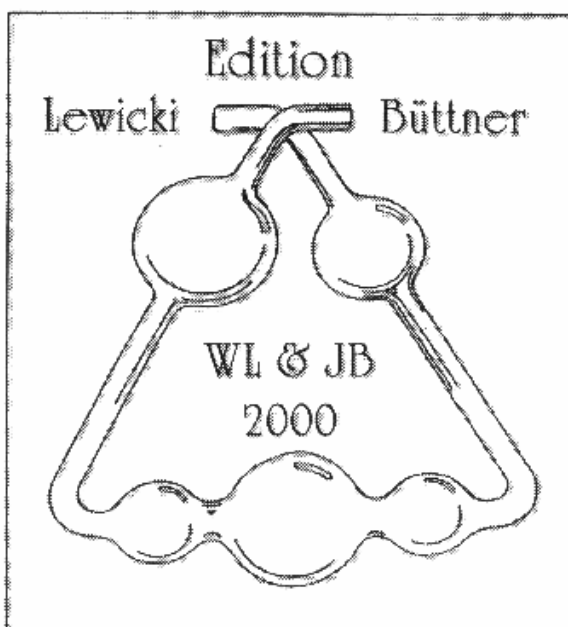


## **The Life and Work of Friedrich Wöhler**

**Edition Lewicki-Büttner. Volume 2**  
Johannes Büttner, Editor

**Robin Keen, The Life and Work of Friedrich Wöhler**  
**(1800 – 1882)**



**The Life and Work of Friedrich Wöhler  
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**by**

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## FOREWORD

### Examining Wöhler

Unlike Liebig, Wöhler only visited Britain once, in August 1835. Unfortunately few details of his journey and impressions have survived, other than his awe and amazement at seeing and travelling on a steam train for the first time from Liverpool to Manchester. Faraday, who did not meet Liebig until 1837, later told Hofmann that when Wöhler called on him at the Royal Institution in London he initially assumed that he must be talking to Wöhler's son, so youthful was his appearance. Wöhler's lifelong youthfulness and vitality is, perhaps, the abiding impression that the historian retains of Wöhler, and it is certainly the memory the reader will have after reading Robin Keen's detailed study of his career.

It was my friendship with Dr William A. Smeaton (1925-2001), Reader in the History of Chemistry at University College, London, that first brought me into contact with the author of this monograph in the mid-1960s. As a young lecturer in the History of Science at the University of Leicester, it was a great honour in 1964 to be asked to be the external examiner for Keen's Master's dissertation on Karl Friedrich Mohr's contributions to volumetric analysis. It must have been one of my earliest experiences of oral examining – a British university ritual to ensure that higher degrees are awarded in a uniform fashion throughout the university system. In 1968, Smeaton persuaded me to take on the editorship of *Ambix*, the well-established academic journal for the publication of research in the history of chemistry, and I soon found myself being regularly called upon to examine doctoral theses in the subject. It was consequently no surprise when, in 1976, Smeaton again invited me to examine Keen's doctoral thesis on Friedrich Wöhler, for which he had been the supervisor or *Thesisvater*. It was surprising to learn 25 years later that Dr Keen had preserved Smeaton's and my comments at this oral examination. They have proved useful in lightly amending the text.

Although first written in the mid-1970s, Keen's study remains the most detailed critical analysis of Wöhler's work and of his relationships with his European contemporaries in existence. Unlike these contemporaries, such as Berzelius, Mitscherlich, Dumas and, especially, Liebig, Wöhler has not attracted much attention by historians of chemistry. This is certainly not because he was obscure and unimportant, but has more to do with the fact that Wöhler was essentially an empirical chemist who avoided theory and controversy and who preferred the dim light rather than the limelight sought by his great friend Liebig. Consequently, although historians have done a good deal of work since the 1970s on the development of nineteenth-century atomic and molecular theory, and on the theoretical controversies in organic chemistry, little of it has affected our interpretation of Wöhler's activities. Chemistry is above all an empirical science, and although it may be more exciting to investigate controversial theoretical developments, the basic practical laboratory work that lies behind such events cannot be neglected. Dr Keen's study provides a notable model of a chemist whose life was primarily experienced in the smelly and tactile world of the laboratory.

