous publications feature very few original illustrations, yet he was at the same time happy to include many references to the illustrations of other authors, particularly in his compilatory works such as *Species Plantarum*. If he felt they were of value, why didn't he arrange for more plants to be illustrated in his own articles, dissertations and books? Might it have been purely a question of cost (only in his later years did Linnaeus become financially comfortable) or was the issue more complex?

Today taxonomists are often indebted to the illustrators of the 17th and 18th centuries, particularly in connection with scientific names coined before about 1800. The development of the type method, in which the application of a scientific name is governed by the identity of a reference (or "type") specimen or illustration, means that many early names have to be interpreted by early illustrations. In compiling my recent book *Order out of Chaos* (2007), the existence of so many drawings and illustrations, in addition to pressed herbarium specimens, has often proved valuable in the interpretation of Linnaeus' intentions.

Linnaeus first made an impact on the publishing scene in the Netherlands where he arrived in 1735 with a number of manuscripts which he hoped to have published there. These included his ground-breaking *Systema Naturae* (1735), his first classification of the natural world which included his controversial division of the plants by the number and arrangement of their floral parts – his so-called "sexual system". This was unillustrated, and his 1736 book, *Fundamenta Botanica*, contained only a few plates illustrating different leaf and inflorescence forms.

His account of the flora of Lapland, however, published as *Flora Lapponica* in 1737 and based on his travels there during 1732, did contain 12 copperplates depicting some of the more interesting plants he had encountered.

Altogether more lavish in the scale and quality of the accompanying illustrations are those featured in two works prepared by Linnaeus while he was in the employment of George Clifford, an Anglo-Dutch banker. Clifford's extensive estate, the Hartekamp, near Haarlem, boasted huge gardens with several hothouses, where Linnaeus and Clifford's gardener, Dietrich Nietzel, managed to coax a banana to flower and fruit, an occurrence so rare that a slim publication, *Musa Cliffortiana*, accompanied by two copperplates, was produced in 1736 to commemorate it.

A much larger work, *Hortus Cliffortianus*, which accounted for all the plants grown at the Hartekamp, appeared in 1738 and was accompanied by 36 large copperplates that Clifford commissioned from Georg Dionysius Ehret and Jan

Wandelaar. It seems likely that the choice of their format and illustrated content was made by Clifford rather than Linnaeus.

After his return to Sweden, Linnaeus published numerous books and articles, as well as hundreds of dissertations which he prepared for his many students to defend (as was normal in the Swedish university system at the time). Linnaeus' major work, *Species Plantarum* (1753), was unillustrated, as were later editions of the *Systema Naturae* and most of the other works in which significant numbers of species were given new binomial names.

However, illustrations, though scarce, do make an occasional appearance, for example with an engraving, in a 1741 article entitled "Lobelia", of the plant he later named *Lobelia inflata* L. (Fig. 1).

Some clues to Linnaeus' attitude to illustrations can be found in some of his early works. In 1737, in the introduction to his *Genera Plantarum*, Linnaeus had given vent to his strong feelings on the subject:

Figure 1. Engraving, from an article in *Acta Societas Regia Scientiarum Upsaliensis* 1741: 23–26, of the plant Linnaeus later named *Lobelia inflata* L. (© Natural History Museum, London)

> I do not recommend drawings…for determining genera – in fact, I absolutely reject them, although I confess they are of great importance to boys and those who have more brain-pan than brain; I confess that they convey something to the unlearned. Before the use of letters came to be known by mortals, wherever the sound of the mouth could not be heard, everything had to be expressed by pictures. But as soon as letters were invented, there was an easier and surer way to communicate ideas by writing. So too in Botany, figures afforded great assistance before the letters were discovered. If one wants to use or review a generic character in some book, one cannot always easily paint, engrave, print and publish a picture; however it is easy with description. We will therefore try to express by words all marks just as clearly – if not more clearly – as others with their splendid drawings.

In 1751, Linnaeus published *Philosophia Botanica*, essentially a compilation of his lectures on botany. Linnaeus was a great teacher, and this work, in its recent 2003 translation by Stephen Freer, provides what the Linnaean scholar Paul Cox characterises as "an opportunity to imagine what it might have been like to sit in that old Uppsala lecture hall, and to hear...Carl Linnaeus, the greatest student of plants to ever grace this earth, discuss with excitement and enthusiasm his view of plants". *Philosophia Botanica* was published two years before Linnaeus' most famous botanical work, *Species Plantarum*, in which he for the first time introduced the consistent use of binomial nomenclature. As such, the earlier work gives an insight into the development of Linnaeus' botanical thought prior to 1753, and it contains some interesting observations on illustrations.

In his description of the Botanical Library, Linnaeus listed chronologically 158 of the principal botanical authors ("Phytologists"), grouping them into a number of categories. These included the "Fathers" (starting with the Greeks, and Hippocrates) who established the first rudiments of botany, the "Describers" (such as John Ray), the "Travellers" (such as Tournefort and Kaempfer), the "Systematists" who had arranged the plants in particular ranks, and the "Nomenclators" (who had named plants).

The "Illustrators" were also recognised here, as those who "have represented the figures of vegetables in pictures". Linnaeus noted that this required "a botanist, a draughtsman, and an engraver", and that "All parts should be recorded in their natural position and size, including the most minute parts of the fruit-body". The works of Dillenius, Colonna and Ehret are deemed "outstanding", those of Rheede, Sloane and Dillenius "valuable", and another eight "poor".

There is perhaps a simple reason for the lack of illustrations in Linnaeus' own works. The historian, Karen Reeds, for example, suggests (*Interdiscipl. Sci. Rev.* 29: 248-258. 2004) that Linnaeus' own lack of skill at drawing may have been a significant factor. While some of his drawings can be found in the journals of his Swedish expeditions (notably to Lapland in 1734, and to Öland and Gotland in 1741), they have not been rated highly by later observers. It is clear that the Swede was not a natural artist, and Reeds suggests that his vehement rejection of "others with their splendid drawings" may not have been unconnected to his inability to produce them himself. Given his own modest financial circumstances, he was ill-positioned to pay an artist instead, and the need for an engraver would have added to the expense.

Figure 2. A plate from the first volume of Dillenius' *Hortus Elthamensis* (t. 121, f. 147. 1732), the lectotype of *Cassine maurocenia* L. (= *Maurocenia frangula* Mill.) (© Natural History Museum, London)

Linnaeus though, was also a pragmatist, and when compiling his botanical *magnum opus*, *Species Plantarum* (1753), he stated in the Preface that, for European plants, he was including only a brief synonymy, "with an outstanding illustrator", but "for Exotics, however, several [synonyms], because they are more difficult and less familiar".

His own lack of artistic skill, however, did not prevent him from holding firm views about the contrasting botanical value of many other authors' illustrated works. Three men were identified by him in *Philosophia Botanica* as "Outstanding" – Dillenius, Colonna and Ehret.

John Jacob Dillenius (1684–1747)

The *Hortus Elthamensis* of John Jacob Dillenius, published in 1732, was an account of the plants growing at James Sherard's garden in Eltham, near London, and was accompanied by 324 large, hand-coloured copperplates which were much cited by Linnaeus (Fig. 2). A Chair of Botany had been endowed at Oxford for Dillenius by the wealthy English botanist, William Sherard (the elder brother of James). The *Hortus Elthamensis* included descriptions and drawings of many horticulturally-interesting plants.

Dillenius, a great authority on cryptogamic plants, also published *Historia Muscorum* (1741) and, from these two works, Dillenius is the author whose illustrations currently contribute the greatest number of figures as Linnaean types, appropriately so, given Linnaeus' high regard for Dillenius' work.

Fabio Colonna (1567–1650)

Linnaeus' second "outstanding" illustrated author was the rather earlier Italian, Fabio Colonna (or Columna). In two books published in 1606 and 1616, Colonna's accounts of southern Italian (and some eastern Mediterranean) plants were accompanied by 246 copperplates, often depicting more than one species. They provided information on many plants unfamiliar to Linnaeus, and a number of them provide types for Linnaean names, including that of *Allium chamaemoly* L. (Fig. 3). While Colonna's work is perhaps less well-known, his attention to detail, and the agreement with Linnaeus' criteria of the parts of the plant being "recorded in their natural position and size, including the most minute parts of the fruit-body" make Linnaeus' enthusiasm understandable.

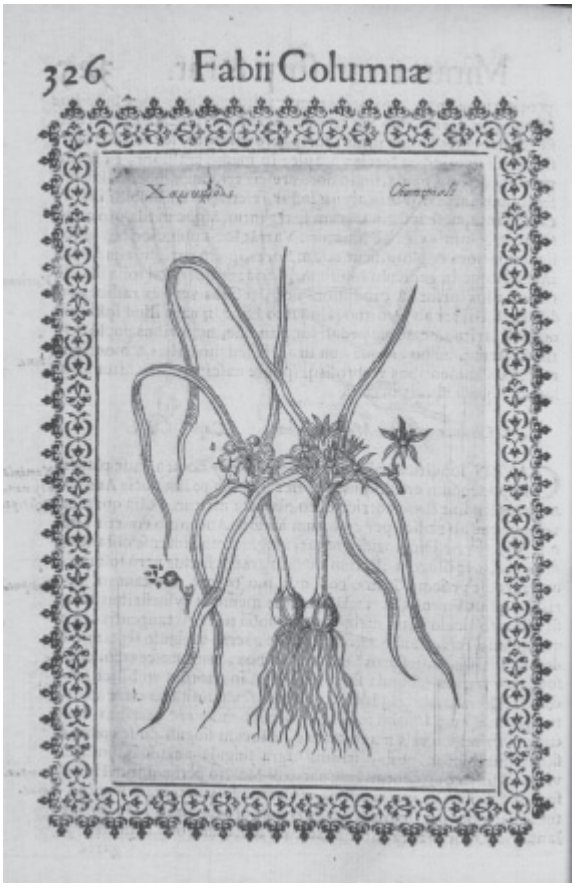

Figure 3. Engraving from Fabio Colonna's *Minus cognitarum stirpium aliquot...Ekphrasis*: 326. 1606, the lectotype of *Allium chamaemoly* L. (© Natural History Museum, London)

Georg Dionysius Ehret (1710–1770)

Ehret was the third illustrator whose work Linnaeus regarded as "outstanding", and whose publications he cited extensively in his own books. However, as Annika Erikson Browne deals with him in detail elsewhere in this publication, he will not be discussed further here.

Plants from the Tropics

The quality, and information content of these illustrations, varied wildly, and their usefulness to Linnaeus doubtless also depended on whether there was complementary information available. Exploration of the globe was still at a comparatively early stage, and although something was known of many parts of Europe, the plants of more remote areas were usually little known. Consequently, the publications of others, particularly where they dealt with the plants of rarely visited places, were studied with great interest by Linnaeus.

It is no great surprise, therefore, to find that many illustrations (Plumier 1697) published by the French monk Charles Plumier (who collected extensively in Haiti and Martinique during three trips between 1689 and 1697, are types for species from the Antilles that were named by Linnaeus in 1753, including *Polypodium reticulatum* L. (*Thelypteris reticulata* (L.) Proctor), because these illustrations and descriptions usually provided the only information that was available. Long after Plumier's death, Linnaeus' Dutch friend Johannes Burman assembled several hundred tracings of previously unpublished Plumier drawings. While preparing them for subsequent (1755–1760) publication, he sent proof copies to Linnaeus who, after appropriate consideration, pasted them on to the walls of his study at his country estate at Hammarby where they can still be seen today.

Linnaeus had a copy of *Metamorphosis insectorum Surinamensium* (1705), by that remarkable Dutch painter, Maria Sibylla Merian, a lavishly illustrated work that also portrayed the food plants of the insects that were the primary focus of the book. In 1753, this was pretty well the only information on Surinam plants available to Linnaeus – and he accordingly based a number of species on her illustrations, including *Spondias mombin* L. (Fig. 4).

Similarly, Linnaeus greatly valued the works of an author such as Hendrik Adriaan Rheede tot Draackenstein, whose 12-volume illustrated account of plants from the Malabar coast of India, *Hortus Malabaricus,* published between 1678 and 1693, proved invaluable to him. The work contained 794 large engravings of Indian plants, and included not only descriptions but a wealth of ethnobotanical information that is now unavailable from any other source, for the local works Rheede cited have since disappeared. In addition to very good descriptions, the entries contain a record of vernacular plant names in a variety of European and native languages. As a result, although the drawings contain errors, and often lack the details necessary to a correct identification, it has been possible for modern scholars to identify confidently all but one of his plants.

Linnaeus adopted 254 names from the *Hortus Malabaricus* in the first edition of his *Species Plantarum*. Some well-known examples of names derived from Rheede include *Carica papaya* L. (epithet derived from Rheede's "Papajamaram"), *Mangifera indica* L. (Rheede cited "mango" as the name for the fruit), and the star-fruit *Averrhoa*

Figure 4. Plate from Maria Sibylla Merian's *Metamorphosis insectorum Surinamensium*: t. 13. 1705, the lectotype of *Spondias mombin* L. (© Linnean Society of London)

carambola L. (epithet derived from Rheede's "Carambolas"). Although Rheede sent plant material to Amsterdam, he seems to have kept no herbarium specimens, so in each case where Linnaeus used the *Hortus Malabaricus* as his source, it is the illustration in that work, rather than a herbarium specimen, that is now the type of the name.

Another influential publication on plants from the Old World tropics was that of Georg Eberhard Rumf (often known as Rumphius), based on plants from the island of Ambon in Indonesia. The *Herbarium Amboinense* was not published until 40 years after its author's death, a consortium of Dutch publishers issuing it in six volumes, between 1741 and 1750. It has subsequently been recognised as the first major account of Malaysian plants, and many botanists have used its descriptions to determine specific names. But bearing in mind that most of the 695 illustrations were undertaken after the author became blind and could no longer authenticate them, the possibilities for error are enormous.

Linnaeus evidently saw the *Herbarium Amboinense* in the late stages of producing his manuscript of *Species Plantarum*, and only 19 of Rumphius' accounts are referred to there. However, he made a more detailed study of them in a later dissertation, *Herbarium Amboinense* (1754), and around 100 of Rumphius' plates serve as types for Linnaean names, including the one that depicts *Cucumis anguinus* L. (= *Trichosanthes cucumerina* L.) (Fig. 5).

Figure 5. The type illustration of *Cucumis anguinus* L. (= *Trichosanthes cucumerina* L.) from Rumphius' *Herbarium Amboinense* 5: t. 148. 1747. (© Natural History Museum, London)

Temperate Floras

Linnaeus frequently noted species as recorded from Siberia, and information on these plants came partly from specimens he had obtained clandestinely from Russia, but chiefly from the first two volumes of Johann Georg Gmelin's *Flora Sibirica*, a product of Gmelin's participation in the Second Kamchatka Expedition.

Although many South African plants had already entered cultivation in Europe by the middle of the 18th century, Linnaeus still relied on the publications of, chiefly Dutch, authors such as Jan Commelin for information about many of them – including *Antholyza ringens* L. (now *Babiana ringens* (L.) Ker-Gawl.), and also his great friend Johannes Burman, whose *Rariorum Africanum Plantarum* of 1738–1739 contained many fine descriptions and illustrations, including *Arctopus echinatus* L. (a member of the Apiaceae).

While illustrations can frequently show the features that allow a confident identification to be made, this is not always the case. Fortunately, some illustrated works, such as those of Sloane, can be associated with herbarium material. Sloane's Jamaican collections are unusual in that his artist, Everhard Kickius, prepared his drawings directly from Sloane's dried specimens, so the published engravings (in Sloane's *A voyage to the islands Madeira... and Jamaica*, 1707; 1725) correspond very precisely with the specimens upon which they were based, and uncertainties of identity of the illustrations can often be resolved by reference to the specimens.

However, there can undoubtedly be difficulties where names are evidently based solely on descriptions and illustrations that are either so poor that they fail to distinguish between a number of similar taxa, or such a mixture of elements that it can be difficult to decide to which element the name should apply.

For example, Engelbert Kaempfer's early account of Japanese plants (*Amoenitatum Exoticarum*, 1712) contained relatively few illustrations, but most were cited by Linnaeus, and almost all of them have been designated as types for their corresponding Linnaean binomials. One of these is the type of *Epidendrum domesticum* L., a name which has been associated with the orchid genus *Vanilla*. However, closer study of Kaempfer's plate suggests that it is a composite of an orchid, and a member of the Iridaceae, and Garay (*Harvard Pap. Bot.* 2: 49. 1997) recently designated the Iridaceous part of the plate as the lectotype, with the result that the name no longer applies to an orchid but, in this case happily, becomes a synonym of the species known as *Belamcanda chinensis* (L.) DC.

Linnaeus relied on illustrations perhaps more than he was aware himself, and taxonomists today striving to stabilise 18th-century plant nomenclature certainly find historical illustrations of tremendous value. It is interesting that, despite his antipathy to them, a quarter of the scientific names he described are now nomenclaturally bound to illustrations that he cited, rather than his beloved herbarium specimens.

Illustrations, such as Commelin's plate of *Chironia frutescens* L. (Fig. 6), have an important role to play as types because it is not uncommon to find that it is the illustrations, rather than the specimens, that correspond with what has become the general usage of the name, and that nomenclatural stability is, in fact, better served by adopting an illustration, rather than a specimen, as the type. Although many of the

Figure 6. Caspar Commelin's plate from his *Hort. med. Amstelaed. Pl. Rar.:* t. 8. 1706 is the lectotype of *Chironia frutescens* L. (= *Orphium frutescens* (L.) E. Mey.) (© Natural History Museum, London)

publications used by Linnaeus would have been produced in small numbers, and were not exactly widely available to other scientists trying to interpret Linnaeus' names, they were nevertheless a great deal more accessible than were the specimens in Linnaeus' own herbarium, and later authors understandably placed weight on illustrations they could see, rather than specimens that were inaccessible.

Linnaeus could not have foreseen the modern nomenclatural importance of illustrations for his own binomials because he would not have recognised the type method. But it is in interpreting and analysing his names that the illustrations he consulted come into their own, and have proved an immensely valuable resource for Linnaean scholars.

Georg Dionysius Ehret: A Glimpse into the Golden Age of Botany

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Georg Dionysius Ehret (1708–1770) was an 18th century botanical artist of great importance, as indicated by his self-portrait (Fig. 1), the first included in a botanical publication of an artist since Fuchs. According to Stearn, Ehret inaugurated the 'Golden Age of Botanical Art'. He "combined botanical exactitude with great beauty of design", and some scholars such as Calmann believe his work has never been surpassed. Ehret illustrated many exotic plants, particularly American varieties. Quite a few of these were introduced and named in the pre-Linnaean style and so have become particularly important for later botanists attempting to find out exactly which plants were referred to by the older names. Ehret was first to publish a graphic display of Linnaeus' sexual system. Ehret's illustrations were often cited by Linnaeus, making them highly significant for the typification of many Linnaean specific names.

Figure 1. Ehret's self portrait.
(Credit: RHS, Lindley Library)

Ehret was not particularly interested in landscape gardens; he was however excited by the results of hothouse culture, which must have seemed astounding to a German

artist, gardener and botanist of that period. Naturally, his enthusiasm may have been bolstered by the impressive financial outlay of keen aristocrats for the collection and growth of exotics; providing Ehret with a nice niche in beautifully capturing them and teaching nobility such as the Duchess of Portland's daughters how to study and draw flora; but his passion for the observation of vegetation from far-flung places is clear.

Ehret enjoyed patronage from all over Europe, including Christoph Jakob Trew (Fig. 2) in his native Germany, the Margrave Karl Wilhelm III of Baden-Durlach, Louis XV, George Clifford of Hartekamp, Sir Hans Sloane, Patrick Browne and John Fothergill. In his memoirs, composed at the age of 50 to support his membership application to the prestigious Imperial German Academy of Naturalists, the Leopoldina in Schweinfurt, he writes that he was born in Heidelberg in 1708. His father, a gardener, introduced him to the joys of drawing plants, but sadly died in Ehret's youth.

Ehret was taken out of school early and thrust into a gardener's apprenticeship with his uncle in Bessungen, near Darmstadt, where he continued to draw throughout the three years of "slavery". His skills improved, aided by his cousin who was the first to purchase his drawings, and provided Ehret with a studio of sorts. Ehret was later recommended by his cousin to Joachim Sievert, gardener to the Margrave at Karlsruhe. The Margrave wished to have paintings produced of his hyacinths, and August Wilhelm Sievert came to Karlsruhe.

Ehret bemoans the fact that a painter of such ability had come across his path but that the artist would not teach Ehret his skill; he only allowed him to grind pigments. Ehret tried his hand at painting a tulip for the Margrave and, as an enthusiastic young gardener and budding artist, attracted favouritism, which incurred problems with the other members of staff, causing young Ehret to leave Karlsruhe after two years. The Margrave was sorry to see him go, and offered Ehret employment if ever he should return. Ehret embarked on his travels with his older bother, working as oarsmen on the Danube River to make their way to Vienna. Sievert provided Ehret with a letter of recommendation to Detlef Simpson, gardener at Regensberg, who in turn offered to introduce Ehret to Weinmann and Loeschenkohl. His brother travelled on to Vienna, while Ehret was employed by Weinmann.

With a meagre wage of 50 Kroner per year, Ehret executed nearly 500 paintings for Weinmann. Regardless of the poor wages, Ehret was now a professional artist. Unfortunately, the arrangement was for 1,000 paintings, so Weinmann refused to pay more than 20 Kroner. Some of Ehret's paintings for Weinmann were probably used in his publication *Phytanthoza Iconographia*. The plates are likely to be based in part on Ehret's drawings; some of the aloes are thought to be the most likely candidates, but his name does not appear with them, which is just as well, as many of the plates in that publication were criticised for inaccuracy. For the next five years Ehret painted plants from the garden of the banker Loeschenkohl, for an annual salary of 100 Reichstaler. He also coloured engravings for Loeschenkohl's copy of the *Hortus Malabaricus.* Ehret remarks that, following his initial anger at the falling out with Weinmann, he "forgave the loss of money" since he learned so much with him about botany. In his leisure hours, he turned his attention to botany and painting, making a collection of plants and around 560 paintings. His intention was to move away from gardening and into this area.

Ehret struck up a friendship with Johann Beurer, who admired his collection of paintings and offered to help find a buyer. His older cousin, Dr. Christoph Jacob Trew, appreciated the quality of Ehret's work, but was uninterested in native and common plants drawn on writing paper. Dr. Trew showed the paintings to Dr. Weidmann, who purchased the group, which is now partially represented in Lord Derby's collection. Dr. Trew asked Ehret to paint exotics for him on large fine paper. Ehret had some difficulty finding subject matter, as there were only two worthy collections in the area, belonging to Ortluff and Loeschenkohl, with the former of whom he did not have good relations. Ehret's friend Beurer described Ortluff as "the most jealous person imaginable". Ehret requested that Dr. Trew practise discretion in showing the 80 plates sent in the hopes that the owners of the flowers would not discover whose exotics were represented.

Figure 2. Portrait of Dr Trew.
(Credit: The Linnean Society)

Beurer continued to act as go-between for Ehret and Trew; his admiration for his friend is demonstrated in a letter to his older cousin:

> He is not only good as a gardener with plants and architectural layout, but also a painter of flowers and an excellent botanist…able to draw a plant so naturally as if it were growing in front of him…in summa he is homo exquisitus in everything, he has only one fault, he is flighty.

At about the age of 25, Ehret obtained leave from Loeschenkohl to go and meet Dr. Trew in Nuremburg, where Trew instructed Ehret on which part of the flower and fruit should be clearly represented to show the different sexes. This later became a bone of contention between Trew, Ehret and Linnaeus, the latter claiming to have shown Ehret how to best show parts of the flower and fruit around four years later, under the protest of Ehret who supposedly "did in the beginning absolutely not want to paint the stamina, pistilla and other small parts, as he argued they would spoil the drawing".

Later Ehret returned to work a little longer for Loeschenkohl, but felt his talent was being wasted with colouring plates for *Hortus Malabaricus*, which he estimated would take six more years to finish. So he quit that job, and travelled to Switzerland to paint plants for Trew at the Botanic Gardens in Basel. Trew and Ehret enjoyed a close professional relationship for the rest of Trew's life, until 1769. Trew was a fantastic mentor for Ehret, and helped him to grasp the botanical relevance of his work. Trew had a medical practice, and was a "versatile and talented scholar and collector. He

was a patron of the Botanical Arts, author and publisher of some of the most magnificent botanical books published in Europe in the 18th century".

In Basel, Ehret made the acquaintance of Samuel Burckhardt, who wished to have an entirely new garden laid out on his estate. Ehret first made and sold a plan to Burckhardt, and was then employed for a year to bring his design to fruition. During this period, the French entered the territory of the Margrave of Baden, causing him to retire to his estate at Basel. Burckhardt called upon him and Ehret's name soon came up. The Margrave was pleased to hear of Ehret; it seems that he had had unreliable gardeners since his departure and so remembered him the more fondly. He came to see Ehret the next day and renewed his offer of employment, but Ehret wished to see more of the world and journey to France and Holland; a brave plan considering that Germany was at war with France! Through Burckhardt, Ehret was able to obtain a passport from the French Governor of Strasburg, dated the 12th of May, 1734, which ordered the French to "not give this man any trouble or hindrance, on the contrary every kind of help and assistance if needed. This is valid for the whole of France". The Margrave gave Ehret a glowing letter of introduction to George Clifford in Holland. It was a document that would prove quite useful in due time, and the Margrave's personal physician, Dr. Eichrodt, provided a similar letter to Bernard de Jussieu in Paris.

