

The Biographical Encyclopedia of Astronomers

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# Preface

Like that of any human activity, the history of astronomy has been played out under the influence of myriad cultural, institutional, political, sociological, technological, and natural forces. Any history that focuses only on the greatest participants in a field likely misses a great deal of interest and historical value. Inasmuch as astronomy is undertaken by and for human beings, therefore, its history cannot be limited to the lives and achievements of a narrow group.

Here we analyze the lives of people who, in our view, produced some substantial contribution to the field of astronomy, were involved in some important astronomical event, or were in some other manner important to the discipline. In doing so we do not discount the work of countless other journeyman astronomers without whom the science would not have progressed as it has.

## Scope

*Biographical Encyclopedia of Astronomers [BEA]* entries presented here do not pretend to illuminate all aspects of a given person's vita. Moreover, some figures included are better known for their enterprises outside of astronomy. In these situations, their astronomical contributions are emphasized.

For many of our entries, the length is limited to something substantially less than 1,000 words due to the lack of available information. There is, of course, an inclination to write a great deal more about persons for whom there is a significant literature already available, *e. g.*, Copernicus, Kepler, Newton, William Herschel, or Einstein. Many such individuals are covered in other standard resources, and we have not felt compelled to repeat all that is already published in those cases. In fact, we look at our entries as a guide to recent scholarship and a brief summary of the important facts about the lives involved. On the other hand, two-thirds of the entries in this encyclopedia are about individuals for whom there is no readily available standard source. In those cases, the length of the article may be longer than might be expected in comparison with those of better known astronomers, and reflects the fact that an entry offers the first (and perhaps only) easily available information about the astronomer involved: It is not difficult to find sources on "Greats" such as Galileo Galilei; however, it is hard to find information on Galilei's acolyte, Mario Guiducci.

Citations within the text have been avoided to enhance readability. Nearly all articles end with a list of selected references. The reader is thus presented with opportunities for further research; no article is intended to be a dead end. Toward that end, if we do not provide additional resources for an entry, the subject will be cross-referenced within other articles for which we do provide selected references.

In compiling the selected references, we have tried to include difficult-to-identify secondary sources. At the same time we have largely excluded standard reference works and include only some of the latest canonical works covering the best-known figures in astronomy.

The *BEA* documents individuals born from Antiquity to approximately mid-1918. Subjects may be living or dead. While some ancient figures have become legendary, we have tried to avoid clearly mythological ones. For example, while the royal Chinese astronomers Ho and Hsi (supposedly third millennium BCE) appear in nearly every history of eclipses, they warrant no entry here.

This terminal birth date assures that the subjects written about have completed most of their careers, and that sufficient time likely has elapsed since their featured accomplishments that a historical perspective on their work is possible. Note that almost all of our subjects began their careers before the watershed transformation of astronomy brought about by the events of World War II. It is also true that the number of astronomers significantly increased after this time. Our youngest subject is Gérard de Vaucouleurs; our oldest is Homer.

## Inclusion Parameters

Our entry selection embraces a broad definition of the word "astronomer." In modern science, little differentiation is made between the words "astronomy" and "astrophysics"; we do not use such a distinction here. For example, our definition includes astrometrists, cosmologists, and planetologists. These three fields were considered separate and self-contained for most of human history. Cosmology, especially, requires the inclusion of many philosophers and theologians.

Early astronomers often also were astrologers. If they performed astronomical pursuits in addition to simple divination, we include them. Likewise, no distinction is made between the professional and the contributing amateur.

With the exception of a few important cases, instrument makers are included only if they pursued astronomical work with their instruments. Surveyors and cartographers are included if their study of the stars went beyond mere reference for terrestrial mapmaking. Lastly, a select group of authors, editors of astronomical journals, founders of astronomical societies, observatory builders and directors, astronomy historians, and patrons of astronomy are included.

A common pitfall in the history of science is to make the story of a discipline appear to be a single ladder ascending toward modern theory. Instead, it is a tree with many branches, only some of which have led to our current understanding of the Universe. Indeed, seemingly dead branches may become reanimated later in time. And branches may merge as ideas once considered unrelated are brought together. A better metaphor may be a vine, one with many grafts.

Scientists who contributed theories no longer held salient, or who made observations now considered suspect, nonetheless are included on our list if their effort was considered scientifically useful in its time, and the basis for further inquiry. At the same time, scientists whose ideas or techniques are now considered prescient, but who were unrecognized in their lifetimes, may appear as well.

The contributions of persons selected for entries in this work were weighed in the context of their times. Thus, while a contribution made by a medieval scholar might seem small by today's standards, it was significant for its era. We are especially proud of our inclusion of "non-western" figures who often have been given little treatment in histories of astronomy. Finally, we have included numerous entries of fewer than 100 words, some just a sentence or two, to introduce their names and place them in context within the broader vistas of astronomy.

Construction of the subject list was done by the editor-in-chief in consultation with the content editors. Well-known historian of astronomy Owen Gingerich generously volunteered his time to comment upon draft lists. Still, while an earnest attempt was made to make an objective selection of our more than 1,500 entries, responsibility for omissions must rest with the editor-in-chief. Most vulnerable to omission were those born in the last century.

### *Project Staffing*

Author solicitation was done by the editor-in-chief. Many of the shortest entries were crafted by the editor-in-chief; some but not most of these short entries were paraphrased from an unpublished typescript draft titled *Biographical Dictionary of Astronomers*, originally prepared by the historian Hector C. Macpherson in 1940. The standardized format of the articles was arrived at by consensus among the editors. Senior editor Thomas R. Williams's *Author Guidelines* proved indispensable.

Editors were invited to join the project by the editor-in-chief. This editorial board includes, more-or-less equally, individuals who entered history-of-astronomy scholarship with a background either in history of science or in astronomy. (Some have both.) Unlike many encyclopedists, we did not use our editorial role to eradicate the individual writing styles of the authors.

Each content editor was assigned a thematic editorial responsibility, though all were called upon, at one time or another, to edit articles outside of this specialty. The assignments were as follows:

- Classical and Medieval Astronomers—Katherine Bracher
- Renaissance and Enlightenment Astronomers—Richard A. Jarrell
- Nineteenth Century Astronomers—Marvin Bolt
- Twentieth Century Astronomers/Astrophysicists—Virginia Trimble
- Astronomers of the Islamic World—Jamil Ragep
- Nonvocational Astronomers—Thomas R. Williams
- Astronomy Popularizers—Jordan D. Marché, II

All content editors also contributed articles to the *BEA*. JoAnn Palmeri edited the vital references for all entries. Additionally she served as our illustrations editor.

For *errata* information, e-mail us at [HOCKEY@UNI.EDU](mailto:HOCKEY@UNI.EDU)

Thomas Hockey  
October 2005

# Acknowledgments

The *Biographical Encyclopedia of Astronomers* [BEA] is above all the product of its authors. These 410 contributors hail from 40 different countries. Nearly every article is an original piece of scholarship. In some cases, scholars about whom entries were written were themselves gracious enough to write articles for us on other subjects.

At the heart of this 6-year project has been its board of editors. Contrary to what the narrow definition of this job title might imply, these people have been actively providing aid, comfort, and advice to the project, since its inception. As to their editorial contribution specifically, this was often far greater, and more time consuming, than is commonly assumed.

The BEA was the idea of Peter Binfield (then Business Development at Kluwer). Dr. Binfield's assistant, Ms. Livia Iebba, also provided support "above and beyond." Dr. Harry Blom, Springer's Senior Editor for Astronomy and Astrophysics, traveled many kilometers to meet with the BEA editorial board and lend support on the long road to publication.

Usually unsung in a project of this nature are those individuals who did not write for us, but instead recommended other willing and qualified authors. Brevity permits me only two examples: Eva Isaksson of the University of Helsinki and Kevin Krisciunas of the Cerro Tololo Interamerican Observatory.

Brenda G. Corbin at the United States Naval Observatory kindly provided us with a manuscript copy of Hector Copland MacPherson's *Biographical Dictionary of Astronomers* (1940), which was never published. We hope that its use in assembling the BEA is similar to what Dr. MacPherson had wished to achieve. Many, though not most, of the shortest entries in the BEA were paraphrased from MacPherson's work.

Certain scholars consulted with us on astronomers of specific nationalities. We appreciate the assistance of Alexander A. Gurshtein (astronomers of the former USSR), Suzanne Débarbat (Francophone astronomers), Helge Kragh (Scandinavian astronomers), Robert Van Gent (Dutch), A. Vagiswari (Indian astronomers), Kevin D. Pang (Chinese astronomers), Jochi Shigeru (East Asian astronomers), and Rudi Paul Lindner (Byzantine astronomers).

The bibliographies of recent works in the history of astronomy published by Ruth Freitag (Library of Congress) were enormously useful. So was the Finding List of Obituary Notes of Astronomers (1900–1997) prepared by Hilmar Dürbeck and Beatrix Ott, with contributions by Wolfgang Dick. The Astrophysics Data System of the National Aeronautics and Space Administration was frequently accessed.

The effort of Daniel W. E. Green, Harvard-Smithsonian Center for Astrophysics and International Astronomical Union Center for Astronomical Telegrams, assured that the proper use of new International Astronomical Union comet and minor-planet nomenclatures was maintained.

H. Miller's Thryomanes font facilitated communicating Arabic text between editors. Yuliana Ivakh helped the editor-in-chief with Cyrillic.

Kari Aunan handled thousands of letters during the author-solicitation process. Wesley Even created and maintained the spreadsheet, so necessary for keeping track of the data and long lists generated by the project. Rachel Wiekhorst operated the document scanner. Jeff Guntren prepared the Table of Contents. I am proud to say that all did so while being undergraduate students at the University of Northern Iowa.

Ruby Hockey undertook the cumbersome filing process.

"Thank you" to the members of the Department of Earth Science, University of Northern Iowa [UNI], especially Lois Jerke. I relied on their infrastructure and good humor greatly. Generous, too, was the support of Dean Kichoon Yang, UNI College of Natural Sciences. Linda Berneking of the UNI Donald O. Rod Library, Interlibrary Loan, also deserves special mention.

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Editor Thomas R. Williams would like to acknowledge Peter Hingley, librarian of the Royal Astronomical Society, and Richard McKim, as well as the staff of Fondren Library at Rice University for their assistance.

The editorial board is grateful for the aid received from the many other scholars and librarians, too many to list here, who assisted with facts, citations, and general comments on individual entries. This public support is echoed by officers of the International Astronomical Union Commission 41 (History of Astronomy)/Inter-Union Commission for History of Astronomy, Ileana Chinnici and Wayne Orchiston, who, in the *ICHA Newsletter* #3 (2002), wrote regarding the *Biographical Encyclopedia of Astronomy*: "While the formation of the ICHA came too late for it to be an active participant in the planning phase, we are happy to report that the ICHA Organizing Committee has given the project its whole-hearted support..."

# Foreword

In the past four decades, the history of astronomy and cosmology has grown into a professional research area, complete with a journal (*Journal for the History of Astronomy*), sessions devoted to the subject at annual meetings of professional societies, and regular meetings of its own, such as the biennial meetings at the University of Notre Dame. Indeed, the field contains subspecialties, such as archaeoastronomy, that hold regular meetings of their own and have journals.

Astronomy is unique in several respects. First, although the research front in all sciences moves ever faster, constantly increasing the distance between the practitioner and the subject's history, in astronomy the time dimension plays a crucial role in current research (as opposed to, for instance, chemistry), and this means that past data, *e. g.*, of eclipse or sunspot observations, continue to play a role in astronomical research. The historian of astronomy is often the intermediary between the astronomer and these data, especially for earlier periods. Second, among the exact sciences, astronomy is the only field in which amateurs continue to play an active, if supporting, role: In a number of cases professional astronomers rely on the services of the amateurs, and many of the services delivered by these amateurs are very professional indeed. But the lines demarking astronomers from historians and professionals from amateurs are not cut-and-dried. There are museum curators and planetarium educators who are amateurs astronomers or do highly professional research on historical periods, and there are professional astronomers who have an abiding interest in the history of their field for various reasons. And lest we forget, there are very large numbers of readers and television viewers with a passive interest in the history of astronomy for whom the human dimension of the quest to understand the heavens is crucial.

Many of the standard histories of astronomy date from the 1930s and 1950s. But these single-volume histories, which once served both as teaching tools and reference works, have become obsolete in the past few decades. More recent single-volume histories of astronomy can serve only as teaching tools and works of general interest. There has, thus, been a growing need for reference works that cover the results of research into the history of astronomy published in the past half century. Recently, two encyclopedias have been published, *History of Astronomy: an Encyclopedia*, edited by John Lankford, and *Encyclopedia of Cosmology*, edited by Norriss S. Hetherington. Concepts and issues are central in these works. The *Biographical Encyclopedia of Astronomers* is a reference work that focuses on individuals; it adds the human dimension without which no science, or its history, can come to life.

Albert van Helden  
Utrecht, September 2005



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# Table of Entries

Names preceded by an article or preposition are alphabetized by the next word in the name. There are two exceptions: One is the Dutch “Van,” “Van de,” “Van den,” and “Van der.” Another is “Warren De La Rue” (alphabetized under D). (Arabic names are alphabetized under the shortened version of the name.)

ʿAbbās Wasīm Efendi	ʿAlī ibn ʿīsā al-Aṣṭurlābī
Abbe, Cleveland	ʿAlī ibn Khalaf: Abū al-Ḥasan ibn Aḥmar al-Ṣaydalānī
Abbo of [Abbon de] Fleury	ʿAlī ibn Khalaf ibn Aḥmar Akhīr [Akhiyar]
Abbot, Charles Greeley	Alighieri, Dante
Abbott, Francis	Allen, Clabon Walter
ʿAbd al-Wājid: Badr al-Dīn ʿAbd al-Wājid [Wāḥid] ibn Muḥammad ibn Muḥammad al-Ḥanafī	Aller, Lawrence Hugh
Abetti, Antonio	Alvarez, Luis Walter
Abetti, Giorgio	Amājūr Family
Abharī: Athīr al-Dīn al-Mufaḍḍal ibn ʿUmar ibn al-Mufaḍḍal al-Samarqandī al-Abharī	Ambartsumian, Victor Amazaspovitch
Abney, William de Wiveleslie	Amici, Giovanni Battista
Abū al-Ṣalt: Umayya ibn ʿAbd al-ʿAzīz ibn Abī al-Ṣalt al-Dānī al-Andalusī	ʿĀmili: Bahā al-Dīn Muḥammad ibn Ḥusayn al-ʿĀmili
Albuzale	Ammonius
Abū al-ʿUqūl: Abū al-ʿUqūl Muḥammad ibn Aḥmad al-Ṭabarī	Anaxagoras of Clazomenae
Abū Maʿshar Jaʿfar ibn Muḥammad ibn ʿUmar al-Balkhī	Anaximander of Miletus
Albumasar	Anaximenes of Miletus
Acyuta Piṣārati	Andalò di Negro of Genoa
Ādami: Abū ʿAlī al-Ḥusayn ibn Muḥammad al-Ādami	Anderson, Carl David
Adams, John Couch	Anderson, John August
Adams, Walter Sydney	Anderson, Thomas David
Adel, Arthur	Andoyer, Marie-Henri
Adelard of Bath	André, M. Charles
Adhémar, Joseph-Alphonse	Ångström, Anders Jonas
Aeschylus	Anthelme, Voituret
Aḥmad Mukhtār: Ghāzī Aḥmad Mukhtār Pasha	Antoniadi, Eugène Michael
Ainslie, Maurice Anderson	Apian, Peter
Airy, George Biddell	Petrus Apianus
Aitken, Robert Grant	Apollonius of Perga
Albert the Great	Appleton, Edward Victor
Albertus Magnus	Aquinas, Thomas
Albrecht, Sebastian	Arago, Dominique-François-Jean
Alcuin	Aratus
Alchvine	Archelaus of Athens
Ealhwine	Archenhold, Friedrich Simon
Flaccus Albinus	Archimedes
Alden, Harold Lee	Archytas of Tarentum
Alexander, Arthur Francis O’Donel	Argelander, Friedrich Wilhelm August
Alexander, Stephen	Argoli, Andrea
Alfonsi, Petrus	Aristarchus of Samos
Alfonso X	Aristotle
Alfonso el Sabio	Aristyllus
Alfonso the Learned	Arrhenius, Svante August
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Alfvén, Hannes Olof Gösta	Āryabhaṭa the Elder
ʿAlī al-Muwaqqit: Muṣliḥ al-Dīn Muṣṭafā ibn ʿAlī al-Qusṭantīnī al-Rūmī al-Ḥanafī al-Muwaqqit	Āryabhaṭa II
	Āryabhaṭa the Younger
	Asada, Goryu
	Yasuaki
	Ascham [Askham], Anthony

- Ashbrook, Joseph  
 Ashraf: al-Malik al-Ashraf (Mumahhid al-Dīn) ʿUmar ibn Yūsuf  
     ibn ʿUmar ibn ʿAlī ibn Rasūl  
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 Atkinson, Robert d'Escourt  
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     Aurelianus Augustinus  
 Autolycus  
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- Baade, Wilhelm Heinrich Walter  
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 Bailly, Jean-Sylvain  
 Baily, Francis  
 Bainbridge, John  
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 Baker, James Gilbert  
 Baldwin, Ralph Belknap  
 Ball, Robert Stawell  
 Balmer, Johann Jakob  
 Banachiewicz, Thaddeus Julian  
 Banneker, Benjamin  
 Banū Mūsā  
 Bär, Nicholas Reymers  
     Raimarus Ursus  
 Barbier, Daniel  
 Barhebraeus: Gregory Abū al-Faraj  
     Grīgōriyōs Bar ʿEbrāyā  
     Grīgōriyōs Bar ʿEbroyo  
 Bar Ḥiyya: Abraham bar Ḥiyya Savasorda  
 Barker, Thomas  
 Barnard, Edward Emerson  
 Barnothy, Jeno M.  
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 Barozzi, Francesco  
     Franciscus Barocius  
 Barringer, Daniel Moreau  
 Bartholin, Erasmus  
 Bartholomaeus Anglicus  
 Bartsch, Jakob  
     Bartschius  
 Bates, David Robert  
 Bateson, Frank Maine  
 Battānī: Abū ʿAbd Allāh Muḥammad ibn Jābir ibn Sinān al-Battānī  
     al-Ḥarrānī al-Ṣābiʿ  
     Albategnius [Albatenus]  
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 Bayer, Johann
- Beals, Carlyle Smith  
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     Bernardus de Trilia  
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     Blanchinus, Francisco  
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 Bigourdan, Camille Guillaume  
 Billy, Jacques de  
 Biot, Edouard-Constant  
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 Birmingham, John  
 Birt, William Radcliff  
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     Alpetragius  
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 Blaauw, Adriaan  
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     Baron Blackett of Chelsea  
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     Gopčević, Spiridion  
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     Viktor Alekseyevich  
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     Laurentius Eichstadius  
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     Tarkhān al-Fārābī  
     Alfarabius  
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     ibn Kathīr al-Farghānī  
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- Fauth, Philipp Johann Heinrich  
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 Fazārī: Muḥammad ibn Ibrāhīm al-Fazārī  
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     Finlay-Freundlich, Erwin  
 Friedman, Herbert  
 Friedmann, Alexander Alexandrovich  
 Frisi, Paolo  
 Frisius, Gemma Reinerus  
     Regnerus  
 Fromondus, Libertus  
 Frost, Edwin Brant  
 Fu An  
 Furness, Caroline Ellen  
 Fusoris, Jean [Johanne]
- Gaillot, Jean-Baptiste-Aimable  
 Galilei, Galileo  
 Galle, Johann Gottfried