While Wöhler's contributions to the development of chemistry were not unimportant (as Keen's study makes abundantly clear), his central significance in the history of chemistry has always been that he acted as mirror to the activities and opinions of his friends Berzelius and Liebig. How much less we would have known about these two colossi of nineteenth-century chemistry if Wöhler had not been their regular correspondent and confidant? Dr Keen rightly makes considerable use of the letters exchanged between Wöhler, Berzelius and Liebig – that of master and pupil in the case of Berzelius, and of intimate friend and collaborator in the case of Liebig. Indeed, one of the considerable merits of the original thesis was that it made available in English some of the dramatic contents of these letters for readers whose knowledge of German was poor or non-existent. This advantage is even more the case in the 21<sup>st</sup> century when English has become the international language of scholarship and only specialist historians now read German. Although the historian may investigate the “public science” of an era



through the published records of scientists and the institutions they served, a real understanding of science can only be captured through the intimate exchange of thoughts to be found in the correspondence of the protagonists.

In publishing Dr Keen's thesis for the first time, references to later relevant publications by other historians have been made at appropriate points for the convenience of the contemporary reader. There have, inevitably, been shifts in the historiography of the history of science since the 1970s. At the time when Dr Keen was conducting his research, historians of science usually had strong scientific backgrounds, which they actively deployed in interpreting the internal history of a discipline. Since the 1970s, historians of science have become much more concerned with the social history of science, that is, with the social and cultural contexts in which science was practised. Were I examining Dr Keen's thesis today, I would therefore expect some attention to have been paid to Wöhler's role in the professionalization of German chemistry and of his place in the development of the University of Göttingen as a centre of scientific research. The absence of these subjects in the book is not, however, a matter for criticism, but a reflection of the way that historians continually change their perspectives. Dr Keen's book provides a solid rock on which younger historians will build other images of Wöhler – for example, as an active member of the Akademie der Wissenschaften in Göttingen. And although we shall undoubtedly learn a good deal more about Wöhler's opinions and activities when the complete unexpurgated edition of the Liebig-Wöhler correspondence is published by Professor Christoph Meinel, it is unlikely to alter Keen's detailed analysis of Wöhler's chemical publications.

When, in 1835, Faraday wrote introductions for Wöhler to visit London gas and glass works, and to visit a copper smelting plant in South Wales, he referred to him as “a chemical philosopher of great eminence from the continent”. At that time Wöhler still had nearly fifty years of activity ahead of him as a chemistry teacher and researcher. Wöhler refuses to be categorised as an inorganic, organic or physical chemist.

Keen's book captures the polymathic range of Wöhler's interests in the amazing sensual world of chemical phenomena and shows why he is remembered as one of the great chemical philosophers of the nineteenth century.

William H. Brock

## EDITOR'S PREFACE

Edition Lewicki-Büttner was established in 2000 on the initiative of Wilhelm Lewicki in order to publish scientific monographs and collected essays primarily devoted to the history of chemistry and related subjects.

The second volume of the series makes available a detailed account of the life and scientific work of the chemist Friedrich Wöhler, who produced important work in all fields chemistry. A lifelong friendship bound him to Liebig. Hitherto Wöhler's life and work has been described in shorter biographical works only. A more extensive representation existed only in the thesis of Dr. Robin Keen, which was developed under the guidance of the chemistry historian William Arthur Smeaton in the Department of History and Philosophy of Science at the University College London. Hitherto this thesis was only available in few typewritten copies and had no wide distribution. Fortunately, the chemistry historian William Hodson Brock who was involved in the PhD exam of Robin Keen, agreed to participate as an advisor in a new printed edition of the thesis. Thus the plan was developed with the active collaboration of the author to edit the thesis thoroughly and to publish it as book in the Edition Lewicki-Büttner.

For the new edition, William Brock and the editor have meticulously reviewed the text. Emphasis was placed upon extending the already extensive documentation of the scientific literature. Important new publications about Wöhler and his scientific work were added. These additions have been incorporated in the text and marked as "addenda".

The representation of chemical formulas was very different at the beginning of the nineteenth century. At first they were usually written according to the suggestions of Jöns Jacob Berzelius. Around the middle of the century, Justus von Liebig among others introduced modifications, from which the notation used today originated. In the

original thesis these formula notations were drawn by hand. In the text now made available all the formulas are printed by a computer program.