Ehret may have been flighty, but his travels seem to have been blessed by fate. He travelled through Lausanne and Geneva before boarding a boat on the Rhone to Lyons. The only other passenger, a French lady accompanied by her servants, turned out to be closely related to Monsieur du Fay, director of the Jardin du Roi. After paying for his ticket, she found Ehret good cheap lodgings in Lyons. He then made his way to Montpelier by postchaise for a mere five shillings, and stayed in lodgings with a landlady whose patois he could not understand. She introduced Ehret to a local German doctor for translation, who by coincidence was an acquaintance of Dr. Trew! Dr. Molie took Ehret to better lodgings, where he stayed for another month. He drew more plants for Dr. Trew, but the heat dried out much of the vegetation, so he joined a group of muleteers.

Ehret reached Clermont, and fate was still on his side; after finding no available lodgings, he resolved to sleep in a stable but was driven to walk the streets after the heat and the smell were too much to bear. By chance he met a man who took him home and gave him his own bed, supper and a glass of wine. Ehret was touched by this kindness. He proceeded on foot to Paris, where he met Bernard de Jussieu, who gave him a room in the garden house of the Jardin des Plantes. Here he drew more plants for Dr. Trew, Charles François de Cisternay du Fay, and the Marquis du Gouvernet, who requested several copies of the Guernsey lily, *Nerine sarniensis* or as they called it, the Japanese lily, which was flowering in his garden, for his friends.

This was one of the first drawings Ehret executed on vellum, which was the tradition employed at the Jardin des Plantes for the King's collection. It is likely that Ehret learned this technique here, perhaps from the young Madeleine Basseporte, who had recently succeeded her instructor Claude Aubriet as official painter and instructor to the royal princesses, under the supervision of Jussieu. Painting on vellum required Ehret to develop a different approach in order to adapt to its unique characteristics. Vellum does not absorb any of the pigment as paper does, it lies on top and can be scraped off. It has a luminous quality, as it tends to be less opaque than paper which

Figure 3. *Lathyrus distoplatphyllus*: a well-observed sketch (Photo: A.E. Browne, Picture: NHM, London) compared with (right) a highly stylised commissioned work on vellum. (Credit: RHS, Lindley Library)

allows the pigment particles to catch more light. Combining this quality with more translucent pigments can enhance this effect. Ehret and Aubriet took this one step further by frequently applying body colour or gouache to give depth and texture in some areas and translucent washes in others for contrast. Watercolours tend to be more transluscent, while gouache paints have an added filler that gives an opaque depth. Vellum was not generally used for publication due to its extravagant expense.

A few traces of Aubriet's style may be detected in some of Ehret's work, including stylised elements such as selective composition, uniform hairs, veins and shadowing on the stem and leaves. Aubriet and Ehret both stylised highly finished works on vellum, intended for wealthy aristocratic patrons, who preferred idealised form with beautiful script, and they also both produced far more closely observed, naturalistic works for men of science. Note (Fig. 5) the flower parts illustrated by Aubriet; here is another opportunity Ehret had to learn the importance of their depiction.

Ehret stayed the winter but the exorbitant cost of living in Paris soon left his pocket empty, so he made plans to travel to Holland in the spring. The Jussieu brothers convinced him to try England instead and provided him with many letters of introduction for his trip. Monsieur du Fay gave him a letter for the Duke of Richmond and obtained a passport from the King himself; a rare commodity that would have allowed Ehret to return whenever he pleased. With this document in hand, despite travelling through French borders as a German in times of war, Ehret was afraid of nothing. His bravado

was demonstrated when asked to produce his passport by the sentinel at Abbeville. Ehret refused to show his precious document to a common soldier, and was led with fixed bayonets to the Governor, who on seeing the passport immediately set him free.

Ehret journeyed to London where he was anxious to see, among other things, the garden of Peter Collinson, the wonders of which Jussieu had related, including the new *Collinsonia* which Jussieu had named for him. He first visited Sir Hans Sloane, who, along with Philip Miller at the Chelsea Physick Garden, promised to promote Ehret, who received many commissions for work and drew a further 200 plants for Dr. Trew. After about a year, however, the commissions ran dry, and so Ehret resolved to travel finally to Holland, to seek out George Clifford, in early 1736. Ehret stayed for nearly a year in Leiden, then a centre of botanical studies, when he heard that Linnaeus was staying with Clifford at Hartekamp, one of the most important botanical gardens of Europe in the 18th century.

Linnaeus described the splendour of Hartecamp: the gardens were "masterpieces of Nature aided by Art," with their "shady walks, topiary, statues, fishponds, artificial mounds and mazes". The zoo was "full of tigers, apes, wild dogs, Indian deer and goats, peccaries and African swine; with innumerable varieties of birds that made the garden echo and re-echo with their cries". But still more exciting to him were the "houses of Adonis" or hot-houses: "When finally, I entered [the] truly regal house and splendidly equipped museum… I as a foreigner felt quite carried away, for I had never seen their equal".

Figure 4. *Aloe arborea* – watercolour on paper by Ehret. (Credit: RHS, Lindley Library)

Boerhaave, who was Clifford's doctor, became acquainted with Linnaeus through Gronovius, Linnaeus' friend and mentor, and convinced Clifford that he should have a personal physician. He recommended Linnaeus, who Clifford hired for 1,000 florins per annum with room and board, a cook and servants, a pair of horses and a carriage. In order that he might impress these two, Ehret produced some new paintings of curious plants he brought from England, some of them newly introduced, with, he writes, "their characteristics added thereto". And once presented to Clifford and Linnaeus, Ehret notes that "no one was more eager in the characteristics of plants" than Linnaeus. The coming together of Ehret and Linnaeus at this time was hailed by W.T. Stearn as a "miraculous coincidence of history".

Figure 5. *Jasminum Arabicum (Coffee arabica)* by Claude Aubriet; a comparison of naturalistic and selective composition. (Credit: RHS, Lindley Library)

Clifford bought almost all the drawings Ehret had with him for 3 Dutch Gulden a piece, and kept him at Hartekamp for over a month producing 20 illustrations for the *Hortus Cliffortianus*, including, according to Ehret, some of the dried plants he brought from England such as *Collinsonia* and *Turnera*. In his memoirs, Ehret bemoaned the fact that he related the story to Linnaeus of the *Collinsonia*, that it flowered first in Collinson's garden and was named by Jussieu, "but as a beginner Linnaeus appropriated everything he heard of to make himself famous".

Certainly there is no indication in the text of Jussieu's involvment. Dr. Trew corroborates this, as well as the dispute on who taught Ehret to depict parts of plants, what Ehret calls "characteristics". Ehret goes so far as to maintain that he profited nothing from Linnaeus in the dissection of plants; he had learned it all from Trew years earlier.

Ehret felt he should receive special credit for his images, instead of being treated as "a common draughtsman". However, in the very next paragraph he writes of how

> During the time I was with Mr. Clifford I was treated courteously… Linnaeus and I were the best of friends; he showed me his new method of examining the stamens, which I easily understood and privately resolved to bring out a tabella of it.

Why did he not wish to draw the tabella for the *Hortus Cliffortianus*? He writes he did not know Linnaeus intended to publish. Linnaeus did publish a tabella in his *Genera Plantarum* and inserted it in *Systema Naturae*, but these were "direct plagiarisms… engraved and printed without knowledge or permission of Ehret".

Figure 6. Leaf detail, illustrating a technique employing mixed application of watercolour and body colour or gouache on selected areas for enhanced contrast of translucent and opaque pigments on vellum. The stem shows stylised uniform hairs typical of works commissioned by aristocrats preferring an idealised form to scientific accuracy. (Credit: RHS, Lindley Library)

It is intriguing that a copy of Ehret's authentic tabella is inserted in Linnaeus' own copy of *Systema Naturae*, held in the Hagströmer Biblioteket. If he had this in his possession, why not use it for his publications and give credit? In fact, Linnaeus' mentor Gronovius, who edited and financed *Systema Naturae*, produced a copy of the tabella and undersold Ehret's copy for half a Dutch gulden each, which had been selling very well for two gulden.

Despite all this, Linnaeus and Ehret kept up a correspondence with glowing compliments to one another, Ehret calling Linnaeus the "Swedish, whom nobody can surpass in the botanique"; and Linnaeus writing "Ehret, the best of artists", and "to Apelles, Flora's adoring painter". Indeed, Ehret is known to be Linnaeus' favourite botanical artist; the walls of his bedroom are to this day papered with Ehret's illustrations. Although Linnaeus never commissioned Ehret to illustrate his publications, this was apparently due to finances rather than professional rivalry.

What was the reasoning behind these conflicting images of their relationship? Ehret seems to have been both excited by Linnaeus' enthusiasm and jealous of the attention Clifford lavished on him. Ehret and Linnaeus were approximately the same age, in their late twenties, and although Linnaeus had only just finished university and was then working on this doctorate, he had also made an expedition to Lapland and had created his new system of classification, and so Clifford felt honoured by his presence.

Linnaeus, for his part, did not appear to give botanical illustration very much respect. He writes in *Genera Plantarum* (1737) that botanical illustration was useful only "to boys and those who have more brain-pan than brain". He thought botanical progress was dependant on the use of clear, detailed, technical written descriptions. Of course, this attitude reflects his own strength as a scientist and wish for people to accept his system, and we also know from attempts in Lapland that he did not posses great drawing ability. Blunt, true to his name, remarked on his artistic abilities:

> Matisse once wrote that his ambition was to draw like his little girl of five; Linnaeus achieved this effortlessly.

In fact, before *Species Plantarum* appeared to bring about modern botanical nomenclature in 1753, the "whole enterprise of botany depended on lifelike printed

pictures". That being said, it appears that some of the same animosities incurred by being favourite that Ehret experienced at Karlsruhe, were now being projected onto Linnaeus. This may have led him to publish the Tabella without consulting Linnaeus. Equally, Linnaeus may not have enjoyed witnessing his new system unveiled graphically without his knowledge or consent, before having a chance to publish the idea. In the end, however, their shared love of botany seems to have overcome their fragile egos, and they remained friends until death. Linnaeus gave Ehret the gift of a genus named in his honour: *Ehretia*. That Ehret rarely used Linnaean names in his drawings when later settled in England we will hope is an example of conformity to the status quo of the time, as binomial nomenclature was not fully accepted until the 1760s, rather than a childish slight.

After a brief stay in Amsterdam, Ehret journeyed to England, where he knew many rare plants to be under cultivation. Ehret understood that he would be able to get the best prices for depicting newly introduced exotics, which he pursued almost to the end of his life in England. He first drew and engraved a banana, *Musa fructu cacumerico longior*, belonging to Baron Joseph Ayloffe. He also notes his great enjoyment at drawing a magnolia from bud to flower in August 1737, walking every day from Chelsea to Parsons Green. His joy in this flower can be seen in his sketch, with energetic radial flourishes of colour and composition, rejecting a systematic approach. He was the first to observe in minute detail the characteristics of the *Magnolia grandiflora* (*Magnolia flore ingenti candido*), a fact which Dr. Trew promoted in the *Commercia Litteraria*.

Ehret stayed with or near Philip Miller, Curator of the Chelsea Physick Garden, who had promised to promote him on his earlier trip. Ehret writes that he did so in the beginning, but they appear to have been some difficulties between the two later on.

Figure 7. A sketch of a magnolia by Ehret.
(Photo: A.E. Browne, Picture: Natural History Museum, London)

Figure 8. *Euphorbia paralias* on vellum by Ehret. (Credit: RHS, Lindley Library)

Miller included only 16 illustrations by Ehret out of 300 included in his *Figures of the Most Beautiful…Plants Described in the Gardener's Dictionary*, published in 1760. Linnaeus remarked "it would have been better" had there been more drawings by Ehret, but he observed that there was some professional rivalry between Miller and Ehret, which effected their friendship. Indeed, Ehret notes in his memoirs, written at the age of 50 in 1758, that he had by then dropped Miller's acquaintance for several years, despite having married his wife's sister, Susanna Kennet, in 1738, and named his only surviving son George Philip Ehret.

Of course Ehret couldn't get along with everyone, and he did enjoy the friendship of many, despite his thick German accent and foreigner's ways. That being the case, however, he may have felt unsure of himself at times, which is demonstrated in this (Fig. 9) crossed out passage; one of many drafts written for submission to the *Philosophical Transactions of the Royal Society*.

Figure 9. A draft with many alterations written for submission by Ehret to the *Philosophical Transactions of the Royal Society.*

Figure 10. The portrait of Ehret by G. James that now hangs in the Rooms of The Linnean Society of London.

Despite his insecurities and occasional professional rows, another of which he had at the Oxford Botanical Garden over hierarchy, he enjoyed a fruitful career full of commissions and noble patronage. The Duchess of Portland's daughters were among the most important and lucrative, but there was also the Duchess of Norfolk, the Duchess of Leeds, the Duchess of Bridgewater's two daughters, the Duke of Kent's two daughters, etc, etc. He writes "if I could have divided myself into twenty I would have had my hands full".

He also attracted the attention of scientists eager to publish his paintings. His work appeared in Patrick Browne's *History of Jamaica*, the first book in the UK to adopt Linnaean nomenclature, as well as Edward Pococke's *Description of the East*, Alexander Russell's *Natural History of Aleppo*, Griffith Hughes' *History of Barbados*, and Trew's celebrated *Plantae Selectae*, which was, sadly, finished after Trew's death. The seven year's war probably prevented Dr. Trew from reaching completion, but it was hailed by many as the most beautiful German plant-book. Bernard de Jussieu said:

> The coloured drawings of plants which you have published surpass in beauty and exactitude everything that has appeared in this genre until now.

Plantae Rariores as well as *Hortus Nitidissimis* were also published by Trew, and Ehret published his own *Plantae et Papiliones Rariores*. Richard Mead, Peter Collinson and John Fothergill also commissioned many drawings, and Ehret had more work than he could handle, having to turn down proposed work for Dr. Trew later in life, when he also complained of failing eyesight.

Ehret died on 9th September 1770. His wife survived him by 11 years, and his son lived in Watford as an apothecary. Ehret's name died with his son, but he had a daughter who produced a large family, one descendant of whom was Sir Arthur Evans, discoverer of Knossos Palace, who acquired and donated Ehret's portrait by G. James to the Linnean Society. Ehret was carried by his talent and skill on a wave of the enlightened interest in natural science of his time. Professionals and amateurs alike put today's levels of enthusiasm to shame. His energy and general good temper as well as his obvious passion and delight of nature come across in his work. He has preserved for us not only the transient beauty of a flower, but also a glimpse into the golden age of botany.

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Botanical Art in the Age of Linnaeus

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The introduction of the Linnaean system of classification began in the 1730s, and was internationally dominant within two decades. During the second half of the 18th century botanical publication was very much under the influence of Linnaeus, and the illustration of botanical monographs was adapted to the demands of Linnaean taxonomy.

Linnaeus' system depended on the numbering of the sexual organs of flowering plants; all his classes except for Cryptogamia are distinguished either by the number of stamens, or by the arrangement of groups of stamens. For an artist producing illustrations for works using the Linnaean system, the most important thing to illustrate was therefore the anatomy of the flower, and more particularly of the sexual organs.

In one sense, this concentration on stamens and pistils resulted in an improvement in the skills of botanical artists. The work of even the best of their predecessors was deficient by Linnaean standards in the depiction of flowers. The engravings after Nicolas Robert published in the *Mémoires pour servir à l'Histoire des plantes* (1676–1701) included the most detailed portrayals of plants hitherto published, but the reader will search in vain for an accurate presentation of the number of stamens. Until Linnaeus, stamen number had no particular diagnostic significance, and artists concentrated their skills on structures that were more obviously useful for identification. The famous anecdote of Linnaeus' meeting with Dillenius makes the point nicely. Challenging Dillenius' claims that his descriptions were inaccurate, Linnaeus tested the plants in Dillenius' garden, starting with a *Blitum,* which Dillenius had described as having three stamens:

> I opened the flower and showed him that it had only one. 'No doubt it's an abnormal specimen', he said. We opened several more, and they were all the same. We passed on to several other genera, and all tallied with my description of them. Dillenius was amazed and said, 'I shall not let you leave'. (Cited in Wilfrid Blunt, *The Compleat Naturalist.*)

The plates in Dillenius' *Hortus Elthamensis* (1732), whatever their other merits, cannot be said to be accurate renditions of stamen numbering. One plate is reproduced here: what Dillenius called *Achyracantha repens*, and Linnaeus called *Illecebrum achyrantha* (Fig. 1). The plate includes a floral dissection, but Linnaeus put this plant in Pentandria, and the plate does not show five stamens. As can be seen from this example, floral dissections were not a new idea in the Linnaean age, although their frequency increased markedly, but it had not previously been thought that the numbering of the stamens was a matter of particular interest.

The concentration on floral parts meant that the microscope, at least in its single-lens version, became a major tool for the artist. Ehret complained in his later years that his eyesight was suffering as a result of the microscopic work he had to do. Linnaeus was later to say that:

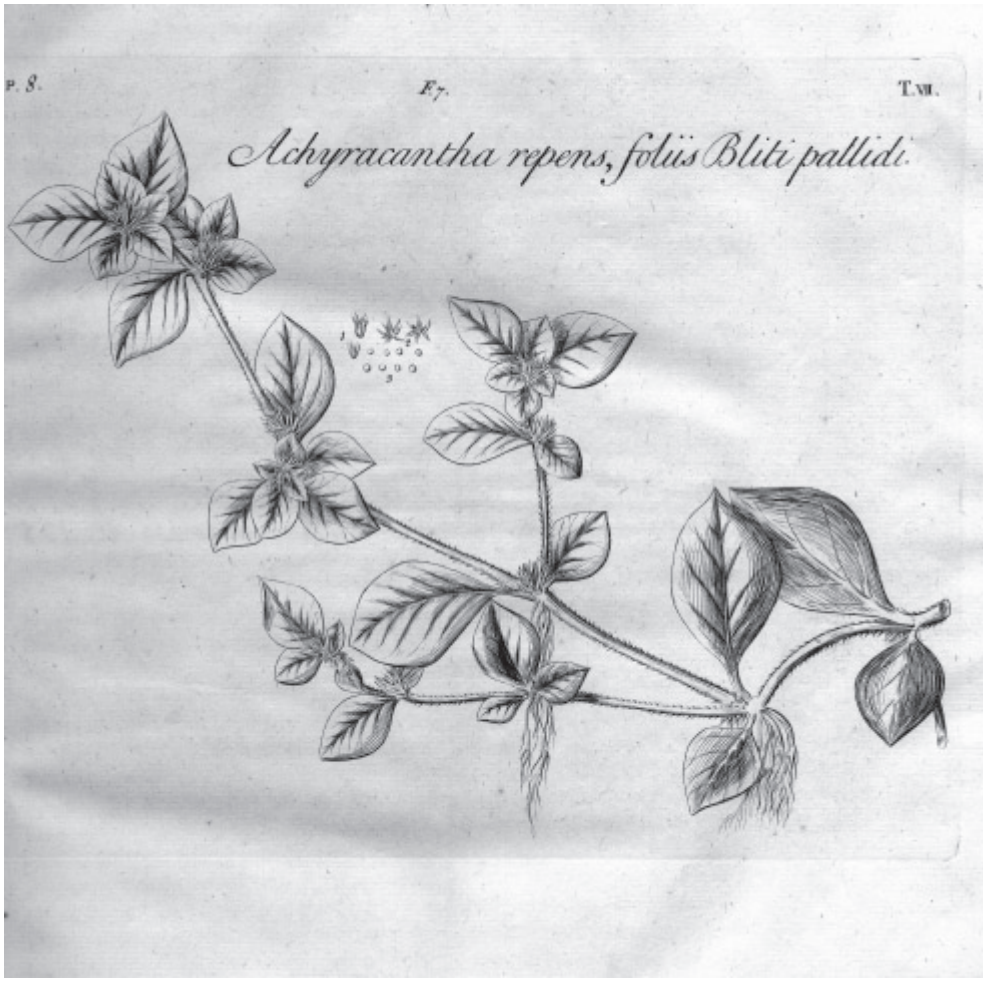

Figure 1. *Achyracantha repens*, foliis Bliti pallidi (*Illecebrum achyrantha*) from J.J. Dillenius, *Hortus Elthamensis* (1732), vol. II plate 7. (Credit: RHS, Lindley Library)

> Ehret did in the beginning absolutely not want to paint the stamina, pistilla and other small parts, as he argued they would spoil the drawing; in the end he gave in, however, and then he liked this kind of work so much that thereafter he observed the most minute and inessential particulars. (Cited in Gerta Calmann, *Ehret.*)

Ehret disputed this, and there is good evidence that he was making floral dissections before his work for Linnaeus; but the anecdote at least shows that such dissections were not commonplace until the introduction of Linnaean taxonomy made them a requirement. Ehret's work helped to popularise the floral dissection and to standardise its presentation; at mid-century one can still find the component parts of the flower scattered around the plate, so to speak, while by the 1770s, especially in the work of James Sowerby and those influenced by him, the parts of the dissection are arranged in a neat line, usually at the base of the plate. Shown opposite (Fig. 2) is one of the plates from Cavanilles' *Dissertationes* (1785–9), showing *Melia azederach*, illustrating nicely the presentation of the dissection in a line.

So the demands of the sexual system resulted in an improved representation of floral anatomy. In the hands of a sensitive observer, this detailed examination of the flower could produce data that went far beyond the requirements of Linnaean classification, and in the end helped to undermine it. The maverick botanist Dominique Villars, in his study of the plants of the Dauphiné, devoted much attention to local variations in morphology – the sort of evidence that Lamarck would rely on in his assertion of the unreality of species; Villars' plate 13 bis (Fig. 3) is a *tour de force*, recording the variations in floral structure observed in a species of *Pleurospermum.*

Figure 2. *Melia azederach*, from Cavanilles,
Monadelphiæ Classis Dissertationes Decem (1785–9). (Credit: RHS, Lindley Library)

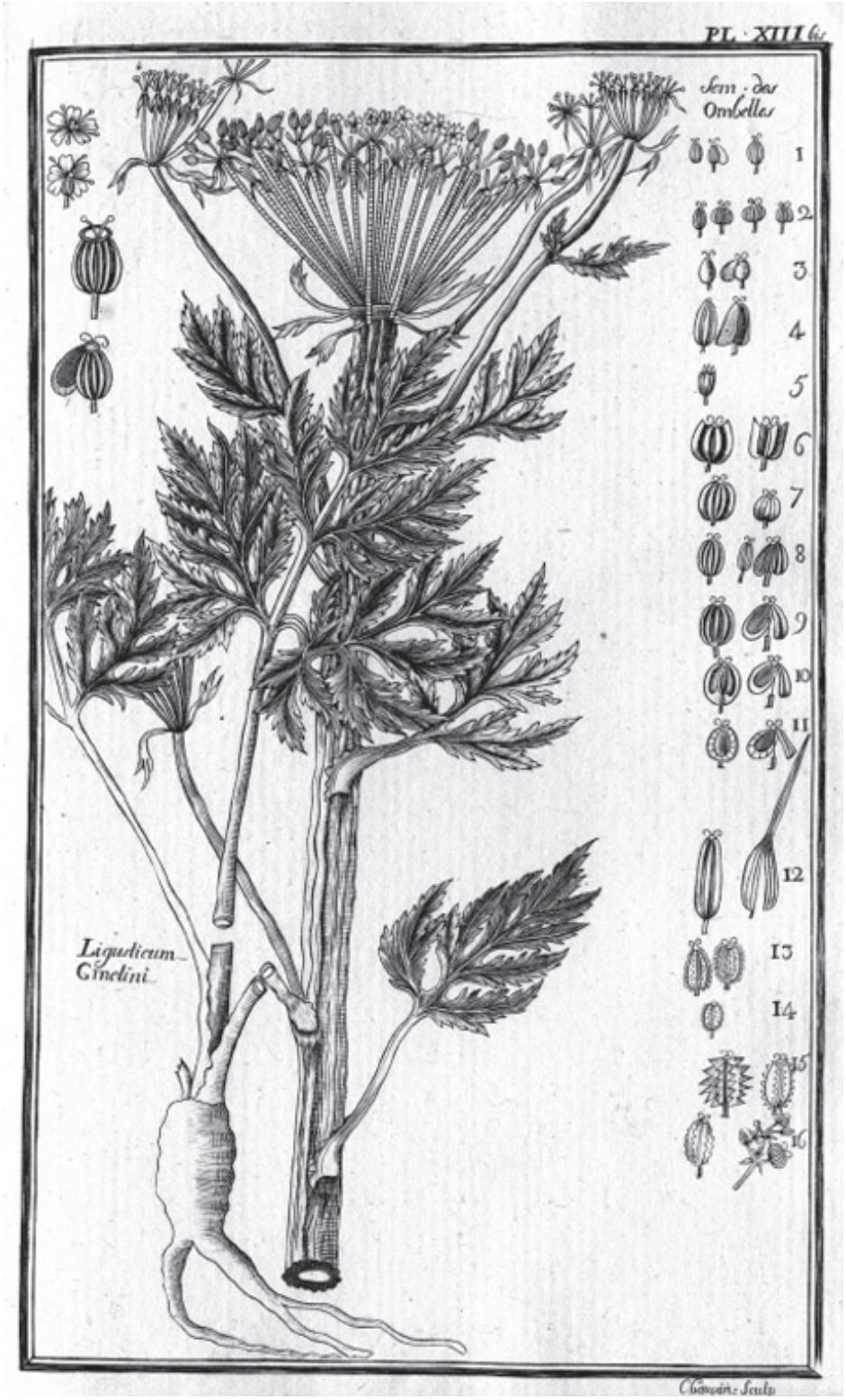

Figure 3. *Ligusticum gmelini* (*Pleurospermum austriacum*), from Dominique Villars, *Histoire des Plantes de Dauphiné* (1786–9), plate 13 bis. (Credit: RHS, Lindley Library)

On the other hand, the concentration on the flower meant that other aspects of plant anatomy were neglected. The depiction of root systems virtually disappears from botanical art in the second half of the 18th century: only bulbous plants which were commonly sold with roots visible, or plants where the roots were of economic importance, tend to have their roots shown. Progressively as the century went on, even general morphology suffered.

