

Correspondence of Swammerdam (1664–1679)

Linguistics and Literature

Eric Jorink

Huygens ING (KNAW)

eric.jorink@huygens.knaw.nl

Abstract

The seventeenth-century Dutch microscopist Jan Swammerdam is famous for his microscopic observations and descriptions of insects. He developed a variety of effective microscopic techniques and made detailed drawings of his specimens. A great deal of information about his life and work is to be found in his letters, which were an important means of communication between intellectuals abroad and at home. The letters are descriptive and set out his research in detail. They have been made publicly available within the context of the Circulation of Knowledge project, in particular through the *ePistolarium* website, which provides ample opportunities for querying the collection of letters. Querying is based on keywords and topics. Search results are displayed in graphical format (a Google map showing the spatial coverage of the correspondence, a clickable time line with markers linked to individual letters, a diagram of the correspondent network). A word list, n-gram list and Keyword in Context Index have been added as additional search tools.

Keywords

language and literature data – Circulation of Knowledge project – Jan Swammerdam

1. Introduction

Jan Swammerdam was a seventeenth century Dutch microscopist and naturalist who is most famous for his microscopic observations and descriptions of insect development that were published posthumously as *The Bible of Nature*,

but is more often referred to as [The Book of Nature](#) due to a mistranslation of the title. Swammerdam pioneered the use of the microscope for zoological purposes, and is considered a founder of both comparative anatomy and entomology.

Born in Amsterdam in 1637, Swammerdam was the son of a pharmacist who always wanted him to earn his living either as a practicing physician or as a member of the Calvinist ministry. Although, he trained as a medical doctor at the prestigious University of Leiden, Swammerdam preferred scientific research to the medical practice and was supported by his father for the majority of his life. In his later years, Swammerdam fell under the influence of a religious mystic, [Antoinette Bourignon](#), and abandoned his scientific work for a time. He died in 1680 at the age of 43 from a recurrence of malaria with much of his work largely unknown and unacknowledged. Ownership rights, translation difficulties, and other complications prevented the publication of Swammerdam's collective papers until 1737, when Dutch doctor [Herman Boerhaave](#) finished translating the opus into Latin (Cobb, 2015).

2. Background

During his medical and anatomical studies, Swammerdam examined the heart, lungs, and muscles and is believed to be the first person to describe red blood cells. He also conducted important observations on how nerves function, described the anatomy of the human reproductive system, and discovered valves in the lymphatic system, which are now called Swammerdam valves. Anticipating the role of oxygen in respiration, Swammerdam suggested that air contained a volatile element that could pass from the lungs to the heart and then to the muscles, providing energy for muscle contraction.

Swammerdam's entomological work involved the life history of insects and the anatomy of mayflies, butterflies, beetles, dragonflies and bees. The first to describe the queen bee, which had previously been incorrectly referred to by scientists as the king bee, Swammerdam developed a classification of insects based on their type of development. Three of the five major groups he described are still retained in modern classification schemes. His detailed study of the development of flies via delicate dissections led him to the revolutionary conclusion that insects undergo metamorphosis through various life stages.

To aid him in his observations, Swammerdam developed a variety of original and highly effective microscopic techniques. For instance, he injected wax



FIGURE 1 *A 19th century fantasy portrait of Swammerdam, based on the face of Hartman Hartmanzoon (1591–1659) from Rembrandt's The Anatomy Lesson of Dr. Nicolaes Tulp. No genuine portrait of Jan Swammerdam is known.*



FIGURE 2
Single-lens microscope (circa 1670).

into specimens to hold blood vessels firm, dissected fragile structures under water to avoid destroying them, and used micropipettes to inject and inflate organisms under the microscope. Swammerdam preferred simple microscopes to compound ones and used small bead-like lenses that he made himself. He also preferred to only observe specimens under direct natural light, and his research was occasionally delayed in the fall and winter months when sunlight was scarce. Without a camera to capture images, Swammerdam made detailed drawings of his specimens and his collective microscopic work is often considered to be the most comprehensive of any single person.