A special weight was attached to the provision of a complete list of Wöhler's publications. The original list in the thesis was based on the bibliography published by August Wilhelm von Hofmann after the death of Wöhler. The appendix listing Wöhler's books, publications in scientific periodicals and translations is now twice as extensive as before and is, for the first time practically complete. All of the citations of publications by Wöhler and other authors in the footnotes were also checked and expanded where necessary. The complete titles of books and papers, which were not always present in the original thesis, have been given and all the bibliographical data presented in a uniform format. Periodical titles have been given in full, rather than in the abbreviated form used in nineteenth-century citations that frequently makes titles hard to find.

Identification of primary and secondary literature written by authors other than Wöhler is facilitated by a "General Bibliography", which is arranged in alphabetical order after the authors' name. In the footnotes, short biographic notes can be found in some places. The person and subject indexes provided will serve to provide a better and quicker access to the text than in the original thesis. In the index of personal names all "historical" subjects are cited with their correct first name as well as – if known – their dates of birth and death.

The appendix also includes a list of the Wöhler's Göttingen students, compiled by Dr. Günther Beer, Göttingen. At the present time there seems to be no way of compiling a list of Wöhler's students during his stay in Berlin and Kassel.

The author and editor hope that the publication of the work with its improvements and additions will help in making the life and work of Wöhler known to a wider audience.

Johannes Büttner

## Acknowledgments

The editor thanks Dr. Robin Keen for the willingness to make his thesis about Friedrich Wöhler available for printing in an edited form in the edition Lewicki-Büttner.

Prof. Dr. William H. Brock has very meticulously reviewed the manuscript and done a number of suggestions for improvement. He is very cordially thanked.

Mrs Loretta Lewicki has taken on and supported the continuation of the edition Lewicki-Büttner actively after the death of her husband in 2001. She has contributed in various ways that the support of chemistry-historical work started by her husband can be continued. The editor is very grateful for this.

Dr. Günther Beer has helped the editor in various ways with his precise knowledge of the history of chemistry in Göttingen, especially in the clarification of difficult biographical and bibliographical questions. He has compiled the list of the Wöhler's students in Göttingen through extensive work in the university archives.

The editor also thanks the staff of the Library of the University Medical School in Hannover for their sedulous and energetic help in obtaining the scientific literature used in this book.

Johannes Büttner

## AUTHOR'S PREFACE

But for the constant support of Dr W.A. Smeaton ("Bill" to his many friends) this thesis would not have been begun and certainly never been finished. As Reader in the Department of History and Philosophy of Science at University College London he encouraged many part-time students through the Master of Science degree, which involved a serious dissertation (mine was on Karl Friedrich Mohr, 1806-1879) and on to Ph.D. theses. Bill had a genius for constructive criticism which often caused me to revise heavily work in progress but always left me enthused to carry on rather than discouraged. This, combined with his grasp of detail, the high repute of his own research, plus a mischievous chuckle, made him an inspiring teacher. He died in 2001 but a seminar group which he founded in the 1960's still meets socially once a year.

Part-time students rely directly or indirectly on the tolerance and help of many supporters. In 1976, before word-processing, Cynthia Myers heroically typed up my scribble; my wife Joan Keen helped with the drafting (and this revision); Jenny Keen proof-read and John Keen managed the verbal unit total. Perhaps as a derivative of this exposure to chemical history both Jenny and John have moved on to higher academic life.

The text of the original thesis and many of the references have been much improved by Dr William Brock's close re-reading and line-by-line review. Study of the history of science has somewhat changed direction in the past thirty years. To encompass the fascinating economic, philosophical, sociological and psychological insights into the processes of science gained by modern historians would have meant a complete rewrite and this has not been attempted. Dr Brock's fine biography of Liebig would be a good starting point for anyone looking for a wider view of the period. While writing the thesis I became increasingly aware that nineteenth century chemistry was a pan-European activity with contributors from Dublin to St Petersburg learning from each other, quarrelling, making alliances, moving forward

(or at least sideways) together: nation states are now doing much the same!

Professor Dr. Dr. Johannes Büttner has been a most meticulous and expert editor. If any errors remain they are of course mine but I am truly grateful for his thoroughness. Furthermore, from his writings I can see that the thesis could have made much more reference to clinical chemistry. Wöhler did, after all, remain a member of the medical faculty at Göttingen.