One device that various artists, most notably James Sowerby, used to retain a certain amount of leaf and stem anatomy while ensuring that the floral dissection remained paramount was the outline: the flower might appear centre-page, in detail and in colour, while behind it appeared a characteristic leaf and stem in outline (including venation), partially obscured by the flower but presenting enough information for the botanist to use leaf morphology as a guide to identification. Leaf outlines in the background of the plate did not, however, uniformly testify to the careful observations of the artist. Linnaeus had published a table of leaf shapes in the *Hortus Cliffortianus*, which was copied elsewhere, so there was a handy set of abstractions available for the artist to use as a fall-back. Sometimes, as in Reichenbach's *Monographia Generis Aconiti* (1820–21), the tangle of lines behind the flower militated against any attempt to use the leaf diagram effectively.

As time went on, one can sense among botanists and their artists an increasing tendency to see how little information need be presented about the parts of the plant other than the flower. Johann Reinhold Forster's pioneering work on the flora of Australasia, the *Characteres Generum Plantarum, quas in Itinere ad Insulas Maris Australis* of 1776, illustrates floral dissections only (Fig. 4), completely eliminating any morphological information about leaves, stems, or habit; such information was, from the point of view of a strict Linnaean, superfluous. This trend can be followed in such works as Thomas Martyn's *Thirty-eight Plates ... to illustrate Linnaeus's System* (1788) and Richard Duppa's *Classes and Orders of the Linnaean System* (1816). The most magnificent flowering of this tendency is to be found in the *Tabulae Phytographicae* of Johannes Gessner (or Gesner). Gessner (1709–90) was a correspondent of Linnaeus from the early 1740s, and earned Linnaeus' praise as "a man whom I esteem above all other botanists". He exchanged ideas and plant specimens with Linnaeus, and planned an illustrated work that would set out comparative details of the different plant families on composite plates for ease of comparison. In 1763 Gessner sent Linnaeus copies of the first two plates of his intended work to be printed, and Linnaeus replied that he was "thunderstruck" by their quality. Gessner died before the work was complete, and Linnaeus never saw the publication. In 1795 Christoph Salomon Schinz finally began the process of seeing Gessner's manuscript through the press; publication continued until 1811 at least, with the last plates unaccompanied by text. A specimen plate is reproduced here (Fig. 5).

Most artists, however, did not pursue reductionism so far, and remained content with the depiction of the flower, its dissection, and a certain amount of leaf and stem. Among the great projects of the later 18th century one can include the *Flora Danica* (1764–1810), John Miller's *Illustration of the Sexual System* (1770–77), Curtis' *Flora Londinensis* (1775–98), and Allioni's *Flora Pedemontana* (1785). Curtis' *Botanical Magazine* was begun in 1787, and carried on a Linnaean tradition of illustration well into the 19th century.

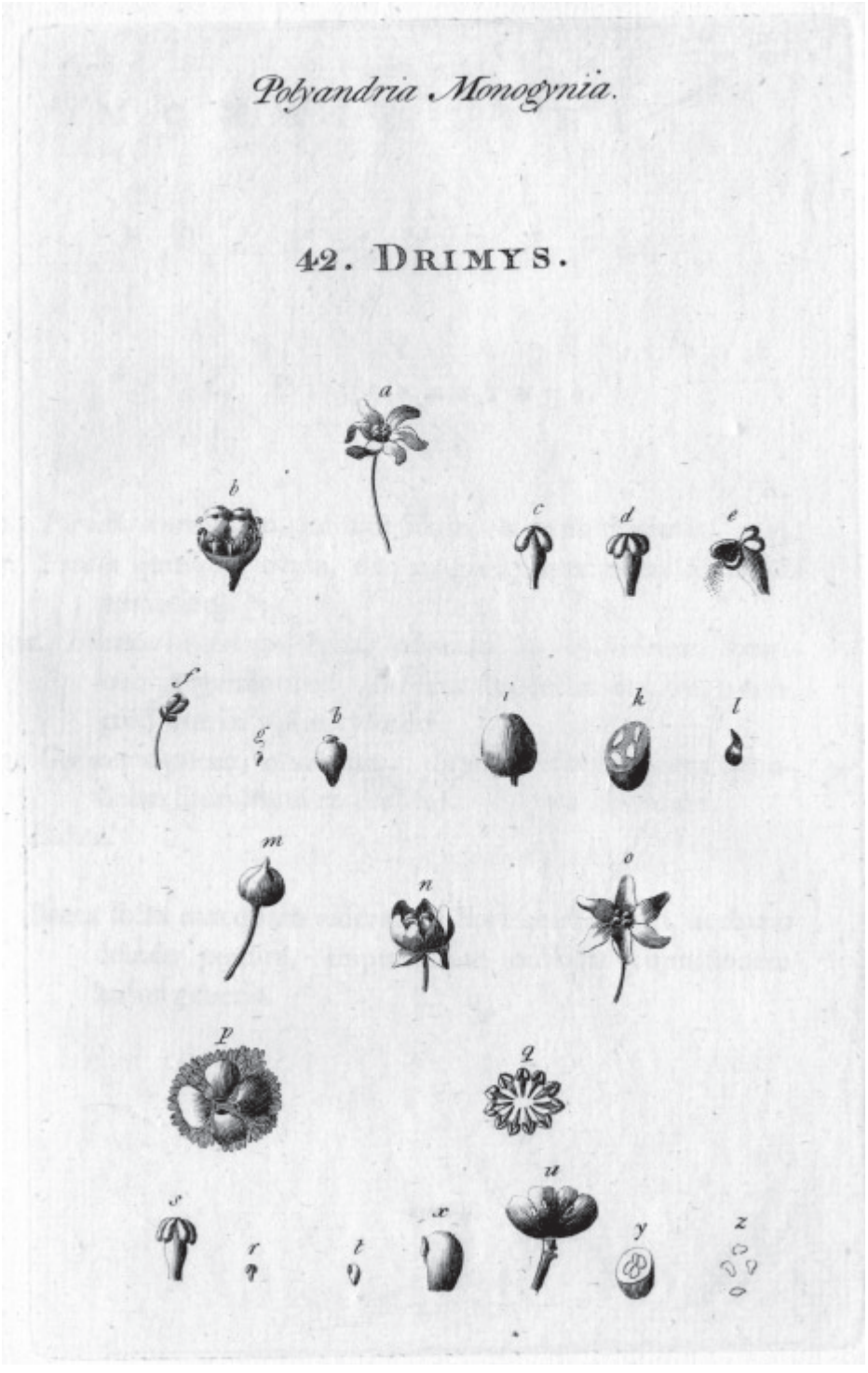

Figure 4. *Drimys*, from Johann Reinhold Forster, *Characteres Generum Plantarum* (1776). (Credit: RHS, Lindley Library)

Figure 5. *Decandria*, from Johannes Gessner, *Tabulae phytognomicae* (1795–1804). (Credit: RHS, Lindley Library)

The age of Linnaean illustration could be said to have ended in self-parody, with the publication of Robert John Thornton's *New Illustration of the Sexual System of Linnaeus*, compiled between 1797 and 1807: the ancestor of the modern coffee-table book, and a complete triumph of style over substance. For a not very extensive text on sexuality in plants and Linnaean classification, Thornton commissioned a battery of well-established artists (and calligraphers!) to produce ornamental plates, some emblematic (a battery of classical gods crowning a bust of Linnaeus), some plant portraits – but portraits with arbitrarily selected landscape backgrounds, unrelated to the native habitat of the plants.

By the time Thornton had completed his beautiful piece of puff, the Linnaean system had come under attack on the continent; Jussieu's rival system of classification, dividing the flowering plants into monocotyledons and dicotyledons, with families based on a variety of critera, was gaining converts, and being added to and improved by Candolle, Robert Brown, and others. The sexual system was labelled an "artificial" system; what the new generation required was a "natural" system, that took all the parts of the plant into consideration. P.J.F. Turpin and the brothers Bauer were the leading artists of the new school. In Turpin's early work for Humboldt, Bonpland and Kunth, based on the herbarium specimens they sent back from South America, he created exact portraits of the individual specimens. Ferdinand Bauer, in his plates for Sibthorp's *Flora Graeca*, reintroduced root systems into his depictions, even though these were not required by the botanist.

Probably the most famous of all botanical artists, Pierre-Joseph Redouté (1759–1840), is best considered as an adherent of the Linnaean tradition in botanical art, even though he was a contemporary of the artists who rebelled against Linnaean principles. In his early work, providing illustrations for works by L'Héritier de Brutelle (*Cornus, Geraniologia*) and Augustin-Pyramus de Candolle (*Historia Plantarum Succulentarum*), he produced magnificent plates that presented the morphology of the entire plant. But once he had achieved sufficient fame and power to control his own publications (so that in *Les Liliacées* and *Les Roses* his name received top billing on the title-page, while the botanists who wrote his text were given much less prominence), he progressively abandoned the ideal of the total plant, and in large part reverted to concentration on the flower alone.

During the course of the early 19th century, the Linnaean system of classification was progressively abandoned throughout Europe, lingering longest in England. But even there the new approaches to plant illustration won out, and work influenced by the Bauer brothers in particular was produced in the second quarter of the century to accompany books that were still basically Linnaean in their textual treatment. Mrs Bury's *Selection of Hexandrian Plants* (1831–34) might still use Linnaean classification in its title, but the illustrations were, in their treatment of the general morphology of the subjects depicted, far removed from the 18th century tradition. The *Botanical Register*, under John Lindley's editorship in the 1820s and 1830s, with drawings by Sarah Anne Drake, rivalled *Curtis's Botanical Magazine* and set a non-Linnaean standard that Curtis eventually caught up with. But the half-century and more of Linnaean domination had led artists into a more detailed examination of certain aspects of plant anatomy than had ever before been required, and introduced a greater rigour into botanical illustration.

Linnaeus' Legacy: Botanical Art from the Age of Transoceanic Discovery

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As well as bringing back novel plants from newly discovered lands, some explorers arranged to capture and disseminate images of how their collections appeared in the living state, images that were as novel in their day as those first satellite views of the far side of the moon. Despite their initially indifferent quality, these not only enthralled and captivated their peers, but also provided information that was essential to the full scientific description of the newly discovered species.

An equally important reason for the creation of botanical art was to record the first flowering in cultivation of new and remarkable species. In this paper, however, I will focus on 18th century botanical art that was generated, or commissioned by, the pioneer explorers, including some of Linnaeus' "disciples", while touching on the art of resident botanists. Linnaeus himself was a pioneering explorer of Lapland, Dalarna, Õland and Gotland. He meant different things to different people. But one thing is certain: he was no great botanical artist. Wilfrid Blunt provided an apt commentary:

> Matisse once wrote that his ambition was to draw like his little girl of five; Linnaeus achieved this effortlessly.

Engelbert Kaempfer (1651–1716) was a near-contemporary of Linnaeus, rather than a follower. However, his images were cited in Linnaeus' works, as described elsewhere in this volume by Charlie Jarvis, and they became the basis for typifying newly described species. Kaempfer was a German-born explorer who lived in Nagasaki, Japan in the early 1690s. In his *Amoenitates Exoticarum*, published in 1712, he provided the first illustrations of the *Camellia* under the Japanese name Tsubakki (Fig.1). After his death, his papers and specimens were acquired through the good offices of Dr Steigerthal by Sir Hans Sloane, who organised an English translation of Kaempfer's *History of Japan*; and this plate, taken from that work (published in 1727) shows an image of an early *Camellia* bearing a strong resemblance to the Tea plant. It is interesting to note that the original German edition was delayed, according to the translator's introduction, by "the want of good engravers". This was to be a recurrent theme throughout the 18th century. As well as describing about a hundred Japanese plants he also wrote about tea, paper making, acupuncture and ambergris.

The early 18th century also witnessed the expansion of state-sponsored exploration in France. Joseph Pitton de Tournefort was dispatched on a mission to the Patriarch of Armenia by King Louis of France from 1700 to 1702, accompanied by the artist Claude Aubriet and botanist Andreas von Gundelsheimer. This expedition laid the foundations for Linnaeus' knowledge of the flora of Anatolia and, later on, Sibthorp & Smith's *Flora Graeca*. Tournefort's far from satisfactory classification of plants also prompted Linnaeus to develop a more practical and all-embracing method, and one which also

Figure 1. Tsubakki, *Camellia japonica* from Engelbert Kaempfer's *Amoenitates Exoticarum* (1712), formerly in the Earl of Derby's library, Knowsley Hall. Courtesy of the Board of Trustees of National Museums Liverpool.

made botanical illustrators pay more attention to the minute details of plants' sexual organs, flowers and fruits.

Sir Hans Sloane, who was a long-serving President of the Royal Society, was born in 1660 and was elected to that body as a comparatively young man in 1685. In 1687 he went to Jamaica as the personal physician to the Duke of Albemarle, but the death of his patient does not seem to have damaged his career. Indeed, it gave him more scope for studying the flora of Jamaica, as John Ray had encouraged him to do, and on his return to Britain he catalogued more than 800 species of plants in 1696. Later, he described the natural history of Jamaica in more detail in his *A voyage to the islands…with the Natural history… of Jamaica*, the first volume of which appeared in 1707 and the second in 1725. Linnaeus placed considerable reliance on Sloane's text and drawings in describing the Jamaican flora in his *Species Plantarum* of 1753, coincidentally the year of Sloane's death.

One of the collections acquired by Sir Hans Sloane was that of the Essex-born explorer Mark Catesby (1683–1749). He too had early contact with John Ray, and when he went to visit his sister in Williamsburg, Virginia in 1712, using a legacy from his father, he first obtained seeds and botanical specimens, some of which he forwarded to the London nurseryman Thomas Fairchild. His success in growing these novelties soon attracted the attention of other botanists, and William Sherard proposed that Catesby should return to America to collect for the Royal Society. He travelled quite widely in the Carolinas and beyond, including the West Indies, sending specimens back to Sir Hans Sloane before returning in 1726. His *Natural History*, in folio with coloured plates, benefitted from the patronage of Peter Collinson, a London haberdasher and keen horticulturist who was also providing financial support to North America's first

native-born botanical collector, John Bartram. Collinson provided an interest-free loan that enabled Catesby to publish his first volume in 1731; two years later he was elected as a Fellow of the Royal Society. Linnaeus made use of material from the *Natural History* in his *Species Plantarum* and also in *Systema Naturae*. Finally, in 1746 Catesby published a Supplement in which he described more material sent to him by Bartram and others.

We know of Collinson's support of Catesby because an extra-illustrated copy of his *Natural History* has been preserved in the Earl of Derby's library at Knowsley Hall. It was Collinson's own copy. In it, his inscription records that he sponsored its publication. Remarkably, no-one has yet discovered the identity of the book's printer. We do know, however, that Catesby taught himself the necessary skill of engraving the plates. Again, the high cost of employing an engraver was evidently an issue. The close links between Bartram, Collinson, Ehret and Catesby are further revealed by the presence in the Knowsley volume of some original drawings of North American plants by Bartram's son William, whose work was praised by Dr John Fothergill in a letter to John Bartram as being almost up to the standard of Ehret's work. This was a somewhat flattering comparison.

Collinsonia commemorates Peter Collinson (Fig. 2), and was introduced from North America where it was first collected by John Bartram. A member of the labiate family, it never really caught on as a popular garden plant.

Jumping ahead in time to refer to pupils of Linnaeus, the most notable Swedish botanist to explore North America in the 18th century was Pehr Kalm, who is commemorated in the genus *Kalmia*. His book *Travels in North America*, originally written in Swedish and published in J.R. Forster's English edition in 1770, describes not only the hardy plants which were the primary focus of his expedition but also the material culture of Native Americans and their interactions with the colonists in everyday life which, together with his natural history observations, give the book a wide appeal. The illustrations, however, are mainly of animals – and waterfalls.

Figure 2. Peter Collinson FRS, SAS, Acad. Reg. Berol. Et Suec. Soc., Æta: LXXV, engraved by J. Miller, showing (on left) the plate of *Collinsonia* from Linnaeus' *Hortus Cliffortianus* (1737/8). Courtesy of the Linnean Society of London.

Hortus Elthamensis, written by Johann Jakob Dillenius (1687–1747) to describe the plants in the Eltham garden of James Sherard, marks a further stage in the development of the Florilegium. Linnaeus' visit to Oxford in 1736 undoubtedly influenced both the form of his great work *Hortus Cliffortianus* and convinced him of the need to procure the services of a competent botanical artist. The plates in *Hortus Elthamensis* were drawn

by Dillenius himself, and the illustrations in his work on mosses, *Historia Muscorum*, leave one in no doubt as to his limitations.

Another powerhouse for plant introductions from North America was the Chelsea Physic Garden, whose curator Philip Miller was at the centre of a web of contacts between explorers, sponsors, cultivators and illustrators. One of these was Dutch-born

Figure 3. Pistachia Nut, *Pistacia vera*, Scarlet Horse Chesnut, *Aesculus pavia* and Oleaster or Wild Olive, *Olea europaea* subsp. *oleaster*, from *A catalogue of trees, shrubs, plants and flowers, both exotic and domestic*, by A Society of Gardeners (1730). Courtesy of the Linnean Society of London.

Jacob van Huysum (ca. 1687–1740) who illustrated, among many other collections, the plants brought back from the West Indies by William Houstoun (1795–1733). Some of these illustrations were included in Miller's *Catalogus Plantarum* (1730) (Fig. 3). Houston collected in Mexico, the Caribbean and tropical South America. It was the demanding horticultural requirements of these tropical plants that propelled the technological innovations at Chelsea, including the construction of hot-wall heated greenhouses. Sadly, van Huysum was driven to drink and failed to measure up to the superlative artistic achievements of his brother Jan.

Philip Miller's other major claim to fame was his *Gardener's Dictionary*, which ran through eight main folio editions and some abridged versions for the less wealthy purchaser. As this was not illustrated, Miller also commissioned the engraving of 300 copper plates for his *Figures of the most beautiful, useful and uncommon plants described in the Gardener's Dictionary,* published in 1760. The title, indeed, encapsulates the criteria used for selecting plants to be figured; Beauty, Utility and Rarity. This volume contained plates based on figures by Bartram, Ehret, Houstoun and J.S. Müller (later anglicised to Miller). In the Introduction, Miller explains that the expenses of production forced him:

> almost from the beginning to contract his plan, and confine it to those plants only which are either curious in themselves, or may be useful in trades, medicine etc., including the figures of such new plants as have not been noticed by any former botanists.

While the British had benefited from plants newly introduced from North America, the Dutch had similarly enriched their gardens with new plants from their colony at the Cape of Good Hope. Many were succulents which, with the rather primitive methods then available, were better suited to surviving long ocean voyages. The Duchess of Beaufort, who had fine gardens at Badminton and the Strand, commissioned a complex if financially incompetent horticulturist, Richard Bradley, to travel to Holland in search of novelties, with an introduction to Boerhaave provided by James Petiver. Bradley was a Fellow of the Royal Society (an accolade perhaps more easy to acquire then than now) with a penchant for succulents. His major work, *Historia plantarum succulentarum*, was a pioneering illustrated book in that it illustrated a range of species drawn, engraved and published by the author himself, many of which had never before been seen in cultivation. This approach was followed many years later by James Bolton (1735–99), a follower of Ehret (Fig. 4), in his *History of funguses growing about Halifax* (1788–91).

It is Linnaeus himself that we must thank for cataloguing one of the most important Dutch botanical garden collections of the early 18th century, the Hartekamp garden of the East India merchant George Clifford. The conjunction of Linnaeus and Ehret in Haarlem in 1735–7 was indeed a most fortunate circumstance, but the frontispiece to this book, engraved by Wandelaar, is worth examining for its symbolism as well as its design. As well as showing the *Musa* for which Clifford was famous, it also advertised the centigrade thermometer and showed the garden's plan. Clifford, thinly disguised as a Classical figure, is also featured among the statuary. With the high production standards for which the Netherlands publishing industry is renowned, *Hortus Cliffortianus* stands as Linnaeus' most lavishly printed work and a worthy legacy of his stay in Holland

Figure 4. Rice, *Oryza sativa* by Georg D. Ehret (ca. 1732). From an album titled *Deliciae Botanicae*, formerly in the Earl of Derby's library, Knowsley Hall. Courtesy of the Board of Trustees of National Museums Liverpool.

(Fig. 5) (Griffiths, M. 2008. Clifford's Banana: How Natural History was made in a Garden. *The Linnean Special Issue No. 7 The Linnaean Collections*).

Linnaeus' visit to Paris, though brief, enabled him to glimpse the splendour of the Velins du Roi. Some were published only in 1788, almost 10 years after his death, in *Recueil des Plantes Gravées par Ordre du Roi Louis XIV.*

While visiting England, Linnaeus also became acquainted with the aforementioned Peter Collinson, seed agent for the American collector John Bartram. Although Bartram was one of the most important sources of North American plants in the period after Catesby, it was his conifer seed that had the most significant landscape impact, due to astute marketing by Collinson. Described as "painting with living pencils", the use of North American conifers in private parks landscaped by his friend Lord Petre, at Worksop, Nottinghamshire and Thorndon, Essex, exhibited a new diversity of textures

and colours. The Weymouth Pine is named not for the Dorset town of that name but for Lord Weymouth who popularised *Pinus strobus* shortly after its introduction to cultivation in England in 1705.

The inspiration for Aylmer Bourke Lambert's *Description of the genus Pinus*, published at the beginning of the 19th century, is said to have been the plantings at Painshill Park laid out by Charles Hamilton, another recipient of Collinson's conifer imports. Lambert also acknowledges the Earl of Derby, in whose library now reposes a collection of original drawings of pines by the Bauer brothers on which some of the published illustrations in *The genus Pinus* were based.


HORTUS
CLIFFORTIANUS
Plantas exhibens
QUAS
In Hortis tam Vivis quam Siccis,
Hartecampi in Hollandia,
COLUIT
VIR NOBILISSIMUS & GENEROSISSIMUS
GEORGIUS CLIFFORD
JURIS UTRIUSQUE DOCTOR,
Reductis Varietatibus ad Species,
Speciebus ad Genera,
Generibus ad Classes,
Adjectis Locis Plantarum natalibus
Differentiisque Specierum.
Cum TABULIS ÆNEIS.
AUCTORE
CAROLO LINNÆO,
Med. Doct. & Ac. Imp. N. C. Soc.
AMSTELÆDAMI 1737.
Mary Egerton
Backford Hall

Figure 5. Title page of a copy of *Hortus Cliffortianus*, by C. Linnaeus (1737/8) formerly owned by Mary Egerton of Backford Hall, Cheshire. Courtesy of the Board of Trustees of National Museums Liverpool.

Having mentioned Ferdinand and Francis Bauer, I regret that the voyage of *The Investigator* under Captain Flinders falls outside the scope of this essay. Some of the finest examples of botanical art from the age of exploration post-Linnaeus were made on voyages to the South Seas, and one of these was Captain Cook's first voyage to observe the Transit of Venus in Tahiti, on which he was accompanied by Sir Joseph Banks. Sydney Parkinson, by profession a draper (like Collinson) was chosen by Banks to work as an illustrator at Kew. He was then recruited as a member of Banks' team to accompany himself and Daniel Solander, a Swede and protégé of Linnaeus, on their voyage. Sadly Parkinson died during the expedition, but not before he had made extensive sketches and finished drawings of the plants and animals of the South Pacific and Australasia. The later sketches were worked up after the expedition by Frederick Miller and others. Inexplicably, the expensively engraved drawings were never published during Banks' lifetime, but as the copper plates survived they eventually provided the raw material for the Alecto edition of Banks' *Florilegium*.

Cook's second voyage was no less botanically productive, and on this journey he was accompanied by Johann Reinhold Forster and his son George. The latter was a competent artist whose work is less well known than it might be on account of the fact that some of his original drawings were acquired by the London physician and botanist Dr John Fothergill, a friend of Collinson and fellow Quaker who owned a private botanical garden. Fothergill's collections of botanical drawings were bought up *en masse* by agents for Tsarina Katerina (Catherine the Second) and were incorporated into the royal collections at St Petersburg. There they remain, and I was privileged to see the Forster drawings during a recent visit to the Komarov Botanical Institute. There are also a number of Ehret's drawings from the Fothergill collection there: a massive, if almost untapped, resource.

