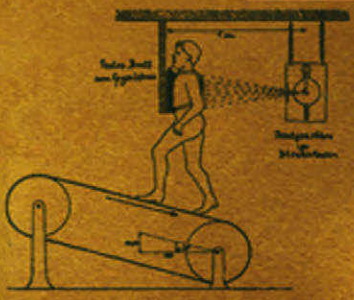
# Nathan Zuntz

## His Life and Work in the Fields of High Altitude Physiology and Aviation Medicine

Hanns-Christian Gunga



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*This book is dedicated to*
*my wife Luise,*
*and my children Leonard, Maxim and Arthur*

# Contents

# Preface

This book deals with the life and work of Nathan Zuntz and specifically addresses the contribution he made to high altitude physiology and aviation medicine. While some of the material on this topic has already been published in English (Gunga and Kirsch, 1995a, 1995b), the overwhelming majority of it is only available in German (Gunga, 1989). Recently, new and interesting sources on the life and work of the Berlin physiologist have come to light. That was why the author gladly accepted the invitation from the History Book Committee of the American Physiological Society in 2005 to write a biography of Nathan Zuntz. The result is a completely new, revised version of the book which is based on more than twenty years of study on the life and work of this physiologist.

This biography could not have been written without the help of numerous people and institutions. First, I would like to thank Dr. John West, the current Chairman of the APS History Book Committee, who personally committed himself so firmly to making this project possible from the very first day.

I am very grateful to the Free University, the Charité, the DLR (German Aerospace Center) in Cologne and the management in Bonn-Oberkassel – namely Dr. Horst Binnenbruck, Dr. Peter Preu, Prof. Dr. Günter Ruyters, Dr. Hans-Ulrich Hoffmann, and Dr. Peter Gräf – and the sponsors Klaus-Peter Ludwig (EADS/EADS-Astrium), Dr. Gerd Bräunig (Kayser-Threde), Dr. Roman Skoblo (IFBL), and Dr. Bernd Mueller (Bayer-Schering Pharma), who made this book possible by providing financial and logistic support. If the *Zentrum für Weltraummedizin Berlin* (ZWMB) (Center of Space Medicine Berlin) had not been founded at the Free University of Berlin in 2000 and if these sponsors had not contributed to creating the "Nathan Zuntz" Endowed Professorship in *Weltraummedizin und extreme Umwelten* (Space Medicine and Extreme Environments) at the Charité Campus Benjamin Franklin (CBF) in 2003, I could not have realized this project. Thanks are also due to those institutions, departments and their staff who took interest in and lent their support to these historical studies – several national and international archives and libraries, the Department of the History of Medicine Charité Universitaetsmedizin Berlin, the historical working group of the DGLRM (German Society for Aviation and Space Medicine), the Life Science Working Group of ESA (European Space Agency), the ISGP (International Society of Gravitational Physiology) as well as the ÖGAHM (Austrian Society of Alpine and High Altitude Medicine).

My special thanks also go to my tireless and always very critical translator, Carmen v. Schöning, and her team. Without the months of very close cooperation and constant enthusiasm for the topic, this book would have been impossible to realize. Brigitte Bünsch, Anja Haller, Bärbel Himmelsbach-Wegner,

Eveline Hofmann, Darren Lipnicki, Thilo Noack, Thomas Schlabs, Mathias Steinach, Lutz-Rainer Weiss, Dr. Andreas Werner, and Dr. Eberhard Koralewski were particularly supportive in the research and the preparation of the manuscript and in dealing with electronic media. I thank them as well for their constant assistance and open minds.

Personal thanks are also due to all my colleagues at the Center of Space Medicine Berlin and the colleagues at the Department of Physiology, namely Prof. Dr. Axel R. Pries and his team, and Dr. Clarence Alfrey, Prof. Dr. Hans-Georg Baumgarten, Prof. Dr. Claus Behn, Prof. Dr. Gilles Clément, Prof. Dr. Rupert Gerzer, Prof. Dr. Bruno Günther, Prof. Dr. Gerda Horneck, Prof. Dr. Alan Hargens, Dr. Reed Hoyt, Prof. Dr. Egon Humpeler, Prof. Dr. Léon-Velarde, Prof. Dr. Dag Linnarsson, Dr. Günther Reitz, Surgeon General German Air Force Dr. Erich Rödig, Prof. Dr. Wolfgang Schobersberger, Dr. Peter Wittels, Prof. Lothar Röcker, Prof. Dr. Hans-Volkhart Ulmer, Prof. Dr. Li-Fan Zhang, Prof. Dr. Fengyuan Zhuang, and the late Carlos Monge and Peter Hochachka for many enlightening and enjoyable discussions. Last but not least, Prof. Dr. Karl Kirsch was largely responsible for teaching me the physiology of humans in extreme environments and calling for the creation of the Endowed Professorship. I would like to thank him expressly for the exciting years we spent working together, the conversations we shared, and the discussions we had about the different working philosophies in our field, the place of science in contemporary society, and on many other topics as well.