In his book, Swammerdam indicated that he only observed specimens visible under direct natural light, generally outdoors on summer mornings. Prior to his microscopic observation of specimens, Swammerdam carried on painstaking dissections with a variety of tools including fine pairs of scissors, a saw made from a small section of watch spring, a fine sharp-pointed pen-knife, feathers, glass tubes, small tweezers, needles and forceps. He utilized a variety of original and highly effective techniques to clean the specimen and to dissolve unwanted tissues and highlight those of interest. Without a camera to capture images, Swammerdam made drawings of his specimens, first in red

crayon, then completed in black ink or pencil. Many of the drawings were ultimately transferred to copper plates for printing (Cobb, 2015).

3. Problem

3.1. *Circulation of knowledge*

The scientific revolution of the 17th century was driven by countless discoveries in the observatory, at sea, in the workshop, in society at large and in the library. There was a dramatic increase in the amount of information, giving rise to new knowledge, theories and world views. But how did the 17th-century scientific information system actually work? How were new elements of knowledge picked up, processed, disseminated and – ultimately – accepted in broad circles of the educated community? In short: how did knowledge circulate? The Dutch Republic played a key role in this “information society” *avant la lettre*. Its global trade network, prosperity and relative tolerance made the Republic a refuge for intellectuals from around Europe. Not only did the book trade in the territory of the Republic account for more than half of Europe’s production of scientific works, but the Republic was also the cradle of the modern scientific journal. The basis of this information system lay in the correspondence between intellectuals.

There is a long tradition in the Netherlands of studying the scientific revolution, starting with E.J. Dijksterhuis in the 1940s and 1950s and continuing today (e.g. K. van Berkel and H.F. Cohen). In recent decades, historians of science and scholarship have become increasingly aware of the pivotal role the 17th-century Dutch Republic played in the international network of humanists and scholars before and during the “scientific revolution”. Important developments in disciplines such as philology, natural philosophy and natural history were fostered in or nurtured by the dynamic intellectual atmosphere of the Dutch Golden Age. Institutions such as universities and publishing houses were instrumental in the production and dissemination of knowledge. Intellectuals from all over Europe visited the Netherlands, which was then considered “the storehouse of the intellectual world” and which is now increasingly studied as such. The 17th-century Republic offers an ideal case for exploring the answers to the above-mentioned question, and correspondence between scholars is the ideal research subject. Until the publication of the first scientific journals in the 1660s, scholarly letters were by far the most direct and important means of communication between intellectuals abroad and at home.

3.2. *Swammerdam's letters*

Swammerdam's letters contain a great deal of information about his life and his work. For example, in a number of letters he explains that he stopped his observations in the autumn and winter, for want of light. Elsewhere, he complains about the cost, accuracy and efficiency of engravers with regard to the production of his plates. The results of his work were initially incorporated into separate treatises and letters to friends, such as Thévenot, although it was Swammerdam's intention to collect these into one volume. The tracts and letters are not of an argumentative kind. On the contrary, they are purely descriptive, setting out in painstaking detail the life cycle and behaviour of the various animals, and the arrangement and function of their external and internal parts.

4. Data

- Data deposited at DANS – DOI:[10.17026/dans-xfd-n8y5](https://doi.org/10.17026/dans-xfd-n8y5)
- Temporal coverage: 1664–1679

The website of the Circulation of Knowledge project, in particular its [ePistolarium](#) web page, provides ample opportunities for querying the letter collections. It is designed to answer the basic questions: “Who sends what to whom and when?” In addition it comes with an interesting option of similarity search. When Swammerdam is selected as sender, several data visualizations become available, such as a Google map showing the spatial coverage of the correspondence, a clickable time line with markers linked to individual letters, a diagram of the correspondent network (in which the names' font size indicates the number of letters to this recipient – but unfortunately not linked) and a co-citation graph of person names.