Linnaeus' legacy of botanical art includes a most unusual phenomenon: botanical wallpaper. At his summer house in Sweden, one of the bedrooms contains a wide-ranging collection of botanical prints from Ehret's *Plantae et Papiliones Rariores*, Sloane's *Natural History* and others, while his study (according to Brian Gardiner's article in *The Linnean*) contains Plumier's original drawings for Burman's *Plantarum Americanarum,* one of which is a type! Clearly Linnaeus subscribed to the view that art is made to be seen.

In *The Art of Botanical Illustration*, Wilfrid Blunt bemoans the fact that too many examples of botanical art of the "age of Ehret" are lying unseen and unsung in private and public collections while the public pays fantastic prices for the "sentimental trifles of the 19th century". In this he is echoing the words of John Ruskin, who lamented the waste of "exquisite original drawings and sketches of great botanists, now uselessly lying in inaccessible cupboards". It is my earnest hope that in this age of the internet such artistic riches will once more be revealed in their full splendour, and that one will no longer be restricted to viewing them in 18th century folios.

The Linnaean Legacy: Three Centuries after his Birth

Part 3: Today and the Future

The Pennant goby (or Fire goby) *Nemateleotris magnifica* (Photo: P.Morris).

Linné and Taxonomy in Japan: On the 300th Anniversary of his Birth

His Majesty The Emperor of Japan HMLS

President, dear friends

I am very grateful to the Linnean Society of London for the kind invitation it extended to me to participate in the celebration of the 300th anniversary of the birth of Carl von Linné. When, in 1980, I was elected as a foreign member of the Society, I felt I did not really deserve the honour, but it has given me great encouragement as I have tried to continue my research, finding time between my official duties.

Today, I would like to speak in memory of Carl von Linné, and address the question of how European scholarship has developed in Japan, touching upon the work of people like Carl Peter Thunberg, Linné's disciple who stayed in Japan for a year as a doctor for the Dutch Trading House and later published *Flora Japonica*.

Carl von Linné, who was born in Sweden in 1707, published in 1735, when he was 28 years old, the first edition of *Systema Naturae*, in which he outlined a new system of classification. According to this system, the plant kingdom was classified into 24 classes based mainly on the number of stamens, the animal kingdom was classified into six classes – quadrupeds, birds, amphibians, fishes, insects and worms – and the mineral kingdom was classified into three classes – rocks, minerals and mined material. Each class was divided into several orders, and examples of some genera were given for each order. Linné firmly believed that nature had been created by God in an orderly and systematic manner, and he aimed to discover the order of nature so that he could classify and name all things created by God and thus complete the system of nature. However, in Linné's system, which classified plants mainly on the basis of the number of stamens, species with different numbers of stamens belonged to different classes, even when their other characteristics were very similar, while species with the same number of stamens belonged to the same class, even when their other characteristics were very different. This led to the idea that the classification of organisms should be based on a more comprehensive evaluation of all their characteristics. This idea gained increasing support, and Linné's classification system was eventually replaced by systems based on phylogeny.

The binomial nomenclature proposed by Linné, however, became the basis of the scientific names of animals and plants, which are commonly used in the world today, not only by people in academia but also by the general public. In the binomial nomenclature, the scientific name of a species consists of a combination of the generic name and an epithet denoting the species. Before Linné established the binomial nomenclature, scientific names consisted of the species' generic name and a description of the characteristics of that particular species which differentiated it from the other species in the same genus. Therefore, when there were many species in one genus, the description differentiating one species from the others became highly detailed and very long, making scientific names difficult to use. To solve this inconvenience, Linné

proposed a new nomenclature, excluding the description of characteristics from the scientific name and simplifying it to a combination of a generic name and an epithet only, with the description of the species to be noted separately.

The International Code of Zoological Nomenclature and the International Code of Botanical Nomenclature stipulate that, when more than one scientific name exists for a particular species, the oldest scientific name shall be adopted. It is also stipulated that, for spermatophytes and pteridophytes, the scientific names in the first edition of Linné's *Species Plantarum*, published in 1753, shall be recognised as the oldest scientific names, and for animals, the scientific names in Clerck's *Aranei Svecici*, a monograph on spiders, and those in the 10th edition of Linné's *Systema Naturae*, both deemed to have been published on 1 January 1758, shall be similarly recognised. The names published before these publications are not recognised as scientific names of the organisms.

In the first edition of *Species Plantarum* and in his later books, Linné described many Japanese plants and gave them scientific names. *Camellia japonica*, for example, was described in the first edition of *Species Plantarum*, and this scientific name is still used today. These Japanese plants were illustrated by Engelbert Kaempfer in his book, *Amoenitatum Exoticarum*, which was published in 1712. Kaempfer was a German doctor who served in the Dutch Trading House in Japan for two years from 1690.

At that time, Japan had isolated itself from the world. Japanese people were not allowed to go abroad, and visits by foreigners to Japan were severely restricted. As the policy of isolation was taken to suppress Christianity, the Dutch, who came for trading purposes only and not to promulgate Christianity, were permitted to come to Japan. The Dutch people were made to live on an artificial island, Dejima, built in the sea off Nagasaki and connected to land by a bridge, and could not leave the island without permission. The head of the Trading House, however, was to visit the shogun at Edo, present-day Tokyo, once a year, accompanied by his delegation including the doctor. Kaempfer thus visited Edo twice during his stay, taking more than 80 days for the trip each time.

It was during his stay in Japan that Kaempfer sketched the plants, which were later published in *Amoenitatum Exoticarum* in 1712. His 256 sketches are now kept in the Natural History Museum.

In 1775, 83 years after Kaempfer left Japan, a Swedish doctor, Carl Peter Thunberg, arrived at the Dutch Trading House. Thunberg was Linné's disciple and later became a full professor at Uppsala University in both botany and medicine. Kaempfer and Thunberg were both doctors who worked in the Dutch Trading House during Japan's period of isolation. But unlike Kaempfer's days, Japanese doctors had a deeper recognition of European medicine when Thunberg came to Japan. This change occurred because in 1720, Shogun Tokugawa Yoshimune relaxed the prohibition on importing books, which had been put in place to prevent Christian ideas from coming into Japan, and allowed the import of books on European science published in China, which were unrelated to Christianity. This development stimulated research on European science and people came to focus their attention on medical books written in Dutch.

Yamawaki Toyo, who had studied classical Chinese medicine introduced into Japan, noted the great difference between what he had learned and the illustrations in

the imported Dutch medical books. To find out which was true, he performed a dissection of a human body in 1754, with permission from the government, and published the results as *An Account of the Observation of Viscera*. From that time onward, dissections were often performed. In 1774, a year before Thunberg arrived in Japan, *A New Book of Anatomy* was published. It had been translated from Dutch into Japanese by Sugita Genpaku and other doctors of Edo. They decided to start the translation when they actually saw a dissection and were convinced of the accuracy of the Dutch book on anatomy. Some of the people who came together knew the Dutch language, but the leader of the translation project, Sugita Genpaku, did not even know the alphabet. Translation proved to be an extremely difficult task, but thanks to the zeal of Genpaku, who wanted to publish the book in Japanese as soon as possible and contribute to medicine, *A New Book of Anatomy* was completed for publication after only three years.

In Kaempfer's posthumous book, *The History of Japan*, he writes that, during his two visits to Edo, only one Japanese doctor visited him just once to ask for medical advice on some disease. In Thunberg's book, *Travels in Europe, Asia and Africa Made During the Years 1770–1779*, however, he writes that immediately upon arrival in Edo, he received visits from five doctors and two astronomers, and that thereafter, Katsuragawa Hoshu, a doctor for the shogun, and his friend Nakagawa Jun-an visited Thunberg almost every day and sometimes stayed till very late into the night to learn from him about various scientific matters. These two doctors had both participated in the translation of *A New Book of Anatomy*. In the book, their names appear after Sugita Genpaku, the translator, as Nakagawa Jun-an, the editor, and Katsuragawa Hoshu, the supervisor. Both of them, Nakagawa Jun-an in particular, could speak Dutch quite well. Thunberg writes that he asked them the Japanese names of the fresh plants which they brought and taught them the Latin names and the Dutch names of the plants.

Exchanges between Thunberg and the two Japanese doctors continued even after Thunberg's return to Sweden. The letters the two doctors wrote to Thunberg are kept in Uppsala University. I saw those letters with Their Majesties the King and Queen of Sweden during our visit to Uppsala University in 1985, as Crown Prince and Crown Princess, and it left a deep impression on both of us.

We do not know exactly when the scientific names under the binomial nomenclature, originated by Linné, were introduced to Japan. As I mentioned earlier, Thunberg writes in his book that he taught Katsuragawa Hoshu and Nakagawa Jun-an the Latin names of plants. It is my view, however, that some doubts remain to conclude, from what Thunberg writes in this book, that the scientific names were first introduced to Japan at that time.

Linné's nomenclature started to be used in Japan after a German doctor, Philipp Franz von Siebold, arrived at the Dutch Trading House in 1823. By the time Siebold came to Japan, there were many Japanese who could speak Dutch. Siebold established a school of medicine and a clinic for treating patients in the suburbs of Nagasaki. He could also leave the island of Dejima to visit patients at their homes or to collect medicinal herbs. It was under such circumstances that in 1829, Ito Keisuke wrote a book in which Linné's nomenclature was used for the first time in Japan. Keisuke took the

scientific names of plants in Thunberg's *Flora Japonica*, which Siebold had brought to Japan, put them in alphabetical order, and added their Japanese names. In the supplement, he introduced Linné's classification system as "Explanation of the 24 Classes".

Keisuke studied under Siebold for six months in Nagasaki, and when he was about to return to his home in Nagoya, he was given Thunberg's book as a gift. Keisuke sent the manuscript of his book, *A Translation of Thunberg's Flora Japonica*, to Siebold in Nagasaki, and Siebold checked it.

In 1854, Japan and the United States signed the Treaty of Peace and Amity as the arrival of the American naval fleet brought to an end Japan's policy of isolation, which had lasted for more than 200 years. After that, Japan started establishing diplomatic relations with many countries. The last shogun, Tokugawa Yoshinobu, resigned from his post in 1867, and a new government was formed under Emperor Meiji. The Meiji government sent students overseas and invited foreign teachers to Japan, and the Japanese people made a great effort to acquire Western knowledge. The foreign teachers who were invited to Japan at this time made a great contribution to Japan, and the students who went to study overseas also contributed in various ways to the subsequent development of Japan.

One of the academic achievements made by Japanese scientists in the 19th century was the discovery of ginkgo sperm by Hirase Sakugoro in 1896. Hirase Sakugoro, who worked as an illustrator in the botanical laboratory of the University of Tokyo and later became a research associate, observed the swimming of ginkgo sperm, and published his paper on this discovery in a botanical journal. A month later, Ikeno Sei-ichiro, an associate professor in the agricultural department of the University of Tokyo who collaborated with Hirase Sakugoro in his studies, found cycad sperm, and also reported it in a botanical journal. It was known at the time that ferns have sperm, but this was the first time in the world that a gymnosperm was found to have sperm. This discovery was not believed at first, but it became accepted after zamia sperm, from the same cycad family, was discovered in the United States the following year in 1897. For this achievement these two researchers were awarded the Imperial Award of the Japan Academy in 1912.

The ginkgo is a gymnosperm unique in its phylogeny because it is a single-order, single-family, single-genus, single-species plant. It flourished in the Mesozoic Jurassic age but survived only in China, and was brought from China to Japan in ancient times. It was given a scientific name by Linné, on the basis of Kaempfer's illustration. The ginkgo tree that Hirase Sakugoro used for his research is still standing in the Koishikawa Botanical Gardens of the University of Tokyo. I visited the botanical gardens with the Empress last year and looked at the ginkgo tree, thinking of the research that was done a long time ago.

In the 20th century, as Japanese taxonomy made progress, more and more new species began to be reported. Before that, Japanese animals and plants were given scientific names by European scientists, and as a matter of course, the type specimens used for naming them were kept in European museums. Therefore, when Japanese researchers wanted to describe a Japanese animal or plant as a new species, they had

to check the type specimens in foreign countries one by one, and the difficulties they encountered were far from trifling.

Thanks to the efforts made by many people, all Japanese spermatophytes, pteridophytes and vertebrates excluding fishes now have scientific names. However, there are still many unnamed fishes, and, in particular, there are many gobioids which must be given scientific names.

When I started my research, I frequently referred to a book titled *Fish Morphology and Hierarchy* by Dr. Matsubara Kiyomatsu, published in 1955. The book covered all Japanese fishes with keys to the species, and it listed 134 gobioids including subspecies. In the more recent *Fishes of Japan with Pictorial Keys to the Species*, published in 2002, the number of gobioids, including subspecies, increased to 412, but 45 of them have only Japanese names and have no scientific names yet.

There were two studies that particularly interested me as I embarked on my research on gobioids. One was "The osteology and relationships of certain gobioid fishes, with particular reference to the genera *Kraemeria* and *Microdesmus*" by Dr. William Gosline published in 1955, and the other was "Studies of the gobioid fishes in Japanese waters; on the comparative morphology, phylogeny, taxonomy, distribution and bionomics," which was an unpublished doctoral thesis by Dr. Takagi Kazunori. With these papers as reference, I proceeded with my taxonomical research. On the one hand, I studied the relationships among many kinds of gobioids, analysing their bones stained with alizarin red. I studied, on the other hand, the differences among species of gobioids by comparing the arrangement of their head sensory canal pores and sensory papillae.

Back in the 1960s, no one in Japan was yet classifying gobioids on the basis of the arrangement of their head sensory papillae. Therefore, in 1967, when I published the classification of the four species of the genus *Eleotris* found in Japan based on the arrangement of their sensory papillae in the *Japanese Journal of Ichthyology*, apparently there were some people who had considerable doubts about my classification. However, the arrangement of the sensory papillae has now become an important factor in classifying gobioids, and I am glad that I have been able to make some contribution in this field.

The binomial nomenclature established by Linné has been immensely beneficial, providing a universal basis for taxonomy throughout the world and enabling taxonomists around the world to communicate with each other through a common language about things existing in nature. Since then, taxonomy to this day has continued to develop on the basis of this binomial nomenclature. As I mentioned at the beginning, Linné's classification system based mainly on the number of stamens was eventually replaced by a system based on a more comprehensive evaluation of all characteristics. It is understandable that the idea of using phylogeny as the basis for taxonomy had not yet appeared at Linne's time. It was almost a hundred years after Linné that the theory of evolution proposed by Darwin and Wallace was presented here at the Linnean Society, and the idea of phylogeny became newly accepted in the academia. In academia today, an even newer field of research, molecular biology based on evolution, is seeing remarkable development. As a result, more importance is placed on phylogeny, and

systems based on phylogeny are considered to be more accurate and are now the mainstream of taxonomy.

As I have been familiar with classifications based on morphology since I was young, the appearance of the electron microscope which enabled me to observe minute morphological characteristics, and my encounter with an even smaller world, where classification is based on DNA analysis at a molecular level, have been great experiences for me as a researcher. In the years ahead, I think the analysis of mitochondrial DNAs will open up great possibilities of discovering new species which cannot be distinguished morphologically but which can be clearly distinguished at a molecular biological level. I hope to understand and take into consideration this newly developing field of research, but at the same time, I intend to continue to give my attention to and keep up my interest in morphology, which is a field of study carried on from Linné's days. I would like to continue my research, always keeping in mind the question of what will be the importance and role of morphology in the field of taxonomy in the future. On the 300th anniversary of Linné's birth, I feel that taxonomy, which used to be based solely on morphology, is entering a new era.

In closing, I would like to thank you again for this invitation and I offer my best wishes for the further prosperity of the Linnean Society of London.

England's Linnaeus

Brent Elliott FLS

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Imagine the scene. It is September 1784. Linnaeus' collections – his herbarium of 19,000 specimens, his shell and insect collections of nearly 5,000 specimens, and his library of 2,000 volumes – have been purchased by James Edward Smith (Fig. 1), for the sum of £1088.5s. They have been loaded onto a ship, which has embarked for England. As the ship makes its way through the Baltic Sea, it finds itself pursued. The King of Sweden, realising what the loss of these collections would do to Sweden's national pride, has sent another ship to stop the collections from reaching England. But the first ship has a decisive advantage, or is faster, and the pursuing ship eventually has to give up. Linnaeus' collections continue on their way to their new home.

Figure 1. The portrait of James Edward Smith which hangs in the rooms of The Linnean Society of London.

There are a few difficulties with this story, most importantly the fact that it didn't happen. There were, indeed, recriminations in Sweden when it was realised that probably the largest natural history collection in the world had been sold to a foreign buyer; J.G. Acrel and C.P. Thunberg came in for reproaches for their part in abetting the purchase; but there was no chase at sea. Anders Dahl, who had coveted Linnaeus' collections for himself, had written to the King, urging that they be reclaimed, even if they were already on board ship, and adding "that foreigners would always taunt the Swedes with their inability to retain such precious collections; that the possessor would become a Dictator in Science…". But things moved too slowly. The Stockholm Export Sea Customs Chamber issued a certificate on 8 October, stating that the ship had passed the last customs post on 29 September, so it was too late to do anything.

But 20 years after the event, the story of the marine chase was being recounted as fact, depicted in Robert John Thornton's *Botanical Extracts*, as a vignette accompanying a portrait of Smith in a plate printed in 1800 (Fig. 2). Smith must have circulated the story; his widow recorded, in her memoir of her husband published in 1832, that "The ship which was conveying this valuable cargo had just sailed, when the king of Sweden, Gustavus III., who had been absent in France, returned home, and sent a vessel to the Sound, to intercept its voyage; but happily it was too late. At the end of October, 1784, the packages were safely landed at the custom-house". The origin of the story no doubt lies in Dahl's plea for the seizure of the goods; perhaps by the time it reached Smith's ears it had already been elaborated from an ineffectual afterthought to a near miss at sea.[1]

The other problem with this story, apart from its inaccuracy, is its curious tone. We can all imagine how a modern historian would present the story: an act of international piracy being held up for admiration, the fledgling British Empire gaining practice in rapacity through commerce, a presage of the disgraceful conniving at removing the Elgin marbles from Greece a few decades later. But this is evidently not how the matter was seen at the time. The rhetoric is that of commercial probity: an honourable contract is made and adhered to by honourable men, despite the efforts of a foreign state to break the contract and force honourable men to renege on their agreements. When Acrel was accused of taking a bribe to ensure that customs procedures were dealt with speedily, Smith wrote indignantly to defend "the rectitude of your behaviour". Right dealing was the keynote of all the correspondence. Smith had had to get his father to advance some money to him, to be able to afford the purchase price; one of his father's letters cautions him "against the enthusiasm of a lover, or the heat of an ambitious man". In all respects, therefore, a triumph for commercial morality, for the spirit of business. Rather than thinking of rapacious imperialism, we should perhaps think of the boast, a generation later, of the Horticultural Society in its early years, that it would show that in England, private enterprise could accomplish what in foreign countries had to be attempted by the state.[2]

Of course, the importance of Linnaeus was well understood in England long before 1784. Linnaeus had himself visited England in 1736, while on temporary leave from George Clifford's garden at Hartecamp, and there, as everywhere else, he had managed to alienate people initially and reconcile them later. Established authorities viewed him as an upstart, bumptious and self-promoting, and only afterward were

Figure 2. Portrait of Sir James Edward Smith above a picture of the chase to recover Linnaeus' collections, which appears in Thornton's *Botanical Extracts* (1800). (Credit: RHS, Lindley Library)

persuaded of his merits as a botanist. (See for instance the story of his meeting with Dillenius.[3]) In the years 1737–38 Linnaeus published three works in Holland: the *Critica Botanica*, *Genera Plantarum*, and *Hortus Cliffortianus*. In these he spelled out both his nomenclature – the two-word code – and his taxonomy. Over the next few decades, one botanist after another began using the Linnaean system, either the nomenclature

or the taxonomy, not necessarily both. Within a year of the publication of the *Genera Plantarum*, Johannes Burman, in his *Rariorum Africanarum Plantarum*, adopted Linnaeus' binomial nomenclature. By the 1750s, Linnaeus' system had effectively ousted Tournefort's, the most generally accepted previous taxonomic system.[4]

But the British did not rush into the arms of Linnaeus; they had had John Ray, and who could ask for better than that? The first English work to use the Linnaean system of classification was Patrick Browne's *Civil and Natural History of Jamaica* in 1756; but Browne did not use the binary nomenclature. In 1759, Philip Miller adopted Linnaean classification – but not the binomial nomenclature – in the seventh edition of his *Gardeners Dictionary.* The following year, in the second volume of his massive *Vegetable System*, Sir John Hill switched over to Linnaean nomenclature. In 1762, William Hudson became the first British author to use both Linnaean classification and nomenclature in his *Flora Anglica*; in 1763, Thomas Martyn followed suit in his *Plantae Cantabrigienses,* and, more importantly for the general public, so did James Wheeler in his *Botanist's and Gardener's New Dictionary*. In 1768, Philip Miller finally adopted Linnaean nomenclature in the eighth edition of his *Gardeners Dictionary.*

By the time Linnaeus died in 1778, both his systems had come into general use in England. Within three years of his death, the first English biography appeared: Richard Pulteney's *General view of the Writings of Linnaeus* (1781). Two years later came the news that Linnaeus' collections were available for purchase. The announcement was sent to Sir Joseph Banks, who had made an unsuccessful bid for them immediately after Linnaeus' death; Banks by this time thought that he had a sufficiently big library, but he recommended to the young James Edward Smith that he try to acquire them – with what result, we have seen. In 1788 Smith founded the Linnean Society, to further spread the Linnaean system; and in a wonderful example of the business-like spirit, when he died in 1828, he did not leave Linnaeus' collections to the Society; they had to raise funds and purchase them from Smith's widow.

With the collections now in London, and the Linnean Society in existence, England had now become the headquarters of the Linnaean system. Linnaeus' biography now began to be tweaked so as to backdate the connection with England.

> Linnaeus might… have obtained an establishment in England, which, it has been thought, was his wish; and certainly his opportunities in this kingdom would have been much more favourable to his designs than in those arctic regions where he spent the remainder of his days. We may justly infer what an exalted idea Linnaeus had of England, as a country eminently favourable to the improvement of science, from the compliment which he paid to London, in a letter to a friend; speaking of that city, he called it '*Punctum saliens in vitello orbis*'. [5]

Smith circulated a story, which became a favourite of the 19th century. When Linnaeus visited England, so the story goes, he saw gorse for the first time; his eyes filled with tears, and he got down on his knees and thanked the Creator for letting him see the sight. This story, like that of the marine chase, did not happen as described. If Linnaeus got down on his knees at his first sight of gorse, it happened in Germany, not in England. But the story continued to be told.[6]

One of the reasons for the international success of Linnaean classification was its simplicity: the reliance on simple arithmetic (the numbering of stamens) as the basis

for most of the classes in the system. A testimony to the simplicity of the Linnaean classification, which led it to be championed as a teaching aid even after its truth to nature had been questioned, can be found in the autobiography of Donald Beaton, the major gardening journalist of the mid-19th century (despite the fact that, having been born into a Gaelic-speaking Highland family, he only learned English as an adult):

> I was now complete master of the Linnean system of Botany, as I thought. I could tell the class and order of any fresh flower, and I could run over a wonderful quantity of hard words and names. I knew the name and class of almost every plant in that part of the country. This was only pastime, compared with … learning to speak English. [7]

The acceptance of Linnaeus' system had to surmount a few philosophical obstacles. Some, like Thomas Pennant, took umbrage at his inclusion of man in the list of animals: "My vanity will not suffer me to rank mankind with Apes, Monkies, Maucaucos and Bats". But Linnaeus was hardly alone in emphasising the animal nature of mankind, and behind Pennant's remark can be seen the even more startling views of Rousseau and Lord Monboddo on the affinities between man and the orang-utan.[8] More notorious was the emphasis on sexuality. Linnaeus' taxonomy was, after all, the sexual system, and Linnaeus' supporters made no effort to downplay the fact – as can be seen from the title of John Miller's magnum opus, the *Illustration of the Sexual System of Linnaeus* (1777). There were certainly some who thought the discussion of plant sexuality indelicate, but in general the English seem to have warmed to the theme, and Linnaean discussions were carried out with intermittent smirking good humour. A letter from the Rev. Samuel Goodenough, later Bishop of Carlisle, is often quoted:

> To tell you that nothing could equal the gross prurience of Linnaeus's mind is perfectly needless. A literal translation of the first principles of Linnaean botany is enough to shock female modesty.