Gallucci, Giovanni Paolo  
 Gambart, Jean-Félix-Adolphe  
 Gamow, George [Georgiy] (Antonovich)  
 Gan De  
 Gaṇeśa  
 Gaposchkin, Sergei [Sergej] Illarionovich  
 Garfinkel, Boris  
 Gascoigne, William  
 Gasparis, Annibale de  
 Gassendi, Pierre  
 Gauss, Carl Friedrich  
 Gautier, Jean-Alfred  
 Geddes, Murray  
 Geminus  
 Gemma, Cornelius  
 Gentil de la Galaisière, Guillaume-Joseph-Hyacinthe  
     Jean-Baptiste le  
 Gerard of Cremona  
     Gerardus Cremonensis  
 Gerasimovich [Gerasimovič], Boris Petrovich  
 Gersonides: Levi ben Gerson  
 Gilbert, Grove Karl  
 Gilbert [Gilberd], William  
 Gildemeister, Johann  
 Giles of Rome  
     Aegidius Romanus  
     Aegidius Colonna [Columna]  
 Gill, David  
 Gillis, James Melville  
 Gingrich, Curvin Henry  
 Ginzburg [Ginsberg], Vitaly Lazarevich  
 Giovanelli, Ronald Gordon  
 Glaisher, James  
 Glaisher, James Whitbread Lee  
 Godin, Louis  
 Godwin, Francis  
 Gökmen, Mehmed Fatin  
 Goldberg, Leo  
 Goldschmidt, Hermann Chaim Meyer  
 Goodacre, Walter  
 Goodricke, John  
 Gore, John Ellard  
 Gorton, Sandford  
 Gothard, Jenō [Eugen] von  
 Gould, Benjamin Apthorpe  
 Graham, George  
 Grassi, Horatio  
 Gray, Stephen  
 Greaves, John  
 Greaves, William Michael Herbert  
 Green, Charles  
 Green, Nathaniel Everett  
 Greenstein, Jesse Leonard  
 Greenwood, Nicholas  
 Gregoras, Nicephoros  
 Gregory [Gregorie], David  
 Gregory, James

Gregory of Tours  
 Grienberger, Christopher  
 Grigg, John  
 Grimaldi, Francesco Maria  
 Groombridge, Stephen  
 Grosseteste, Robert  
 Grotian, Walter  
 Grubb, Howard  
 Grubb, Thomas  
 Gruithuisen, Franz von Paula  
 Guiducci, Mario  
 Guillemin, Amédée-Victor  
 Guo Shoujing  
     Kuo Shou-ching  
 Guthnick, Paul  
 Gylđen, Johan August Hugo  
  
 Haas, Walter Henry  
 Ḥabash al-Ḥāsib: Abū Jaʿfar Aḥmad ibn ʿAbd Allāh al-Marwazī  
 Hadley, John  
 Hagen, Johann Georg  
 Hagihara, Yusuke  
 Hahn, Graf Friedrich von  
 Hájek z Hájku, Tadeá  
     Thaddaeus Hagecius  
     ab Hayck, Tadeá  
     Nemicus, Tadeá  
     Agecio, Tadeá  
 Ḥajjāj ibn Yūsuf ibn Maṭar  
 Halbach, Edward Anthony  
 Hale, George Ellery  
 Hall, Asaph  
 Hall, John Scoville  
 Halley, Edmond  
 Halm, Jacob Karl Ernst  
 Hansen, Peter Andreas  
 Hansteen, Christopher  
 Harding, Carl Ludwig  
 Haridatta I  
 Harkness, William  
 Haro Barraza, Guillermo  
 Harper, William Edmund  
 Harriot, Thomas  
 Hartmann, Johannes Franz  
 Hartwig, Carl Ernst Albrecht  
 Hārūn al-Rashīd  
 Hāshimī: ʿAlī ibn Sulaymān al-Hāshimī  
 Hatanaka, Takeo  
 Hay, William Thomson  
 Heckmann, Otto Hermann Leopold  
 Hegel, Georg Wilhelm Friedrich  
 Heis, Edward [Eduard, Edouard]  
 Helicon of Cyzicus  
 Heliodorus of Alexandria  
 Helmholtz, Hermann Ludwig Ferdinand von  
 Hencke, Karl Ludwig  
 Henderson, Thomas

- Henry, Joseph  
Henry of Langenstein  
    Henry of Hesse the Elder  
    Heinrich von Langenstein  
Henry, Paul Pierre and Prosper-Mathieu  
Henyey, Louis George  
Heraclides of Heraclea  
    Heraclides of Pontus  
    Heraclides Ponticus  
Heraclitus of Ephesus  
    Heraclitus the Riddler  
    Heraclitus the Obscure  
Herget, Paul  
Herman, Robert  
Hermann the Dalmatian  
Hermann the lame  
    Reichenau, Hermann von  
    Hermannus Contractus  
Herrick, Edward  
Herschel, Alexander Stewart  
Herschel, Caroline Lucretia  
Herschel, John (Jr.)  
Herschel, John Frederick William  
Herschel, (Friedrich) William [Wilhelm]  
Hertzprung, Ejnar [Einar]  
Herzberg, Gerhard  
Hesiod  
Hess, Victor Franz [Francis]  
Hevel, Johannes  
    Hevelius  
Hevelius, Catherina Elisabetha Koopman  
Hey, (James) Stanley  
Hicetus  
    Nicetus  
Higgs, George Daniel Sutton  
Hildegard of Bingen-am-Rhine  
Hill, George William  
Hiltner, William Albert  
Hind, John Russell  
Hinks, Arthur Robert  
Hiorter, Olof  
Hipparchus of Nicaea  
Hippocrates of Chios  
Hirayama, Kiyotsugu  
Hire, Philippe de la  
Hirst, George Denton  
Hirzgarer, Matthias  
Hoek, Martinus  
Hoffleit, Ellen Dorrit  
Hoffmeister, Cuno  
Hogg, Frank Scott  
Holden, Edward Singleton  
Höll, Miksa  
    Hell, Maximilian  
Holmberg, Erik  
Holwarda, Johannes Phocylides [Fokkens]  
Homer  
Honda, Minoru  
Honter, Johannes  
Hooke, Robert  
Hörbiger, Hanns  
Horn d'Arturo, Guido  
Hornsby, Thomas  
Horrebow, Christian  
Horrebow, Peder Nielsen  
Horrocks [Horrox], Jeremiah  
Hough, George Washington  
Hough, Sydney Samuel  
Houtermans, Friedrich Georg  
Houzeau de Lehaie, Jean-Charles-Hippolyte-Joseph  
Hoyle, Fred  
Hubble, Edwin Powell  
Huggins, Margaret Lindsay Murray  
Huggins, William  
Hulburt, Edward Olson  
Humason, Milton Lassell  
Humboldt, Alexander Friedrich Heinrich von  
Humphreys, William Jackson  
Ḥusayn, Ḥasan and Muḥammad  
Hussey, William Joseph  
Huth, Johann Sigismund Gottfried  
Huygens, Christiaan  
Hypatia  
Hypsicles of Alexandria  
  
Ibn Abī al-Faṭḥ al-Ṣūfi: Shams al-Dīn Abū ʿAbd Allāh Muḥammad  
    ibn Abī al-Faṭḥ al-Ṣūfi  
    Abī al-Faṭḥ al-Ṣūfi  
Ibn Abī al-Shukr: Muḥyī al-Milla wa-ʿl-Dīn Yaḥyā Abū ʿAbdallāh  
    ibn Muḥammad ibn Abī al-Shukr al-Maghribī  
    al-Andalusī [al-Qurṭubī]  
    Abī al-Shukr  
Ibn al-Aʿlām: ʿAlī ibn al-Ḥusayn Abū al-Qāsim al-ʿAlawī al-Sharīf  
    al-Ḥusaynī  
Ibn Bājja: Abū Bakr Muḥammad ibn Yaḥyā ibn al-Ṣāʿigh al-Tujībī  
    al-Andalusī al-Saraqustī  
    Avempace  
    Bājja  
Ibn al-Bannāʾ: Abū al-ʿAbbās Aḥmad ibn Muḥammad ibn ʿUthmān  
    al-Azdī al-Marrākushī  
    al-Bannāʾ  
Ibn Bāso: Abū ʿAlī Al-Ḥusayn ibn Abi Jaʿfar Aḥmad ibn Yūsuf Ibn Bāso  
    Bāso  
Ibn Ezra: Abraham ibn ʿEzra  
    Ezra  
Ibn al-Hāʾim: Abū Muḥammad ʿAbd al-Ḥaqq al-Ghāfiqī al-Ishbīlī  
    al-Hāʾim  
Ibn al-Haytham: Abū ʿAlī al-Ḥasan ibn al-Ḥasan  
    Alhazen  
    al-Haytham  
Ibn ʿIrāq: Abū Naṣr Maṣṣūr ibn ʿAlī ibn ʿIrāq  
    ʿIrāq  
Ibn Ishāq: Abū al-ʿAbbās ibn Ishāq al-Tamīmī al-Tūnisī  
    Ishāq



Ibn al-Kammād: Abū Jaʿfar Aḥmad ibn Yūsuf ibn al-Kammād  
al-Kammād

Ibn Labbān, Kushyār: Kiyā Abū al-Ḥasan Kushyār ibn Labbān  
Bashahrī al-Jilī (Gilānī)

Labbān, Kushyār

Ibn al-Majdī: Shihāb al-Dīn Abū al-ʿAbbās Aḥmad ibn Rajab ibn  
Ṭaybughā al-Majdī al-Shāfiʿī

al-Majdī

Ibn Muʿādh: Abū ʿAbd Allāh Muḥammad ibn Muʿādh al-Jayyānī  
Muʿādh

Ibn al-Raqqām: Abū ʿAbd Allāh Muḥammad ibn Ibrāhīm ibn ʿAlī  
ibn Aḥmad ibn Yūsuf al-Mursī al-Andalusī al-  
Tūnisī al-Awsī ibn al-Raqqām

al-Raqqām

Ibn Rushd: Abū l-Walīd Muḥammad ibn Aḥmad ibn Muḥammad  
ibn Rushd al-Ḥafīd

Averroes

Rushd

Ibn al-Ṣaffār: Abū al-Qāsim Aḥmad ibn ʿAbd Allāh ibn ʿUmar  
al-Ghāfiqī ibn al-Ṣaffār al-Andalusī

al-Ṣaffār

Ibn Sahl: Abū Saʿd al-ʿAlāʾ ibn Sahl  
Sahl

Ibn al-Ṣalāḥ: Najm al-Dīn Abū al-Futūḥ Aḥmad ibn Muḥammad  
ibn al-Sarī Ibn al-Ṣalāḥ

al-Ṣalāḥ

Ibn al-Samḥ: Abū al-Qāsim Aṣbagh ibn Muḥammad ibn al-Samḥ  
al-Gharnāṭī

al-Samḥ

Ibn al-Shāṭir: ʿAlāʾ al-Dīn ʿAlī ibn Ibrāhīm

al-Shāṭir

Ibn Sid: Isaac ibn Sid  
Sid

Ibn Sinā: Abū ʿAlī al-Ḥusayn ibn ʿAbdallāh ibn Sinā  
Avicenna

Sinā

Ibn Ṭufayl: Abū Bakr Muḥammad ibn ʿAbd al-Malik ibn  
Muḥammad ibn Muḥammad ibn Ṭufayl al-Qaysī

Abubacer

Ṭufayl

Ibn Yūnus: Abū al-Ḥasan ʿAlī ibn ʿAbd al-Raḥmān ibn Aḥmad ibn  
Yūnus al-Ṣadafi

Yūnus

Ibrāhīm ibn Sinān ibn Thābit ibn Qurra

Ihle, Abraham

Ingalls, Albert Graham

Innes, Robert Thorburn Ayton

Ino, Tadataka

Irwin, John Henry Barrows

Isfizārī: Abū Ḥātim al-Muẓaffar ibn Ismāʿīl al-Isfizārī

Ishāq Ibn Ḥunayn: Abū Yaʿqūb Ishāq ibn Ḥunayn ibn Ishāq  
al-ʿIbādī

Isidore of Seville

Isidorus Hispalensis

Jābir ibn Aflaḥ: Abū Muḥammad Jābir ibn Aflaḥ

Jacchia, Luigi Giuseppe

Jackson, John

Jacob ben Makhir ibn Tibbon

Don Profeit Tibbon

Profatius

Jagannātha Samrāt

Jaghminī: Sharaf al-Dīn Maḥmūd ibn Muḥammad ibn ʿUmar  
al-Jaghminī al-Khwārizmī

Jai Singh II

Jansky, Karl Guthe

Janssen, Pierre Jules César

Jarry-Desloges, René

Javelle, Stéphane

Jawhari: al-ʿAbbās ibn Saʿīd al-Jawhari

Jeans, James Hopwood

Jeaurat, Edme-Sébastien

Jeffreys, Harold

Jenkins, Louise Freeland

Jia Kui

John of Gmunden

Krafft, Johann

John of Holywood

Johannes de Sacrobosco

Sacrobosco

John of Lignères

Johannes de Lineriis

John of [Juan de] Messina

John of Muris [Murs]

Jean de Meurs

Jehan de Murs

Johannes de Muris

John [Danko] of Saxony

John of Toledo

Johnson, Manuel John

Jonckheere, Robert

Jordan, Ernst Pascual

Joy, Alfred Harrison

Jurjānī: ʿAlī ibn Muḥammad ibn ʿAlī al-Ḥusaynī al-Jurjānī  
(al-Sayyid al-Sharīf)

Jūzjānī: Abū ʿUbayd ʿAbd al-Wāḥid ibn Muḥammad  
al-Jūzjānī

Jyeṣṭhadeva

Kaiser, Frederik [Frederick, Friedrich]

Kaluza, Theodor Franz Eduard

Kamāl al-Dīn al-Turkmānī: Kamāl al-Dīn Muḥammad ibn Aḥmad  
ibn ʿUthmān ibn Ibrāhīm ibn Muṣṭafā  
al-Māridīnī al-Turkmānī al-Ḥanaḥī

Kamalākara

Kanka

Kant, Immanuel

Kapteyn, Jacobus Cornelius

Kāshī: Ghiyāth (al-Milla wa-) al-Dīn Jamshīd ibn Masʿūd ibn  
Maḥmūd al-Kāshī [al-Kāshānī]

Kauffman, Nicolaus

Mercator, Nicolaus

Keckermann, Bartholomew

Keeler, James Edward

Keenan, Philip Childs

Keill, John

Kempf, Paul Friedrich Ferdinand

Kepler, Johannes

- Kerr, Frank John  
 Keśava  
 Keyser, Pieter [Petrus] (Theodori) Dirckszoon  
 Khafri: Shams al-Dīn Muḥammad ibn Aḥmad al-Khafri  
     al-Kāshī  
 Khaikin, Semyon Emmanuilovich  
 Khalifazāde Ismāʿīl: Khalifazāde Çınarī Ismāʿīl Efendi ibn Muṣṭafā  
 Khalili: Shams al-Dīn Abū ʿAbdallāh Muḥammad ibn Muḥammad  
     al-Khalili  
 Kharaqī: Shams al-Dīn Abū Bakr Muḥammad ibn Aḥmad  
     al-Kharaqī [al-Khiraqī]  
 Khayyām: Ghiyāth al-Dīn Abū al-Faṭḥ ʿUmar ibn Ibrāhīm  
     al-Khayyāmī al-Nishāpūrī  
     Omar Khayyām  
 Khāzin: Abū Jaʿfar Muḥammad ibn al-Ḥusayn al-Khāzin  
     al-Khurāsānī  
 Khāzini: Abū al-Faṭḥ ʿAbd al-Raḥmān al-Khāzini (Abū Manṣūr  
     ʿAbd al-Raḥmān, Abd al-Raḥmān Manṣūr)  
 Khujandī: Abū Maḥmūd Ḥāmid ibn al-Khiḍr al-Khujandī  
 Khwārizmī: Muḥammad ibn Mūsā al-Khwārizmī  
 Kidinnu [Kidin, Kidenas]  
 Kienle, Hans Georg  
 Kiepenheuer, Karl-Otto  
 Kiess, Carl Clarence  
 Kimura, Hisashi  
 Kindī: Abū Yūsuf Yaʿqūb ibn Ishāq al-Kindī  
 King, William Frederick  
 Kirch, Christfried  
 Kirch, Christine  
 Kirch, Gottfried  
 Kirch, Maria Margaretha Winkelman  
 Kircher, Athanasius  
 Kirchhoff, Gustav Robert  
 Kirkwood, Daniel  
 Klein, Hermann Joseph  
 Klein, Oskar Benjamin  
 Klinkerfues, Ernst Friedrich Wilhelm  
 Klotz, Otto Julius  
 Klumpke Roberts, Dorothea  
 Kneller, Andreas  
     Cellarius  
 Knobel, Edward Ball  
 Knorre, Viktor Carl  
 Kobold, Hermann Albert  
 Köhler, Johann Gottfried  
 Kohlschütter, Arnold  
 Kolhörster, Werner Heinrich Julius Gustav  
 Kolmogorov, Andrei Nikolaevich  
 Konkoly Thege, Miklós [Nikolaus]  
 Kopal, Zdeněk  
 Kopff, August  
 Kordylewski, Kazimierz  
 Korff, Serge Alexander  
 Kovalsky, Marian Albertovich  
     Voytekovich, Marian Albertovich  
 Kozyrev, Nikolai Alexandrovich  
 Krebs, Nicholas  
     Nicholas Cusanus  
     Nikolaus von Cusa  
     Nicholas of Cusa  
 Kremer, Gerhard  
     Gerardus Mercator  
 Kreutz, Heinrich Carl Friedrich  
 Krieger, Johann Nepomuk  
 Kron, Gerald Edward  
 Krüger, Karl Nicolaus Adalbert  
 Kūhī: Abū Sahl Wījan ibn Rustam [Wustam] al-Kūhī  
     [al-Qūhī]  
 Kuiper, Gerard Peter  
 Kulik, Leonid Alexyevich  
 Küstner, Karl Friedrich  
  
 La Caille [Lacaille], Nicolas-Louis de  
 Lacchini, Giovanni Battista  
 Lacroute, Pierre  
 Lagrange, Joseph Louis  
     Lagrangia, Giuseppe Lodovico  
 Lalande, Joseph-Jérôme  
     de la Lande, Joseph-Jérôme  
     Lefrançois de la Lande, Joseph-Jérôme  
 Lalla  
 Lallemand, André  
 Lambert, Johann Heinrich [Jean Henry]  
 Lamont, John [Johann von]  
 Lampland, Carl Otto  
 Lanczos, Cornelius  
     Löwy, Kornel  
 Lane, Jonathan Homer  
 Langley, Samuel Pierpont  
 Langren, Michael Florent van  
     Langrenus  
 Lansbergen, Jacob  
 Lansbergen, Philip  
 Laplace, Pierre-Simon de  
 Lārī: Muṣṭaliḥ al-Dīn Muḥammad ibn Ṣalāḥ ibn Jalāl al-Sādī  
     al-ʿIbādī al-Anṣārī al-Lārī  
 Larmor, Joseph  
 Lassell, William  
 Lau, Hans Emil  
 Leadbetter, Charles  
 Leavitt, Henrietta Swan  
 Lebedev, Petr Nikolaevich  
 Leclerc, Georges-Louis  
     Comte de Buffon  
 Ledoux, Paul  
 Le Doulcet, Philippe Gustave  
     Comte de Pontécoulant  
 Lefrançois, Michel  
     Lefrançois de Lalande, Michel  
 Legendre, Adrien-Marie  
 Leibniz, Gottfried Wilhelm  
 Lemaitre, Georges Henri-Joseph-Edouard  
 Leovitius, Cyprianus  
 Lepaute, Nicole-Reine  
     Étable de la Brière, Nicole-Reine  
 Lescarbault, Edmond Modeste  
 Leucippus of Miletus  
 Leuschner, Armin Otto

Le Verrier, Urbain-Jean-Joseph  
 Lexell, Anders Johan  
 Li Chunfeng  
 Liais, Emmanuel-Benjamin  
 Liddel, Duncan  
 Lin, Chia Chiao  
 Lindblad, Bertil  
 Lindemann, Adolf Friedrich  
 Lindsay, Eric Mervyn  
 Lipsky, Yuri Naumovich  
 Littrow [Littroff], Johann Joseph (Edler) von  
 Littrow, Karl Ludwig von  
 Liu Zhuo [Chò]  
 Lobachevsky, Nikolai Ivanovich  
 Locke, John  
 Lockyer, Joseph Norman  
 Lodge, Oliver Joseph  
 Lohrmann, Wilhelm Gotthelf  
 Lohse, Wilhelm Oswald

Lomonosov, Mikhail Vasilievich  
 Loomis, Elias  
 Lorentz, Hendrik Antoon  
 Lorenzoni, Giuseppe  
 Lovell, Alfred Charles Bernard  
 Lowell, Percival  
 Lower, William  
 Löwy, Maurice  
     Löwey, Moritz  
 Loys de Chéseaux, Jean-Philippe  
 Lubieniecki Stanislaw  
     Lubienitzley Stanislas  
 Lucretius (Carus), Titus  
 Ludendorff, Friedrich Wilhelm Hans  
 Lundmark, Knut Emil  
 Luther, Karl Theodor Robert  
 Luyten, Willem Jacob  
 Lyot, Bernard  
 Lyttleton, Raymond Arthur

If a name within the text appears in **bold**, there exists an entry on that astronomer elsewhere in the encyclopedia.