As the network graph already suggests the letters are quite unevenly distributed over the recipients, as becomes more clear from the pie chart below:

The largest share goes to Thévenot. [Melchisédech Thévenot](#) (c. 1620–29 October 1692) was a French author, scientist, traveler, cartographer, orientalist, inventor, and diplomat. He was also famous for his popular 1696 book *The Art of Swimming*, one of the first books on the subject and widely read during the 18th century (Benjamin Franklin, an avid swimmer in his youth, is known to have read it). From about September 1664, Swammerdam lived in Paris as the guest of Thévenot. He was an active member, as was his friend Steno, of

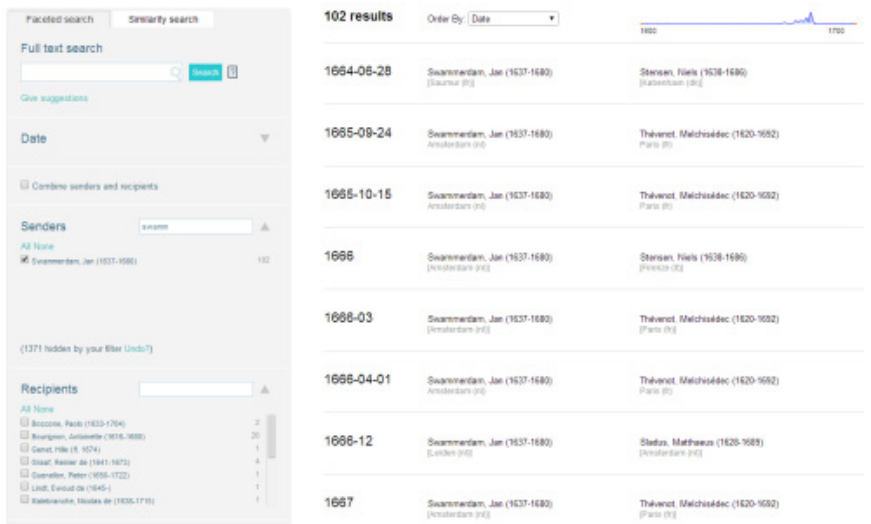


FIGURE 3 *ePistolarium* page with Swammerdam selected.