But Goodenough was a founder member of the Linnean Society, a man who thought Linnaeus' writing sublime, and his remark was probably tongue in cheek, especially as he went on to say: "It is possible that many virtuous students might not be able to make out the similitude of *Clitoria*". [9]

The most famous treatment of the sexuality of plants came in Erasmus Darwin's poem *The Botanic Garden*, the second part of which, *The Loves of the Plants*, a versified version of Linnaean classification, was published first in 1789. Darwin's formula was anatomical personification: for each flower discussed, the pistil was treated as a nymph being courted by one or more swains, the anthers, with the jovial implication that plants lived lives of jolly polygamy. The success of Darwin's poem was immense; one contemporary wrote that "It has silenced for ever the complaints of poets, who lament that Homer, Milton, Shakespeare and a few Classics had left nothing new to describe". Among those who thoroughly approved of its discussion of plant sexuality was the poet Anna Seward, who seemed to endure the shock to her modesty with great equanimity.[10]

In the wake of Darwin came Robert John Thornton (ca.1768–1837), who celebrated Linnaeus in that most pointless and silly of major botanical publications, the *New Illustration of the Sexual System of Linnaeus,* the ancestor of the modern coffee-table book. The great theme of Thornton's work is the discovery of the sexuality

of plants; the biggest single instalment of text is his essay on the subject; the portraits of botanists favour those who helped to impose the sexual system.

The irony of the English enthusiasm for Linnaeus is that the establishment of the Linnean Society preceded by a single year the publication of Antoine-Laurent de Jussieu's *Genera Plantarum* (1789), and the beginnings of the reaction against Linnaeus. European botanists sought to replace Linnaeus' 'artificial' system with a 'natural classification' that would establish the real relationships between plant genera, taking all the parts of the plant, not merely the sexual organs, into consideration. Jussieu's work was publicised and added to by Augustin-Pyramus de Candolle and others, and in England by Robert Brown, John Lindley and William Jackson Hooker. Genera that had been previously established, but had been lumped together by Linnaeus, were once again distinguished.[11] Lindley was particularly vociferous, condemning Linnaeus' system for its inconsistencies in grouping (e.g. plants with variable stamen numbers included in a single genus despite the obstacle this created to assigning the genus, 'so that it is necessary to understand the Natural System, to make use of the Artificial System').[12] The result? People continued to teach the Linnaean system; it continued to be used in schools. Mind you, the fact that Lindley produced three different, conflicting versions of a system of natural classification during the course of his lifetime was probably not a good advertisement for the stability of such a system.

The fact that alternatives to Linnaeus' taxonomy were available, associated with great names in botany, and, at least on the continent, increasingly preferred to Linnaeus', could not escape attention. As early as the 1780s, Pulteney's original advertisement for his *General view of the Writings of Linnaeus* claimed:

> No system yet invented can stand a rigorous examination through all its parts, and Linnaeus was, perhaps, better acquainted than any other man with the defects of his own.[13]

Sir James Edward Smith lived long enough to see the triumph of Jussieu's system on the continent, and wrote *A Grammar of Botany* (1821), in which he praised Jussieu, and argued that his and the Linnaean systems were really compatible.

After the death of Willdenow in 1813, it is hard to think of any new botanical work initiated on the continent that relied on Linnaeus' taxonomy, apart from such eccentricities as the *Deutschlands Wildwachsende Arzney-pflanzen* (1823–1828) by Johann Gottlieb Mann, a virtual autodidact. Further editions of Linnaeus' *Species Plantarum* and *Systema Vegetabilium* continued to appear into the 1830s, before botanists finally gave up on them; by that time De Candolle's *Prodromus* had been begun in an attempt to replace it.

In England, on the other hand, the sexual system remained the basis of most botanical publishing well into the second quarter of the 19th century. Take, for instance, Aylmer Bourke Lambert's *Description of the Genus Pinus*. Everything in the first edition (1803–7) was, as the title suggests, assigned to the genus *Pinus*, including *Pinus larix* and *Pinus abies*. For the 1828 edition, Lambert was assisted by David Don, and new genera were recognised for recently introduced trees: *Araucaria, Thuja, Podocarpus,* and *Taxodium* all appeared as separate genera, but as late as 1842 the cedars still appeared under *Pinus – Pinus cedrus, Pinus deodora*. Lindley himself

had to compromise with the Linnaean system, when in 1836 he was hired to finish Sibthorp's *Flora Graeca* after Sir James Edward Smith's death.

And so it went. Works organised according to the Linnaean system continued to appear in England: James Wheeler's *Catalogus Rationalis Plantarum Medicinalium* (1830), James Rennie's *Alphabet of Medical Botany* (1834), James Forbes' *Journal of a Horticultural Tour through Germany &c* (1837)… Mrs Bury's *Selection of Hexandrian Plants* was issued from 1831 to 1834, at a time when the term Hexandria was a fading memory on the continent. Even where the author was a supporter of natural classification, Linnaean classification had to come first, as in John Claudius Loudon's *Hortus Britannicus* (published in 1830, with supplements following up to 1850). It was not until 1857 that Arthur Henfrey's *Elementary Course of Botany*, the last textbook in England to list the Linnaean classes, could finally say that "the Linnaean System is seldom had recourse to, except as a means of furnishing an Artificial Key to the genera of a limited region".[14]

So the Linnaean system of classification had survived in England for some 40 years after it had fallen from favour on the continent. And the reason for this is that, since the latter end of the 18th century, Linnaeus had effectively been an English national treasure.

References

1. The image of the marine pursuit is taken from the plate depicting Sir James Edward Smith, in Thornton's *Botanical Extracts* (Plate dated 1800). The passage from the memoir of Smith: *Memoir and Correspondence of Sir James Edward Smith* (1832) I, p. 26. For the details of what actually happened, see B. Daydon Jackson, *Linnaeus* (London: H.F. & G. Witherby, 1923), pp. 345–57, and Wilfrid Blunt, *The Compleat Naturalist* (London: Collins, 1971), pp. 236–8.
2. The letter defending Acrel: Smith, op. cit., I, p. 127. The letter from Smith's father: ibid., p. 97.
3. Dillenius anecdote: Jackson, op. cit., pp. 156–8, and Blunt, op. cit., pp. 114–15, give slightly different versions.
4. For the onward march of Linnaean thought in Europe, see Frans A. Stafleu, *Linnaeus and the Linnaeans* (Utrecht: International Association of Plant Taxonomy, 1971).
5. Pulteney: *General View of the Writings of Linnaeus*, 2nd ed. (London: R. Taylor and Co., 1805): pp. 47–48.
6. Gorse episode: Jackson, op. cit., p. 158, and see p. 135 for Linnaeus having seen gorse in Germany. Smith tells the story in Smith and Sowerby, *English Botany*, plate 742.
7. Donald Beaton, "My autobiography", *Cottage Gardener*, vol. 13 (1853–54), pp. 153–8; the quotation is from p. 156.
8. Pennant: *History of Quadrupeds* (1781) – cited Blunt p. 154. For Rousseau and Monboddo, see Jean-Jacques Rousseau, *Discours sur l'Origine et les Fondements de l'Inégalité parmi les Hommes* (Amsterdam: Marc Michel Rey, 1755), and especially note 9, for the suggestion that the original form of man was similar to the "Orang-outang"; Lord Monboddo, *Of the Origin and Progress of Language* (Edinburgh: A. Kincaid, 1773), vol. I, p. 269, referring to the orang-utan as "in the first stage of the human progression".
9. Goodenough: Blunt, op. cit., p. 245. This is not one of the letters printed in Smith, *Memoir and Correspondence*, though there are plenty of others, which give substance to my suggestion that Goodenough's comment was tongue-in-cheek. See A. T. Gage, *A History of the Linnean*

Society of London (London: Taylor and Francis, 1938), p. 5–33 passim, for Goodenough's activities in the Society.

10. Desmond King-Hele, *Doctor of Revolution: the Life and Genius of Erasmus Darwin* (London: Faber and Faber, 1977), p. 197; the quotation is from Manning Edgeworth.
11. Though since *Species Plantarum* is the official starting point for botanical nomenclature, it is the revivers rather than the original coiners of these names who are officially credited with them – so that, for example, we are said to owe Pelargonium to L'Héritier de Brutelle rather than to Tournefort.
12. John Lindley, *Ladies' Botany*, 2nd edition (London: James Ridgway and Sons, c.1835), pp. vi-viii. There is not yet a thorough history of natural classification, but a good beginning has been made in Peter F. Stevens, *The Development of Biological Systematics* (New York: Columbia University Press, 1994).
13. For Pulteney's original advertisement, see William George Maton's preface to Pulteney, 2nd edition, op. cit., p. ix.
14. Arthur Henfrey, *Elementary Course of Botany* (London: John Van Voorst, 1857), p. 199.

Linnaeus' Lapland Herbarium in Paris

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The background

Linnaeus' Iter Lapponicum occurred between the 12 May and 10 October 1732. He celebrated his 25th birthday on the second day of his journey, which took him round the Bothnian Gulf with three expeditions inland. The second of those (6–30 July) was the most important, leading up into and through the mountains, down to the Atlantic coast of Norway. Only the 6–20 July was spent in the mountains or west of them at the coast, the rest of the journey took him over lowlands. Much has been written about this journey, and it has been explored from many angles – botanical, zoological, mineralogical, ethnographical, economical, to mention only the more prominent aspects.

The journey was inspired by Linnaeus' teachers in Uppsala, the professors Lars Roberg and Olof Rudbeck jr, especially the latter who had himself travelled in Lapland in 1695. A grant was given to Linnaeus by the Royal Society of Science in Uppsala.

Linnaeus kept a diary throughout the journey, but of varying accuracy and with lacunae for certain passages. It was not published in his lifetime. The first printed edition is the translation into English initiated by Sir James Edward Smith and accomplished by a Swedish merchant in London, Carl Troilius. The scholarly and definitive edition of that diary was published in three volumes by Fries, Fries & Jacobsson (2003–2005).

The only contemporary publication resulting from the journey, apart from a short plant list (Linnaeus 1732) is *Flora Lapponica* (Linnaeus 1737) one of his many major works printed in Holland. It is not really a flora of a restricted area, since it includes many species met outside Lapland (and a few not seen along the journey at all). But the most important contents deal with Lapland, with lots of information not only on botany, but about the usage of plants, not least among the Saamis (called Lapps by Linnaeus), their growing places, morphological features and much more.

The herbarium and its scientific role

A lesser known relic from the Lapland journey is the collection of about 260 plant specimens. There are few indications of plant collection in the diary. In the beginning "a heap of paper to put plants within" is mentioned among the equipment, and the text occasionally recommends "vide in sicco", which indicates dried material. The extant pressed specimens are now found bound within covers in the library at the Institut de France in Paris, totally different from places where herbaria are normally preserved. The background is as follows.

The plant collection from his Lapland journey was included in the wealth of scientific material that Linnaeus brought with him to Holland in 1735. The herbarium had probably formed one basis for the descriptions in *Flora Lapponica*. The connection is obvious since Linnaeus himself has written on the herbarium sheets figures in

agreement with the number of the species in *Flora Lapponica*. The specimens are glued to writing paper (22 x 15 cm). They are usually small and of very varying quality, but are in general inferior to the material in the Linnaean collections at the Linnean Society of London. This is quite natural in view of the fact that they were collected during a long journey, when it was essential to gather only small samples, and with regard to storing them for transport home.

Rather a few botanists have studied this herbarium. The first and most important was Professor Thore M. Fries, of Uppsala, the well-known biographer of Linnaeus who, in 1861, published an annotated list of contents (Fries 1861) which still constitutes the basis for our knowledge of this herbarium. Later the Swedish priest, S.J. Enander, a specialist on *Salix*, wrote a brief report (Enander 1910) and A.H.G. Alston of the British Museum (Natural History) produced a microfilm (Alston 1957). William Stearn commented on the herbarium in the facsimile edition of *Species Plantarum* (Stearn 1957) and emphasised its importance for typification of those binary names in *Species Plantarum*, which were given to plants first described in *Flora Lapponica*. In recent times B. Jonsell and C.E. Jarvis have consulted the collection for *Flora Nordica* and the Linnaean Plant Name Typification Project (Jonsell & Jarvis 2002, Jarvis 2007). Two sets of colour transparencies were produced, one now at the Natural History Museum (Department of Botany), London, and the other at the Museum of Evolution, Uppsala University.

Far from all the species in *Flora Lapponica* are represented in the herbarium. We shall never know whether the others have been lost or never existed. It is striking that all cryptogams, including all ferns, are lacking. They are the last plant species, nos. 380–534, in the *Flora* (nos. 535–537 are recorded by Linnaeus as "Lithophyta"). Of the 379 phanero-gamic species in the *Flora* about 130 are

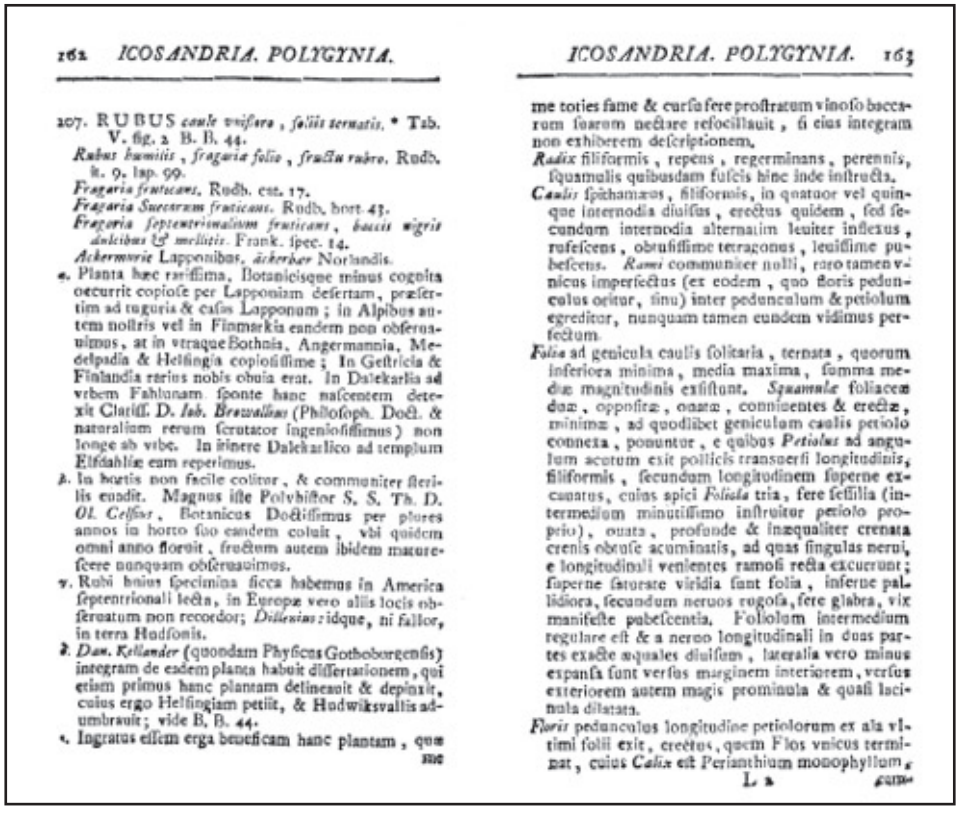
Figure 1. *Linnaea borealis* from the Lapland herbarium is the lectotype of the species name and the type of the generic name. *Campanula serpillifolia* was the name replaced by "Linnaea floribus geminatis Gronovii" in the plate caption of *Flora Lapponica*. The account of the text is headed "Planta nostra".

Figure 2. The specimen of *Parnassia palustris* in the Lapland herbarium. The number is in Linnaeus' handwriting, the text relating to *Flora Lapponica* probably by Johannes Burman.

missing. It is difficult to give an exact number due to some uncertainties about the connection between a specimen and the *Flora*. Fries (1861) pointed especially to difficulties within the genus *Salix*. As a rule the agreement is, however, good, thanks to the numbers that Linnaeus noted both on the sheets and in the *Flora*.

Fries (1861) also emphasised that many species could not have been collected in Lapland, nor in northern Sweden or Finland at all. They may of course have been collected during the journey north or south, but some of them could not possibly have been gathered along the route. Since Linnaeus does not give any localities no certainty can be reached. One example is no. 304, *Arnica montana* for which Linnaeus in *Flora Lapponica* gives "Smolandia" as its growing place. He includes it because

Figure 3. The specimen of *Rubus arcticus* in the Lapland herbarium. The figure by Linnaeus, the text probably by Johannes Burman.



162 ICOSANDRIA. POLYGYNIA.

207. RUBUS *caule vnifloro, foliis ternatis.* * Tab. V. fig. 2 B. B. 44.
Rubus humilis, fragaria folio, fructu rubro. Rudb. ii. 9. fap. 99.
Fragaria fruticans. Rudb. cat. 17.
Fragaria Succorum fruticans. Rudb. hort. 43.
Fragaria feptentrionalium fruticans, baccis nigris dulcibus & mellitis. Frank. fpec. 14.
Achermorie Lapponibus, *ächerbar* Norlandis.

α. Planta hæc rariſſima, Botanicisque minus cognita occurrit copioſe per Lapponiam deſertam, præſertim ad ruguria & caſas Lapponum; in Alpibus autem noſtris vel in Finmarkia eandem non obſervauimus, at in vtraque Bothnia, Angermannia, Medelpadia & Helſingia copioſiſſime; In Geſtricia & Finlandia rarius nobis obuia erat. In Dalekarlia ad vrbem Fahlunam ſponte hanc naſcentem detexit Clariſſ. D. *Iob. Browallius* (Philoſoph. Doct. & naturalium rerum ſcrutator ingenioſiſſimus) non longe ab vrbe. In itinere Dalekarlico ad templum Elfdahliæ eam reperimus.

β. In hortis non facile colitur, & communiter ſterilis euadit. Magnus iſte Polyhiſtor S. S. Th. D. *Ol. Celſius*, Botanicus Doctiſſimus per plures annos in horto ſuo eandem coluit, vbi quidem omni anno floruit, fructum autem ibidem matureſcere nunquam obſeruauimus.

γ. Rubi huius ſpecimina ſicca habemus in America ſeptentrionali lecta, in Europæ vero aliis locis obſeruatum non recordor; *Dillenius* idque, ni fallor, in terra Hudſonis.

δ. *Dan. Kellander* (quondam Phyſicus Gothoburgenſis) integram de eadem planta habuit diſſertationem, qui etiam primus hanc plantam delineauit & depinxit, cuius ergo Helſingiam petiit, & Hudwiksvallis adumbrauit; vide B. B. 44.

ε. Ingratus eſſem erga beneficam hanc plantam, quæ me

ICOSANDRIA. POLYGYNIA. 163

me toties fame & curſu fere proſtratum vinoſo baccarum ſuarum nectare refocillauit, ſi eius integram non exhiberem deſcriptionem.

Radix filiformis, repens, regerminans, perennis, ſquamulis quibusdam fuſcis hinc inde inſtructa.

Caulis ſpithamæus, filiformis, in quatuor vel quinque internodia diuiſus, erectus quidem, ſed ſecundum internodia alternatim leuiter inflexus, rufeſcens, obtuſiſſime tetragonus, leuiſſime pubeſcens. *Rami* communiter nulli, raro tamen vnicus imperfectus (ex eodem, quo floris pedunculus oritur, ſinu) inter pedunculum & petiolum egreditur, nunquam tamen eundem vidimus perfectum.

Folia ad geniculs caulis ſolitaria, ternata, quorum inferiora minima, media maxima, ſumma mediæ magnitudinis exiſtunt. *Squamulæ* foliaceæ duæ, oppoſitæ, ouatæ, connitentes & erectæ, minimæ, ad quodlibet geniculum caulis petiolo connexa, ponuntur, e quibus *Petiolus* ad angulum acutum exit pollicis transuerſi longitudinis, filiformis, ſecundum longitudinem ſuperne excauatus, cuius apici *Foliola* tria, fere ſeſſilia (intermedium minutiſſimo inſtruitur petiolo propio), ouata, profunde & inæqualiter crenata crenis obtuſe acuminatis, ad quas ſingulas nerui, e longitudinali venientes ramoſi recta excurrunt; ſuperne ſaturate viridia ſunt folia, inferne pallidiora, ſecundum neruos rugoſa, fere glabra, vix manifeſte pubeſcentia. Foliolum intermedium regulare eſt & a nervo longitudinali in duas partes exacte æquales diuiſum, lateralia vero minus expanſa ſunt verſus marginem interiorem, verſus exteriorem autem magis prominula & quaſi laciniula dilatata.

Floris pedunculus longitudine petiolorum ex ala vltimi folii exit, erectus, quem Flos vnicus terminat, cuius *Calix* eſt Perianthium monophyllum,

L 2 cum-

Figure 4. The account of *Rubus arcticus* in *Flora Lapponica* (2 pages of a little more than 3) showing in what detail some species are treated in that work, which has more elaborate treatments of species than any other Linnaean Flora.

Rudbeck jr thought he had observed it growing in Lapland, which Linnaeus refutes in a comment as a confusion with *Arnica alpina*, no. 305. The specimen 304 is undoubtedly *Arnica montana* and must have been added to the Lapland collection after the return to Uppsala (although perhaps collected much earlier).

As a rule Linnaeus collected only one specimen of each species, which was quite natural given the circumstances. There are, however, in the Linnean Society of London specimens that appear as duplicates, since they, too, have the *Flora Lapponica* number in Linnaeus' handwriting. They are often of better quality and larger than those in Paris. That is somewhat enigmatic and it cannot be excluded that they are specimens of *Flora Lapponica* species which Linnaeus acquired later and gave the *Flora Lapponica* number.

Most specimens in the Lapland herbarium can be regarded as "original elements", that is, specimens that can be considered as types for names in *Species Plantarum* (Linnaeus 1753) provided there is a reference to *Flora Lapponica*. Owing to various shortcomings among the Lapland specimens, some of which are mentioned above, they usually have to give way to specimens from other herbaria. All the same, about 25 specimens, i.e. ca. 10 % of the total number of sheets, have been chosen as lectotypes

Figure 5. Two orchid species on the same sheet of the Lapland herbarium, *Listera ovata* and *L. cordata*. Only the latter is treated in *Flora Lapponica*, as No. 316, which exemplifies that occasionally species not met with on the Lapland journey have been added to the herbarium.

for Linnaean species names, among them "herba nostra", *Linnaea borealis*. A complete list of the herbarium specimens with names in Latin and Swedish, as well as references to *Flora Lapponica*, was given by Jonsell & Jarvis (2003) in the *Iter Lapponicum* edition.

After Linnaeus' Holland years

The further fate of the Lapland herbarium is rather peculiar. When in Holland Linnaeus promised to deliver it as a gift to his friend Johannes Burman (1707–1779), who had been most helpful to Linnaeus in many respects. He saw to it that manuscripts were printed, that fruitful contacts were made in the learned world and he sorted out various complications that occurred (Uggla 1937). One 'thank you' for such assistance would be the Lapland herbarium, but in the end, Linnaeus left Holland in 1738 bringing the herbarium back with him to Sweden. One month after his return to Sweden, 11 October 1738, Linnaeus sent a letter to Burman, in which he apologises for not having presented him with the Lapland plants. He even confesses that he has been obliged to give specimens to persons to whom he could not deny them, and adds that he has now collected new specimens of all those species. They will arrive later that autumn or in the spring at the latest, Linnaeus concludes. In his reply Burman is friendly but wondering, a bit maliciously, how it could have been possible to collect all those new specimens "without exception" as Linnaeus wrote, in such a short time, and from Lapland. A letter from Burman of 7 April 1739 says that the collection had still not arrived with him. When they did arrive is not known, because of a lacuna of over 15 years in the

correspondence between Linnaeus and Burman. They were, however, extant in the property left by Nicolaas Burman (1753–1793), the son of Johannes. After the death of Nicolaas' wife in 1810 the Burman library and collections were purchased by Benjamin Delessert (1773–1847), an industrialist, banker and amateur botanist. After his death all herbaria in his possession were delivered to the Botanical Garden in Geneva and the library to Institut de France in Paris. Since the Lapland herbarium had been bound within hard covers and appeared to be a book it went with the library.

No specimens in the present collections make an obvious impression of having been added after the journey. The specimens are, as already mentioned, small and seem to be arranged similarly throughout. Only the *Flora Lapponica* numbers seem to have been written by Linnaeus. The phrase names from *Flora Lapponica*, usually in the upper part of the sheets, are in the handwriting of J. Burman.

The lack of cryptogams (including ferns), as mentioned previously, and some other *Flora Lapponica* species, may be explained by the gifts Linnaeus wrote about to Burman. The promise to replace those specimens was apparently never fulfilled.

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The conservation of iconic objects and Linnaeus' books and wallpaper

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This paper concerns conservation in general and specifically, just as the title implies, those objects that have attained an iconic status, i.e. they not only have an intrinsic value, but they also touch a concept of holiness and great admiration. Their existence gives us associations to the roots of our history and the preservation of such objects is complex in the sense that any conservation measures taken may lock the past into our own sense of how this past should look, or even worse, as the object may deteriorate, the lack of preservation may also block out the past completely. The objects I will be concentrating on are, of course, books from the Uppsala University Library's Linnaean collections and also the botanical prints which Linnaeus put on the walls of the bedroom in his summer cottage at Hammarby, not far from Uppsala.