# Table of Entries

Names preceded by an article or preposition are alphabetized by the next word in the name. There are two exceptions: One is the Dutch “Van,” “Van de,” “Van den,” and “Van der.” Another is “Warren De La Rue” (alphabetized under D). (Arabic names are alphabetized under the shortened version of the name.)

Maclaurin, Colin Cailean MacLabhrúinn	Maury, Antonia Caetana De Paiva Pereira
Maclear, Thomas	Maury, Matthew Fontaine
Macrobius, Ambrosius (Theodosius)	Maxwell, James Clerk
Mädler, Johann Heinrich von	Mayall, Margaret Walton
Magini, Giovanni Antonio	Mayall, Nicholas Ulrich
Mahendra Sāri	Mayer, Christian
Maimonides: Abā ʿImrīn Māsī [Moses] ibn ʿUbayd Allih [Maymān] al-Qurʾabū	Mayer, Johann Tobias
Mairan, Jean-Jacques Dortous de Mairan, Jean-Jacques	Mayer, Julius Robert
Majrūʾ: Abā al-Qīsim Maslama ibn A ʾī mad al-ḥ isib al-Fara Ḥī al-Majrūʾ	Mayr, Simon Marius
Makaranda	McClellan, Frank
Makemson, Maud Worcester	McCrea, William Hunter
Maksutov, Dmitry Dmitrievich	McIntosh, Ronald Alexander
Malapert, Charles	McKellar, Andrew
Malebranche, Nicholas	McLaughlin, Dean Benjamin
Malmquist, Karl Gunnar	McMath, Robert Reynolds
Maʾmān: Abā al- ʿAbbās ʿAbdallih ibn Hīrān al-Rashūd	McVittie, George Cunliffe
Manfredi, Eustachio	Méchain, Pierre-François-André
Manilius [Manlius], Marcus Mallius, Marcus	Mee, Arthur Butler Phillips
Maraldi, Giacomo Filippo Maraldi I	Megenberg, Konrad [Conrad] von Chunradus de Monte Puellarum
Maraldi, Giovanni Domenico [Jean-Dominique] Maraldi II	Mellish, John Edward
Markarian, Beniamin Egishevich	Melotte, Philibert Jacques
Markgraf, Georg	Menaechmus
Markov, Andrei Andreevich	Menelaus of Alexandria
Markowitz, William	Menzel, Donald Howard
Marrikushū: Sharaf al-Dūn Abā ʿAlū alḥ asan ibn ʿAlū ibn ʿUmar al-Marrikushū	Merrill, Paul Willard
Marwarrādhū: Khilid ibn ʿAbd al-Malik al-Marwarrādhū	Mersenne, Marin
Mishʿallih ibn Atharū (Sīriya) Messahala	Messier, Charles
Maskelyne, Nevil	Metcalf, Joel Hastings
Mason, Charles	Metochites [Metoxites], Theodore [Theodoros, Theoleptos]
Mästlin [Möstlin], Michael Moestlinus	Meton
Möschlin, Michael	Metrodorus of Chios
Mathurinītha ʿArman	Michell, John
Maudith, John	Michelson, Albert Abraham
Maunder, Annie Scott Dill Russell	Middlehurst, Barbara Mary
Maunder, Edward Walter	Mikhailov, Aleksandr Aleksandrovich
Maupertuis, Pierre-Louis Moreau de	Milankovitch [MilankoviĀ], Milutin
Maurolico, Francesco	Miller, John Anthony
	Millikan, Robert Andrews
	Millman, Peter Mackenzie
	Milne, Edward Arthur
	Milton, John
	Mineur, Henri Paul
	Minkowski, Hermann
	Minkowski, Rudolph Leo Bernhard
	Minnaert, Marcel Gilles Jozef

Mūram ōelebūMaī māḍ ibn Quāb al-Dūn Mū ammad ibn  
Muī ammad ibn Māsī Qī Ḥizide

Mitchel, Ormsby MacKnight

Mitchell, Maria

Mizzū:Zayn al-Dūn [Shams al-Dūn] AbāAbd Allih Muī ammad  
ibn Aī māḍ ibn ʿAbd al-Raī ūm al-Mizzū aḥ anafū

Mohler, Orren Cuthbert

Molesworth, Percy Braybrooke

Moll, Gerard

Mollweide, Karl Brandan

Molyneux, Samuel

Molyneux, William

Monck, William Henry Stanley

Monnier, Pierre-Charles le

Lemonnier, Pierre-Charles

Monnig, Oscar Edward

Montanari, Geminiano

Moore, Joseph Haines

Moore-Sitterly, Charlotte Emma

Morgan, Augustus de

Morgan, Herbert Rollo

Morgan, William Wilson

Morin, Jean-Baptiste

Morley, Edward Williams

Morrison, Philip

Mouchez, Ernest Amédée Barthélémy

Moulton, Forest Ray

Mouton, Gabriel

Mrkos, Antonín

Mukai, Gensho

Muler, Nicolaus

Mulerius

Müller, Edith Alice

Müller, Johann

Regiomontanus

Müller, Karl

Müller, Karl Hermann Gustav

Muñjila

Mañjula

Muñoz, Jerónimo

Naburianu [Naburianus, Nabû-ri-man-nu]

Najm al-Dūn al-Miṣrū:Najm al-Dūn AbāʿAbd Allih Muī ammad  
ibn Muī ammad ibn Ibrihūm al-Miṣrū

Napier, John

Nasawū: Abā al-ḥ asan ʿAlū ibn Aī māḍ al-Nasawū

Nasmyth, James Hall

Nasāālus: Muī ammad ibn ʿAbd Allih

Basāālus

Nayrūzū: Abā al-Abbīs al-Fa Ḥ ibn ḥ itim al-Nayrūzū

Nernst, Walther Hermann

Neugebauer, Otto E.

Neumann, Carl Gottfried

Nevill [Neville], Edmund Neison

**Neison, Edmund**

Newcomb, Simon

Newton, Hubert Anson

Newton, Isaac

Nicholas of Lynn [Lynne]

Nicholson, Seth Barnes

Nielsen, Jean Louis Nicholas

Nietzsche, Friedrich Wilhelm

Nightingale, Peter

Petrus (Philomena) de Dacia

Petrus Dacus [Danus]

Nūlakalāha Somayji

Nininger, Harvey Harlow

Nūsibārū:al-ḥ asan ibn Muī ammad ibn al-ḥ usayn

NiṢim al-Dūn al-Aʿraj al-Nūsibārū

Nishikawa, Joken

Tadahide

Nordmann, Charles

Norton, William Augustus

Norwood, Richard

Novara, Domenico Maria da

Ploti Ferrariensis

Numerov [Noumeroff], Boris Vasil'evich

Nunes, Pedro

Nušl, František

O'Connell, Daniel Joseph Kelly

Odierna [Hodierna], Giovanbatista [Giovann Battista, Giovanni  
Battista]

Oenopides of Chios

Offusius, Jofrancus

Öhman, K. Yngve

Olbers, Heinrich Wilhelm Matthias

Olcott, William Tyler

Olivier, Charles Pollard

Olmsted, Denison

Olympiodorus the Younger [the Platonist, the Neo-Platonist,  
the Great]

Oort, Jan Hendrik

Öpik, Ernst Julius

Oppenheimer, J. Robert

Oppolzer, Egon Ritter von

Oppolzer, Theodor Ritter von

Oresme, Nicole

Oriani, Barnaba

Osiander, Andreas

Outhier, Réginald [Réginaud]

Ovid

Ovidius Naso, Publius

Page, Thornton L.

Palisa, Johann

Palitzsch, Johann

Palmer, Margaretta

Pannekoek, Antonie

Papadopoulos, Christos

Pappus of Alexandria

Paramečvara of Viācčeri [Paramečvara I]

Parenago, Pavel Petrovich

Parkhurst, Henry M.

Parmenides of Elea

- Parsons, Laurence  
Fourth Earl of Rosse
- Parsons, William  
Third Earl of Rosse
- Pawsey, Joseph Lade
- Payne-Gaposhkin [Payne], Cecilia Helena  
Gaposhkin, Cecilia Helena
- Payne, William Wallace
- Pearce, Joseph Algernon
- Pearson, William
- Peary, Robert Edwin
- Pease, Francis Gladhelm
- Peek, Bertrand Meigh
- Peirce, Benjamin
- Peiresc, Nicolas-Claude Fabri de
- Pèlerin de Prusse  
Preussen, Pilgrim Zeleschicz von  
Peregrinus de Prussia
- Peltier, Leslie Copus
- Peregrinus de Maricourt, Petrus
- Perepelkin, Yevgenij Yakovlevich
- Péridier, Julien Marie
- Perrin, Jean-Baptiste
- Perrine, Charles Dillon
- Perrotin, Henri-Joseph-Anastase
- Peters, Christian August Friedrich
- Peters, Christian Heinrich Friedrich
- Petit, Pierre
- Pettit, Edison
- Peucer, Caspar
- Peurbach [Peuerbach, Purbach], Georg von
- Pfund, August Hermann
- Phillip of Opus
- Phillips, Theodore Evelyn Reece
- Philolaus of Croton
- Philoponus, John  
John the Grammarian  
John of Alexandria
- Piazzzi, Giuseppe
- Picard, Jean
- Piccolomini, Alessandro
- Pickering, Edward Charles
- Pickering, William Henry
- Pigott, Edward
- Pingré, Alexandre-Guy
- Pićmić, Paris Marie
- Plana, Giovanni Antonio Amedeo
- Plancius, Petrus  
Platevoet, Petrus
- Planman, Anders
- Plaskett, Harry Hemley
- Plaskett, John Stanley
- Plato
- Plaut, Lukas
- Pliny the Elder  
Plinius Secundus
- Plummer, Henry Crozier Keating
- Plutarch
- Poczobut Marcin [Martin Poczobutt]
- Poe, Edgar Allan
- Pogson, Norman Robert
- Poincaré, Jules-Henri
- Poisson, Siméon-Denis
- Pond, John
- Pons, Jean-Louis
- Popper, Daniel Magnes
- Poretsky, Platon Sergeevich
- Porter, John Guy
- Porter, Russell Williams
- Posidonius
- Pouillet, Claude-Servais-Mathias-Marie-Roland
- Pound, James
- Poynting, John Henry
- Prager, Richard
- Prentice, John Philip Manning
- Pritchard, Charles
- Pritchett, Carr Waller
- Proclus
- Proctor, Mary
- Proctor, Richard Anthony
- Prosperin, Erik
- Przybylski, Antoni
- Ptolemy  
Claudius Ptolemaius
- Puiseux, Pierre-Henri
- Purcell, Edward Mills
- Pythagoras
- Qabūṣū: Abā al-Ṭaqr ʿAbd al-ʿAzūz ibn ʿUthmān ibn ʿAlū al-Qabṣū  
Alcabitius
- Qī Ḥizīde al-Rāmū: Ṭalī ī al-Dūn Māsī ibn Muī ammad ibn  
Māī mād al-Rāmū
- Qīsim ibn Mu āarrif al-Qaān: Abā Muī ammad Qīsim ibn  
Muāarrif ibn ʿAbd al-Raī mīn  
al-Qaān al- ṭ ulayāulū al-Quṣubū  
al- Andalusū
- Qaān-i al-Marwazū: ʿAyn al-Zamīn Abā ʿAlūḥ asan ibn ʿAlū  
Qaān [Qa āān] al-Marwazū
- Qian Lezhi
- Qusāi ibn Lāqī al-Ba ʿlabakkū  
Costa ben Luca
- Quetelet, Lambert Adolphe Jacques
- Qunawū: Mū ammad ibn al-Kītib Sūnīn al-Qunawū
- Qāshjū: Abā al-Qīsim ʿAlī al-Dūn ʿAlū ibn Mū ammad QushĀi-zīde
- Rīghavīnanda Āarman
- Ramus, Peter [Petrus]  
Ramée, Pierre de la
- Raṅganītha I
- Raṅganītha II
- Rankine, William John Macquorn
- Ranyard, Arthur Cowper
- Rauchfuss, Konrad  
Cunradus Dasypodius
- Rayet, Georges-Antoine-Pons
- Raymond of Marseilles

- Reber, Grote  
 Recorde, Robert  
 Rede, William  
 Redman, Roderick Oliver  
 Regener, Erich Rudolph Alexander  
 Régis, Pierre-Sylvain  
 Regius, Hendrick  
     Henricus Regius  
     Roy, Hendrick de  
 Reinhold, Erasmus  
 Reinmuth, Karl Wilhelm  
 Renieri, Vincenzo  
 Respighi, Lorenzo  
 Rheita, Antonius Maria Schyrleus de Schyrle [Schierl, Schürle]  
     Johann Burchard  
 Rheticus  
     Lauchen, Georg Joachim von  
 Rho, Giacomo  
 Ricci, Matteo  
 Riccioli, Giovanni Battista  
 Riccò, Annibale  
 Richard of Wallingford  
 Richaud, Jean  
 Richer, Jean  
 Riḥwīn al-Falakū: Rḥwīn Efendi ibn ʿAbdallih  
     al-Razzīz al-Falakū  
 Ristenpart, Frederich Wilhelm  
 Ritchey, George Willis  
 Rittenhouse, David  
 Ritter, Georg August Dietrich  
 Ritter, Johann Wilhelm  
 Roach, Franklin Evans  
 Roberts, Alexander William  
 Roberts, Isaac  
 Robertson, Howard Percy  
 Robinson, Thomas Romney  
 Roche, Édouard Albert  
 Roeslin, Helisaeus  
 Roger of Hereford  
     Rogerus Infans  
     Rogerus Puer  
 Rohault, Jacques  
 Römer [Roemer], Ole [Olaus]  
 Rooke, Lawrence  
 Rosenberg, Hans  
 Rosenberger, Otto  
 Ross, Frank Elmore  
 Rossi, Bruno Benedetto  
 Rossiter, Richard Alfred  
 Rothmann, Christoph  
 Rowland, Henry Augustus  
 Rudīnū: Abā ʿAbdallih Muī ammad ibn Sulaymīn (Muī ammad)  
     al- Fisū ibn ṭ ihir al-Rudīnū al-Sāsū al-Milikū  
     [al- Maghribū]  
 Rümker, Christian Karl [Carl] Ludwig  
 Rumovsky, Stepan Yakovlevich  
 Runge, Carl [Carle] David Tolme  
 Russell, Henry Chamberlain  
 Russell, Henry Norris  
 Russell, John  
 Rutherford, Ernest  
 Rutherford, Lewis Morris  
 Rydberg, Johannes [Janeé] Robert  
 Sabine, Edward  
 Ṭadr al-Sharūa al-Thīnū: ʿUbaydallih ibn Mas ʿād al- Maī bābū  
     al-Bukhīrū al-ḥ anafū  
 Safford, Truman Henry  
 Safronov, Viktor Sergeevich  
 Ṭighīnū: Abā ḥ imid A ī mad ibn Muī ammad al-Ṭighīnū  
     [al-Ṭaghīnū] al-Aṣāurlībū  
 Saha, Meghnad N.  
 Ṭī ʿid al-Andalusū: Abā al-Qīsim Ṭī ʿid ibn abū al-Walūd Aamad  
     ibn ʿAbd al-Raī mīn ibn Muī ammad ibn Ṭī ʿid  
     al-Ṭaghlibū al-Quṭūbū  
 St. John, Charles Edward  
 Salih Zeki  
 Samarqandū: Shams al-Dūn Mū ammad ibn Ashraf al-ḥ usaynū  
     al-Samarqandū  
 Samaw'al: Abā Naṣr Samaw'al ibn Yaī yī ibn ʿAbbis al-Maghribū  
     al-Andalusū  
 Sampson, Ralph Allen  
 Sanad ibn ʿAlū: Abā al-ṭ ayyib Sanad ibn ʿAlū al-Yahādū  
 Sanford, Roscoe Frank  
 Santini, Giovanni-Sante-Gasparo  
 Äatinanda  
 Saunder, Samuel Arthur  
 Saunders, Frederick Albert  
 Savary, Felix  
 Savile, Henry  
 Sawyer Hogg, Helen Battles  
     Hogg, Helen Battles  
 Schaeberle [Schäberle] John [Johann] Martin  
 Schalén, Carl Adam Wilhelm  
 Schall von Bell, Johann Adam  
     Tang-Jo-Wang  
 Scheiner, Christoph  
 Scheiner, Julius  
 Scheuchzer, Johann Jakob  
 Schiaparelli, Giovanni Virginio  
 Schickard, Wilhelm  
 Schiller, Julius  
 Schjellerup, Hans Karl Frederik Christian  
 Schlesinger, Frank  
 Schmidt, Bernhard Voldemar  
 Schmidt, Johann Friedrich Julius  
 Schmidt, Otto Iulevich  
 Schöner, Johannes  
 Schönfeld, Eduard  
 Schreck, Johann  
     Terrentius  
     Terrenz, Jean  
     Schrödinger, Erwin  
 Schröter, Johann Hieronymus  
 Schüler, Wolfgang  
 Schumacher, Heinrich Christian  
 Schuster, Arthur  
 Schwabe, Samuel Heinrich