FIGURE 4 *Spatial coverage of Swammerdam's correspondence.*

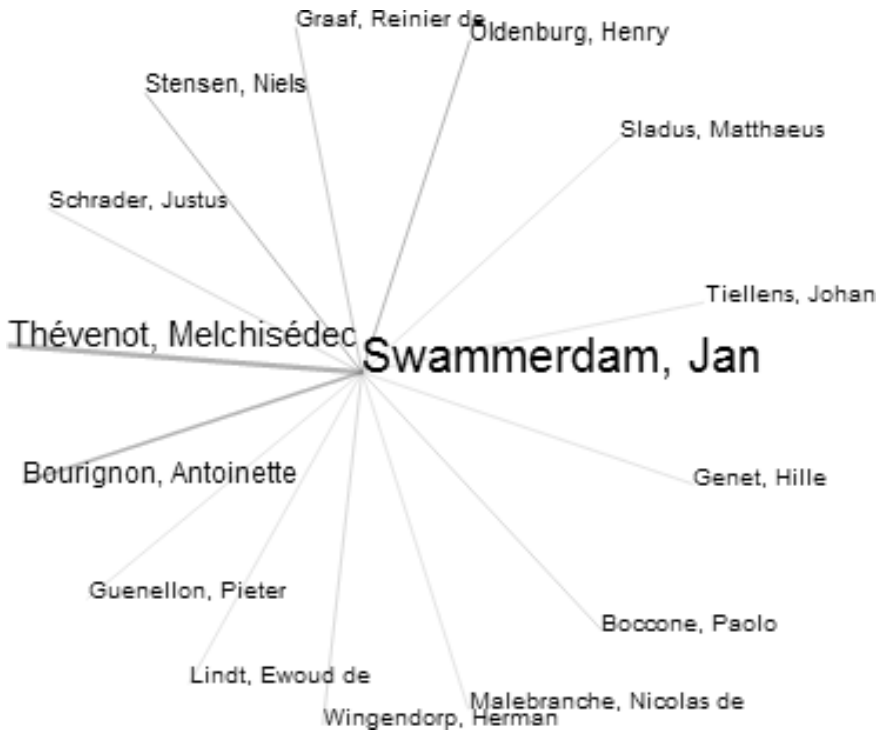


FIGURE 5 *Swammerdam's correspondence network.*

Thévenot's scientific academy, an informal club that met to watch experiments and dispute over Cartesian ideas.

The second in the list is [Antoinette Bourignon de la Porte](#) (13 January 1616–30 October 1680). She was a French-Flemish mystic and adventurer. She taught that the end times would come soon and that the Last Judgment would then be felled. Her belief was that she was chosen by God to restore true Christianity on earth and became the central figure of a spiritual network that extended beyond the borders of the Dutch Republic, including Holstein and Scotland. The Antoinette was accompanied in her exile by a friend of Swammerdam's. Jan wrote to her for spiritual comfort on 29 April 1674, and asked her permission before publishing his researches on the mayfly. He visited her in Schleswig-Holstein, between September 1675 and June 1676.

Although the collection is exceptionally well made accessible, the subject(s) of the letters cannot be easily looked up and may be even difficult to indentify; a mixture of things are often mentioned in a single letter. The Epistolarium

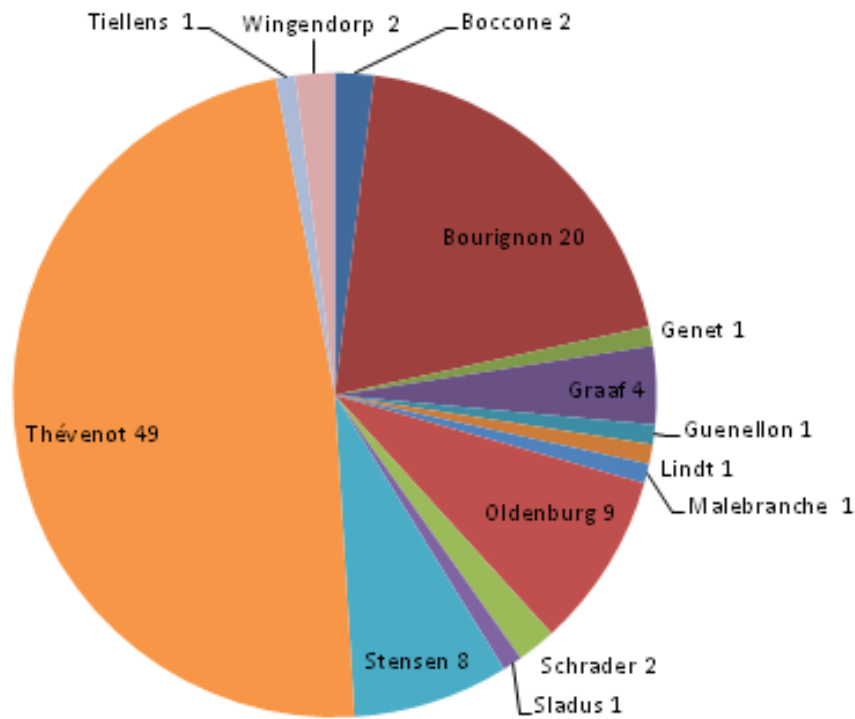


FIGURE 6 *The recipients of Swammerdam's letters.*

relies on keyword search and topic modeling. However, the list of keywords added to each letter does not cover the subjects in a way that is sufficient for a user who wants to get an overview of the content. Would he nevertheless get an idea of what is discussed in these documents, then a study of the vocabulary may be a good idea. Because the majority of Swammerdam's letters is in *Dutch*, we have added a [word list](#) and [list of n-grams](#) (i.e. a contiguous sequence of *n* words in the text) for this part of the collection (both created with a stoplist of most frequent with no substantive meaning), both of them can be explored online.