Linnaeus' times, his legacy, as well as the objects which were left behind after his death can certainly be said to have attained an iconic status. If we compare them to other objects from a conservation point of view, we find similarities. Saint Göran and the Dragon is one important Swedish example. This is a wooden sculpture dated 1489, which can be found in Storkyrkan in Stockholm. The sculpture was commissioned to commemorate Sten Sture's victory over the Danish army in the battle of Brunkeberg 1471 and ever since it has been a symbol of Swedish independence, and especially so during late the 19th century and early 20th century nationalism movement. The wooden sculpture is in a fairly good shape but during its past, prior to debates on how to conserve it, it had been treated several times. Another example is the warship Wasa that also has an iconic value, both as a unique artefact from the 17th century and as a symbol for the young nation with aspirations of becoming a strong power on the European scene. Perhaps it also serves as a symbol of the shortcomings of these aspirations as the ship sank on its maiden voyage. The conservation of the ship was costly and time consuming, with long committee meetings also a part of the planning for conservation, which ever since 1962 has caused fierce controversies about suitable techniques and treatments. In an international context, the conservation of Leonardo's masterpiece "The last supper", a painting which in itself bore a self-destructive structure, has also caused endless debates during its history of conservation, more than 20 years post-second World War. All three examples are linked by the fact that their conservation has attracted a lot of interest from many experts and inevitably loud debates on the best treatment options. This characterises and paralyses the treatments of some of our most important objects – the iconic objects.

In this context one may have to ask oneself when is an object old enough to be a candidate to put on the "iconic" pedestal? In general, an object which is 150 years old or more is often regarded as an artefact. Our memory can stretch back to our

grandparents i.e. 100 years, but 150 years is considered to be "really old" and if we take a look at our traditions in libraries of naming collections "special collections" 150 years is often the boundary set for "special collection" library material. In the case of iconic objects, depending on their uniqueness, historical context and importance, these can reach an artifactual value much more quickly. Common for all objects is that they become fragile with age, disregarding their value.

A current conservation project at the Uppsala University Library is the collection of books that were given back to Sweden from the Linnean Society. They have been housed both at Hammarby and the University Library due to a long tradition of manuscript librarians such as Arvid Uggla and Carl Otto von Sydow having had a special interest in Linnaeus. In connection with the tercentenary celebrations funds were raised for the conservation of these books. During the last two years the cataloguing and conservation have been carried out simultaneously and the books have also been transferred to safe storage. The books are now also being catalogued as a part of the Linnaeus Link Project which is carried out together with, among others, the Linnean Society and the Natural History Museum in London.

The collection contains an interesting variety of books, many of which have been interleaved and filled with notations on useful things such as gardening and different cures for illnesses, as well as proverbs serving as a guide for young students. Apart from the interesting information that can be gathered from the mere choice of titles, the books are also full of notations and systematic tables and are worthy of more thorough study, which will soon be less problematic due to the conservation of the books. Re-backing of a leather binding is one treatment option often used when the hinges of the leather spine are completely broken down. The original spine is always kept and put back on the book.

The books were extremely dirty, a remnant from a time when heating was often local and involved some kind of combustion process. Be it coal, gas or wood, London or Stockholm, the books bear traces of times when particle pollution must have been abundant and nothing could be done to protect libraries from being contaminated. Prior to conservation, a cleaning process was deemed absolutely necessary. It was carried out partly by using different dry cleaning techniques and partly by using a mild emulsion of tensides and water, with a similarly gentle application of the substance as a foam. This treatment has, among other things, stopped the transfer of dirt from the covers to the text-block.

In book-conservation, leather has traditionally been used for both re-backing and the covering of cracks and blemishes. Before re-backing the leather is dyed using light fast dyes mixed to a shade that will blend reasonably with the original leather. Leather consists of three different layers of the animal skin, the middle or corium layer being the most important for the long-term flexibility and durability of the material. The necessary paring, or thinning down of the leather is done by machine and by hand, the normal leathers being calf, goat or sheep. These leathers are sometimes pared down to a thickness of approximately 0.5 mm. However, if extremely thin layers are needed, for example in the covering of cracks, the skin has to be thinned out to an extent that it looses its strength. To overcome this problem, conservators have started using alternatives to leather.

One example of this practise is to use thin but strong Japanese paper to reinforce cracks and to build up new headcaps if these have been lost. Japanese paper is a long-fibred tissue with excellent durability, flexibility and strength and has been the main working method employed during the conservation of Linnaeus' books. The reasons for using this method are quite convincing since it will make a strong but still thin repair, the paper can be tinted and surface treated to blend in with the leather. The repair is quite reversible if for some reason one would like to remove the repair in the future.

Let us go back to Hammarby, Linnaeus' summer cottage, which he acquired in 1758. Linnaeus was quite aware of the risks of storing combustible materials and he kept his collections apart from the living quarters, in what he called "his museum" – a stone building on a hilltop near to the main building at Hammarby. The reason for doing this was most certainly due to the less fortunate fate of the collections of his predecessor as a professor of medicine in Uppsala, Olof Rudbeck, who, when the wooden print-blocks of his great botanical book were devoured by the flames, lost a lifetime's work in the Uppsala fire of 1702. After the fire Olof Rudbeck claimed himself and his wife to be as poor as when they lay in the cradle and, devastated, he died later that year. In building his museum, Linnaeus actually employed the protective technique of fire compartmentalisation for his collections, an age-old method, and still fundamental to the protection of collections in museums, libraries and archives.

Linnaeus' correspondence, or net-working as would probably be the modern way of describing his many national and international contacts, brought him a large array of publications and specimens from all over the world. Among the works he enjoyed the most were Georg Dionysius Ehret's pictures of plants published in *Plantae Selectae* from 1750. Linnaeus' personal friendship with Ehret was certainly one reason for him to admire the prints, but they also stand out as among the most beautiful pictures of flowers and plants ever made and he had them pasted on the walls of his bedroom. In doing so, he deliberately put them at risk, even explaining that he did not care if they were destroyed. As long as he lived he wanted to enjoy the pictures.

The earliest photographs we have from his bedroom are those of Emma Schenson, published in the 1860s by Elias Fries in a photographic album to the honour of Linnaeus. Judging from these pictures, it is obvious that the prints had suffered damage already in the 19th century, probably due to neglect in the first half of the 1800s.

There are a few notations on early attempts of conservation of the prints. Already, from when the property was acquired by the Swedish State in 1879, there is a notation that some damaged prints were cut down and replaced with new ones. This technique was also employed in the conservation carried out in 1937, but documentation of the treatment is scarce and sometimes only scribbled down on pieces of cardboard, later found in a drawer. A comparison of the state of decay in the 1860s and in 2005 shows similarities, however, and many prints have darkened considerably during the last century.

The Swedish National Property Board has carried out extensive research into the climate of the house and preliminary data from these measurements show that the house follows the normal fluctuations in temperature and humidity, but the hygroscopic materials in the walls and paper retain a slightly higher water content in comparison to the indoor air. The results also show that the season with the highest water content is in early autumn. In this period the relative humidity level can be above 70%, not,

however, during prolonged periods, which in itself is a risk for visible outbreaks of mould. Still, such a high level of humidity has probably contributed heavily to the breakdown of the paper. A comparison with a bound version of *Plantae Selectae* at the Uppsala University Library clearly shows that the main damage is to the brittle paper, staining from different sources and, perhaps most obvious of all factors, damage from exposure to light. The colours in the library copy still remain bright and clear.

In a survey of damage to the four walls in the bedroom, named A, B, C, and D, the initial impressions of the damage mentioned above have been confirmed and show that the paper is to a large extent, hydrolyzed, which means that it is brittle and may break easily. This became obvious when a bird managed to enter the room and in colliding with the D-wall, caused a lacuna in one of the prints.

If we take a closer look at some of the prints in Hammarby, cracks are a typical sign of damage and are the result of movements of the wooden house. A general brownish colour is probably due to discoloration from the lignin in the logs, a phenomenon one sometimes sees in prints mounted on cardboard also containing lignin. On the *Cereus*, or cactus flower, one can clearly see the effects of bleaching so common to many of the organic dyes used in the 18th century. Many dyes have changed their hues due partly to the bleaching effects of light, but probably also to the complex chemistry of the prints interacting with their environment.

The *Musa* or bananas have a prominent place on the wall facing the entrance to the bedroom. Bananas were highly valued as a novelty in Europe and one of the triumphs of Linnaeus as a gardener, was to grow bananas at George Clifford's Hartekamp in Holland. Light damage is most prominent on this fruit where, especially, the green has turned into brown, a phenomenon sometimes seen in copper containing green colours. The brownish discoloration which can be seen on the Cedar tree-print was there already in the 1860s. However, the browning of the paper may have been emphasised by later treatments with paste containing alum or gelatine which have been used to attach a thin layer of silk, a conservation method first presented at the first international conference on conservation in St Gallen in 1898 by the Cardinal Franz Ehrle, then responsible for the Vatican Library's conservation.

In 2005 the National Property Board, which has the ultimate responsibility for preserving the building, arranged a seminar to discuss different treatment options, a procedure which is very common for iconic objects like Linnaeus' house. If we describe the results from this seminar in a simplistic way one might say that it resulted in a dichotomy where some proposed that nothing should be done to the wallpaper and others suggested treatments which included taking the prints down for conservation. I call this way of arguing conservation clusters – a gathering of two opposing opinions, with very few in between, a human behaviour which is recognisable to anyone.

Many of us would probably agree that one of the most valued characteristics of his wallpaper is that Linnaeus wanted to furnish his bedroom in this manner. However we may also rest assured that the room does not look like it did in the 18th century. We can find 20th century wrapping paper in some of the mends and we know that prints have been taken down and others put up, but it is all too easy to delude ourselves and uncritically say that this is the way Linnaeus arranged his walls. They have been touched too many times for this to be true. In general the seminar did agree that the

prints should be kept on the walls, to take them down and store them at some other place would make no sense.

The controversies started when the treatment methods were discussed and the greatest concern was if the prints needed to be taken down for treatment. The weakness of the paper supports the notion of taking them down to strengthen them; the difficulty in doing this speaks against it. The importance of any decision made raises the temperature of such discussions – this is typical for the conservation of iconic objects.

The best way of sorting out all these difficult questions is to put together a risk assessment which will answer questions such as "has the improper backing played a role in the degradation process and if so to what extent". If we answer yes to this question and if we think that this is a serious problem we can position this issue in the 'red' area of a risk assessment chart. Furthermore, if we think that there is a way to lower the influence of this specific risk, there is a possibility to move the issue into the green area of the chart. If we combine the risk assessment with immediate voting between alternatives with a green or red card we can avoid the conservation clusters and consequently also the decision-making paralysis as we go through all the relevant issues. It is at the end that it becomes obvious how the voters independently regard each question. Let me give you an example with the following question "is the current humidity level dangerous to the prints?" If we are presented with 10 green cards and two reds, the reds indicate that this question must be further analysed. If we are shown 12 green cards – this question has no relevance and can be left aside. A risk assessment seminar for Linnaeus wallpapers did take place during the summer of 2007 and managed to break up the dichotomies to such an extent that it was decided that it was necessary to strengthen the wallpaper. As a start for this project a team of paper conservators starting their work during 2008 will conserve the D-wall.

"Youth is full of sport, age's breath is short." Shakespeare's words can be a metaphor not only for man but also for the objects of mankind. This includes the objects of iconic value as they are liable to break down just as any other object and they also deserve the very best of care. A good decision-making process and skilful treatment can give them that care.

The Linnean collections at Uppsala University

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It is well known that the main collections Linnaeus had gathered during his lifetime were sold to James Edward Smith in England, where they became the foundation of the Linnean Society of London. However, there is considerable material left at Uppsala University with close connection to Linnaeus.

At the time when Linnaeus assumed his professorship of medicine and botany in 1741 Uppsala University had no actual natural history collections. After that, a series of donations during 1740=1750 formed the basis of a museum of natural history (*Museum Naturalium Academiae Upsaliensis*). These donations were well documented and formally registered by the University Board. Linnaeus also described the material in some dissertations which were, as usual, defended by his disciples. The relationship between this material and Linnaeus' own material, collected together with the material sent to him as gifts from scientists around the world, and the material his "apostles" collected for him during their foreign travels, does not seem to have been formalised. Most of the material was evidently incorporated into Linnaeus' private collection rather than with that of the University museum. However, after a fire in Uppsala in 1768 the two collections became physically separated as a consequence of Linnaeus' decision to move his material to Hammarby, where he built his own museum (*Museum in altis*) in 1769. The remaining material was housed in the buildings at the Botanical Garden (now the Linnaeus Garden) where it had been during the whole Linnaeus period.

Later donations and collections housed in other parts of the university at the time of Linnaeus now constitute the Linnaean material of Uppsala University housed in the Museum of Evolution.

Botanical material

The oldest collection is Joachim Burser's *Hortus Siccus* or the "Burser Herbarium", as it is called for practical reasons. Originally it consisted of plant material bound in 26 volumes. The volumes primarily contain plants from Central Europe, but one of them is devoted entirely to Danish plants. This plant collection was created in the early 17th century and had been brought to Sweden from Denmark as war booty. In Linnaeus' day, the Burser Herbarium was kept at the University Library and was thus available to him. It is therefore regarded as original material for Linnaeus' plant descriptions. The herbarium contains more than 3,000 pages, roughly 10% of which have been selected by modern-day researchers as principal representatives (lectotypes) for Linnaeus' names (see also C. Jarvis, *Order out of Chaos*, 2007).

When Linnaeus had been in Uppsala almost one year he met the dean Olof Celsius = who was working on the flora of the Province of Uppland and had collected considerable material which he had included in leather-bound volumes named *Flora*

Uplandica. Linnaeus now became involved in helping Celsius to complete the work. Finally it included six volumes, containing 711 pressed plants, primarily gathered by Celsius, but some with writing by Linnaeus, which proves that he had access to the whole work.

Queen Lovisa Ulrika financially supported some of Linnaeus' "apostles" and was given sets of plant material which were later donated to Uppsala University and are now named Queen Lovisa Ulrika's herbarium. This consists of North American plants collected by Pehr Kalm (see *Thunbergia* 19, 1993) and Palestinian plants collected by Fredrik Hasselquist. This material is duplicates of material in the Linnean collection in London.

There are also some hundred sheets with the hand of Linnaeus on them which are kept separate, together with the above mentioned collections in the strongroom of the museum.

Zoological material

Although there is no plant material in the remaining *Museum Naturalium Academiae Upsaliensis*, there are almost 300 zoological preparations, half of which are judged to have been studied by Linnaeus.

Further Linnaeus material came to Uppsala in 1803, in the form of a donation from King Gustav IV Adolf, that included his paternal grandmother's, Queen Lovisa Ulrika's, collection of conchilia (that is, seashells and mussel shells), insects, plants (see above), fossils, and minerals. Linnaeus had once worked on parts of this collection.

The total number of objects in the zoological Linnaeus collection (including Gustav IV Adolf's donation, etc.) is now more than 2,700. The number of species registered is

Figure 1. Lemming, *Lemmus lemmus*, captured 1732 by Linnaeus at Virihaure, Province of Lapland. Length 13 cm.

Figure 2. Mole, *Talpa europaea*, captured 1749 by Linnaeus at Skillinge, Province of Skåne. Length 12 cm.

1,303, but this figure is uncertain since many specimens have not been subjected to review in terms of their classification.

As William Stearn suggested we also count the type of *Homo sapiens* to be present in Uppsala Cathedral.

Mineralogical material

Linnaeus' mineral observations were based on material he gathered on his journeys to the Bergslagen mining region. His mineral collection was part of the material sold to England but, as mentioned, Gustav IV Adolf donated Queen Lovisa Ulrika's collections to Uppsala University in 1803. On these, Linnaeus writes:

> The other part of Your Majesty's rich collection, namely, the magnificent Corals, the clear Crystals, and the rich Ores, I have left to be the work of another day.

His intention was apparently never followed up. Today these minerals are an integral part of the mineral collection at the Museum of Evolution.

Linnaeus' specimens of mammals and birds

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Introduction

For the past few years I have been working on the extensive and historic collections of mammals and birds used by Linnaeus in describing many new taxa. The specimens of these two groups have not hitherto been studied and the work will make known the specimens seen by Linnaeus, their identity in the light of modern taxonomy, and will provide descriptions and coloured photographs.

Much of the material originates from the natural history cabinet of King Adolf Fredrik (1710–1771) and the collection of the Royal Swedish Academy of Sciences (Kungliga Vetenskapsakademien or KVA) in Stockholm and is now kept in the Naturhistoriska Riksmuseet in Stockholm. A lesser amount of material is in the Evolutionsmuseet, University of Uppsala, and this includes specimens given by Adolf Fredrik to the University Museum in 1745, a series of donations in Linnaeus' time and Linnaeus' own material. Together the present day Stockholm and Uppsala collections include specimens which were studied and described by Linnaeus of some 55 species each of mammals and birds.

Housing the collections

Lovisa Ulrika (1720–1782; Fig. 1), younger sister of Frederick the Great of Prussia, arrived in Sweden in August 1744. She was already married to Crown Prince Adolf Fredrik although they had never met; the bridegroom's place at the wedding in Berlin had been taken by her younger brother (Laine, 1998). The marriage was celebrated in the Hall of State at Drottningholm Palace on the island of Lovön, west of Stockholm, and soon afterwards the Swedish King Fredrik I transferred the fief of Drottningholm to Lovisa Ulrika.

In the middle of the 18th century it was fashionable among the European aristocracy to have personal collections of curiosities,

Figure 1. Queen Lovisa Ulrika painted by Lorentz Pasch the Younger in 1767. The National Museum of Fine Arts, Stockholm, Drh 501.

Figure 2. Drottningholm Palace.

artefacts and articles of value. Both the Crown Prince and his wife had collections and for the royal couple this was an enterprise driven by the desire to amass material of the most rare, conspicuous and interesting objects. Both had natural history cabinets, Lovisa Ulrika's consisting mainly of dried invertebrate and plant material at Drottningholm Palace, Adolf Fredrik's consisting mostly of vertebrate material in alcohol at Ulriksdal Palace to the northeast of Stockholm.

Drottningholm Palace as it now stands mostly dates from the end of the 17th century (Fig. 2). Queen Hedvig Eleonora, widow of Charles X (1622–1660), commissioned Tessin the Elder, royal architect since 1646, to build a new palace on the site of the previous royal manor destroyed by fire at Christmas 1661, soon after the Queen had bought it. The new Palace and its gardens became one of the most extensive and costly building projects to be undertaken in Sweden at the time. Work on the building, its Baroque interiors and gardens was continued by Tessin the Younger after his father's death in 1681. On taking over use of the palace, Lovisa Ulrika instructed the architect Carl Hårleman to add a new storey to the existing wings surrounding courtyards on each side of the main building (Brown *et al*., 1997). Work began in 1747 and created on the north side a line of five rooms to accommodate her increasing collections of coins, medals, antiquities and natural history objects. A picture gallery was made to house part of the Queen's collection of French, Dutch, English and Swedish art. Books were housed in the small room in the northwest corner of the building but in 1760 Lovisa Ulrika employed Jean Eric Rehn, architect, designer and drawing master to the Royal children, to transform the picture gallery into a larger library, to furnish the natural history room (Fig. 3), and to redecorate elsewhere in the Rococo style.

Ulriksdal Palace was built in about 1640 in Renaissance style for Jacob de la Gardie, the Constable of the Realm. Queen Hedvig Eleanor purchased it from him in 1669. The building has been much altered and its present appearance dates from the first half of the 18th century (Fig. 4). King Adolf Fredrik and his Queen used the Palace but it is not now known where the King's collections were kept.

After the King's death in 1771 the collection at Ulriksdal was moved in 1773 to

Figure 3. The natural history room at Drottningholm Palace.

join that at Drottningholm. In 1777 Drottningholm and its collections were purchased by the Swedish State. In 1801, Conrad Quensel, curator at the KVA, persuaded King Gustav IV, grandson of Adolf Fredrik and Lovisa Ulrika, to hand over his grandfather's specimens in alcohol to the Academy. The collection, which included many mammals and birds, was incorporated into the Naturhistoriska Riksmuseet in 1828 and became the property of the museum in 1965. The remainder of the collections from Drottningholm, mostly dried material from Lovisa Ulrika's cabinet and also a few dried specimens originally at Ulriksdal, went to the Uppsala University Museum in 1803.

Figure 4. Ulriksdal Palace.

The KVA was founded in 1739 as an independent scientific society, primarily by Linnaeus who became its first curator. Until 1829 it was housed in what is now no. 30, Stora Nygatan in Stockholm. An unpublished inventory in 1788 by C.F. Hornstedt, then curator, lists the small collection of specimens before the arrival of King Adolf Fredrik's cabinet in 1801. Further unpublished inventories were produced by the curators C. Quensel in 1800 and 1803, O.F. Swartz in 1809, and (dried specimens only) J.W. Dalman in 1823. Unpublished inventories which included the King's material after its incorporation into the Museum collections were put together by Sundevall between 1857 and 1859 and by Bergström in 1942.

Linnaeus' own natural history specimens were kept at his home in Uppsala and later at Hammarby, an estate some four kilometres southeast of Uppsala dating from

the 1630s and purchased by Linnaeus in 1758. He built a new family home and subsequently a small stone store, to house his collections and books, which was completed in 1769.

Linnaeus' study of the collections and his publications

In 1744 Crown Prince Adolf Fredrik and Lovisa Ulrika visited Linnaeus in Uppsala, where he had been appointed Professor of Medicine in 1741, and in 1745 Adolf Fredrik donated natural history duplicates from his collection to the University Museum. Linnaeus and his student Laurent Balk published a dissertation on this material in 1746, *Museum Adolpho-Fridericianum*, the first publication to describe material in the Royal collections.This was republished in the series *Amoenitates Academicae* in 1749.

In 1751 Adolf Fredrik became King and in the same year Lovisa Ulrika asked Linnaeus to study the collections at both Ulriksdal and Drottningholm. Linnaeus made four visits to Drottningholm in 1751 and 1752, spending a total of 13 weeks on the work, and three visits to Ulriksdal in 1753 and 1754, totalling nine weeks. Additional visits to Drottningholm were made in 1754, 1766 and 1770 (Lovén, 1887). Linnaeus' publication on part of the King's vertebrate material appeared in 1754, *S:ae R:ae M:tis Museum Adolphi Frederici Regis*, in a large folio with copper plates by Jean Eric Rehn and Olaf von Dalin, engraved by Jacob Gillberg (there are unfortunately no illustrations of birds and only two reproduced paintings of live mammals). The text is in Latin and Swedish in adjoining columns – the Swedish version at the King's request. The second part of the King's material was published in 1764, in conjunction with the Queen's invertebrate material, in octavo, Latin only and without illustrations, the delay having been caused by a shortage of funds in the Royal household.

The earlier 1754 account of the King's material was incorporated in the 10th edition of Linnaeus' *Systema Naturae* of 1758, which is the basis of modern zoological nomenclature, and in the second edition of the *Fauna Svecica* (1761), and both the 1754 and 1764 accounts were included in the larger 12th edition of the *Systema Naturae* (1766). Additional material was published in the animal appendix to the *Mantissa Plantarum* (1771). The existence of specimens in the King's collection and their 1754 or 1764 descriptions were recorded in the 10th and 12th editions of the *Systema Naturae* by the notation "*Mus. Ad. Fr.*" with the relevant page number.

Origins of the material in the collections

Very little information is available on the origins of the mammals and birds in the King's cabinet, probably because it was a private collection for which no records were kept. However, for a few specimens, and for a few in the KVA, the donor and the geographical provenance may be put forward with some certainty.

The collection in Uppsala is better documented, the specimens and their donors (Adolf Fredrik when Crown Prince, Claudius Grill, Magnus Lagerström, Jonas Alströmer, King Gustav IV and Linnaeus himself) having been documented first by Linnaeus' successor at the University, Thunberg (1787), followed by Lönnberg (1896; includes birds but not mammals), Holm (1957) and Wallin (1994).

I give here a few examples of specimens from the Stockholm and Uppsala collections.

Daniel Rolander (1725–1793), a pupil of Linnaeus and one of his so-called Apostles, was an entomologist. In 1755 he went for a year to Surinam, then a Dutch colony. On his return he sold his journal and much of his plant material to a botanist at the University of Copenhagen, who published descriptions of the specimens. Some of Rolander's material went into the collections of the KVA. An excellent specimen in alcohol of a male spectral bat, NRM 532015 in Stockholm (Fig. 5), is probably that described by Linnaeus (1758) as *Vespertilio spectrum* (currently *Vampyrum spectrum*). Linnaeus credited the locality ("America australi"), but not the description, of the specimen to Rolander. Linnaeus's description is detailed and accurate and he clearly had access to a specimen.

Figure 5. Spectral bat, *Vampyrum spectrum* (Linnaeus 1758), NRM 532015.

Pehr Kalm (1716–1779) was also a pupil and Apostle of Linnaeus. He travelled to North America in 1748 and on his return to Sweden in 1751 brought back a vast collection of plants and seeds which he divided between Linnaeus, the KVA and, in 1754, Queen Lovisa Ulrika. The remainder of Kalm's collection was lost in 1827 in the fire which destroyed Åbo (Turku), his home town. The return of animal material by Kalm is recorded in a number of places (letter to Linnaeus from Philadelphia dated 5 December 1750, published in *Bref och skrifvelser af och till Carl Linné*, vol 1, pp. 1–8; the first part "Genera Americae septemtrionalis" of Linnaeus' 1751 Dissertation *Nova plantarum genera;* Juel & Harshberger, 1929; Kerkkonen, 1959) and it seems very likely that a star-nosed mole *Sorex cristatus* (currently *Condylura cristata*) from the collections of the KVA, NRM 532024 (Fig. 6), and described by Linnaeus in 1758, is a specimen brought back to Sweden by Kalm. Linnaeus credited Kalm with the locality (Pennsylvania) but not the description of the species. The description is detailed, accurate and without reference to previous authors and it is clear that Linnaeus had access to a specimen on which he based his own account. There is no other record of a specimen of *S. cristatus* in the mammal collections of the Naturhistoriska Riksmuseet in Stockholm.