- Schwarzschild, Karl  
 Schwarzschild, Martin  
 Schwassmann, Friedrich Karl Arnold  
 Scot, Michael  
 Scottus [Scotus] Eriugena, Johannes [John]  
 Seares, Frederick Hanley  
 Secchi, (Pietro) Angelo  
 See, Thomas Jefferson Jackson  
 Seeliger, Hugo von  
 Seleukus of Seleukeia  
 Seneca  
 Serviss, Garrett Putnam  
 Severin, Christian  
     Longomontanus  
 Severus Sebokht [Sebokht, Sebukht, Seboht]  
 Seyfert, Carl Keenan  
 Shain [Shayn, Shajn], Grigory Abramovich  
 Shakerley, Jeremy  
 Shams al-Dūn al-Bukhīrū  
 Shane, Charles Donald  
 Shapley, Harlow  
 Shapley, Martha  
     Betz, Martha  
 Sharaf al-Dūn al-ġ āsū  
 Sharonov, Vsevolod Vasilievich  
 Sharp, Abraham  
 Shi Shen  
 Shibukawa, Harumi  
 Shūrizū: Qāb al-Dūn Mā mād ibn Masʿād Muṣlī al-Shūrizū  
 Shirwīnū: Faṭī allih ibn Abā Yazūd ibn ʿAbd al-ʿAzūz ibn Ibrīhūm  
     al-Shībarīnū al-Shirwīnū al-Shamihū  
 Shizuki, Tadao  
 Shklovsky [Shklovskii, Shklovskij], Iosif Samuilovich  
 Sibā al-Mīridūnū: Muī ammad ibn Muī ammad ibn Aī mad Abā  
     ʿAbd Allih Badr [Shams] al-Dūn al-Miṣrū  
     al-Dimashqū  
 Siguenza y Góngora, Carlos (de)  
 Sijzū: Abā Saʿūd Ā mad ibn Muī ammad ibn ʿAbd al-Jalūl al-Sijzū  
 Silberstein, Ludwik  
 Silvester, Bernard  
     Bernardus Silvestris  
 Sima Qian  
     Ssu-Ma Ch'ien  
 Simplicius of Cilicia  
 Sitter, Willem de  
 Sizzi, Francesco  
 Skjellerup, John Francis  
 Slipher, Earl Carl  
 Slipher, Vesto Melvin  
 Slocum, Frederick  
 Smart, William Marshall  
 Smiley, Charles Hugh  
 Smith, Sinclair  
 Smyth, Charles Piazzi  
 Smyth, William Henry  
 Snel [Snell], Willebrord  
     Snellius  
 Snyder, Hartland  
 Soldner, Johann Georg  
 Somerville, Mary Fairfax Grieg  
 Sorby, Henry Clifton  
 Sosigenes of Alexandria  
 South, James  
 Spencer Jones, Harold  
 Sphujidhvaja  
 Spitz, Armand Neustadter  
 Spitzer, Lyman, Jr.  
 Spörer, Friedrich Wilhelm Gustav  
 Ārūpati  
 Stabius, Johann  
 Stark, Johannes  
 Steavenson, William Herbert  
 Stebbins, Joel  
 Stephan, Jean-Marie-Édouard  
 Stern, Otto  
 Sternberg [Shternberg], Pavel Karlovich  
 Stetson, Harlan True  
 Stevin, Simon  
 Stewart, Balfour  
 Stewart, John Quincy  
 Stewart, Matthew  
 Stöffler, Johannes  
     Stoefflerus  
 Stokes, George Gabriel  
 Stokley, James  
 Stone, Edward James  
 Stone, Ormond  
 Stoney, George Johnstone  
 Storer, Arthur  
 Störmer, Fredrik Carl Mülertz  
 Stoyko, Nicolas  
     Stoiko-Radilenko, Nicolas  
 Strand, Kaj Aage Gunnar  
 Stratton, Frederick John Marrian  
 Streete, Thomas  
 Strömberg, Gustav  
 Stromgren, Bengt Georg Daniel  
 Strömberg, Svante Elis  
 Stroobant, Paul-Henri  
 Struve, Friedrich Georg Wilhelm  
     Struve, Vasily Yakovlevich  
 Struve, Georg Otto Hermann  
 Struve, Gustav Wilhelm Ludwig  
     Struve, Ludwig Ottovich  
 Struve, Karl Hermann  
     Struve, Hermann Ottovich  
 Struve, Otto  
 Struve, Otto Wilhelm  
     Struve, Otton Vasilievich  
 Stukeley, William  
 Su Song  
     Su Sung  
 Suárez, Buenaventura  
 Suess, Hans Eduard  
 Ṭāfū: Abā al-ḥ usayn ʿAbd al-Raī mīn ibn ʿUmar al-Ṭāfū  
 Sulaymīn ibn ʿIṣma: Abā Dīwād Sulaymīn ibn ʿIṣma  
     al-Samarqandū  
 Sundman, Karl Frithiof



Suyā āu: Abā al-Faḥ Abd al-Raī mīn Jalīl al-Dūn al-Suyā āu

Swan, William

Swedenborg, Emanuel

Swift, Lewis

Swings, Polydore [Pol] Ferdinand Felix

Swope, Henrietta Hill

Synesius of Cyrene

ṭ abarū: Abā Jāfar Muī ammad ibn Ayyāb

al-ḥ isib al- ṭ abarū

Tacchini, Pietro

Takahashi, Yoshitoki

Taqūal-Dūn Abā Bakr Muī ammad ibn Zayn al-Dūn Mārāf

al-Dimashqū alḥ anafū

Tarde, Jean

Tardeus

Taylor, Geoffrey Ingram

Tebbutt, John

Teller, Edward [Ede]

Tempel, Ernst Wilhelm Leberecht

Tennant, James Francis

Terby, François Joseph Charles

Tezkireci Kōse Ibrihūm

Thibit ibn Qurra

Thackeray, Andrew David

Thales of Miletus

Theodosius of Bithynia

Theon of Alexandria

Theon of Smyrna

Theophrastus

Tyrtamus

Thiele, Thorvald Nicolai

Thollon, Louis

Thom, Alexander

Thome, John [Juan] Macon

Thomson, George Paget

Thomson, William

Baron Kelvin of Largs

Lord Kelvin

Tikhov, Gavril Adrianovich

Timocharis

Tisserand, François-Félix

Titius [Tietz], Johann Daniel

Todd, Charles

Todd, David Peck

Tolman, Richard Chace

Tombaugh, Clyde William

Torricelli, Evangelista

Toscanelli dal Pozzo, Paolo

Tousey, Richard

Triesnecker, Franz [Francis] de Paula von

Trouvelot, Étienne-Léopold

Trumpler, Robert Julius

Tserasky [Tzeraskii], Vitol'd [Witold] Karlovich

Ceraski, Vitol'd [Witold] Karlovich

Turner, Herbert Hall

ṭ āsū: Abā Ja 'far Muī ammad ibn Muī ammad ibn al-ḥ asan Naṣūr

al-Dūn alṭ āsū

Tuttle, Horace Parnell

ʿUbaydū: Jalīl al-Dūn Faḥ Allih al- ʿUbaydū

Ulugh Beg: Muī ammad ṭ araghīy ibn Shihrukh ibn Tūmār

Gārgīn

Umawū: Abā ʿAlū alḥ asan ibn ʿAlū ibn Khalaf al-Umawū

al-Khatūb al-Umawū al-Qūūbū

Unsöld, Albrecht

ʿUrḤī: Mu'ayyad (al-Milla wa-) al-Dūn (Mu'ayyad ibn Barūk

[Burayk]) al-'UrḤī (al-'śmirū al-Dimashqū)

Urey, Harold Clayton

ʿUārid: ʿUārid ibn Mu ī ammad al-ḥ isib

Väisälä, Yrjö

Van Albada, Gale Bruno

Van Allen, James Alfred

Van Biesbroeck, Georges-Achille

Van de Kamp, Peter [Piet]

Van de Sande Bakhuyzen [Bakhuysen], Hendrik Gerard

[Hendricus Gerardus]

Van den Bos, Willem Hendrik

Van den Hove, Maarten

Martinus Hortensius [Ortensius]

Van Maanen, Adriaan

Van Rhijn, Pieter Johannes

Varīhamihira

Vaucouleurs, Gérard Henri de

Verbiest, Ferdinand

Very, Frank Washington

Vespucci, Amerigo

Vico, Francesco de

Vinci, Leonardo da

Virdung, Johann

Virgil [Vergil]

Vergilius Maro, Publius

Vitruvius, Marcus

Pollio, Marcus

Vogel, Hermann Carl

Vögelin, Johannes

Vogelinus

Vogt, Heinrich

Volkoff, George Michael

Vorontsov-Veliaminov [-Velyaminov], Boris Aleksandrovich

Wibkanawū: Shams al-Munajjim [Shams al-Dūn] Mū ammad ibn

ʿAlū Khwija al-Wibkanawū [Wibaknawū]

Wachmann, Arno Arthur

Walcher of Malvern

Waldmeier, Max

Wales, William

Walker, Arthur Geoffrey

Walker, Sears Cook

Wallace, Alfred Russel

- Wallis, John  
 Walther, Bernard [Bernhard]  
 Wang Xun  
 Ward, Isaac W.  
 Ward, Seth  
 Wargentin, Pehr Wilhelm  
 Wassenius [Vassenius], Birger  
 Waterston, John James  
 Watson, James Craig  
 Watts, Chester Burleigh  
 Webb, Thomas William  
 Weigel, Erhard  
 Weinek, László [Ladislaus]  
 Weiss, Edmund  
 Weizsäcker, Carl Friedrich von  
 Wendelen, Govaart [Gottfried, Godefried]  
     Godefridus Wendelinus  
 Werner, Johannes  
 Wesselink, Adriaan Jan  
 Weyl, (Claus Hugo) Hermann  
 Wharten, George  
 Wheeler, John Archibald  
 Whewell, William  
 Whipple, Fred Lawrence  
 Whiston, William  
 Whitehead, Alfred North  
 Whitford, Albert Edward  
 Whiting, Sarah Frances  
 Whitrow, Gerald James  
 Widmanstätten, Aloys [Alois]  
     Joseph Franz Xaver von  
 Wildt, Rupert  
 Wilhelm IV  
     Landgrave of Hessen-Kassel  
 Wilkins, Hugh Percival  
 Wilkins, John  
 William of [Guillaume de] Conches  
     Guilelmus de Conchis  
 William of Moerbeke  
 William of [Guillaume de] Saint-Cloud  
 Williams, Arthur Stanley  
 Williams, Evan Gwyn  
 Wilsing, Johannes Moritz Daniel  
 Wilson, Albert George  
 Wilson, Alexander  
 Wilson, Herbert Couper  
 Wilson, Latimer James  
 Wilson, Olin Chaddock, Jr.  
 Wilson, Ralph Elmer  
 Wing, Vincent  
 Winlock, Joseph  
 Winnecke, Friedrich August Theodor  
 Winthrop, John  
 Wirtanen, Carl Alvar  
 Wirtz, Carl Wilhelm  
 Witt, Carl Gustav  
 Wittich, Paul  
 Wolf, Charles-Joseph-Étienne  
 Wolf, Johann Rudolf  
 Wolf, Maximilian Franz Joseph Cornelius  
 Wollaston, William Hyde  
 Woltjer, Jan, Jr.  
 Wood, Frank Bradshaw  
 Wood, Robert Williams  
 Woolley, Richard Van der Riet  
 Wren, Christopher  
 Wright, Chauncey  
 Wright, Thomas  
 Wright, William Hammond  
 Wrottesley, John  
 Wurm, Karl  
 Wyse, Arthur Bambridge  
 Xenophanes of Colophon  
 Ximenes, Leonardo  
 Yaī yī ib n Abū Maṣṣār: Abā ʿAlū Yā yī ibn Abū Maṣṣār  
     al- Munajjim  
 Yaʿqāb ibn ṭ iriq  
 Yativgʿabha  
 Yavanečvara  
 Yixing  
     I-Hsing  
     Seng Yixing  
     Yixing Chanshi  
 Young, Anne Sewell  
 Young, Charles Augustus  
 Zach, János Ferenc [Franz Xaver] von  
 Zacut: Abraham ben Samuel Zacut  
 Zanotti, Eustachio  
 Zanstra, Herman  
 Zarqilū: Abā Isī iq Ibrihūm ibn Yaī yā al-Naqqīsh al-Tujūbū  
     al-Zarqilū  
     Azarquiel  
 Zeeman, Pieter  
 Zeipel, Edvard Hugo von  
 Zel'dovich, Yakov Borisovich  
 Zhamaluding: Jamil al-Dūn Muī ammad ibn ṭ ihir ibn  
     Muī ammad al-Zaydū al-Bukhīrū  
     Jamil al-Dūn  
 Zhang Heng  
     Chang Heng  
 Zhang Sixun  
 Zinner, Ernst  
 Zöllner, Johann Karl Friedrich  
 Zu Chongzhi  
     Tsu Ch'ung-chih  
 Zucchi, Nicollo  
 Zupi, Giovan Battista  
 Zwicky, Fritz

If a name within the text appears in **bold**, there exists an entry on that astronomer elsewhere in the encyclopedia.

# Introduction

*History is the essence of innumerable biographies.*

Thomas Carlyle, *Essays*, "On History"

Astronomy has a long and rich tradition, and as the record shows, the history of that tradition is tied closely to collective biography.<sup>1</sup> The present volumes represent a modern attempt to provide a comprehensive biographical encyclopedia of astronomers. The purpose of these volumes is twofold. First, as ready reference, they are designed to provide easy access to biographical information in the history of astronomy. Cutting across space and time, biographical entries are international in scope and cover the period from classical Antiquity to the late 20th century. Second, drawing on a variety of specialized scholars, these volumes aim to serve as an "access point" for continuing research. While individual entries "stand alone" as ready reference, taken collectively, they offer a map of the complex communities that gave science shape.<sup>2</sup> The following introduction has two purposes: first, to sketch the origins of collective biography and its place in the history of astronomy; second, to illustrate the design and use of collective biographies as reference and research tools.

## Biography And History

*There is properly no history, only biography.*

Ralph Waldo Emerson, *Essays*, "History"

History—here I mean historical writing—traces its origins to classical Antiquity, to the celebration of heroes and the lives of great men. Although *lives* were written before Plutarch's aptly titled classic, the modern sense of biography—a fair-minded history of a particular life—took mature form only in the 19th century.<sup>3</sup> The history of writing lives challenges the boundaries that currently separate history, biography, literature, rhetoric, and political commentary. While the roots of modern biography can be traced to the Renaissance (including early examples of science biography), sharp distinctions between "history and biography" are difficult to sustain, not only because the categories continue to overlap but because both share a common ancestor—what we now call collective biography.<sup>4</sup> As background to the present volumes, the following historiographic essay sketches these changing relations.<sup>5</sup>

The origins of *biography* (literally, *life writing*) are found in classical Antiquity as part of a long tradition dedicated to the celebration of heroes.<sup>6</sup> For two millennia, what we now know as *history* was often viewed as philosophy teaching by example. A brief glance at early writers suggests that biography and collective biography share a complex evolution. While Damascius (sixth century) was the first writer to use the Latin term *biographia*, John Dryden was the first to use *biography* in print (1683), this in reference to Plutarch's *Lives*. Words are important but much more was at work. Viewed over time, historical writing included what is now known as history, biography, and collective biography, as well as elements from other branches of the humanities and social sciences.

Biography has served many masters. Between Antiquity and the Renaissance, its main role was to tell the lives of statesmen, philosophers, and saints. As a display of literary and rhetorical skill, its principal aim was to instruct and inspire. Among ancient Greek and Latin authors, the biographical art is evident in the *Lives* of Critias, the *Memorabilia* of Xenophon, the *Lives of the Philosophers* by Diogenes

<sup>1</sup> I wish to thank the BEA Editorial Board for the invitation to write the Introduction. While I have contributed several articles in these volumes, I have had no role in designing or editing the present work.

<sup>2</sup> Collective biography invites the reader to explore the interplay of individuals, ideas, and groups. One scholar went further: "In group biography, one becomes defined by the many. The group biography in fact becomes a protest against the erosion of a viable communal life and marks the socialization of biography as it incorporates several lives, not a single life." Nadel, Ira Bruce (1984) *Biography: Fiction, Fact & Form*, New York, p. 192.

<sup>3</sup> See *Telling Lives: The Biographer's Art*, Marc Pachter, ed., Philadelphia, 1979; *Telling Lives in Science: Essays on Scientific Biography*, Eds. M. Shortland and M. Yeo, Cambridge, 1996; Edmund Gosse, "Biography," in *Encyclopaedia Britannica*, 11th Edition (New York, 1910) Vol. 3: 952–954; Virginia Woolf, "The Art of Biography," *The Atlantic Monthly* 163 (1939): 506–510; and Sidney Lee, "Principles of Biography," *Elizabethan and Other Essays*. Oxford, 1927: 31–57.

<sup>4</sup> Collective biography—short sketches of individual lives representing a group—is a recent term that might be applied to earlier traditions. Collective biography is sometimes associated with prosopography, a method used by social scientists and social historians based on data from collective biography. For an overview, see Helge Kragh, "Prosopography," *An Introduction to the Historiography of Science*, Cambridge, 1987, pp. 174–181. As an example of trends in a specific historical field, see *Fifty Years of Prosopography: The Later Roman Empire, Byzantium and Beyond*, Ed. Averil Cameron, Oxford, 2003.

<sup>5</sup> Historiography—the history of historical writing—suggests that history, biography, and collective biography share common roots. For background, see Herbert Butterfield, "Historiography," *Dictionary of the History of Ideas*, Vols. 2, (New York, 1973): 464–498; for history of science, see John R. R. Christie, "The Development of the Historiography of Science," *Companion to the History of Modern Science*, London and New York, 1990, pp. 5–22, and Helge Kragh, *An Introduction to the Historiography of Science*, Cambridge, 1987.

<sup>6</sup> Over time, biography seized on the individual character of virtue and vice; collective biography celebrated group achievement by virtue of vocation. A counter example is *Catalogus Hereticorum* (1522?) by Bernardus de Luttenburg, which devotes two chapters to heretics and their errors.

Laertius, Plutarch's *Parallel Lives*, and Suetonius's *Lives of the Twelve Caesars*.<sup>7</sup> It should be noted that these authors are often not identified as historians, but as scholars, poets, or letter writers. When we consider the best-known early historians—from Herodotus (*circa* 480–*circa* 430 BCE) and Thucydides (*circa* 460–400 BCE) to noted writers such as Pliny (23–79), Livy (59 BCE–17), and Vespasiano (1421–1498)—short biography was an essential element in their annals and accounts.<sup>8</sup>

## Origins of Modern Biography

The origins of modern biography—the first sustained attempts to write the life of a single individual—can be traced to the Renaissance. The earliest examples were literary. William Roper (1496–1578) wrote the life of Sir Thomas More, George Cavendish (1500–1561?), the life of Cardinal Wolsey; later, Izaak Walton published a series of biographies, including the life of John Donne (1640).<sup>9</sup> Collective biography also found favor as poets, artists, and scholars joined ranks with statesmen, saints, and kings.<sup>10</sup> Thomas Fuller's *History of the Worthies of England* (1662) extended earlier traditions into more secular territory, while Aubrey's *Minutes of Lives* (its working title) is still widely read today. An early member of the Royal Society, John Aubrey (1626–1697) became interested in biography through his friend, Anthony à Wood (1632–1695), in researching the latter's *Athenae Oxonienses* (1691–1692), a “living and lasting history” of Oxford University based on group biography.<sup>11</sup> The more widely read work is now known as Aubrey's *Brief Lives*.<sup>12</sup> Although Wood judged him “credulous,” Aubrey wrote vivid and often intimate biographical sketches, including a number of figures from the New Science—Robert Boyle, René Descartes, Edmond Halley, Thomas Hobbes, Robert Hooke, Nicolas Mercator, and Christopher Wren. Aubrey interviewed many of his subjects. In retrospect, a key problem was the scarcity of personal diaries and journals, as the publication of memoirs and letters was not yet fashionable.<sup>13</sup> Aubrey's contemporary, Thomas Sprat (1635–1713), wrote the *Life of Cowley* (1668) and his better-known *History of the Royal Society* (1667).<sup>14</sup> Drawing on institutional registers and journals, Sprat sprinkled his *History* with short biographies. His aim was to provide living proof of the “usefulness” of “true philosophy.” Institutional histories have since used collective biography as a key component in their narratives.