The usage of specific words can be further analyzed by a look-up in the *concordance* (Key Word In Context format), which can be downloaded as a PDF file (5.5 Mb). Both, wordlist and concordance are based on screen copies of the Dutch letters, currently published in the Epistolarium. The files consist of plain text and are available as supplement (zip file, 85 Kb).

A	B	C	D	A	B	C	D	E
Nr.	Frequency	Word		Nr.	Frequency	Probability	N-gram	
1965	166	Godt		142	12	0.176	Mijn Heer	
2295	117	Ik		144	15	0.146	Myn Heer	
2977	94	naa		189	22	0.124	U E	
2106	79	Heer		129	28	0.091	Jesus Christus	
4611	79	uE		84	18	0.054	gelijck als	
5354	76	waar		168	31	0.051	Soo dat	
1018	74	deese		174	23	0.046	t eenemaal	
1300	72	En		95	11	0.045	hoop dat	
1969	70	Godts		159	18	0.044	onder de	
2711	70	liefde		100	37	0.035	Ik heb	
4226	68	Soo		89	18	0.034	Het is	
2655	67	leeven		85	13	0.032	ghy my	
4607	64	u		59	47	0.031	door de	
5398	63	Want		5	46	0.031	alle de	
2157	61	Het		86	38	0.03	heb ik	
4424	58	t		50	18	0.028	des Heeren	
2046	57	haare		165	14	0.028	over te	
853	52	Christus		143	12	0.028	moeten wy	
1089	48	dingen		132	16	0.026	liefde Godts	
4119	46	sien		185	33	0.025	tot de	
4897	46	verlaaten		210	16	0.023	waar door	
994	44	datse		146	18	0.022	naa de	
4609	44	UE		94	12	0.022	Het welck	
4070	42	seght		137	40	0.021	met de	
5428	42	weer		190	16	0.02	uyt de	
999	41	De		161	33	0.019	op de	
990	40	Dat		131	11	0.019	leeven ende	
2787	40	Maar		73	143	0.018	ende de	
5431	40	weesen		1	32	0.018	aan de	

FIGURE 7 *Swammerdam's vocabulary of Dutch letters. Left: word list; right: N-grams. Stoplist used. (Click here to explore the vocabulary: https://docs.google.com/spreadsheets/d/1dITmWmrqnuEYGA2mOEbO_-D3oPshfy_Lfo8f4IzBU/edit?usp=sharing)*