Fredrik Hasselquist (1722–1752), a pupil and Apostle of Linnaeus, travelled to the Middle East in 1749. He died near Smyrna (Izmir, Turkey) and Linnaeus persuaded Queen Lovisa Ulrika to acquire his collections and notes. Hasselquist described a specimen of the Egyptian jerboa in 1751, and also figured it in 1752. A detailed account appeared in the history of his travels edited and published by Linnaeus in 1757. Linnaeus (1758) described and named the species *Mus jaculus* (currently *Jaculus jaculus*),

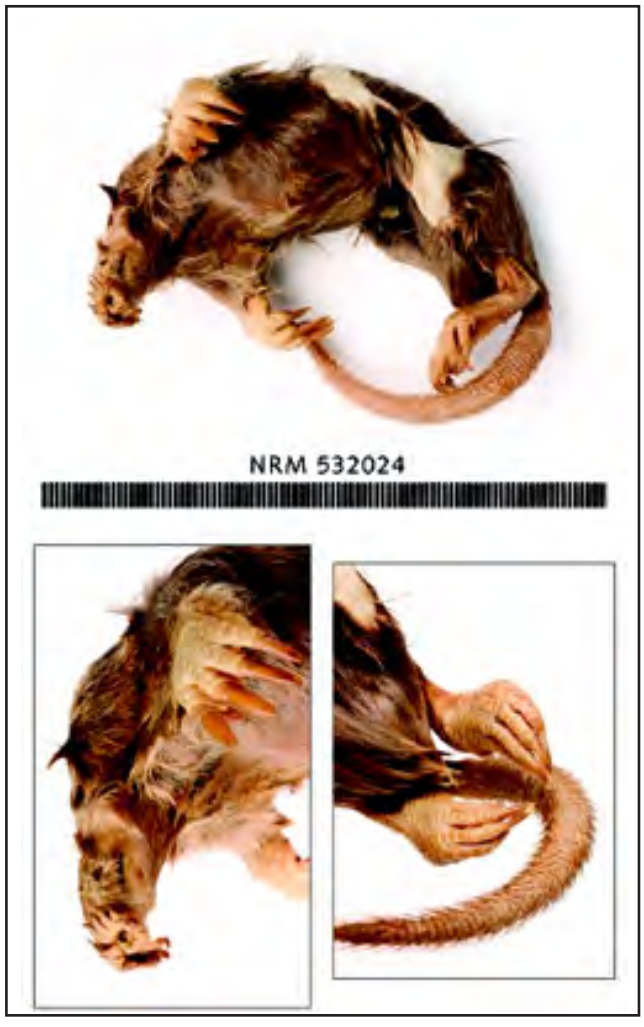

Figure 6. Star-nosed mole, *Condylura cristata* (Linnaeus, 1758), NRM 532024.

referring to Hasselquist's publications, and gave a longer description in his 1764 account of King Adolf Fredrik's collection. Specimens NRM 532050 in Stockholm and UUZM 119 in Uppsala (Fig. 7) are both of this species. The type locality is the Giza pyramid from where Hasselquist wrote that he had seen specimens and caught them alive.

Magnus Lagerström (1691–1759) was one of the directors of the Swedish East India Company, founded in 1731 as a trading organisation. He obtained much natural history material through his ships' captains and contacts and made donations to the Royal couple, the KVA, Linnaeus and the Uppsala University Museum (Löwegren, 1952). A specimen in Uppsala, UUZM 96 (Fig. 8), of the red-breasted blackbird of Central and northern South America was included in a donation made by Lagerström to the University Museum in 1748. The bequest was recorded by Thunberg (1787), Lönnberg (1896), Holm (1957) and Wallin (1994). Linnaeus described the specimen in 1754 in his dissertation *Chinensia Lagerstromiana*, subsequently republished in 1759 in the series *Amoenitates Academicae*. Linnaeus described a further specimen in

Figure 7. Egyptian jerboa, *Jaculus jaculus* (Linnaeus, 1758), UUZM 119.

King Adolf Fredrik's cabinet (NRM 566026 in Stockholm) in 1754. In the dissertation and *Museum Adolphi Frederici*, Linnaeus used the name "Turdus haematodes". In all subsequent publications he used the specific name *militaris*, and in 1758 and 1759 he placed the species in the genus *Emberiza* Linnaeus, 1758. In his description of *Emberiza militaris* (currently *Sturnella militaris*) of 1758, Linnaeus referred to his two 1754 descriptions so there is no doubt, despite the change of name, that the same species was described in all three publications.

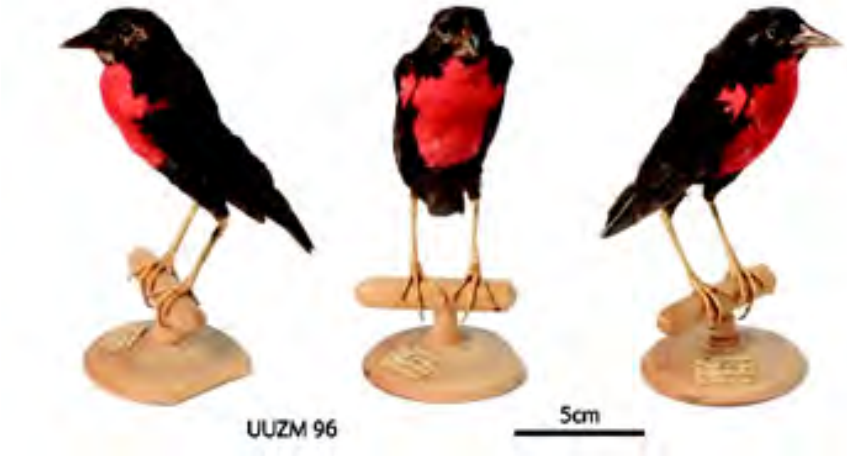

Figure 8. Red-breasted blackbird, *Sturnella militaris* (Linnaeus, 1758), UUZM 96.

Acknowledgements

The Symposium "Unlocking the Past. Linnaean collections – past, present and future" in June 2007 was an excellent way to celebrate Linnaeus' tercentenary and I thank Professor Roland Moberg and Annika Windahl Pontén in Uppsala for their invitation to participate. The staff of the Vertebrate Department, Naturhistorisks Riksmuseum, Stockholm, the Evolutionsmuseet, University of Uppsala, and the libraries and Mammal Section of the Natural History Museum, London have all been most supportive and helpful during my continuing researches. Harry Taylor of the Photography Department at the NHM, London, took pictures which surpassed all my expectations of the Linnaean mammals and birds in Stockholm and Uppsala (and much else besides), and Katarina Heldring-Morris has translated a large amount of Swedish. Three of my visits to Stockholm (2002, 2003 and 2006) were supported by grants from the European Commission, originally the High Lat scheme and now Synthesys (grant no. SE-TAF 1173), and I am grateful for this assistance.

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The Linnaeus Link Project

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Carl Linnaeus' published works and the works of his 331 students continue to have great historical significance and key scientific relevance. Known today as an important figure both scientifically and culturally, Linnaeus' work encompassed all plants and animals then known to the Western world. Through his publications – in particular, *Species Plantarum* and *Systema Naturae* – he established the nomenclature we use for species today. Many organisations possess collections with works by Linnaeus and his students and many of these are important for taxonomic, historical and bibliographical research. For example, the Linnean Society of London owns Linnaeus' personal library of books, manuscripts and correspondence.

The Linnaeus Link Project is an international collaboration between libraries with significant holdings of Linnaean material. Its main aim is to produce a comprehensive, online union catalogue of Linnaean publications to facilitate research for people worldwide enabling them to identify specific copies and locations for his, and his students', works anywhere in the world. Linnaeus Link has grown to include the British Library, Danish National Library of Science and Medicine, the Hunt Institute for Botanical Documentation, the Royal Swedish Academy of Sciences, the Linnean Society of London, the Natural History Museum, London, Stockholm University Library, Uppsala University Library, The Swedish Linnaeus Society, and the Linnaean Correspondence Project.

The Project started in 1996 when I talked to Gina Douglas, Librarian and Archivist at the Linnean Society of London, about an idea I had for an online resource for all of Linnaeus' published works which would raise their profile and accessibility. I had become aware through my then responsibility for the Linnaean collection in the General Library at the Natural History Museum of how difficult people found it to find individual works and specific references within them, even with the help of the splendid but rather complicated paper-based catalogue written by Basil Soulsby, *Catalogue of the works of Linnaeus* second edition 1933. Gina suggested that I talk to Tomas Anfalt of the Linnaean Correspondence Project. On his next visit from Sweden Tomas, Gina and I talked through the idea. Tomas was taken with it and our meeting was followed by a period of email discussions with a wider group of interested parties in Britain, Europe and the US, finally leading to a face to face inaugural meeting in London in April 1999.

An important task for the project is to identify and characterise significant holdings of Linnaean material worldwide. Charlotte Tancin, from the Hunt Institute for Botanical Documentation has coordinated the world wide survey of Linnaean collections. We

now have a much clearer awareness of where Linnaean material can be found. The survey results continue to grow and are themselves an aid to research.

Anne Freeman, the Electronic Services Librarian at the Natural History Museum in the early days of the project, helped me to write the first project proposal. It was she who came up with the name "Linnaeus Link" which is so appropriate that it is hard to think of it by any other name.

The Project is indebted to the Linnean Society of London for its generous support, including funding the salary of a Project Officer, from 2004 to April 2007 to catalogue the extensive Linnaean collection at the Natural History Museum, with the Museum providing staff support and facilities. Cathy Broad's transfer from the Linnean Society to act as Project Officer was beneficial as Cathy had both cataloguing expertise and a knowledge of Linnaeus. From October 2006 to March 2007 Rita Dockery took over that role and the resulting high-quality electronic records formed the initial core of the Linnaeus Link catalogue, providing a test-bed for technical implementation of the system.

When I left the Natural History Museum in 2004 Diane Tough took over as Linnaeus Link Project Coordinator and with Bernard Scaife, the Digital Library Manager, played an important part in the successful completion of the project.

Linnaean records from The Linnean Society of London, The Natural History Museum, the Danish Royal Library comprising the National Library and Copenhagen University Library, and Uppsala University Library, have been included already and records from the Botanic Garden and Botanic Museum Berlin-Dahlem will be coming online soon. Viveca Halldin-Norberg from Uppsala University became a project partner in 2005 and was very influencial in getting Swedish organisations enthused about the project and in ensuring that Uppsalan records became available on Linnaeus Link. The National Herbarium of the Netherlands, Leiden University Branch, the Royal Botanic Garden Madrid and the Conservatoire et Jardins Botaniques de Genève are preparing to contribute their records. It is hoped that their records will be online in 2008. The British Library was a helpful early partner, first represented by Graham Jefcoate and Barbara Hawes, with Christian Jensen taking over from Graham in more recent years. The BL is working on making their records compatible with the catalogue.

The Linnaeus Link catalogue has now been transferred from the Natural History Museum and is being managed by the Linnean Society. The system is being migrated to the University of London Computer Centre which is hosting it on behalf of the Linnean Society. The Linnaeus Link Project Coordinator role has now passed to Lynda Brooks at the Linnean Society with Ben Sherwood providing expert technical support.

The Linnaeus Link Union Catalogue is now available online on the Linnean Society of London website *http://www.linnean.org/index.php?id=323*. There are currently over 1,500 separate bibliographic records on the system. The Project logo is designed to show Linnaeus' importance in all domains of the natural world.

The 12th Linnaeus Link Project annual partners meeting took place in Uppsala in September 2007. At the meeting there was a formal launch of the Linnaeus Link Catalogue, and the delegates were delighted to see the tangible results. They congratulated the teams at the Natural History Museum and the Linnean Society of London for bringing the project to fruition.

Linnaean Landscapes - Transforming Linnaeus' Cultural Context into a Cultural Heritage

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Introduction

Carl Linnaeus (1707–1778) worked and lived during the main part of his life in Uppsala, Sweden, and many traces of his life are still present in and around this town. He filled the *Hortus Upsaliensis* with plants from all over the world. He took his students on botanical excursions around the town along eight trails that he named *Herbationes Upsalienses*. He bought the country estate called Hammarby, including Sävja. There he built houses, planted gardens and farmed the land. For more than half of his life he lived in Uppsala with family and friends, colleagues and students, neighbours and labourers, leaving an impact on Uppsala and its environs.

The most important Linnaean landmarks in Uppsala became protected in the 19th and 20th centuries. The buildings and garden in Hammarby were bought by the Swedish state in 1879. The Swedish Linnaean Society, established in 1917, reconstructed the abandoned *Hortus Upsaliensis* and the adjacent old professor's home in the early 20th century. The Uppsala municipality bought Sävja in 1974 and reconstructed three Linnaean excursion trails of *Herbationes Upsalienses* in 1978.

However, by the beginning of the 21st century many areas around Uppsala with traces from Linnaeus' life and work were still unprotected. Earlier generations of scientists had good knowledge about these areas, but their knowledge, as well as the oral tradition in the countryside, had now sunk into oblivion and were not available to the urban planners. The city was expanding rapidly and a new city development plan was being established. The Linnaean traces were threatened.

Linnaean Landscapes

To face this threatening situation, a new project started in spring 2002, Linnaean Landscapes. The aim was to produce knowledge about sites connected to Linnaeus in the Uppsala countryside and present it to the responsible bodies so that these traces could become part of the city development. The project research was cross disciplinary, with the original project board consisting of Dr Mariette Manktelow, a systematic botanist based at Uppsala University, Mr Jan Helmer Gustafsson, an archaeologist and County Council Antiquarian and Mr Rolf Jacobson, biologist and civil servant in nature and park development at the Uppsala Municipality. In 2003 the board was expanded to include Dr Urban Emanuelsson, a landscape ecologist and Director of the Centre of Biodiversity, Dr Ing-Marie Munktell, historian and Director of the Museum Gustavianum at Uppsala University and Dr Mats Wilhelm Pettersson, ecologist and landscape photographer.

Efforts were made to communicate the knowledge both to locally involved parish associations and to civil servants at the municipal, county and national levels. A web

site *www.linnaeanlandscapes.org* was set up to publish new facts. Linnaean Landscapes had to be launched as an independent project since it was too broad to be placed under any one organisation or university. The broad character of the project was a problem when applying for financial support. The very first funding came from the Linnean Society of London, which was a breakthrough for the project and showed the international values of the landscapes.

Linnaean Landscapes was planned to last from 2002–2012, with a half time point in 2007. The first six years were the most intense, using the energy of the Tercentenary preparations to achieve the main goal: to convince responsible landowners and managers to include conservation in their management plans. The different projects are listed below.

Hammarby Landscape, 2002–2012

Linnaeus was the greatest landowner in the parish of Danmark. The farmland surrounding Hammarby was never included in the museum estate in 1879, but was commercially farmed. There were still many 18th century traces left in the agricultural land, but some had been destroyed due to lack of knowledge. The farm buildings were pulled down in the 19th century to decrease the risk of fire, and this had, with time, given visitors the wrong impression of Hammarby as a summerhouse rather than a farmstead. In 2002 it was difficult to make owners and managers interested in the historical value of the surroundings of Hammarby.

In 2005 Linnaean Landscapes published a development plan for Hammarby and its surroundings on its web site (Gustafsson *et al.* 2005) and, by 2007, most suggestions from this development plan had been realized. Uppsala Municipality and the Uppsala

Figure 1. It was important to make people understand that Hammarby was a farmstead and not merely a summerhouse. Photograph by Mats Wilhelm (*www.matswilhelm.com*).

County Administrative Board erected 18th century style wooden fences in the fields surrounding Hammarby, recreating the borders on a map from 1763. The Swedish Minister of Environment was invited by Linnaean Landscapes to replant two of Linnaeus' entrance ash trees, cut down in the 1980s because of old age. Uppsala University took on the task of recreating Hammarby's stable as a service building, a project sponsored by a local building company, Sh Bygg. A great moment was the 13 May 2007 when the Uppsala County Governor, Anders Björck inaugurated a Cultural Reserve around Hammarby, with the aim of reviving the agriculture of Linnaeus' time.

From 2008 to 2012 Linnaean Landscapes will continue to work on the knowledge of Hammarby and the possibilities of preserving the view from Hammarby itself.

Linnaean Plants, 2003–2006

Several plant species have spread around Uppsala from Linnaeus' cultivations, but in 2002 only one major botanical inventory was published (Manktelow 2001), in which more than 40 species in Hammarby were identified as probable remnants from *Hortus Upsaliensis*.

The Linnaean Plants Project was originally aimed at confirming the genetic identity of Linnaean plants by means of DNA fingerprinting. However, two research funding applications were turned down at the Swedish Research Council Formas. The project was ranked very high, but did not fit into the scope of Formas or any other funders in Sweden. The scope then changed towards extending the botanical inventories around the farms and manors where Linnaeus had friends and colleagues, and Linnaean species were found in several of these. Linnaean Landscapes worked with the botanical association Botaniska Sektionen in Uppsala to make inventories on the *Herbationes Upsalienses* trails to find extant plant populations from Linnaeus' time. Other projects sparked off by our activities were an inventory of Linnaean plants in Sävja undertaken by Uppsala Municipality in Sävja and by Kronoberg County Administrative Board in Råshult (Manktelow 2005). Our knowledge inspired landscape architect Ulf Nordfjell in his contribution to the Chelsea Flower Show in 2007 ordered by the Swedish National Linnaeus Commission. His *Linnaeus Garden* was partly inspired by Linnaean species in Hammarby and won a gold medal.

Sävja, 2003–2007

The parish association of Danmark has taken good care of Sävja through voluntary efforts, but they struggled with getting a full response from the landowner, Uppsala Municipality. Although easily reached by local communication, Sävja was not open to the public. A suburban villa area surrounded the museum, and the city development plan suggested new housing quite close to the museum area, something that would destroy traces of the 18th century Sävja farmland. No recent botanical or historical inventories had been made.

Linnaean Landscapes started an active communication with Uppsala Municipality to change the city development plan, and the surrounding landscape remained unexploited. We decided to support and encourage the active parish association in their communication with Uppsala Municipality. Our research focused on the reconstruction of the excursion trail *Herbatio Danensis*, which would give much focus on Sävja since it passed through the estate.

Figure 2. To emphasise the international value of *Herbationes Upsalienses* the trails were marked with the Linnaeus medallion in cooperation with the Linnean Society of London. Photograph by Mats Wilhelm (*www.matswilhelm.com*).

The response from Uppsala Municipality was very good, and by 2007 houses were renovated, new fences put up around the farm, a botanical inventory made on the estate (Roger Englund, unpublished data), and the parish association had got financial support to keep Sävja open to the public daily.

Herbationes Upsalienses, 2002–2008

By 2002 the three reconstructed excursion trails of *Herbationes Upsalienses* were in great need of renovation. They were partly not historically correct, and there was no recent information available about the total excursion system. The protocols from Linnaeus' excursions were mainly unpublished and the knowledge of *Herbationes Upsalienses* was restricted to the botanical and zoological communities. Linnaean Landscapes suggested a development plan in four steps: 1. research, 2. reconstruction, 3. availability and, 4. conservation. Cross disciplinary research in botany and landscape history was carried out in order to reconstruct the original trails, using field work studies as well as interpreted excursion protocols. The data obtained was offered to the Uppsala Municipality in their efforts to renovate the three existing excursion trails. The municipality accepted the idea of also restoring *Herbatio Danensis*, and incorporated it into the Tercentenary preparations.

Inspired by the suggestions from Linnaean Landscapes, the Uppsala Municipality increased the availability of *Herbationes Upsalienses* with signs along the trails carrying information in Swedish and English and special texts for Swedish school children, brochures with Swedish and English texts, a website *www.linnestigarna.se*, excursion

guides trained in Linnaean teaching techniques, and pieces of art installed along the trails to spark off the curiosity of the ramblers.

A decision to reconstruct all eight trails in *Herbationes Upsalienses* was made in 2006 by all political parties in the County Council. Conservation of the trails, including lookouts and viewpoints, is now the focus of Linnaean Landscapes for 2008 together with monitoring of remnant plant and animal populations studied by Linnaeus and his students.

Sara Christina Linnaea and Gränby, 2002-2006

An almost unknown place in Uppsala was the homestead of Linnaeus' daughter Sara Christina Linnaea, in Gränby, east of Uppsala. She lived there during 1798–1835, the last 14 years as a widow. Her house burnt down in 1972, but remnants of the garden and farmland were still visible in the grazed area. Gränby was an exploitation area in the city development plan. Linnaean Landscapes saw a potential in Gränby as a place in which to focus on the Tercentenary gender perspective, since Sara Christina's sister, Elisabeth Christina Linnaea, had knowledge of botany.

Important historical facts were obtained through interviews with an elderly lady born in Gränby, Mrs Anna Söderberg. This made it possible for Linnaean Landscapes to officially inaugurate Gränby as a Linnaea memorial homestead in 2003, a ceremony carried out by the County Council politician Britt Löfgren. Unfortunately Mrs Söderberg passed away a month before the inauguration.

Biological values in the area also altered the building plans in favour of the Linnaean area in Gränby. The landowner Uppsala Municipality renovated the site and in 2007 erected an art monument by Anette Wixner and Bodil Gellermark to symbolise the

Figure 3. The artist Anette Wixner by the monument symbolising Sara Christina Linnaea's house. Photograph by Björn Tingström.

house of Sara Christina Linnaea. The municipality also created a path for children through the agricultural landscape. Gränby has inspired artists and scientists to interpret and study women in botany.

Pehr Kalm and Funbo Lövsta, 2004–2007

Another place not previously well known in Uppsala was Funbo Lövsta, once owned by Linnaeus' friend Baron Sten Carl Bielke. Linnaeus' famous student Pehr Kalm lived there from 1741–1747 before he travelled to America. Several traces were present in buildings and in the surrounding farmland, among them a number of plant species originating from the agricultural experimental plantations made by Bielke. Funbo Lövsta was of great interest abroad, but the landowner, Swedish Agricultural University, was not fully aware of its historical values. In the city development plan, Funbo Lövsta was a site suggested for Uppsala's first wind power station and an extra sewage plant for the city.

A dialogue with the Uppsala Municipality about the historical values of Funbo Lövsta changed the city development plan. The next goal was to make the Swedish Agricultural University aware of the historical values. Linnaean Landscapes supported Malin Eriksson, a landscape architect student at the university, in her exam works on Funbo Lövsta (Eriksson 2005, 2006). It came to our knowledge that Herbert R. Rambo in Philadelphia, USA, with Swedish ancestry, wanted to reintroduce the apple variety Rambo into Sweden. Linnaean Landscapes suggested Funbo Lövsta as a site for this and the Swedish Agricultural University to host the apple reintroduction. In 2007 the American Ambassador Michael M. Wood planted the Rambo apple in a ceremony which attracted attention to Funbo Lövsta as a historical site. Malin Eriksson was employed to create the information for visitors.

Art & Linnaean Landscapes, 2002–2007

The connection between art and science is very important in the project. Art helps us to perceive the facts of science, a knowledge that Carl Linnaeus also practised in his writing and speaking. A group of artists was tied to the project, all with different means of expression: Anette Wixner (oil on canvas), Bodil Gellermark (ceramics), Mats Wilhelm (landscape photography), Hans Hedlund (copperplates, sculpture), Marie Öhrn (theatre) and Margaretha Bååth (water colour), all participated with different art projects during 2002–2007. They finally united in a Tercentenary exhibition in the Museum Gustavianum. Although the art project was formally finished in 2007, many small independent projects were sparked off and continue.

Conservation strategy, 2002–2012

The Linnaean Landscapes elements include lookouts and landscape views. In Sweden there is no legal framework for conservation of vast landscape areas. The issue of getting a legal framework for vast landscapes has been an issue to Linnaean Landscapes throughout the project. The views of the landscape are an essential part of a historical site, and an example is Hammarby, where the view belongs to two different municipalities.

Figure 4. Vice-chancellor of the Swedish Agricultural University Lisa Sennerby Forsse holding the Rambo apple tree in Funbo Lövsta. She is flanked by Herbert R. Rambo from Philadelphia and the American Ambassador in Sweden Michael M. Wood. Photograph by Björn Tingström

Conclusions

We conclude that we have reached our goals from 2002 to 2007. There was little knowledge available and no official discussion about Linnaean traces in the Uppsala countryside. There was little interest among landowners and managers to extend their responsibilities beyond limits present at that time. After an initial period characterised by insecurity on how to approach an independent project belonging to nobody and everybody, we see today that the ideas of Linnaean Landscapes are widely accepted and to a large extent taken over by responsible owners and managers. Linnaean Landscapes ("Linnés Historiska Landskap") has become a concept in the city development plan of Uppsala Municipality and is top priority in the Uppsala cultural political program.

The success of this project is due to the joint effort of a large number of people who have sympathised with its aims and interacted in the work. For their support and cooperation the board of the Linnaean Landscapes is immensely grateful. The resulting integration of historical values into a developing society is a gift to future generations inheriting the Linnaean Landscapes in Uppsala.