Biography—indeed “science biography”—took recognizable form with the work of Pierre Gassendi (1592–1655). A noted philosopher and astronomer, Gassendi was among the first to write the lives of individual astronomers. An advocate of the New Science, Gassendi employed his knowledge of nature and the language skills of a classical scholar. According to his English translator, Gassendi was “comparable to any of the ancients.”<sup>15</sup> His versatility served him well in telling the lives of Nicolaus Copernicus and Tycho Brahe, as well as Georg Peurbach and

<sup>7</sup> As one example of recent scholarly treatment of ancient biography, see Tomas Hägg and Philip Rousseau, Eds. *Greek Biography and Panegyric in Late Antiquity. The Transformation of the Classical Heritage*, 31. Berkeley, 2000. Examples from other periods include David J. Sturdy, *Science and Social Status: The Members of the Académie des sciences, 1666–1750*. Rochester, New York, 1995 and Frank A. Kafker, *The Encyclopedists as a Group: A Collective Biography of the Authors of the “Encyclopédie.”* For an overview of key issues, see Clark A. Elliott, “Models of the American Scientist: A Look at Collective Biography,” *Isis*, Vol. 73, No. 1 (March, 1982): 77–93.

<sup>8</sup> From preclassical times, the transition from oral traditions, epics, and story telling (understood as historical literature) was accompanied by the production of records. In addition to annals and chronologies, the earliest forms of government required dynastic lists, while legal considerations of inheritance (as one example of precedence) called for extended genealogies. Between Greek and Roman writers, early forms of historical writing would now be classified as political commentary, contemporary history, or history of the times. Cicero expresses the Roman ideal of the historian as a writer who seeks motives, portrays individual character, analyzes results, and who “supports the cause of virtue and moves the reader by literary artistry.” (Herbert Butterfield, “Historiography,” *Dictionary of the History of Ideas*, 5. Vols., New York, 1973, Vol. 2: 464–498, p. 470.) Butterfield summarizes the view of Tacitus: “the deeds of good men ought not to be forgotten and that evil men ought to be made to fear the judgment of posterity.” “Historiography,” p. 479.

<sup>9</sup> He also wrote biographies of Henry Wotton (1651), Richard Hooker (1665), George Herbert (1670), and Robert Saunderson (1678).

<sup>10</sup> A late 16th-century writer lamented: “For lives, I find it strange, when I think of it, that these our times have so little esteemed their own virtues, as that the commemoration and writings of the lives of those who have adorned our age should be no more frequent. For although there be but few sovereign kings or absolute commanders, and not many princes in free states (so many free states being now turned into monarchies), yet are there many worthy personages (even living under kings) that deserve better than dispersed report or dry and barren eulogy.” Thomas Blundeville, *The True Order and Method of Writing and Reading Histories*, London, 1574 (no pagination), quoted in *Versions of History from Antiquity to the Enlightenment*, Ed. Donald R. Kelley, New Haven, 1991, 397–413, p. 407.

<sup>11</sup> Wood's *History*, prompted by his friend, Dr John Fell, dean of Christ Church, brought him much fame and notoriety. His grand project, the *Athenae Oxonienses*, was essentially a biographical dictionary mixing historical narrative, collective biography, and bio-bibliography. Assisted by Aubrey and Andrew Allam (neither adequately acknowledged), Wood drew on a variety of printed sources ranging from published works to institutional documents from libraries, archives, and governmental offices. John Fell, influential with the university press, assisted with publication. Wood was eventually sued for libel and removed from the university.

<sup>12</sup> Aubrey's *Lives*, written between 1669–1696, exists in four folio manuscript volumes. The public appearance of the *Lives* has a complicated publishing history. While early editions appeared in the late 18th century, an early standard edition appeared only in 1898. John Aubrey. “*Brief Lives*,” *Chiefly Contemporaries, set down by John Aubrey, between the years 1669 & 1696*. Edited by Andrew Clark. 2 Vols. Oxford, 1898.

<sup>13</sup> Diaries and letters are critical resources for biographers and historians. The best known diaries of this period, published centuries later, include *The Diary of Robert Hooke* (Eds. H.W. Robinson and W. Adams, 1935); *The Diary of Samuel Pepys*, 11 Vols. (Eds. R. Latham and W. Matthews, 1970–1983); and *The Diary of John Evelyn*, 6 Vols. (Ed. E.S. de Beer, 1955–). Publication of personal and scholarly letters began in the 17th century. Early efforts include the letters of N-C Fabri de Peiresc, Galileo Galilei, Johannes Hevelius, and René Descartes, among others.

<sup>14</sup> Thomas Sprat. *The History of the Royal-Society of London, for the Improving of Natural Knowledge*. London, 1667. Sprat's polemic for the New Science is thematic, philosophical, and passionate. His use of biography is not central to his arguments but ever-present in illustrating his claims.

<sup>15</sup> Gassendi's *Vita*, discussed more fully below, was translated by William Rand and published as *The Mirrour of True Nobility & Gentility* (London, 1657).

Johannes Regiomontanus.<sup>16</sup> In retrospect, Gassendi's success was linked to an emerging biographical principle, to portray the "conjunction of life and mind."<sup>17</sup> Like other contemporaries, Gassendi used history to support his scientific claims while shedding light on the inner workings of science.<sup>18</sup> His most cited biography is a tribute to his friend and patron, Nicolas-Claude Fabri de Peiresc (1580–1637). A noted humanist scholar and amateur of science, Peiresc collaborated with Gassendi in astronomy and in conducting optical experiments. Gassendi's biography portrays Peiresc's motives for studying nature and the relation between his personality and worldview. One of the first biographies translated from Latin into English, Gassendi's *Mirrouir of True Nobility* (W. Rand, trans., 1657; *Vita* 1641) has been favorably compared to a later classic biography, Boswell's *Life of Johnson* (1791). Gassendi met Boswell's strictest criteria: Boswell's masterpiece is an intimate and telling portrait; it clearly shows that the biographer and subject had "ate, drank, and communed."<sup>19</sup>

Boswell's *Life of Johnson* established biography as a legitimate form of historical writing. Importantly, Boswell's central interest in Johnson's life was to portray the "progress of his mind"—to tell his story accurately but not without passion. For Boswell, in "every picture there must be shade as well as light," and while not wishing "to cut his claws nor make a tiger a cat," his portrait of Johnson included all the "blotches and pimples."<sup>20</sup> Boswell transformed biography into a conventional and fashionable form of historical writing.

By the 19th century, biography gained maturity and great prestige. It was here, in the Century of Science, that a new genre appeared. It is now called "science biography." In the century that followed, particularly after World War II, numerous science biographies appeared. They celebrated traditional heroes as well as obscure figures. Classic studies of Isaac Newton, to take the oldest tradition, illustrate important shifts in the objectives of science biography. Since his death, Newton has been the subject of dozens of studies, from early hagiographic accounts to modern archive-based interpretations devoted to "Newton the Man."<sup>21</sup> Newton posed problems for biographers from the outset, particularly as unknown manuscripts came to light betraying his passion for alchemy, religion, and prophecy. Heralded as the "Splendid Ornament of Our Time" by Sir Edmond Halley, "High Priest of Science" by Sir David Brewster, and "Last of the Magicians" by Baron John Maynard Keynes, Newton's many faces continue to challenge traditional assumptions about the proper relation between science and biography. Despite differences and continuing debate, scholars agree that biography should leave readers less worshipful and more intrigued.<sup>22</sup>

The distinction between biography and history is a modern development. Although both share a common ancestor—and a strong family resemblance—each has a distinct physiognomy. To overstate a difference, biography stems from the belief that history is made by human beings, not by abstract ideas or impersonal forces. Equally overstated, history emphasizes the view that larger themes, trends, and movements account for change. In brief, if biography is a solo instrument, history is an orchestra. The limits of either perspective (assuming such distinctions can be sustained) are clear. In either case, authors assume a point of view. Biographers take the view that life is not encountered

<sup>16</sup> Latin versions appeared in several editions, the first in Paris (1654), the second in The Hague: Pierre Gassendi, *Tychonis Brahe, equitis Dani, astronomorum coryphaei, vita... Accessit Nicolai Copernici, Georgii Peurbachii, and Ioannis Regiomontani, astronomorum celeberrimum, vita*. Hagae Comitum (Vlacq) 1655.

<sup>17</sup> See Gassendi's introductory letter to Jean Chapelain in the Preface to Peurbach and Regiomontanus.

<sup>18</sup> Chronology was an important element in the New Science. Practitioners include not only Johannes Kepler and Issac Newton but an extraordinary group that mixed classical studies with advanced skills in astronomy, among them Joseph Scaliger, Wilhelm Schickard, Ismaël Boulliau, J-F Gronovius, John Greaves, Edward Bernard, Nicolas Heinsius, John Bainbridge, Sir Christopher Heydon, J-H Boecler, Henry Savile, James Ussher (archbishop of Armagh), Vincenzo Viviani, and Edmond Halley.

<sup>19</sup> Pierre Gassendi. *The Mirrouir of True Nobility & Gentility, Being the Life of the Renowned Nicolaus Claudius Fabricius Lord of Peiresk, Senator of the Parliament at Aix*. Trans. W. Rand, London, 1657.

<sup>20</sup> The phrase "warts and all" biography (perhaps derived from Boswell's "blotches and pimples") resonates with Walt Whitman's charge to his biographer, "... do not prettify me: include all the hells and damns."

<sup>21</sup> The first full-scale biography of Isaac Newton was written by Sir David Brewster (1781–1868), the noted physicist and journalist. Brewster's first excursions in biography were popular. But as author of *The Life of Sir Isaac Newton* (1831) and *Martyrs of Science: Lives of Galileo, Tycho Brahe and Kepler* (1841), Brewster soon found himself defending his principal hero. In 1822, the French astronomer J-B Biot (1822) made claims that Isaac Newton was intellectually crippled by mental illness, and hinted at Newton's questionable moral behavior. A decade later, Francis Baily made much of Newton's unfairness in his *Account of the Rev<sup>d</sup> John Flamsteed* (London, 1835). To defend Newton, Brewster gained access to little-known Newton manuscripts in the Portsmouth Collection (and Hurstbourne Collection). Much to his surprise, Brewster unearthed evidence that linked Newton to unorthodox religious and alchemical views. The result was Brewster's *Memoirs of the Life, Writings and Discoveries of Sir Isaac Newton* 2 Vols. (1855). On balance, Brewster did little to respond to the substance of the claims by Biot and Baily, essentially ignoring Newton's alchemy while denying Newton's illness of 1693. Some 80 years later, L.T. Trenchard More blasted Brewster's approach in his *Isaac Newton: A Biography* (1934). Charging him with playing the role of advocate to "The High Priest of Science," More claimed that Brewster made "almost no attempt to present Newton as a living man or to give a critical analysis of his character" (*Newton*, pp. vi–vii). Into this debate next came the noted economist, John Maynard Keynes (1883–1946). A wealthy collector of rare manuscripts, Keynes acquired hitherto unknown manuscripts of Isaac Newton on alchemy and religion. On the basis of these documents, Keynes famously proclaimed that "Newton was not the first of the age of reason. He was the last of the magicians" ("Newton the Man," 1947, *Newton Tercentenary Celebrations*, 1947, pp. 27–34). A generation later, the noted historian Frank Manuel published an important trilogy, *Isaac Newton, Historian* (1963), *The Religion of Isaac Newton* (1974), and *A Portrait of Isaac Newton* (1968)—a brilliant but controversial psycho-biographical study. Two decades later, a Newtonian synthesis of sorts appeared, *Never at Rest, A Biography of Isaac Newton* (Cambridge, 1980) by Richard S. Westfall. As Newton's biographer, Westfall aimed to "present his science, not as the finished product... but as the developing endeavor of a living man confronting it as problems still to be solved" (p. x). Westfall's credo captures the modern sense of science biography. Subsequent biographers have followed suit. In his *Isaac Newton, Adventurer in Thought* (London, 1992), A.R. Hall suggests the problem with earlier approaches was that the "mythical Newton, a new Adam born on Christmas Day and nourished by an apple from the tree of knowledge, came to obscure the real man who had worked in dynamics, astronomy, and optics" (p. xii). A number of important studies continue to appear. Although the biographical tradition surrounding Newton is longstanding, it shares important similarities with subsequent biographic traditions associated with Charles Sigmund Albert, Darwin, Freud, and Einstein.

<sup>22</sup> Thomas L. Hankins, "In Defence of Biography: The Use of Biography in the History of Science." *History of Science*, 17: 1–16. See also Helge Kragh, "The Biographical Approach," in H. Kragh, *An Introduction to the History of Science*, Cambridge, 1987, 168–173.



as a category or theme. Although it focuses on an individual life, biography can be used as an historical lens to refract the full range of human experience—from individual aspirations to enduring achievements. Those who write “science biography” often aim to show how scientists go about their business, how ideas and theories emerge, and how life and work make a coherent whole. In the end, most readers recognize that biography can be honest without telling the whole truth.

## Modern Collective Biography

*A biography should either be as long as Boswell's or as short as Aubrey's.*

Lytton Strachey

Collective biography—short sketches of individual lives representing a group—traces its roots to classical Antiquity, and since then it has been popularized, institutionalized, and widely embraced.<sup>23</sup> Collective biography has a long tradition of telling the story about science “in the making.” Since the time of Aristotle, authors have taken pains to record the efforts of predecessors (if only to show how misguided their views) just as modern authors have summoned ancient authors to support new theories. Applied to astronomy, an important assumption of collective biography is that “astronomy” is not only a body of knowledge but a body of people. It addresses individual lives as well as forms of life. Taken collectively, most astronomers—observers, mathematicians, calculators, astrologers, speculative philosophers—were not heroic figures. While few historians doubt the significance of Newton, many are persuaded of the importance of minor figures.<sup>24</sup> Scholars continue to debate the appropriate balance between individuals and groups.

The history of astronomy—like other scholarly specialties—is inseparably linked to collective biography. Among the early pioneers in this genre, two deserve brief mention: Giovanni Battista Riccioli (1598–1671) and Edward Sherburne (1618–1702). Echoing tradition in his title, Riccioli's *Almagestum novum* (Bologna, 1651) was not the first work to use history as evidence for his cosmological views.<sup>25</sup> Engaged in the great debate over the Ptolemaic, Tychonic, and Copernican world systems, Riccioli used history to tip the scales in favor of an Earth-centered model. A Jesuit by training, Riccioli published his two-volume work in defense of charges leveled against Galileo Galilei (1616 and 1633). Riccioli heaped new observations on old theories to support the Tychonic model.<sup>26</sup> To counter Copernicus's claims, Riccioli marshaled an army of believers in the immobility of the Earth, and not surprisingly, the Copernicans were vastly outnumbered.<sup>27</sup> Working old arguments into a new narrative, Riccioli used history and biography in what amounted to a Copernican counter-reformation. Riccioli's collective biography contains some 400 astronomers from Antiquity to his own age. It fills 20 folio pages—in small type.<sup>28</sup>

Appearing several decades later, Edward Sherburne's *Sphere of Marcus Manilius* (1675) contains the first modern collective biography of astronomers.<sup>29</sup> Responding to wide-spread interest in the ancient astrologer Manilius (flourished 10), Edward Sherburne (1618–1702) presented the first English translation of Book One of the *Astronomicon*, and along with it, his remarkable “Catalogue of the Most Eminent Astronomers, Ancient & Modern.” It was a model for future collective biographies. Following earlier traditions,<sup>30</sup> Sherburne's *Astronomical*

<sup>23</sup> As one recent scholar summarized, “Initially, the analytic life was a minority voice as large, multivolume biographies dominated Victorian lives. However, a tradition originating in short Latin lives, renewed by antiquaries of the 16th century, popularized by Aubrey's *Brief Lives* in the seventeenth, dignified by Johnson's *Lives of the Poets* in the eighteenth, and culminating in works like Strachey's *Portraits in Miniature* in the twentieth, reasserted the centrality of the brief life. In the 19th century, the form reached its apogee in collective lives, biographies in series and biographical dictionaries. Their extraordinary sales and continued influence is a measure of their importance.” Ira Bruce Nadel, *Biography: Fiction, Fact & Form*, New York, 1984, p. 13.

<sup>24</sup> One reviewer of the *Dictionary of Scientific Biography* wrote, in some sense “obscure second-rate scientists are as important as, and probably even more significant than, scientific geniuses” given (in his view) that “the real subject matter of the history of science is not the individual scientist, but the scientific community as a whole.” Jacques Roger, “The DSB: A Review Symposium,” *Isis*, 71 (1980): 633–652, p. 650.

<sup>25</sup> Giovanni Battista Riccioli, *Almagestum novum, astronomiam veterem novamque complectens*, (2 Vols.) Bologna, 1651.

<sup>26</sup> The Tychonic model can be described as geocentric and geo-static, and more accurately as geo-heliocentric. A geo-heliocentric model has the planets to revolve around the Sun, but in turn, the Sun revolves annually around the central and stationary Earth. Geo-heliocentric models were in principle observationally equivalent to a heliocentric model. Viewed in context, they served as an intelligent alternative rather than as a “compromise” cosmology. See M.A. Hoskin and Christine Jones, “Problems in Late Renaissance Astronomy,” *Le Soleil a la Renaissance*. Paris, 1965. Further details about the history and various mutations of the geo-heliocentric model can be found in Christine Schofield-Jones' doctoral dissertation.

<sup>27</sup> If theory selection is based on *Numerus, Mensura, Pondus*, historians have mused over the number, size, and weight of Riccioli's arguments. By one reckoning, J-B Delambre counted some 57 arguments against a moving Earth. For his part, Riccioli claims “40 new arguments in behalf of Copernicus and 77 against him.” See J-B Delambre, *Histoire de l'Astronomie Moderne*, Vol. 1, Paris, 1821, pp. 672–681 and G-B-Riccioli, *Almagestum novum*, 2 Vols., (Bologna, 1651). See Volume 2, Section 4, Ch. 1, pp. 290 *et seq.*, where Riccioli expands his list of Copernicans and non-Copernicans weighing arguments for and against a moving Earth; see also pp. 313–351. For Riccioli's reckoning of the number of arguments, see *Apologia pro Argumento Physicomathematico contra Systema Copernicanum adiecto contra illud Novo Argumento ex Reflexo motu Gravium Decidentium*. Venice, 1669; Dorothy Stimson, *The Gradual Acceptance of the Copernican Theory of the Universe*, New York, 1917, pp. 79–84, provides a general discussion.

<sup>28</sup> Riccioli, *Almagestum novum*, Pt I. Following a historical narrative, Riccioli offers a chronological outline of astronomy (xxvi–xxviii) followed by an alphabetical list of over 400 astronomers (xxviii–xlvi). Entry length varies from a few lines to nearly a full page in the case of Tycho Brahe. Though long and often laborious (over 1,500 pages), Riccioli's volumes provide one of the best introductions to the history of astronomy up to his time. Technically skilled and historically inclined, Riccioli provides useful perspectives on contemporary authors, including Copernicus, Brahe, Longomontanus, Kepler, Galilei, Boulliau, and others.

<sup>29</sup> Edward Sherburne, *The Sphere of Marcus Manilius made an English Poem with Annotations and an Astronomical Appendix* (London, 1675).

<sup>30</sup> The more noted early astronomer-historians include Schickard, Gassendi, Riccioli, Boulliau, Viviani, and eventually Halley.