I met Wilhelm Lewicki only twice but could not fail to notice his friendliness, enthusiasm, energy and generosity. For the Liebig-Wöhler-Friendship-Prize and the opportunity to visit Göttingen in 2001 I am most grateful.

Thanking some students who had written to him fifty years after the urea synthesis Wöhler remarked that he rejoiced in the progress of younger chemists “and like an old coachman who can no longer travel, I love to hear the whipcracks of younger men”. This reflects exactly my respect for the new generation of historians who are doing so much to illuminate the paths scientists have travelled.

London 2004

Robin Keen



### Friedrich Wöhler

Engraving by Conrad Cook of a painting by Conrad l'Allemand (about 1841). Printed by William Mackenzie, Glasgow, Edinburgh, London & New York.



## CHAPTER 1. Sources

The principal sources of information about the life and work of Friedrich Wöhler are as follows:

1. Friedrich Wöhler died on 23<sup>rd</sup> September 1882 and August Wilhelm v. Hofmann<sup>1</sup> published before the end of the year a 147-page obituary and a 27-page list of his published papers and books. Hofmann had access to some of the letters that had passed between Wöhler's friends and his family. Since Wöhler was 82 years old when he died there were few people alive who knew or could remember him during his younger creative period, and hence Hofmann is reliable for Wöhler's later years but was not particularly well placed to review the significance of work carried out in the 1820's. Under the circumstances of publication this biography could hardly be critical, and Hofmann tends to err well on the side of eulogy. [The editor of this book has prepared a nearly complete list on Wöhler's publications (see: Appendix)].

2. In 1949 Johannes Valentin published a short book<sup>2</sup> on Friedrich Wöhler as one of a series on great scientists. This is a semi-popular biography, without footnotes or references, and the emphasis is on Wöhler the man rather than on Wöhler the chemist. Valentin had access to some family papers and to the published letters: the book is very

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1 Hofmann, A.W.: Zur Erinnerung an Friedrich Wöhler. Berichte der Deutschen Chemischen Gesellschaft 15 (1882), p. 3127-3290 [reprinted in: Wöhler, F.: Nachdruck der Aufsätze: August Wilhelm v. Hofmann 'Zur Erinnerung an Friedrich Wöhler' und Friedrich Wöhler 'Jugenderinnerungen eines Chemikers' aus den Berichten der Deutschen Chemischen Gesellschaft zu Berlin von 1882 und 1872. Georg Schwedt [Hrsg.]. Goltze-Druck: Göttingen, 1982 (original pagination). Hereinafter cited as: Hofmann, Wöhler.

2 Valentin, J.: Friedrich Wöhler. Stuttgart: Wissenschaftliche Verlagsgesellschaft, 1949 (Grosse Naturforscher, 7).

useful for biographical details and there are eight illustrations but it does not contain any critical review of Wöhler's chemical work.

3. In 1902, to celebrate the centenary of Wöhler's birth, the Göttingen Academy of Science published the copious correspondence<sup>3</sup> that had taken place between Wöhler and Berzelius from 1823 till Berzelius's death in 1848. Wöhler collected all Berzelius's letters together and left them to the Swedish Royal Academy of Science on the condition that they should not be opened until January 1<sup>st</sup> 1900. Berzelius's widow had already given Wöhler's letters to the Academy. Berzelius's letters were translated into German for publication; Wöhler's daughter, Emilie, copied and put into order her father's letters. The production was scholarly, with footnotes and detailed cross references. There are hardly any references to letters that prove to be missing, and internal evidence suggests that the correspondence must be close to complete. The publishers state that Wöhler censored certain very personal passages and that after the passage of half a century since Berzelius's death few can take offence at what remains of Berzelius's sharp remarks about the personalities of his day. They also found it necessary to strike out certain passages which by the standards of 1901 were felt to be embarrassing comments on personal relationships, dotted lines indicating where passages had been deleted. Besides these reservations the printed text of Wöhler's letters is said to be exactly as written and Berzelius's letters are said to be an exact translation.

Correspondence with the Librarian of the Royal Swedish Academy of Sciences<sup>4</sup> shows that:

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3 Wallach, O.: Briefwechsel zwischen J. Berzelius und F. Wöhler. Königliche Gesellschaft der Wissenschaften zu Göttingen. O.Wallach [Hrsg.], J.von Braun [Komment.]. Leipzig: Engelmann, 1901. 2 vols. [Reprint: Vaduz/Liechtenstein: Sändig Reprint Verlag, 1984]. Hereinafter cited as: Wallach, Briefwechsel Berzelius-Wöhler.