Acknowledgements

Linnaean Landscapes wish to thank the Linnean Society of London, Sparbanksstiftelsen i Uppland and the Uppsala Municipality for financial and moral support. An extended gratitude is expressed to all collaborators during 2002–2007.

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A Tribute to Linnaeus at the Chelsea Flower Show 2007

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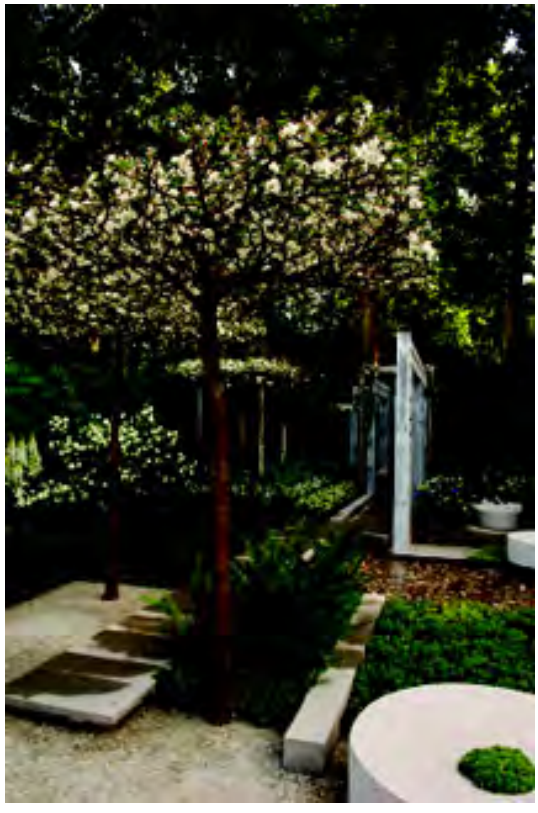
2007 was the tercentenary of the Swedish botanist, scientist and explorer, Carl Linnaeus. His life and work was celebrated through numerous activities and exhibitions, especially in his native Sweden, but his passion for the natural world was celebrated at the RHS Chelsea Flower Show 2007, in London, with a garden commissioned by the Swedish Government and coordinated by the The National Tercentenary Committee in Sweden, in cooperation with the Swedish Embassy in London and the Swedish Institute in Stockholm and was the 'Tribute to Linnaeus' show garden that I was commissioned to design.

The show garden was a contemporary design. Its composition, the materials chosen and plant selections all paid tribute to particular aspects of Linnaeus and his native landscape. Many of the themes explored in the garden design are deeply rooted in the cultural heritage and identity of Sweden. The garden design celebrated both a modern interpretation and traditional values and also techniques including architecture and design.

Today we associate the Swedish style from the 18th century, which Linnaeus was part of, with the Gustavian style, influenced by the rich royal court of France, but considerably simplified due to the poorer conditions in Sweden at the time. Today this modest, simple and yet exquisite style is much admired and is also a source of inspiration for more modern designs, such as in this garden, where simplicity and strictness of the lines and decorations are manifest.



The "Tribute to Linnaeus" garden at the Chelsea Flower Show in London, 2007.

'Tribute to Linnaeus' is a contemporary, stylised interpretation of Swedish nature. It aims to communicate a feeling for Swedish nature – thus it is not an attempt to create an imitation of nature. Simplicity is a key word: simple plants in simple arrangements presenting a spring garden with a snowy or icy expression. Common garden plants, some of which grow wild in Sweden, were in shades of white with icy yellow and icy blue, in contrast to purple and green. The feeling of snow in April was my aim.

Hedges of *Picea*, a traditional hedging plant, gave basic structure and enclosure to the garden. The primary tree species used were Pine and Birch, both iconic to the Swedish landscape. *Malus*, cultivated by Linnaeus in his botanic gardens, was used with flat cut crowns to compliment the character of the Pine and Birch.

Other plants used in the garden were a mix of those grown or cultivated by Linnaeus, together with species which grow wild in Sweden. Those plants used in the garden which were originally planted by Linnaeus in his own gardens at Hammarby outside Uppsala and are still growing there today include; *Lilium martagon* 'Album', *Asarum eruopaeum* and *Jovibarba globifera* (*Semperivium soboliferum*).

Several other plants chosen for the garden are known for being cultivated by Linnaeus at his botanical garden in Uppsala, these include; *Lingustrum vulgaris*, *Viburnum opulus* 'Roseum', *Malus*, *Fritilaria melagris*. *Astrantia major*, *Digitalis purpurea*, *Iris sibirica*, *Osmunda regalis* and of course the trademark *Linnaea borealis*. The wild species used can be traced back to Linnaeus' days included; *Vaccinium vitis-idaea*, *Deschampsia cespitosa* and *Fragaria vesca*. Linnaeus organised the botany and I wanted to do the same with the design. So I used the plants which we do connect with nature more strictly, as in grids, and the garden plants in the way of nature.

The garden was partially divided diagonally by perforated timber walls, partly a pergola. The openings within the walls framed more precise and specific views within the garden. Encouraging different ways of looking into the garden reflects the enduring curiosity of Linnaeus and his scientific approach to nature. The subdivisions made by the timber walls also defined different plant micro-climates for shady, sunny, drought or moisture loving plant species. The walls combined historical and modern construction techniques. They were painted in colours similar to those used on barns and houses in the Swedish countryside, including red (made from red oxide) and silver grey, the colour most associated with the Gustavian style.

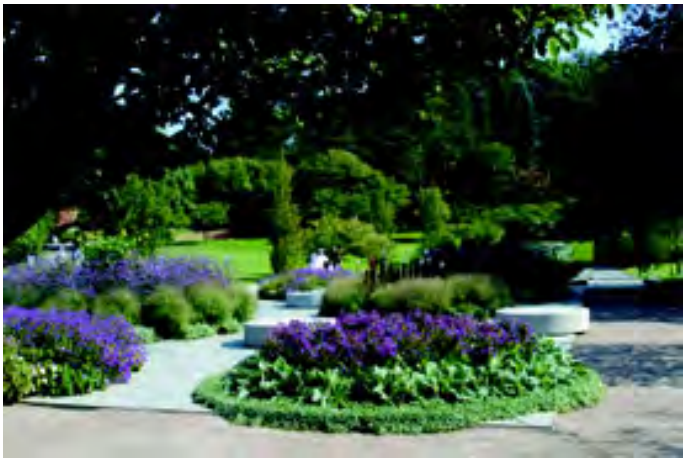
Water was used in the garden to represent its fundamental importance to the Swedish woodland landscape. The water within the garden did not mimic nature but referred to its many different characteristics: The source of water from a spring, the collection of water in a dark woodland tarn, the violent flow of water as it rushes over native cobbles.

To create a feeling of deep forest and a more severe climate, clear water trickled from a spring, framed in a circle of golden maidenhair. Linnaeus has documented his special love for maidenhair, having used it as a mattress as well as a cover when he spent the night in the wood during his journeys through Sweden. The water was calm and still in a dark tarn and, on the other side of a narrow pathway of granite, rushed over a cobblestone area. Just as in gardens of history, whether they might be Moorish or Italian renaissance, the water in this contemporary garden was inspired by Swedish nature and created the centre, symbolising the source of life.

Granite is the native stone of Sweden. It is one of the natural resources which has played an important part in the development of the Swedish economy. Its location and use was explored in research work by Linnaeus and it continues to be used in all aspects of construction. The primary, hard landscape material in the garden was granite from the Swedish West coast.

The bedroom walls of Linnaeus' Summer house at Hammarby were decorated with illustrations from *Plantae Selectae* by Georg Dionysius Ehret. These images have been transformed into digital art on large vertical laser cut sheets of steel by the Norwegian artist Anne-Karin Furunes and were incorporated into the garden design.

The garden has been moved to the Botanical Garden in Göteborg, where it was reopened one month after Chelsea. The garden is placed in a totally new main entrance area that I have designed (see below).



Exhibitor and sponsor was The National Tercentenary Committee in Sweden, in cooperation with the Swedish Embassy and the Swedish Institute in Stockholm.

Designer: Ulf Nordfjell, Landscape architect, Stockholm

Coordinator: Julie Toll, London, Tobias Nordlund Sweden

Contractor: Ricky Baxter, Brambles London.

Naming Nature: The Future of the Linnaean System

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Botanical Secretary of the Linnean Society

In celebrating the Tercentenary of Carl Linnaeus, we have rightly concentrated on his great contribution to the biology and society of his times, and to a certain extent have been looking behind us to the past. But Linnaeus himself was a forward-looking man, and he would have been disappointed if we did not use the Tercentenary to assess the prospects of the science he so loved. Bremer (2008) has shown how Linnaeus' sexual system, introduced in the first edition of *Systema Naturae* (Linnaeus, 1735), has been superseded by more analytical, more character-rich and more repeatable systems of classification. The knowledge that all of life shares a genealogy and that diversity is generated by evolution by natural selection has meant a step-change in our ability to discern patterns and work out processes for the generation of the diversity that Linnaeus concentrated on documenting. I like to think he would have been pleased with this knowledge – after all, it was he who quite firmly strove to unite all of life (humans included) in the various editions of his *Systema Naturae*.

It is, however, Linnaeus' naming system that has endured into the 21st century virtually unchanged. The two-word names we use today for species were conceived by Linnaeus (1753) as an efficient method for remembering and communicating about organisms (Stevens, 2002). Others had used two-word names for species before Linnaeus, but these were mixed in with one-word names, three-word names and polynomials – there was no consistency. Carl Linnaeus was an eminently practical botanist. He recognised the drawbacks of such long and unwieldy names and "invented" this simplified, two-word naming system in *Species Plantarum* (1753). He gave each species a genus name and what he called the "trivial name" – the second word hanging in the margin that simplified everything. For the first time, scientists could apply a consistent and uniform system to ALL plants (and after 1758 to animals too). The simplicity of the system delighted many scientists, and it soon caught on. This same system is still used today to name new species of plants and animals, and to communicate about them scientifically. In extending his binomial (or binominal) system to all of life in the 10th edition of *Systema Naturae* (Linnaeus, 1758), Linnaeus created the efficient cataloguing tool for life on Earth that we still use today. A name is merely a tool for the efficient retrieval of information and thus consistency in naming (always spelled the same, the same wherever the species occurs) is critically important to getting science done. This was true in Linnaeus' day, but it is even more relevant today. Today we know more about life on Earth – 1.8 million described species, and information about these many organisms is scattered throughout the scientific and popular literature.

A scientific name using the Linnaean conventions provides an efficient information retrieval system, especially if one adds on the power and complexity of the Internet.

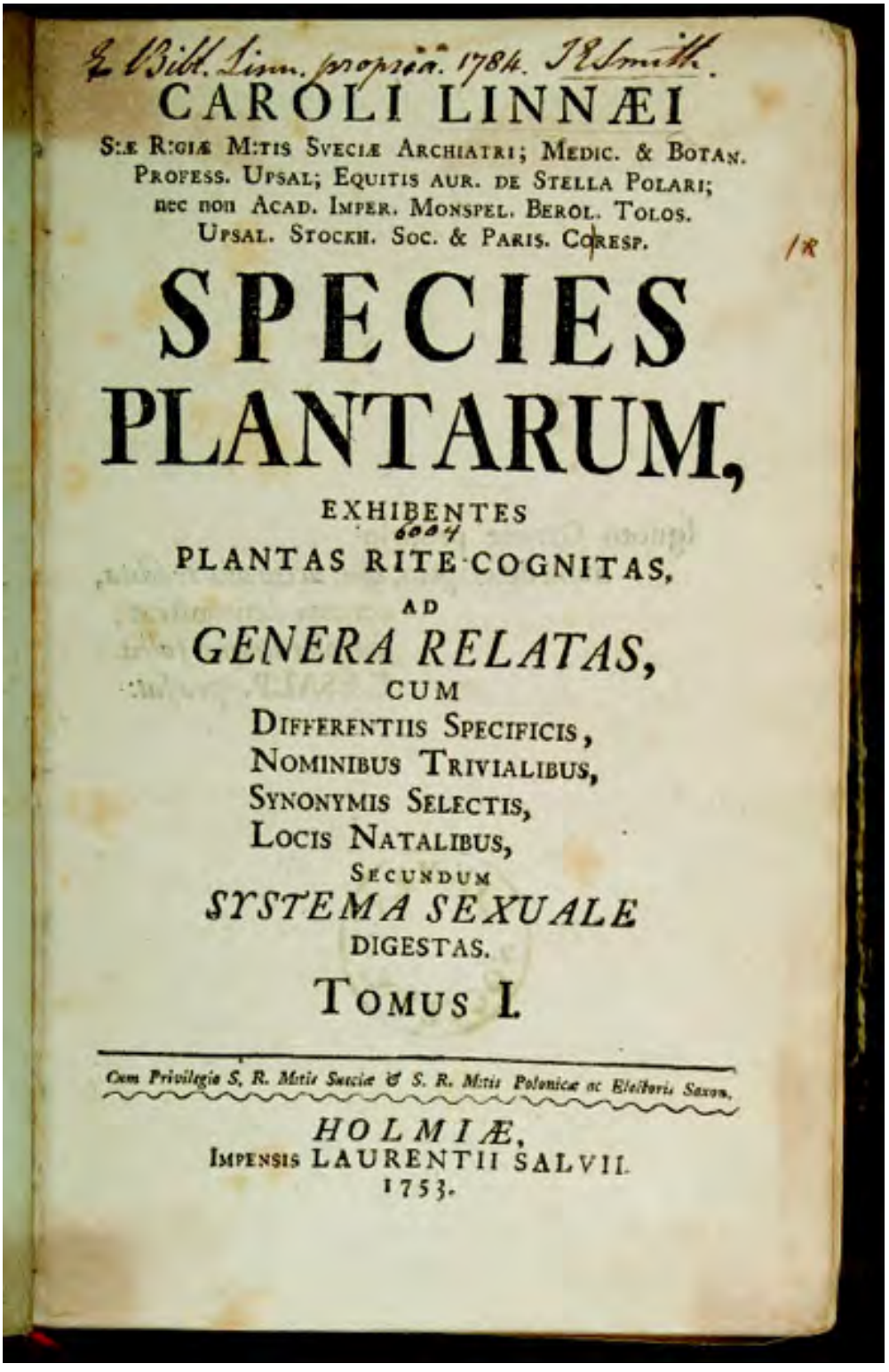
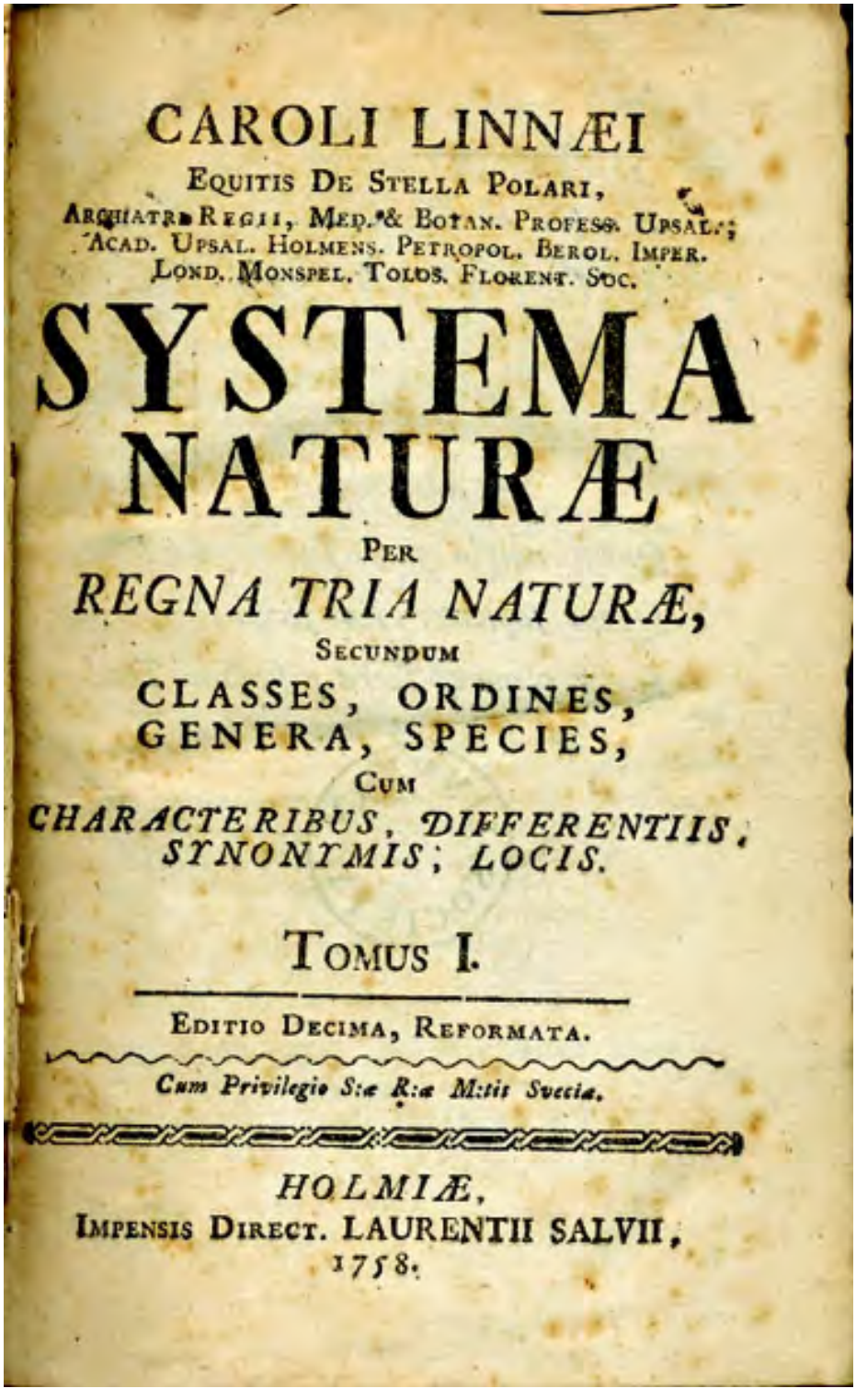


Figure 1. The title page of Linnaeus' *Species Plantarum* (1753).



CAROLI LINNÆI

EQUITIS DE STELLA POLARI,

ARCHIATR. REGII, MED. & BOTAN. PROFESS. UPSAL.;

ACAD. UPSAL. HOLMENS. PETROPOL. BEROL. IMPER.

LOND. MONSPEL. TOLOS. FLORENT. SOC.

SYSTEMA NATURÆ

PER

REGNA TRIA NATURÆ,

SECUNDUM

CLASSES, ORDINES,
GENERA, SPECIES,

CUM

CHARACTERIBUS, DIFFERENTIIS,
SYNONYMIS; LOCIS.

TOMUS I.

EDITIO DECIMA, REFORMATA.

Cum Privilegio S:æ R:æ M:tis Sveciæ.

HOLMIÆ,
IMPENSIS DIRECT. LAURENTII SALVII,
1758.

Figure 2. The title page of Linnaeus' *Systema Naturae*, 10th Edition (1758).

Godfray (2002) has argued that the science of taxonomy is made for the Internet – information and image rich, complex and multi-layered. The power of the world-wide web and the search engines that access it means that information that previously might have taken weeks or years to compile can be accessed in one query – if the information is online. This is where species names come into their own as an index to taxonomic information. A name opens a whole new world. The use of scientific names to index life on Earth was taken to a new level earlier this year when the *Encyclopedia of Life* was launched (*http://www.eol.org*). This ambitious project, kick-started by E.O. Wilson (who spoke about it at the Society in late 2007) and made available in its "alpha" form in February 2008 with 30,000 entries, will have a "page" for each of the 1.8 million species we know today, ultimately with the associated literature about that species digitised and openly available (through the *Biodiversity Heritage Library*, see *http://www.biodiversitylibrary.org/*). Harnessing the power of the Internet, EOL will be able to bring huge amounts of information together in one place in a one-stop-shop for knowledge about the other organisms with which we share the planet. If it works. It is up to everyone interested in natural history to make it work, contributions are sought from everyone with an interest through a Wikipedia-type interface. The use of scientific names as the index for EOL shows how useful they are, and how useful they will continue to be far into the future.

We need to name species and other taxonomic categories in order to communicate about them, both amongst scientists and with the public at large. The species category has long been imbued with an almost mystical status, stemming in part from the arguments that species were more "real" than other taxonomic categories (e.g., Mayr, 1942), and latterly in part due to the use of species names in conservation legislation (Mace, 2004; Isaac *et al.*, 2004). Part of the appeal of species as units, in my opinion, has to do with the noun-adjective structure of species names; species names feel like regular speech, they feel natural. The great utility of scientific names has not to do with the transferability of rank across taxonomic groups, but instead to their international acceptance, within each taxonomic group, to circumscribe more or less the same group of organisms. This difference is key to how we communicate about species – for practical use it is important that *Primula vulgaris* or *Solanum lycopersicum* refers to the same sorts of individuals wherever they occur, it is not so important for communication that *Solanum lycopersicum* means the same thing as *Balaenoptera musculus*. The units we talk about need not necessarily be the same as the units for conservation (see Isaac *et al*., 2005) or the units of evolution (see Raven, 1976); it might be convenient to have a multi-purpose unit, but in fact, it may lead to false assumptions and inferences about not only pattern of characters, but also process of diversification (Raven, 1977).

But will we be able to give binomial Latin names like those Linnaeus used to all organisms, from whales to microbes? Probably not. If we have only to date described about 10% of the diversity of life on Earth using traditional methods, we will never get as much information as we think we need for other purposes if we do not think laterally, just as Linnaeus did. It may be that we only need give formal "Linnaean" names to taxa where the name will have a particular use, say an endangered species or an essential crop plant. Some taxa may be too numerous for us to give them all formal names; the emerging science of biodiversity informatics may develop techniques that

Figure 3. The bee orchid *Ophrys apifera* painted by G. Watkin.

can establish a new indexing system for these kinds of organisms. A species name does not mean that those taxa are equivalent, as I argue here.

Attempting to come up with a universal species definition that will ensure that a species of butterfly is exactly equivalent to a species of rose is to a certain extent like trying to count the number of angels that can dance on the head of a pin – intrinsically and intellectually fascinating, but ultimately not particularly practical in the short or even useful in the long term. Unless we just get on with the job and use species as hypotheses, as units of classification (e.g., Liden & Oxelman, 1989; Dupré, 2001) that are subject to test and reformulation on the acquisition of new evidence, we cannot begin to investigate process or pattern in nature. Species need not be special, but

rather should be seen as an incredibly useful starting point for the investigation of where diversity is and how it is generated. We should not get hung up on whether the names are all equivalent or upset when they change, or cross when people disagree. Without a baseline, whether of names or of other identifiers, I fear that practical challenges facing natural history today, such as inventory, monitoring and conservation, run the risk of being put off into the future, when it might just be too late for us to meet them.

Conservation can be completely independent of taxonomic status; it should not matter if, for example, the bonobo or the killer whale or the bee orchid is classified as a species, subspecies or local population (Isaac *et al*., 2004). If species lists are to be used in conservation planning, it is important that those using them realise the limitations and hypothetical nature of such lists – species lists are really only a baseline prepared for a particular use. Lists prepared for one purpose, if used uncritically for another, can cause problems (Royal Society, 2003). The expectation that mere lists of species will be usable for everything we might now need or could possibly need in the future is hopelessly naïve.

Figure 4. Killer whale (*Orcinus orca*) and Bonobo (*Pan paniscus*). (Photos. P. Morris)

The preparation of a global list of all known plant species was a dream of Charles Darwin (Nic Lughadha, 2004), and in his will he left funds to begin the task as *Index Kewensis*, now much improved and expanded as the International Plant Names Index (IPNI, http://www.ipni.org). He was not at all concerned that the exact definition of a species was difficult to pin down (since evolution ensured this was impossible, see Mallet, 2008), but rather wanted this list for practical reasons. The botanical community today has great impetus to actually realise Darwin's dream, using Linnaeus' system. At the sixth Conference of the Parties to the Convention on Biological Diversity in The Hague in 2002, the *Global Strategy for Plant Conservation* (GSPC, Secretariat of the CBD, 2002) was adopted. The GSPC has 16 targets, the first and most fundamental of which is the preparation of a "working list of all known plant species, as a first step towards a world flora". Impediments to achieving this goal are many (Crane, 2004; Nic Lughadha, 2004), but the recognition that such lists of species names are not static,

but subject to continual updating and improvement is critical. The names in the global list may be units of a variety of types, but most importantly they are units of communication that will allow us to approach conservation action in a concerted way.

The species, called by its Linnaean two-word name, is a practical category for entities we wish to talk about and ultimately identify and conserve. Its name allows us to retrieve efficiently all known information about it from wherever it might be. In remembering Linnaeus at the close of his Tercentenary, let us remember not only his relevance to the science of his day, but the relevance of his tools to the science of tomorrow. Let us also remember that Linnaeus was a great innovator, but that not all his ideas worked or have been carried forward to today. In our attempts to come to grips with the challenges facing us and the other species with which we share the planet, it is worth reflecting on the importance of such innovation and on the necessity of looking forward and adapting our outlook as new challenges arise.

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CONTENTS