*Appendix* (pp. 1–126) contains some 1,000 biographical entries, varying from several lines to several pages. Less polemical than Riccioli, Sherburne's purpose was no less passionate. He aimed to tell the story of the "origins and progress" of astronomy from the very beginning—literally, from Adam (5600 BCE). Sherburne's Catalogue contains detailed information about a large number of his friends and colleagues, and it remains useful for historians evaluating contemporary issues and reputations. Young Isaac Newton, as one example, receives a surprisingly short entry—easily dwarfed by those of Tycho and Hevelius.<sup>31</sup>

Collective biography came of age in the 17th century. Although writers continued to celebrate political and religious figures, a shift took place with the appearance of works on artists and scholars as well as advocates of the New Science. During the previous century, Konrad Gesner (1516–1565) published his pioneering *Bibliotheca Universalis* (Zürich, 1545–1549), Giorgio Vasari (1512–1574) his *Lives of the Artists*, and extending a long tradition, the *Acta Sanctorum* (1643 *et seq.*) swelled to 68 folio volumes. This monumental work gave new meaning to the word hagiography.<sup>32</sup> Toward the end of the century, men of learning again took center stage with the appearance of Charles Perrault's *Les hommes illustres*,<sup>33</sup> and soon thereafter, J-P Nicéron's *Mémoires pour servir à l'histoire des hommes dans la République des Lettres* (1729–1745, Paris). Both works included biographies of astronomers.<sup>34</sup>

The most comprehensive work of the century was published by Louis Moréri (1643–1680), *Le Grand Dictionnaire historique* (Lyon, 1671).<sup>35</sup> Unprecedented in scope and rigor, Moréri established new possibilities. For present purposes, while it contained biographies of all the major astronomers up to that day, Moréri's *Dictionnaire* represented unprecedented opportunities for combining history and biography.<sup>36</sup> First published in French, his *Dictionnaire* was soon translated into English, German, Italian, and Spanish, and within a century (1671–1759), some twenty editions appeared.<sup>37</sup> The success of Moréri's work was followed by an avalanche of encyclopedias and dictionaries that constituted an intellectual movement in itself. Less widely noted, the encyclopedia movement was paralleled by the publication of scholarly *Éloges*, most notably by Bernard de Fontenelle (1657–1757) and subsequent secretaries of the French Académie des sciences.<sup>38</sup> Certainly one of the most influential works of the century was the *Dictionnaire historique et critique* (4 Pts, 2 Vols., Rotterdam, 1697) of Pierre Bayle (1647–1706). Later called the "Arsenal of the Enlightenment," Bayle's *Dictionnaire* appeared in five editions over the next 50 years, not including an influential English translation (2nd Edition, 1734–1738).<sup>39</sup> Praised for its topical articles (particularly on reforming religion, philosophy, and politics), Bayle's *Dictionnaire* was less comprehensive than Moréri, and while prone to philosophical polemics, its influence was immense. Like Moréri, Bayle included important biographies on noted thinkers, many associated with the New Science, astronomy, and cosmology. By tradition, Bayle's *Dictionnaire* foreshadowed the *Encyclopédie*, an Enlightenment showcase designed by Denis Diderot (1713–1784), Jean D'Alembert (1717–1783), and other advocates of toleration and reform. The influence of the *Encyclopédie* in transforming political, social, and intellectual institutions would be difficult to overstate. Aided by dramatic increases in literacy, the explosive growth of the printing press, wider use of the vernacular, and the proliferation of learned journals, scholars joined the public sphere as never before, often pointing to Bacon, Galilei, and Descartes as models of free thinking and useful knowledge.<sup>40</sup> Historical evidence and philosophical principle soon became equal partners in political polemics. By the end of the century, collective works multiplied across national boundaries, among the most important, the *Encyclopaedia Britannica* (3 Vols., Edinburgh, 1771) and Chamber's *Cyclopaedia*

<sup>31</sup> Sherburne, *The Sphere*, Brahe, p. 63; Hevelius, pp. 110–111; Newton, p. 116.

<sup>32</sup> Hagiography can be described as a literary tradition devoted to telling the lives of ecclesiastical figures, notably martyrs and saints canonized by the Church of Rome. Hagiography has since gained a heroic connotation associated with "secular saints" such as Newton, Darwin, Freud, and Einstein.

<sup>33</sup> Charles Perrault. *Les hommes illustres qui ont paru en France pendant ce siècle avec leurs portraits au naturel*, 2 Volumes (1697 and 1700, Paris).

<sup>34</sup> Jean-Pierre Nicéron. *Mémoires pour servir à l'histoire des hommes dans la République des Lettres* (1729–1745, Paris).

<sup>35</sup> Louis Moréri. *Le Grand Dictionnaire historique, ou le mélange curieux de l'histoire sacrée et profane*, (Lyon, 1671 *et seq.*).

<sup>36</sup> The Moréri edition of 1759, for example, contains biographies of astronomers from Antiquity through the early 18th century, among them, Boulliau 2: 137; Copernicus 4: 105–106; Cunitz 4: 324; Descartes 4 (2): 115–119; Galilei 5 (2): 32–33; Kepler 6 (2): 17–18; Mersenne 7: 488; Brahe 10: 181–182; as well as Newton 8: 1001–1002 and other countrymen, Wallis 10: 756; and Ward 10: 764–765. Several articles are particularly noteworthy, for example, the early reception of Descartes's work in universities and subsequent controversies with church authorities is both thorough and unprecedented; the article on J-B Morin contains unique information and is nuanced in interpretation; and Newton is already showing signs of icon status, heralded as one of "the most learned men of our age." The Moréri edition is noteworthy for high standards; articles often quote from primary sources and occasionally from unpublished letters and manuscripts.

<sup>37</sup> Subsequent editions appeared under the editorship of C-P Goujet (1697–1767) and E-F Drouet (1715–1779).

<sup>38</sup> The impulse to publish these *éloges* (biographies of deceased men of learning) came from several directions. The *éloge* of the French Académie des sciences show similarities with earlier biographical traditions. As idealized portraits "extolling the moral virtues of the post-Renaissance sciences" (p. ix) they represent, as Charles B. Paul has argued, a classic form of collected scientific hagiography. Re-inventing an old tradition, Fontenelle (1657–1757) and his successors (Mairan, Fouchy, and Condorcet) published over 200 posthumous eulogies of Académie members during the 18th century. As commemorative pieces, they underscored societies' debt and popularized the belief that scientists were modest, dedicated, disinterested seekers after truth devoted to social improvement and human progress. See Charles B. Paul, *Science and Immortality: The Éloges of the Paris Academy of Sciences (1699–1791)*. Berkeley, 1980.

<sup>39</sup> Pierre Bayle. *Dictionnaire historique et critique*, Rotterdam, 1697, fol. 2 Vols. Many editions followed: a second edition (3 Vols., Amsterdam, 1702); the fourth edition (4 Vols., Rotterdam, 1720), edited by Prosper Marchand; and a ninth edition in 10 Volumes appearing shortly thereafter. The second edition of the *Dictionnaire* was translated into English (4 Vols., London, 1709), and later the fifth edition (1730) was translated by Birch and Lockman (5 Vols., London, 1734–1740). Other editions with supplements and additional translations followed, among them a German translation (4 Vols., Leipzig, 1741–1744), with a preface by J.C. Gottsched. It is widely reported that Bayle undertook his *Dictionnaire* due to unacceptable errors and omissions found in Moréri. Later editions of Moréri show a remarkable level of scholarship.

<sup>40</sup> In his *Preliminary Discourse to the Encyclopedia of Diderot* (1751) d'Alembert rehearsed the "traditional litany" of heroes from the scientific revolution (traditionally Copernicus to Newton) explaining how "a few great men . . . prepared from afar the light which gradually, by imperceptible degrees, would illuminate the world" (Ed. R. Schwab, New York, 1963), p. 74. Voltaire echoed a similar view in his famous chapter on the "Academies" in his *Age of Louis XIV (Le Siècle de Louis XIV, 1751)*.

(2 Vols., London, 1728).<sup>41</sup> By the end of the century, the publication of private letters of individuals—literary, political, philosophical—became fashionable as learned conversation and salon gossip found its way into print.

The 19th century saw an explosion of multivolume publications. Among them, a new tradition began to emerge with the publication of the complete works of individual scientists—*opera omnia*, collected papers, and published correspondence. Intellectuals increasingly entered the public sphere. One of the early landmarks reflecting the Republic of Letters was the *Biographie universelle ancienne et moderne* (52 Vols. Paris, 1810–1828), edited by J-F Michaud (1767–1839).<sup>42</sup> Spanning time and space, Michaud's *Biographie* remains one of the most enduring universal dictionaries of all time. Boasting high scholarly standards, it is composed of substantial articles signed by eminent authors. As one example, the article on Newton, written by the well-known physicist, Jean-Baptiste Biot (1774–1862), became a symbol of the international and increasingly controversial character of celebrity.<sup>43</sup> As local heroes gained international status, national reputations were hotly disputed. Astronomers were well represented.<sup>44</sup>

An extreme example—finally affecting reputations of both the living and the dead—involved the French mathematician, Michel Chasles (1793–1880), the noted Copley Medalist and Member of the Académie des sciences.<sup>45</sup> In 1867, Chasles claimed that his celebrated countryman, Blaise Pascal (1623–1662), had sent letters (hitherto unknown) to young Isaac Newton during the years 1654–1661. In effect, Chasles suggested that the French mathematician had handed over the secret of the Universe—the law of universal gravitation—to an Englishman. The dispute that followed involved two years of public wrangling and scholarly exchanges between Newton and Galilei experts—finally followed by a trial and prison sentence. In the end, Chasles came to discover (along with an international audience) that his claims were based on false documents forged by one Vrain-Denis Lucas (1818–*circa* 1871).<sup>46</sup> Chasles eventually acknowledged that he had been duped, swindled, and humiliated.<sup>47</sup> The *Affaire Vrain Lucas* is an extreme example of historical celebrity and national pride gone awry, a dramatic reminder that biography, like other forms of historical writing, is always written from a perspective.

A watershed in collective biography came with specialized dictionaries devoted to individual countries.<sup>48</sup> These “national biographies” have since become showcases of scholarship and—increasingly—for international cooperation. Following a century of political conflict and upheaval, the great national biographies stemmed from a sense of pride and patriotism. First appearing in the early decades of the 19th century, major national biographies began to appear across Europe, from the great universal dictionary of Moréri in France (52 Vols., 1810–1828) to the national dictionaries of Sweden (23 Vols., 1835–1857); the Netherlands (24 Vols., 1852–1879); Austria, 35 Vols., (1856–1891); Belgium (35 Vols., 1866–); Germany (45 Vols., 1875–1900); Great Britain (63 Vols., 1882–1900); the United States (30 Vols., 1928–1936; 1994); France (19 Vols., 1933–); and Italy (59 Vols., 1960–).<sup>49</sup> Although defined geographically, national biographies can be an invaluable resource of information on astronomers, whether major or minor figures.

Among the national biographies that dominated 19th-century scholarly publication, the most eminent was the widely celebrated *Dictionary of National Biography* [DNB] (1882–1900). The DNB soon became a symbol of scholarly collaboration, not unlike the

<sup>41</sup> Ephraim Chambers, *Cyclopaedia; or an Universal Dictionary of Art and Sciences, containing an Explication of the Terms and an Account of the Things Signified thereby in the several Arts, Liberal and Mechanical, and the several Sciences, Human and Divine*, London, 1728, fol. 2 Vols. A noted example of publishing letters of the learned is Angelo Fabroni, *Lettre inedite di uomini illustri*, 2 Vols. Florence, 1773 and 1776.

<sup>42</sup> [Joseph-François] Michaud, *Biographie universelle ancienne et moderne*, 52 Vols., Paris, 1810–1828 (32 supplement Volumes); a good deal of the work was completed by his younger brother, Louis-Gabriel Michaud (1773–1858). A second revised edition appeared in 45 Volumes (Paris, 1843–1865).

<sup>43</sup> J-B Biot, “Isaac Newton,” *Biographie Universelle*, Vol. 30: 366–404. As noted above, Biot raised important questions about Newton's mental illness—hinting at his beliefs in alchemy and religion—which later spurred a defense by Sir David Brewster as well as a growing tradition of scholarly debate.

<sup>44</sup> Michaud and subsequent editors enlisted the most noted scholars of the day as contributors. Several noted biographies of astronomers were written by J-B Delambre (Kepler; Boulliau; A-G Pingré) and by J-B Biot (Copernicus; Galilei; Newton).

<sup>45</sup> Articles by Chasles, and the many responses, are found in the *Comptes rendus des séances de l'Académie des sciences* beginning in July 1867 (Tome LXV). Consisting of hundreds of pages of text (involving extracts and complete transcriptions of “letters”), the appearance of these exchanges ran from roughly July 1867 to January 1868 (Tome LXVI). By this time, Sir David Brewster joined the fray, along with the English astronomer, Robert Grant. They were joined by scholars from Italy and France, Galileo scholars, among them Pietro Angelo Secchi and Paolo Volpicelli, and French specialists, among them the Pascal scholar, A-P Faugère. The *Affaire Vrain Lucas*, combined with the colossal theft of manuscripts by Guglielmo Libri (1802–1869), may have prompted European archivists to refine the inventories of their manuscript collections. This dramatic display of scholarly effort, fueled by scandal and the loss of national treasures, likely gave impetus to the publication of *Opera and Correspondence* of major figures. On the Libri Affair, see P.A. Maccioni Ruju and Marco Mostert, *The Life and Times of Guglielmo Libri (1802–1869), scientist, patriot, scholar, journalist and thief, A 19th century story*. Hilversum, 1995.

<sup>46</sup> On the Vrain-Lucas affair, see Henri Bordier and Émile Mabilbe, *Une fabrique de faux autographes, ou récit de l'Affaire Vrain Lucas*. Paris, 1870; *Le parfait secrétaire des grands hommes ou Les lettres de Sapho, Platon, Vercingétorix, Cléopâtre, Marie-Madeleine, Charlemagne, Jeanne d'Arc et autres personnages illustres*, Ed. Georges Girard, Paris, 2003; and Joseph Rosenblum, *Forging of False Autographs, Or, An Account Of The Affair Vrain Lucas*. New Castle, Delaware, 1998.

<sup>47</sup> Although Newton would have been 12 years old at the beginning of the exchange—and despite irregularities in other documents in his possession—Chasles persisted in publishing his views in the prestigious *Comptes rendus* of the Académie des sciences. Overall, Vrain Lucas forged some 27,000 documents, including letters purportedly written by Mary Magdalene, Aristotle, Alexander the Great, and Lazarus (both before and after his resurrection). Virtually all were written in French. Lucas was fond of the scientific revolution; among his favorite figures were Pascal, Galilei, Louis XIV, and Boulliau.

<sup>48</sup> Robert B. Slocum. *Biographical Dictionaries and Related Works; An International Bibliography of More than 16,000 Collected Biographies*, 2nd edition, 2 Vols., (Detroit, 1986) [First edition, 1967]. This volume lists major biographical dictionaries and encyclopedias according to standard categories, from national or area designations to vocation and related thematic distinctions.

<sup>49</sup> See Appendix for further bibliographic details.



*Oxford English Dictionary* and *Encyclopaedia Britannica*.<sup>50</sup> Drawing on hundreds of contributors, the *DNB* contained some 30,000 entries, supplemented by 6,000 additions. The *DNB* was reprinted in 1908, and thereafter, future publication fell to Oxford University Press (1917). Significantly, the *DNB* was viewed not as a completed project but as an ongoing enterprise. That was a century ago. Jumping forward in time, plans were put in place in 1992 to publish the new *Oxford Dictionary of National Biography* [ODNB], which was completed in 2004.<sup>51</sup> This modern edition, the most comprehensive biographical dictionary of its kind, contains some 54,922 lives filling 60 volumes. Foreshadowing future efforts in collective biography, the ODNB has set new standards by providing electronic online access for subscribers, thus ensuring easy updates and unprecedented capacity for searching and comparing individuals across traditional categories.<sup>52</sup>

## Since the Enlightenment

Since the Enlightenment, important developments have taken place in the theory and practice of historical writing. Like other specialized areas of research, the history of astronomy has benefited from increased access to manuscripts and primary sources, not to mention profound changes in educational institutions and dramatic increases in the availability of printed works. These ongoing and often parallel developments began to converge in the form of pioneering works in the history of science. Some of these early works are still available in print, several in the history of astronomy.

A classic example was published by the noted astronomer, J-B Delambre (1749–1822). His impressive multivolume study, *Histoire de l'Astronomie* (1817–1821; 1827) still shows exceptional talent as it moves across ancient, medieval, and modern astronomy.<sup>53</sup> Delambre's work combines the technical skills of an astronomer with the language skills of a classical scholar. Standing the test of time, his six-volume *Histoire* skillfully weaves technical analysis with biographical references—most memorable are entire pages filled with elegant equations. A work for specialists, Delambre's *Histoire* is based squarely on the analysis of published works. Today, his approach might be called “technical thick-description.” Although his narrative sails boldly across difficult seas (observation, data reduction, mathematical procedures, and the calculation of tables), his travel-chart is organized around individuals, not concepts or historical periods.

But if Delambre's approach is not thematic, neither is it about *lives*.<sup>54</sup> While his chapter titles and subsections bear the names of individuals, Delambre tells the reader little about his subjects.<sup>55</sup> Instead of a biographical or historical narrative, he offers technical analysis of specific problems. For Delambre and his contemporaries, the use of a “thematic narrative” in the history of astronomy still lay in the future. For now, chronology, bibliography, and technical analysis ruled the day.<sup>56</sup> Delambre's mentor, Joseph-Jérôme de Lalande (1732–1807), echoes the point,<sup>57</sup> and a similar transitional approach is equally evident in the work of a learned contemporary, Alexandre-Guy Pingré

<sup>50</sup> Known initially by the working title of *Biographia Britannica*, much of the early work was undertaken by the first editor, Sir Leslie Stephen (1824–1901); he was eventually replaced by Sir Sidney Lee (1859–1926). The first volume of the *DNB* appeared on 1 January 1885; the last, number 63, in 1900.

<sup>51</sup> The ODNB has been widely reviewed by scholars, and was recently dubbed “the greatest reference work on earth” (*Daily Telegraph*). Stefan Collini, in “Our Island Story,” *London Review of Books*, Vol. 27 (20 January, 2005) concludes his review suggesting that “In deeply unpropitious times, the *Oxford Dictionary of National Biography* has refreshed and fortified our sense of what can still be meant by the collective endeavour of ‘scholarship.’”

<sup>52</sup> Though widely discussed in recent decades, the advent of electronic texts and powerful search potential continue to change the scholarly landscape. After several minutes searching all the entries in the ODNB, I present the following purposely mixed findings: From 50,000 individuals, 3,267 are linked with *science*; within the entire ODNB, the word *revolutionary* appears 1,380 times; *child prodigy* 39 times; *intellectually brilliant* 7 times; *arrogant* 307 times; and *quite mad* 3 times. Overall, the ODNB contains biographies on 231 astronomers of whom six are women. Searching religious affiliation among the astronomers (selecting from 20 categories) yields two Lutherans (not further specified) and 33 Catholics (not refined here by seven subcategories). Electronic texts allow unprecedented capacities for linking words, concepts, and categories.

<sup>53</sup> Jean-Baptiste Delambre, *Histoire de l'astronomie ancienne*. 2 Vols. (Paris, 1817); *Histoire de l'Astronomie du moyen âge*. (Paris, 1819); *Histoire de l'astronomie moderne*. 2 Vols. (Paris, 1821); *Histoire de l'astronomie au XVIII<sup>e</sup> siècle*. (Paris, 1827).

<sup>54</sup> Delambre wrote a number of solid and lengthy biographical articles for the *Biographie universelle*, including articles on Hipparchus, Kepler, La Caille, Lalande, Ptolemy, and Picard. For an overview of Delambre's career, see the works of I. Bernard Cohen cited below.