1027 cke, ende aangebooren neygingen beminnen. Waar op	Godt	by Jesaja seght, Dat een Osse sijn Meester, ende
1028 n de liefde sijns Vaders gebleven is. Och, seght	Godt	by Moses, Dat sy sulck een herte hadden om my te
999 rdt, ende dat het weesentlick in ons is: dan kan	Godt	by ons, in ons, ende deur ons wonderen doen; die
980 erlooren: want alsoo de reeden verduwen is, ende	Godt	daar is uyt gewecken, soo strijt sy t'eenemaal t
1005 kan gaan, daar sijn geest in sal leeven: want men	Godt	dan alleen, sonder de aartsche ende de tijdelick
988 iet en wercken, maar alleen gelooven. Waarom haar	Godt	de rechtveerdigheyt sonder de wercken toereekent
1000 rijckheyt deeser saacken, die my aan alle kanten	Godt	deeden sien, tasten ende voelen; maar die ick dsa
14564 an vast is. Hier meede afbraakende soo sal ik na	godt	den eengen ende alleen goeden geever van alles be
14562 ge gave door de sonde verloren heeft. Want indien	godt	den mensch die dingen gegeeven hatt, die gy u inb
1064 nschappen boven natuurelijcker wijze verkreegen.	Godt	die en neemt nooyt welgevallen, in wercken die va
1073 ende onse geneegentheeden daar aan bechten: want	Godt	die ons sonder eenigh aansien van loon en profijt
925 te worden, gelijk als hy selver heyligh is. Want	Godt	die sal sonder annoeminge des persoons naa een y
14556 ik daar met alle kragt naa trachten wilden. Want	godt	die seght, die soekt die vindt ende die klopt sal
1065 Godt bidde my van gelicken te willen verleen.	Godt	die wil u meede bewaaren mijn Heer, en geeven dat
1007 brengen; ende de aanhangen Godts, een Geest met	Godt	doet worden. Vader ick bidde voor die geene die i
1024 van die hy bemint. Het welck als de ziel ontrent	Godt	doet, aan de welcke sy niet en kan presen teeren,
1004 at men t'eenemaal de reeden verliest, wanneer men	Godt	door de reeden wil begripen: ende de reedelijck
981 den te beweeven, sijn misdaadt te beklagen, ende	Godt	door de verdienste ende de voorspraacke van Chris
1014 sy alle de selve wercken moeten doen, naemlijck:	Godt	door sijn Soon, dien Erst-geboornen aller creatu
1033 overvloed der godtloosen. Het leeven in den toorn	Godt	duurt maar een oogenblik, daar het selve in sijn
915 e beesigheeden te blijven en de te volherden. Die	Godt	echter, hoe wel t'eenemaal onverdient, met sijne
14561 in de ongetrouwighd vervallende. Soo heeft hem	godt	eghter syne sonde om de voorbeede Christi genaadi
1059 rstigh moeten toesien, datwe ons niet te wijt van	Godt	en begeeven, naemlijck: met onse noodtaacklijck
923 ht sijn, in deese werelt, ende niet meerder: Want	Godt	en is geen aanneemer van personen. Ende hy bem
924 erspeeligheden, die gestraft moeten worden. Want	Godt	en verrijcht onse geestelijcke soo wel als onse n
1079 nt het haar onmogelijck is, om iesus de wijsheyt	Godt	ende de kracht Godts te begripen. Want hoewel s
995 efde, ende die in de Liefde blijft, die blijft in	Godt	ende Godt in hem. Soo dat dan, Die het Woort en G

FIGURE 8 *KWIC index of Swammerdam's vocabulary of Dutch letters.*

References

- Cobb, M., Neaves, S.H. & Davidson, M.W. (2015). [Jan Jacobz Swammerdam \(1637–1680\)](#). In: *Molecular Expressions. Sciences Optics & You*.
- Cobb, M. (2000). [Reading and writing The Book of Nature: Jan Swammerdam \(1637–1680\)](#). *Endeavour* 24:3 1 pp. 122–128.
- Fearing, F. (1929). Jan Swammerdam: A Study in the History of Comparative and Physiological Psychology of the 17th Century. *The American Journal of Psychology* 41:3 pp. 442–455.
- Fournier, M. (1990). [The Book of Nature: Jan Swammerdam's microscopical investigations](#). *Tractrix* 2 pp. 1–24.
- Jorink, E. (2003). Outside God there is Nothing: Swammerdam, Spinoza, and the Janus-Face of the Early Dutch Enlightenment in: van Bunge, W. (Ed.), *The Early Enlightenment in the Dutch Republic 1650–1750: Selected Papers of a Conference Held at the Herzog August Bibliothek Wolfenbüttel 22–23 March 2001*. Leiden pp. 81–108.
- Jorink, H.G.M. (2013). [De profeet en de boekhouder. Johannes Swammerdam, Antoni van Leeuwenhoek en de begintagen van de microscopie](#). In: *Fascinerend leven. Markante figuren en ideeën uit de geschiedenis van de biologie*, pp. 179–208.
- Ruestow, E.G. (1996). *The Microscope in the Dutch Republic: The Shaping of Discovery*. New York.
- Ruestow, E.G. & Edward, G. (1985). Piety and the defense of natural order: Swammerdam on generation in: Osler, M. & Farber, P.L. (eds.) *Religion Science and Worldview: Essays in Honor of Richard S. Westfall*. New York pp. 217–241.