4 I am grateful to C. Wijkström of the library staff. [The nature of course language used in the deleted passages can be gathered from Bernhard, C.G.: Through France with Berzelius: Live Scholars and Dead Volcanoes. Oxford: Pergamon Press, 1989].

- (i) 275 out of 278 letters from Wöhler are represented in Otto Wallach's publication; the other three letters were unknown in 1901 and have since been published.
- (ii) Berzelius's letters have disappeared.
- (iii) A sample of dotted line passages, checked by the librarian in Wöhler's original letters, shows that the passages do not relate to any chemical matters.

It can thus reasonably be assumed that the correspondence as published is an accurate record of what passed between Wöhler and Berzelius, and that it can be used to date the work discussed by the two chemists.

4. The published edition of letters between Justus Liebig and Wöhler<sup>5</sup> appeared in 1888, six years after Wöhler's death. In the Deutsches Museum, München, there is a letter dated 9th March 1882, dictated by the ageing Wöhler and sent to Kolbe:

"You know that Liebig gave my letters to his grandson Justus Carrière. There are over 800. He was good enough to lend them to me and I had them to separate the important from the trivial and dictate the extracts. These covered 518 handwritten sides. Now I have to carry out the more difficult task of making extracts from Liebig's letters to me, including some already published."

The title of the published volumes also indicates that this collection is only an extract from the whole correspondence. The foreword to the collection was written by A.W. Hofmann and he quotes Wöhler as recalling the pleasure of his work with Liebig:

"It was a happy time, the period we worked together, but it began to end when Liebig began to work on his far-reaching ideas on the influence of chemistry on physiology, whilst I worked on the translation and publication of Berzelius's work - a labour which began as a pious work and ended by using up valuable time that set back my own creative work."

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5 Hofmann, A. W. (ed.), Wöhler, Emilie (ed.): *Aus Justus Liebig's und Friedrich Wöhler's Briefwechsel in den Jahren 1829-1873*. Braunschweig: Vieweg, 1888. 2 vols. (Hereinafter cited as *Briefwechsel, Liebig-Wöhler, I or II*, with the page reference and date of the letter). A new complete edition is prepared by Christoph Meinel, Regensburg, and will be published in the future.

Hofmann reports that it was only the heavily-cut version of the letters that he was able to prepare for publication: in fact I doubt whether he saw the original letters. Wöhler's daughter Emilie again helped with the arrangement of the material. Hofmann admits that there is a great deal missing and that the reader seeks answers to questions in later letters and finds nothing. But Hofmann either did not know, or did not reveal, how much of the correspondence he was publishing.

The unsatisfactory nature of the published correspondence is quickly evident to a reader. It is noticeable that Wöhler's part seems sometimes to be that of an intelligent commentator on Liebig's work and career, and the discontinuities are irritatingly obvious. Even if the originals had not been seen these two volumes would appear suspect as primary source material, particularly when unravelling points of detail.

Correspondence with Libraries in Berlin, Göttingen, and München (Deutsches Museum)<sup>6</sup> failed to reveal any substantial number of Liebig-Wöhler letters, though each of these had in their archives a few letters between these two men and other chemists. I found in the Bayerische Staatsbibliothek in München three boxes of papers labelled "Liebigiana" catalogued only as part of a collection of Liebig's papers. These boxes contain a large part of the correspondence between the two men, though there are large gaps. Most of the letters are in fair condition though the paper of the earlier pages is brittle and the late letters seem to have been stored in a damp place. Wöhler's handwriting is relatively legible.

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6 Unpublished letters: The most important collection of Wöhler's Letters is held by the Bayerische Staatsbibliothek in München: this comprises the bulk of Wöhler's correspondence with Liebig. The Deutsches Museum has letters between Wöhler and Kolbe: these are concerned largely with publishing and contain little chemistry. There are also a few letters between Wöhler and other chemists. Göttingen University Library holds a collection of unpublished letters of a general nature, mostly insignificant. There is, for example, a letter to Gauß fixing the date of an oral Ph.D. examination, and a letter from the U.S.A. enquiring whether lady students were accepted at Göttingen on the same terms as men: the reply is not recorded. Wöhler's publishers, Vieweg of Braunschweig hold a number of business letters which I have not seen.