<sup>55</sup> Delambre's *Histoire de l'Astronomie Moderne*, which lacks a traditional table of contents, contains 16 books; each chapter title except the first (Réformation du Calendrier) is given a single individual name (Copernic, Tycho-Brahé, Képler, etc.) or the names of several individual astronomers (“Métius, Boulliaud, et Seth-Ward”). Minor figures, to Delambre's credit, receive substantial analysis.

<sup>56</sup> A recent scholar suggested that Delambre's “six volume *Histoire* is the greatest full-scale technical history of any branch of science ever written by a single individual” further adding it “sets a standard very few historians of science may ever achieve.” (I. Bernard Cohen, “Delambre,” *Dictionary of Scientific Biography*. Vol. 4: 14–18, p. 17). Elsewhere Cohen explained that Delambre's approach was to go through “each chronological period by describing and analyzing first one treatise and then another [he] thereby avoids any attempt at a historical ‘synthesis,’ or generalization, largely confining himself to critical analyses and expositions of major and minor contributions within the rigid framework . . .” “Introduction,” J-B-J Delambre, *Histoire de l'Astronomie Moderne*, Reprint, New York, 1969, p. xvi.

<sup>57</sup> Jérôme de Lalande (1732–1807) published a similarly impressive work—again, still useful today—that followed the tradition of linking units of information along a clean chronological line. It would now be known as annotated bibliography, *Bibliographie astronomique avec l'histoire de l'astronomie depuis 1781 jusqu'à 1802*. (Paris, 1803). Not a history but a reference tool, Lalande's *Bibliographie* lists every known astronomical work from circa 480 BCE to 1802. Containing some 660 pages, it was unrivaled as a chronological bibliography of the history of astronomy. By design, it also served as a chronological list of astronomers. At the end of his book, Lalande provided a concise “history of astronomy” (1781–1802), in effect, a calendar of astronomical events and activities similar to the annual publications of the *Académie des sciences*. A similar model was adopted by G. Bigourdan in publishing the work of A-G Pingré (see below).

(1711–1796).<sup>58</sup> But organizational approaches to historical writing were changing. At the close of the century, Adam Smith (1723–1790), the noted economist, developed a more thematic approach in his *Principles Which Lead and Direct Philosophical Enquiries; Illustrated by the History of Astronomy* (1795).<sup>59</sup> As the title suggests, Smith used history to explore the roots of human progress. As an ancient form of knowledge, astronomy provided Smith with an example that linked material and moral improvement.<sup>60</sup> Many of these early historical writings mixed technical analysis with bio-bibliography. In varying degrees, each shows a shift toward narrative, from chronicling events to evaluating themes. An important virtue of historical narrative is that it accommodates “time’s arrow” along with traditional interests in analysis, biography, and bibliography.<sup>61</sup>

Since the Enlightenment, research and reference tools have appeared in growing numbers, and as philosophy and science have become more specialized, historical works have followed suit. In the history of science, the German physicist and bibliographer, Johann Christian Poggendorff (1796–1877) published a pioneering biographical handbook. Poggendorff’s evolving multivolume *Biographisch-Literarisches Handwörterbuch der exakten Naturwissenschaften* (1863–1904, *et seq.*) initially contained some 8,400 biographical entries. It was the first comprehensive bio-bibliographical work of its kind. Although it emphasized the physical and exact sciences, it covered all countries and chronological periods.<sup>62</sup> Outside the physical sciences, William Munk (1816–1898) published his *Roll of the Royal College of Physicians* (3 Vols., 1878), one of many multivolume works showing increased specialization. An example: George Sarton (1884–1956), among the early founders of the discipline, provided a detailed roadmap to ancient science in his *Introduction to the History of Science* (1927–1948, Baltimore).<sup>63</sup> Continuing the journey (ancient to medieval) Pierre Duhem (1861–1916) published his monumental *Le système du monde*, 10 Vols. (1913–1959, Paris), providing a detailed study of the physical sciences, including the history of astronomy.<sup>64</sup> Similarly styled encyclopedic narratives appeared by Lynn Thorndike (1882–1965), *History of Magic and Experimental Science* (8 Vols., 1923–1958),<sup>65</sup> while R.T. Gunther’s *Early Science in Oxford* (14 Vols. 1923–1945, Oxford) is more typical of institutional works. As pioneers, Sarton, Duhem, Thorndike, and Gunther represent a transitional encyclopedic tradition that joined bio-bibliography with a thin chronological narrative. Finally, a more recent trend in collective biography is evident in “Who’s Who” publications. These works have helped fill biographical gaps left by other approaches, particularly in the professions. One of the most comprehensive works of collective science biography contains some 30,000 entries, *The World Who’s Who in Science: A Biographical Dictionary of Notable Scientists, From Antiquity to the Present* (Chicago, 1968), edited by Alan Debus.<sup>66</sup>

<sup>58</sup> Pingré’s *Annales céleste du dix-septième siècle* (1901), as the title suggests, is based on a year-by-year celestial calendar; it offers a treasure trove of detailed information about celestial events, observations, publications, and people. Like his predecessors, Pingré’s skeletal structure was never fleshed out; there is no narrative theme and little life, although it sometimes offers exceptional biographical insight.

<sup>59</sup> Two early historians of astronomy, James Ferguson (1710–1776) and Robert Grant (1814–1892), followed similar strategies of mixing biography and historical narrative that echoed the interpretive themes of their day (Robert Grant, *History of Physical Astronomy, From the Earliest Ages to the Middle of the Nineteenth Century* (London, 1852)). Grant’s title may be misleading. His 14-page introduction covers the period up to Newton; the following 13 chapters are devoted to the theory of gravitation, particularly the genesis and reception of the “immortal discoveries of Newton” (p. 20). Although occasional flourishes of whiggism may jar the modern reader, Grant’s *History* remains impressive. On the solid basis of primary sources, it shows admirable technical mastery, historical rigor, and remarkable rectitude of judgment.

<sup>60</sup> Striking a more traditional note, Joseph Priestley (1733–1804), a Unitarian minister, echoed a similar theme. Priestley saw the natural philosopher as “something greater and better than another man” as his work involved the “contemplation of the works of God.” Joseph Priestley, *The History and Present State of Electricity, with Original Experiments*. 2 Vols., 3rd ed. (London 1775): Vol. 1, p. xxiii.

<sup>61</sup> Earlier historians with interests in other areas had been emphasizing topical and thematic approaches since the beginning of the 17th century, notably John Selden (1584–1654) and the noted French historian, Jacques Auguste de Thou (1553–1617). In the nascent history of science, more thematic approaches are evident in William Whewell, *History of the Inductive Sciences* (1837). Voltaire, their contemporary, is widely noted for stretching historical narratives from political concerns to science, learning, and the arts. Although a trend toward historical narrative is evident in the history of science, two later classics, by Arthur Berry (1898) and J.L.E. Dreyer (1906), continued to entitle chapter headings (and many subsections) with the names of specific individuals. Biography remains an important organizational strategy in the history of astronomy.

<sup>62</sup> Johann Christian Poggendorff (1796–1877), Professor at the University of Berlin (1834), served as editor of *Annalen der Physik und Chemie* (1824–1877) and was a member of the Prussian Academy of Sciences (1839). Poggendorff’s work first appeared in two volumes (1863) and gradually expanded into seven parts (“Band I” to “Band VII,” 1863–1992; Part 8 was begun in 1999). Poggendorff is particularly strong for the physical sciences—astronomers, mathematicians, physicists, chemists, mineralogists, geologists, naturalists, and physicians. An electronic version of Poggendorff’s work is now available in database format. It reportedly contains entries for some 29,000 scientists from ancient to modern times. The electronic edition (DVD) is under the auspices of Sächsische Akademie der Wissenschaften zu Leipzig. See Appendix for bibliographic details.

<sup>63</sup> George Sarton. *Introduction to the History of Science*. 3 Vols., Baltimore: Williams and Wilkins, 1927–1948.

<sup>64</sup> Pierre Duhem. *Le système du monde, Histoire des doctrines cosmologiques de Platon à Copernic*. The volumes include I. *La cosmologie hellénique*; II. *La cosmologie hellénique*; III. *L’astronomie latine au Moyen Age*; IV. *L’astronomie latine au Moyen Age*; V. *La crise de l’aristotélisme*; VI. *Le refus de l’aristotélisme*; VII. *La physique parisienne au XIV<sup>e</sup> siècle*; VIII. *La physique parisienne au XIV<sup>e</sup> siècle*; IX. *La physique parisienne au XIV<sup>e</sup> siècle*; IX. *La cosmologie de XV<sup>e</sup> siècle. Ecoles et universités*.

<sup>65</sup> Lynn Thorndike. *A History of Magic and Experimental Science* (8 Vols., New York, 1923–1958).

<sup>66</sup> Several thematic reference works have appeared in recent decades, notably the *Dictionary of the History of Ideas* (1974), now in a new edition; *Encyclopedia of Philosophy* (1967); *Companion to the History of Science* (1990); and particularly useful for identifying minor figures, the *Isis Cumulative Bibliography* (1971–).

An important scholarly tradition—which continues today—emerged in the 19th century with the publication of the complete works of noted scholars and scientists.<sup>67</sup> No discussion of science biography would be complete without mentioning the significance of these scholarly monuments. Among the oldest and most powerful research tools for historians of science, these works first appeared as *opera omnia*, *oeuvres complètes*, or as *Lettres* or *Complete Correspondence* of the traditional heroes of our discipline. Contemporary interest in heroic individuals reflects the philosophy of science at the time, not to mention nationalistic tendencies and expressions of local pride.<sup>68</sup> Challenging in scope and complexity, the extant body of letters and manuscripts of leading scientists required exceptional scholarship, collective effort, and substantial institutional support. Arguably, these requirements help define modern collective biography as well as the character of private, institutional, and national funding. Because these works have appeared over the course of several centuries, it is instructive to consider changing standards of scholarship.<sup>69</sup>

Heralded as “one of the most ambitious projects ever undertaken in studies of the history of science,” the *Dictionary of Scientific Biography (DSB)* (1970–1980) occupies an important place at the end of this brief historical introduction.<sup>70</sup> The *DSB*, sponsored by the American Council of Learned Societies and supported by the National Science Foundation, has been identified as a collaborative work that at once asserted and affirmed the identity of a discipline.<sup>71</sup> Published with remarkable speed and regularity in the course of a decade (1970–1980), the original 16-volume set includes over 5,000 biographical entries in the history of science from Antiquity to the 20th century.<sup>72</sup> Overall, the scholarly response to the *DSB* was extremely positive. Some proclaimed it “magnificent” and “triumphantly executed,” others offered detailed criticism and useful suggestions.<sup>73</sup> In the end, despite the unprecedented scope of a project this size, most reviewers returned to time-honored principles that define the design and use of collective biography—*inclusion criteria*, *entry length*, and issues of *coverage*. By tradition, key areas of concern turn on the relative importance of historical figures—their positive contributions, contemporary influence, subsequent significance, and their role in representing or typifying a group. Difficult decisions are involved. To suggest the size of the problem, what weight does a Leviathan like Isaac Newton have compared to a small fry like John Newton (a contemporary almanac writer)? Scholarly reviews of the *DSB* reconfirm a diversity of opinion—and sustained acceptance—of collective biography.<sup>74</sup> Classified by field, the *DSB* contains articles on some 750 astronomers, most from the modern period.<sup>75</sup>

<sup>67</sup> A selected list, considered chronologically, includes Pierre Gassendi, *Opera Omnia* (6 Vols., Lyon, 1658); Benedict de Spinoza, *Opera Posthuma* (Amsterdam 1677), Dutch edition, *Die nagelate Schriften van B. d. S.* (n.p., 1677); J. Bernoulli (1744); René Descartes (1824–1826 *et seq.*); Johannes Kepler (*Opera*, 1858–1871; GW, 1935–); A. L. Lavoisier (6 Vols., 1862–1893); C. F. Gauss (12 Vols., 1863–1933); J. L. Lagrange (14 Vols., 1867–1892); P-S Laplace (14 Vols., 1878–1912); A. L. Cauchy (26 Vols., 1882–1970); Christiaan Huygens (22 Vols., 1888–1950); René Descartes (12 Vols., 1897–1913); Galileo Galilei (20 Vols., 1890–1910); Blaise Pascal (14 Vols., 1904–1914; 1964–1992, *et seq.*); Leonard Euler (43; 72 Vols., 1909; 1911–1996); Tycho Brahe (15 Vols., 1913–1929); G-W Leibniz (1923–); Isaac Newton (7 Vols., 1959–1977); Nicolaus Copernicus (4 Vols., 1978–); Robert Boyle (1999–2000; 2001); and Albert Einstein (1987–). Similar volumes have recently appeared for Thomas Hobbes (1994), John Flamsteed (1995–2003), and John Wallis (2003 *et seq.*). Taken separately, less heroic figures have attracted scholarly interest, savants such as N-C Fabri de Peiresc (1888–1898; 1972), Marin Mersenne (1932–1986), and Henry Oldenburg (1965–1986). The *Discepoli di Galilei* (1975–1984) was designed to shed light not only on individuals but working groups. See Appendix for bibliographic details.

<sup>68</sup> On the title pages of one edition of Galilei’s works, for example, one finds in over-sized colored type the name of Benito Mussolini. In France, Philippe Tamizey de Larroque, editor of the *Lettres* of N-C Fabri de Peiresc, was a enthusiastic but unrepentant promoter of his hero, the glory of Provence.

<sup>69</sup> As an example, Johannes Kepler has two major editions dedicated to his work. Christian Frisch edited the first major edition, *Joannis Kepleri opera omnia* 8 Vols. (Frankfort and Erlangen, 1858–1871); the more recent appeared as *Gesammelte Werke* (22 Vols., Munich, 1938–). The differences are notable. As an example, Frisch presents Kepler’s letters unsystematically, sometimes appended to various parts of his relevant published works. The modern *Gesammelte Werke*, by contrast, supplies the complete text of all known correspondence organized and annotated in familiar modern format. A second example involves the *Lettres* of N-C Fabri de Peiresc. In more than one instance, the editor of Peiresc’s letters, Tamizey de Larroque, combined various versions of letters (originals, drafts, copies) in a well-meaning effort to provide a more complete text—but alas, without alerting the reader. Larroque sometimes omitted portions of Peiresc’s published letters (and on occasion entire letters) judging them “too scientific.”

<sup>70</sup> Another reviewer proclaimed the *DSB* the “greatest contribution to scholarship in the history of science of the second half of the 20th century.”

<sup>71</sup> The *DSB* was “designed to make available reliable information on the history of science through the medium of articles on the professional lives of scientists. All periods of science from classical Antiquity to modern times are represented, with the exception that there are no articles on the careers of living persons.” (Preface). *DSB* entries are signed and usually include a bibliography; geographical coverage is international, although China, India, and the Far East are not treated as extensively as others.

<sup>72</sup> The *DSB* appeared in 16 Volumes during the years 1970–1980, followed by supplements. Entries provide the subject’s birthplace and date, family information and background, education and intellectual development, treatment of growth and directions of the subject’s scientific work and scientific personality in relation to predecessors, contemporaries, and successors. Inclusive across time and space, entry length was in three categories (300–700; 700–1300; and 1300–3600 words), reflecting the individual’s contribution and influence.

<sup>73</sup> A brief survey suggests three principal concerns: thematic boundaries defining the group; inclusion criteria; and relative length of entries. As general principles, collective biography should be inclusive, symmetrical, authoritative, and where possible, based on primary sources. In practice, editors wisely supply contributors with an editorial “boiler plate” to ensure symmetry (date and place of birth and death; parents and siblings; birth order position; religion; education; publications; friends; students; appointments and honors; institutional affiliations; contemporary influence; personal finance; work habits; motives for pursuing science; etc.). One reviewer of the *DSB* suggested editors request “guideposts” to cue readers: “the subject’s most significant work is X,” or “a critical influence was Y.” Editorial decisions are particularly acute when major collective biographies (such as the *DNB* and *DSB*) are reduced to a single comprehensive volume. The *Concise Dictionary of National Biography* (Pt. 1, Oxford, 1903; 2nd Ed. 1906) consists of entries one-fourteenth the number of words from the parent edition. Entries in the *Concise Dictionary of Scientific Biography* (New York, 1981) are 10 percent the length of those in parent volumes.

<sup>74</sup> The *DSB* is currently being revised and expanded to include individuals from the 20th century and those previously omitted. The new *DSB* will be in electronic format and fully searchable.

<sup>75</sup> The *Concise DSB* contains “Lists of Scientists By Field” (749–773) which facilitates this rough estimate; arguably, a more accurate reckoning would be 500 “astronomers.”

## Conclusion

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Readers of the *BEA* will find a familiar format aimed at easy access. The only notable departure from tradition is that individual entry length shows less dramatic variation than in earlier works. With an eye toward supplying specialists and laymen with appropriate references, individual entries vary from 100 to 1500 words. Readers may note that entries for the likes of Newton and Einstein may be rivaled by less-known astronomers. The rationale is twofold: First, entry length helps rescue a number of astronomers from relative oblivion; second, it provides readers with scarce information not readily found in secondary works, sometimes not available in English or in modern languages. Major figures continue to receive substantial entries but with less lengthy largesse. This strategy also reflects the wider availability of source material for major figures.

As we look to the past, collective biography has not only proven adaptable to changes in historical writing, it has been central to the story from the start. Like other forms of scholarship, individual works of collective biography will continue to be judged by their rigor, utility, and scholarly merit. But while readers have come to expect increasingly higher levels of expertise, inclusion, and ease of access, most modern readers remain curiously consistent—even old fashioned—in their expectations about biography. As in the past, readers will continue to appreciate an appropriate anecdote, particularly if it puts a face on a thought or makes a life and career more coherent. In the end, the lives of scientists are human lives, and if *biography* is about an individual life, *collective biography* is about *forms of life*. Biography, like astronomy, has a long and rich tradition. It tells the story of forgotten constellations; it contemplates patterns of human achievement and human aspiration. Those now distant worlds—puny and brief—seem no less majestic, no less alluring.

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## Appendix

### Reference and Research Resources

This list of biographical sources is suggestive, not exhaustive. It aims to provide selected sources that may be useful for identifying biographical sources in the history of astronomy and cosmology. Additional detailed research can be pursued by means of specialized scholarly studies found in the second section, which includes the complete works, correspondence, and cumulative bibliographies of noted figures. For further information on biographical reference sources, see Robert B. Slocum. *Biographical Dictionaries and Related Works: An International Bibliography of Approximately 16,000 Collective Biographies*, 2 Vols., 2nd ed., Detroit, 1986.