Comparison of the manuscript with the printed edition shows Hofmann's collection to be a very much condensed version. Furthermore, this condensation has often been carried out by paraphrasing the contents rather than by simple extraction of relevant passages. For instance, the letters for 1838 are printed as 14 pages of extracts. In fact there were 26 letters written by Wöhler in that year, before the first<sup>7</sup> one quoted in the book, and these cover in manuscript 182 sides 25cm x 20cm, all closely written. Liebig's letters to Wöhler in 1838, 24 in all, are equally voluminous.

In many places the grammar has been restyled so that the style is more literary than in the original. The first letter<sup>8</sup> printed by Hofmann is indeed the first letter in the collection, but Hofmann's version is an elegant précis of Wöhler's manuscript, chemically unaltered but sharpened in impact by the omission of much trivial chemical observation.

There are printed letters that are missing from the bundles of originals, including the often quoted letter<sup>9</sup> from Liebig inviting Wöhler to join him in joint research on the oil of bitter almonds in 1832.

It would seem that Wöhler saw the preparation of the correspondence for publication as a way of paying tribute to his friend Liebig. Wöhler's own letters are much more extensively cut than Liebig's and he has reduced his part in some of their joint work so that he appears as a foil to Liebig's genius rather than an essential contributor to the work. In fact, in their monumental work on uric acid, which was reported in a 100-page paper in *Annalen*<sup>10</sup>, most of the practical work was carried out

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7 Briefwechsel Liebig-Wöhler, I, p. 121, 30 June 1838.

8 Briefwechsel Liebig-Wöhler, I, p. 4, 8 June 1829.

9 Briefwechsel Liebig-Wöhler, I, p. 53, 15 June 1832.

10 Wöhler, F., Liebig, J.: Untersuchungen über die Natur der Harnsäure. *Annalen der Pharmacie* 26 (1838), p. 241-340. Reprinted (with commentary) in: J. Büttner & W. Lewicki, eds., *Stoffwechsel im tierischen Organismus. Historische Studien zu Liebig's Thier-Chemie*. Seesen: HisChymia Verlag, 2001, pp. 235-305.

by Wöhler - analyses excepted - and the direction of research governed entirely by his preparative skills; the printed letters do not bring this out clearly. He also realized, no doubt, that Liebig was a great public figure and that the public would naturally be more interested in his work than in Wöhler's own. The printed letters have thus to be treated with caution. Never deliberately misleading, they nevertheless represent Wöhler's 1880 view of what was important in earlier years, and selection can never be entirely neutral. Errors, doubts, and personal irritations have disappeared. Even in the manuscripts a few passages have been cut away, and some censored in black ink. Where these can still be read they are always details of personal ailments of their mutual acquaintances, e.g., in June 1850, "Is it true that Varrentrapp's wife went mad and is now dead?"

5. In 1893 Justus Carrière, who had assiduously collected together Liebig's papers, published the correspondence between Liebig and Berzelius<sup>11</sup> dating from 1831-1845. Carrière had in his possession Wöhler's letters to Liebig, and each time he quotes from them he states that he is using the handwritten letters. In his preface he explains the discrepancies between dates of these letters and the dates in the printed volumes: "..... frequently different writings were put together under one date." Wöhler's family did not permit him to publish anything new from the letters in their possession from Liebig to Wöhler. The brief extracts are used of course to illustrate Berzelius's relationship and quarrels with Liebig rather than to illustrate Wöhler's own work. I have been unable to trace the originals of these letters: they do not seem to be in München, Stockholm, or in the Liebig Museum at Gießen.

6. Wöhler's own publications are all easily accessible, almost all of his papers appearing in Poggendorff's "*Annalen der Physik und Chemie*" or, later, Liebig's "*Annalen der Chemie und Pharmacie*". The British

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11 Carrière, J.(ed.): Berzelius und Liebig. Ihre Briefe von 1831-1845. München and Leipzig: Lehmann, 1893. 2nd edition 1898. Reprint: Sändig Reprint-Verlag: Vaduz, 1967 (hereinafter cited as: Briefwechsel Berzelius-Liebig, with the page reference and the date).