### Selected Reference Sources

- ADB** (*Allgemeine Deutsche Biographie*). 56 Vols., Leipzig, 1875–1912; reprinted Berlin, 1967–1971.
- ANB** (*American National Biography*). 24 Vols., Oxford University Press, 1999.
- AMWS** (*American Men and Women of Science: A Biographical Directory*). New York, 1906–. (Prior to 12th edition (1971) entitled *American Men of Science*).
- AO** (*Athenae Oxonienses*), A New Edition. A facsimile of the London edition of 1813, Anthony Wood, 4 Vols., Reprint, New York and London, 1967.
- B-DH** (*Dictionnaire historique et critique*), Pierre Bayle, 4 Vols., Rotterdam, 1720.
- BDAS** (*Biographical Dictionary of American Science: The Seventeenth Through the Nineteenth Centuries.*), edited by Clark A. Elliott, Westport, 1979.
- BDS** (*Biographical Dictionary of Scientists*), 3rd ed., edited by Roy Porter and Marilyn Bailey Ogilvie, 2 Vols., New York, 2000.
- BGA** (*Bibliographie générale de l'astronomie*), edited by J.C. Houzeau de Lehaie and A.B.M. Lancaster, 3 Vols., Brussels, 1887–1889.
- BK** (*Bibliografia Kopernikowska 1509–1955*), edited by Henryk Baranowski, Reprint, New York, 1970.
- BLH [P]** (*Biographisch-literarisches Handwörterbuch zur Geschichte der exakten Wissenschaften.*), edited by J. C. Poggendorff, Leipzig and Berlin, 1863–1926. Band VIIa -Supplement. Berlin, 1969.
- BNB** Académie Royale de Belgique. (*Biographie Nationale Belgique*), 20 Vols., Brussels, since 1866–.
- BU** (*Biographie Universelle, Ancienne et Moderne*) ou (*Histoire, par ordre alphabétique : de la vie publique et privée de tous les hommes qui se sont fait remarquer par leurs écrits, leurs actions, leurs talents, leurs vertus ou leurs crimes.*), J-F Michaud, 85 Vols., in 45 Vols. Paris: Michaud Frères, 1811–1862. *Second, revised edition.* (variants)
- BWN** (*Biographisch Woordenboek der Nederlanden*), 21 Vols., Haarlem, 1852–1878.
- CBD** (*Chambers' General Biographical Dictionary*), 32 Vols., London, 1812–1817 (1984)
- CA** (*Alumni Cantabrigienses: A Biographical List of All Known Students, Graduates and Holders of Office at the University of Cambridge to 1900*), J. Venn, 10 Vols., Cambridge University Press, Cambridge, 1922–1954.
- DAB** (*Dictionary of American Biography*), 20 Vols., New York, 1928–1936; reprinted in 10 Vols. with supplements, New York.
- DBF** (*Dictionnaire de Biographie Française*), edited by J. Balteau et al., with supplements, Paris, 1932–.
- DBI** (*Dizionario Biografico Degli Italiani*) (currently 59 Vols., Rome, 1960–).
- DNB** (*Dictionary of National Biography*), edited by Sir Leslie Stephen et al., 72 Vols., 1885–1912 (1964); See **ODNB** below.
- DSB** (*Dictionary of Scientific Biography*). Charles Scribner's Sons, New York, edited by Charles Coulston Gillispie (Vols. I–XVI) and Frederic L. Holmes (Vols. 17–18). (Volumes I–XIV: 1970–1976; Volume XV: *Supplement I*, 1978; Volume 16: *Index*, 1980; Volumes 17–18: *Supplement II*, 1990.)
- EC** (*Encyclopedia of Cosmology*), edited by Norris S. Hetherington, New York, 1993.
- FS** (*Les Femmes dans la Science*). Notes Recueillies by Alononse Rebiere, 2nd Edition, Paris, 1897.
- G-HC** (*A Historical Catalogue of Scientific Periodicals*) (1665–1900), New York, 1985.
- HEA** (*History of Astronomy: An Encyclopedia*), edited by John Lankford, New York, 1997.
- ICB** (*ISIS Cumulative Bibliography*). A Bibliography of the History of Science formed from *ISIS Critical Bibliographies* 1–90, 1913–1965, Vols., 1–2 (Personalities). London, 1971, et seq. (*Critical Bibliographies* 1–90 (1913–1965), 6 Vols.; 91–100 (1966–1975), 2 Vols.; 101–110 (1976–1985), 2 Vols.; (1986–1995), 4 Vols.
- M** (*Biographie universelle ancienne et moderne*, publiée par Michaud), Joseph-François Michaud, Paris, 1810–1828, 52 Vol. in-8, plus 32 Vols. supplément.
- ML** (Louis Moréri, *Le grand Dictionnaire historique, ou le mélange curieux de l'histoire sacrée et profane*), Lyon, 1671 et seq.
- N** (Jean-Pierre Nicéron, *Mémoire pour servir à l'histoire des hommes illustres dans la République des Lettres, avec un catalogue raisonne de leurs ouvrages*), 43 Vols., Paris, 1727–1745.
- NBG** (*Nouvelle Biographie Générale, Depuis les temps les plus reculés jusqu'à nos jours*), 46 Vols. in 24, Paris: Firmin Didot, 1853–66, edited by F. Hoeffer, variants.
- NBU** (*Nouvelle Biographie Universelle*) (title variants) 46 Vols., Paris, 1852–1866; reprinted in 23 Vols., Copenhagen, 1963–1969.
- NDB** (*Neue Deutsche Biographie*), edited by Historischen Kommission of the Bayerischen Akademie der Wissenschaften, 7 Vols., et seq., Berlin, 1953–.
- ODNB** (*Oxford Dictionary of National Biography*), 61 Vols., Oxford, 2004.
- P-BLH** (*Biographisch-literarisches Handwörterbuch der exakten Naturwissenschaften*), Johann C. Poggendorff et al., Leipzig: Barth, 1863–1904; Leipzig, 1925–1940; Berlin, 1955–. (Variant titles), Reprinted: Band 1–6, to 1931. Ann Arbor, 1945.
- RS** (Royal Society of London, *Catalogue of Scientific Papers, 1800–1900*). London, 1867–1902; Cambridge, 1914–1925, 19 Vols.
- SBB** (*Scientists since 1660: A Bibliography of Biographies*), edited by Leslie Howsam, Brookfield, Vermont, 1997.
- SCB-1** (*A Short-title Catalogue of Books printed in England . . . 1475–1640*), edited by A.W. Pollard and G.R. Redgrave, London, 1926.
- SCB-2** (*Short-title Catalogue of Books printed in England . . . 1641–1700*), edited by D.G. Wing, 3 Vols., New York, 1945–1951.
- W-BD** (*The Biographical Dictionary of Women in Science*), edited by Marilyn Ogilvie and Joy Harvey, 2 Vols., New York and London, 2000.
- WS** (*Women in Science, Antiquity through the Nineteenth Century: A Biographical Dictionary with Annotated Bibliography*), edited by Marilyn Bailey Ogilvie. Boston, 1986.
- WS-A** (*American Women in Science: A Biographical Dictionary*), edited by Martha J. Bailey, Santa Barbara, 1994.
- WSI** (*Women Scientists From Antiquity to the Present: An Index*), edited by Caroline L. Herzenberg, West Cornwall, CT, 1986.



## Selected Research Sources

- AO** (*Oeuvres complètes de d'Alembert*), Alembert, Jean Le Rond d', Paris, 1821–1822, Reprint 1967.
- AOP** (*Oeuvres philosophiques, historiques et littéraires de d'Alembert*), Alembert, Jean Le Rond d', 18 Vols., Paris, 1805.
- BBO** (*Jacobi Bernoulli, Basileensis, Opera*), Jacob Bernoulli, (1654–1705), 2 Vols., Geneva, 1744.
- BF-W** (*Works of Francis Bacon*), Francis Bacon, edited by J. Spedding, R.C. Ellis, and D.D. Heath, 14 Vols., London, 1857–1874.
- BRC** (*The Correspondence of Robert Boyle*), Robert Boyle, edited by Michael Hunter, Antonio Clericuzio, and Lawrence M. Principe, 6 Vols., London, 2001.
- BRW** (*The Works of Robert Boyle*), Robert Boyle, edited by Michael Hunter and Edward B. Davis, Pickering and Chatto Ltd, 14 Vols., London, 1999–2000.
- BRW-B** (*The Works of the Honourable Robert Boyle*), To which is prefixed The Life of the Author, Robert Boyle, edited by Thomas Birch, 5 Vols., in folio, London, 1744; "A New Edition," 6 Vols., London, 1772.
- C** (*Nicholas Copernicus' Complete Works*), Nicolas Copernicus, edited by Jerzy Dobrzycki, translation and commentary by Edward Rosen, 4 Vols., London and Basingstoke, 1978–.
- CC** (*Carteggio*), Bonaventura Cavalieri, edited by Giovanna Baroncelli, Florence, 1987.
- COO** (*Opera Omnia*), Girolamo Cardano, 10 Vols., Reprint, New York and London, 1967.
- DC** (*Correspondance*), René Descartes, edited by Charles Adam and Gaston Milhaud, 8 Vols., Paris, 1936–1963.
- DGG** (*Le Opere dei Discepoli di Galileo Galilei*), Carteggio, Edizione Nazionale, Vol. 1 (1642–1648), Vol. 2 (1649–1656), edited by Paolo Galluzzi and Maurizio Torrini, Florence, 1975, 1984.
- DO** (*Oeuvres de Descartes*), René Descartes, edited by Charles Adam and Paul T. Tannery, 13 Vols., 1897–1913.
- DSP** (*Scientific papers*), George Howard Darwin, Cambridge, 1907–1916.
- EC** (*Correspondance mathématique et physique de quelque célèbres géomètres du XVIII<sup>ème</sup> siècle*), Leonard Euler, edited by P.H. Fuss, 2 Vols., St. Petersburg, 1843.
- ECP** (*The Collected Papers of Albert Einstein*), Princeton University Press, Princeton, 1987–.
- EO** (*Leonhardi Euleri Opera Omnia*), Leonard Euler, edited by Charles Blanc, Asot T. Grigorijan, Walter Habicht, Adolf P. Juskevici, Vladimir I. Smirnov, Ernst Trost, 3 Vols. Basil, 1975 (1911).
- EO-2** (*Leonhardi Euleri Opera Omnia*), *Series prima* (*Opera mathematica*, 29 in 30 Vols.), *Series secunda* (*Opera mechanica et astronomica*, 31 in 32 Vols.), *Series tertia* (*Opera physica et Miscellanea*, 12 Vols.), *Series quarta A* (*Commercium epistolicum*, 9 Vols.), and *Series quarta B* (*Manuscripta*, approx. 7 Vols.), Basel, Birkhäuser, 1911–1996.
- ESO** (*Early Science in Oxford*), edited by R.T. Gunther, 14 Vols., Oxford, 1923–1945.
- FGL** (*The Gresham Lectures of John Flamsteed*), John Flamsteed, edited by Eric G. Forbes, London, 1975.
- FO** (*Oeuvres de Fermat*), Pierre Fermat, edited by Paul Tannery, Charles Henry, and Cornelis de Waard, 5 Vols., Paris, 1891–1922.
- FOM** (*Varia opera mathematica D. Petri de Fermat / accesserunt selectae quaedam ejusdem epistolae, vel ad ipsum a plerisque doctissimis viris Gallice, Latine, vel Italice, de rebus ad mathematicas disciplinas, aut physicam pertinentibus scriptae*), Pierre Fermat, Toulouse, 1679.
- GAC** (*Amici e corrispondenti di Galilei*), Galileo Galilei, edited by Antonio Favaro, with introductory notes by Paolo Galluzzi, 3 Vols., Florence (reprinted) 1983.
- GGO** (*Le Opere di Galileo Galilei*), Galileo Galilei, Edizione Nazionale, edited by Antonio Favaro, 20 Vols., Florence, 1890–1939.
- GOO** (*Petro Gassendi, Opera Omnia, hactenus edita auctor ante obit recensuit*), Pierre Gassendi, edited by H.L. Habert de Montmor and F. Henry, 6 Vols., Lyon, 1658–1675.
- HC** (*The Correspondence of Thomas Hobbes*), 2 Vols., Oxford, 1994.
- HCP** (*Correspondence and papers of Edmond Halley*), Edmond Halley, Oxford, 1932.
- HD** (*The Diary of Robert Hooke MA., M.D., F.R.S. 1670–1680*), Robert Hooke, London, 1935.
- HEW** (*The English Works of Thomas Hobbes of Malmesbury*), Thomas Hobbes, edited by Sir William Molesworth, 11 Vols., London, 1839–1845.
- HOC** (*Oeuvres Complètes de Christiaan Huygens*), Christiaan Huygens, publiées par la Société Hollandaise des Sciences, 22 Vols., The Hague, 1888–1950.
- HP** (*The Hartlib Papers*), Samuel Hartlib, The Hartlib Project, directed by Michael Leslie, Mark Greengrass, Michael Hannon, Patrick Collinson, with assistance from Timothy Raylor, Judith Crawford and others, University of Sheffield. (CD-ROM edition)
- IB** (*Institut de France: index biographique des membres et correspondants de l'Académie des Sciences de 1666 a 1954*), Institute de France, Gauthier-Villars, Paris, 1954.
- IBAC** (*Académie des sciences. Index Biographique des Membres et Correspondants de l'Académie des Sciences*), Paris, 1968.
- KA** (*Joannis Kepleri astronomi opera omnia*), Johannes Kepler, edited by Christian Frisch, 8 Vols., Frankfurt, 1858–1871.
- KGW** (*Gesammelte Werke*), edited by Walther van Dyck, Max Caspar, and Franz Hammer. Munich, 1937–.
- L** (*The Correspondence of John Locke*), John Locke, edited by E.S. de Beer, 8 Vols., Oxford, 1976–1989.
- L-CII** (*Carteggio Linceo*), 3 parts, *Atti della Reale Accademia Nazionale dei Lincei, Memorie della Classe di Scienze Morali, Storiche e Filologiche (Part I anni 1603–1609)* pp 1–120, (*Part II, anni 1610–1624, Sezione I*, 1610–1615) Vol. 7, 1938 (XVI), pp 123–535; *Part II, Sezione II (anni 1616–1624)*, pp 537–993; *Part III (anni 1621–1630)*, pp 999–1446.
- L-PG** (*The Lives of the Professors of Gresham College*), John Ward, London, 1740; Reprint, New York and London, 1967.
- LBO** (*Bibliographie des Oeuvres de Leibniz*), edited by Emile Ravier, Hildesheim, 1966.
- LCC** (*Catalogue critique des manuscrits de Leibniz*), Gottfried Wilhelm Leibniz, edited by A. Rivaud, Poitiers, 1914–1924.
- LMN** (*Mathematischer Naturwissenschaftlicher und Technischer Briefwechsel*), Gottfried Wilhelm Leibniz, 2 Vols., (1663–1683) Berlin, 1976–1987.
- LO** (*Oeuvres de Lagrange*), Joseph-Louis Lagrange, Paris, 1867–1892. Also, *Oeuvres*, Paris, 1973.
- LOC** (*Oeuvres complètes*), Pierre-Simon Laplace, 14 Vols., Paris, 1878–1912.
- LR** (*Register zu Gottfried Wilhelm Leibniz Mathematische Schriften und Der Briefwechsel mit Mathematikern*), Gottfried Wilhelm Leibniz, edited by Joseph Ehrenfried Hofman, Hildesheim and New York, 1977.
- LSB** (*Samtliche Schriften und Briefe*), Gottfried Wilhelm Leibniz, Damstadt, Leipsig, Berlin, 1923–.
- LUI** (*Lettre inedite di uomini illustri*), edited by Angelo Fabroni, 2 Vols., Florence, 1773 and 1776.
- MAS** (*Mémoires de l'Académie Royale des sciences depuis 1666 jusqu'à 1699*), 9 Vols., Paris, 1729–1732.
- MC** (*Correspondance du P. Marin Mersenne*), P. Marin Mersenne, edited by Paul Tannery, Cornelis de Waard, and Armand Beaulieu, 16 Vols., Paris, 1932–1986.
- M-CL** (*Collected letters of Colin MacLaurin*), Colin MacLaurin, Nantwich, Cheshire, England, 1982.

- MCL** (*Carteggio Magliabechi, Lettere di Borde, Arnaud e associati Lionesi ad Antonio Magliabechi (1661–1700)*), Antonio Magliabechi, edited by Salvatore Ussia, Florence.
- MO** (*Oeuvres de Malebranche*), Nicolas de Malebranche, Vols. 18–19, (*Correspondance actes et documents*), edited by André Robinet, Paris, 1978.
- MP** (*The Mathematical Practitioners of Tudor & Stuart England*), E.G.R. Taylor, Cambridge, 1954.
- MP2** (*The Mathematical Practitioners of Hannoverian England*), E.G.R. Taylor, 1714–1840, Cambridge, 1966.
- MPBS** (*Manuscript Papers of British Scientists, 1600–1940*), London, 1982.
- NC** (*The Correspondence of Isaac Newton*), Isaac Newton, edited by H.W. Turnbull, J. F. Scott, and A. Rupert Hall, Cambridge, 7 Vols., 1959–1977.
- NMP** (*The Mathematical Papers of Isaac Newton*), Isaac Newton, edited by Derek T. Whiteside, 8 Vols., Cambridge, 1967–1981.
- OC** (*The Correspondence of Henry Oldenburg*), Henry Oldenburg, edited by A. Rupert Hall and Marie Boas Hall, 9 Vols., Madison, 1965–1973; Vols., 10 and 11, Mansell, London, 1975–1977; Vols., 12–13, Taylor and Francis, 1986.
- P-C** (*Les Correspondants de Peiresc, Lettres inédites*), Nicolas-Claude Fabri de Peiresc, 2 Vols., Reprint, Geneva, 1972.
- P-L** (*Lettres de Peiresc*), Nicolas-Claude Fabri de Peiresc, edited by Philippe Tamizey de Larroque, 7 Vols., Paris, 1888–1898.
- PDC** (*Diary and Correspondence of Samuel Pepys, F.R.S.*), Samuel Pepys, edited by Richard Braybrooke, 4 Vols., London, 1848–1849.
- PHI** (*Les Hommes illustres qui ont paru en France pendant le XVIIe siècle*), Charles Perrault, 2 Vols., Paris, 1696–1700.
- PO** (*Oeuvres de Blaise Pascal*), Blaise Pascal, edited by Leon Brunschvicg, Pierre Boutroux, and Felix Gazier, 14 Vols., Paris, 1908–1914.
- POC** (*Oeuvres complètes*), Blaise Pascal, preface by Henri Gouhier, notes by Louis Lafuma, editions du Seuil, Paris, 1963.
- PT** (*Philosophical Transactions: giving some Accompt of the present Undertakings, Studies and Labours of the Ingenious in many considerable parts of the World*), edited by Henry Oldenburg, London and Oxford, 1665–1677.
- S-C** (*The Correspondence of Spinoza*), Benedict de Spinoza, edited and translated by Abraham Wolf, London, 1928.
- S-OP** (*Opera Posthuma*) Benedict de Spinoza, edited by J. Jellis, Amsterdam 1677; Dutch edition, *Die nagelate Schriften van B. d. S.* (n.p., 1677).
- SS** (*The Principal Works of Simon Stevin*), Simon Stevin, edited by E.J. Dijksterhuis, D. J. Struik, A. Pannekoek, Ernst Crone, and W.H. Schukking, 4 Vols., Amsterdam, 1955–1964.
- TBO** (*Tychonis Brahe Dani Opera Omnia*), Tycho Brahe, edited by J.L.E. Dreyer, 15 Vols., Copenhagen, 1913–1929.
- TO** (*Opere di Evangelista Torricelli*), Evangelista Torricelli, edited by Gino Loria and Giuseppe Vassura, 4 Vols., in 5 pts, Faenza, 1919–1944.

# Geographical Place Names in Biography Headers

Birth and death places are given as [city], [country] when well known, *e. g.*, London, England and Rome, Italy. Lesser-known places are often accompanied by regional/provincial/county/state names, *e. g.*, Beverley, Humberside, England and Lusigny, Aube, France. States in the USA, Canadian provinces, and Australian states are included.

All place names are given as they are found on current maps. Where city names have changed historically, the modern version follows the original within parentheses, *e. g.*, Constantinople (Istanbul, Turkey) and Pitschen (Byczyna, Poland). In cases where cities have disappeared, the nearest modern place is given, *e. g.*, Colophon (near Selcuk, Turkey).

Regional/provincial/county/state names as well as country names are placed within parentheses if they did not exist at the time of the subject's birth or death. Place names are given in the original language except where common English versions exist, *e. g.*, Milan, Germany, Bavaria, Tuscany, Munich, *etc.*

Richard A. Jarrell