Finally, I wish to thank my dear wife, Luise, and my children Leonard, Maxim, and Arthur for their understanding those innumerable times I told them I was "going to be a little bit late."

Berlin, January 2008

# Introduction

The year 2000 saw the foundation of the Zentrum für Weltraummedizin Berlin (ZWMB, Berlin Center of Space Medicine) at the Freie Universität Berlin (Free University of Berlin). The Nathan Zuntz Professorship for Space Medicine and Extreme Environments was established three years later. This book focuses on the very early days of high altitude physiology and aviation medicine in Berlin, a city that has played an important role in the history of these sciences, and on the accomplishments of Nathan Zuntz (1847–1920), who was a professor of animal physiology at the Königliche Landwirtschaftliche Hochschule (Royal Agricultural College). As Zuntz died in 1920, this book will not deal with the darkest chapter in the history of high altitude and aviation medicine in Germany: the involvement of physiologists, medical staff, and research institutions, such as the Deutsche Forschungsgemeinschaft, in human experiments during the Nazi regime. This topic has become, and continues to be, the subject of research in recent decades (Bower, 1987; Hunt, 1991; Harsch, 2000, 2001, 2004; Eckart, 2006, 2008). On the other hand, this study will illustrate how the life and work of Zuntz, as well as the technical and logistical capabilities available in Berlin before the 1930s, exemplified the leading role that Germany took in scientific research in comparison to the work done in England, France, and the United States. Immediately after the end of the war, from May/June 1945 onwards, under the codenames "Project Paperclip" and its successor operation "Operation Overcast," the Pentagon had already made efforts to seek out leading aviation scientists in the ruins of Germany and to recruit them for American research institutes (Gimbel, 1986; Bower, 1987: 203–272). Some of these scientists first gathered in Heidelberg at the Kaiser Wilhelm Gesellschaft (Kaiser Wilhelm Society) to give an overview of the knowledge on aviation that existed in Germany; they continued to do so for the next two years (*German Aviation in World War II*, 1950; Report from Heidelberg, unpaginated). German specialists in aviation medicine were among the first scientists ever to be brought to the United States in this way. In the years to come, they decisively shaped the development of aviation and space medicine in America (Winau, 1987: 348–350). Among them was Otto H. Gauer (1909–1979), whose life and work will have to be dealt with separately. He was a young scientist, educated in the physical sciences and medicine, who took an interest in gravitational physiology. Gauer returned to Germany from the United States in the early 1960s and was made Chair of Cardiovascular Physiology at the Department of Physiology at the Free University of Berlin in 1961.

In the early 1980s, Karl Kirsch (1938–), a student of O. H. Gauer and the late Rolf Winau,[1] visited some of the German scientists who were still living in

the United States to interview them (oral history); a study which was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) (Kirsch and Winau, 1986: 633–635). In the course of their studies on the history of aviation and space medicine, they discovered the early work of Nathan Zuntz (1847–1920). His publications *Höhenklima und Bergwanderungen in ihrer Wirkung auf den Menschen* (The Effect of High Altitude Climate and Hiking on Human Beings, 1906) and *Zur Physiologie und Hygiene der Luftfahrt* (On the Physiology and Hygiene of Aviation, 1912), in particular, sparked their interest in the life and work of this scholar, especially since no comprehensive account and scientific evaluation of his life and work had yet been published. Of course, Jokl (1967: 321–328) and Wittke (1970: 295–298) had previously noted the importance of his work, above all in their history of high altitude physiology. However, the breadth of Zuntz's research and its influence on the development of aviation medicine, as well as his fundamentally new thoughts and methodical structures, had at best only begun to be explored.

In 1985 I was asked to discuss the life and work of Zuntz as part of a medical thesis. The work was completed in 1989 (Gunga, 1989), and excerpts of this thesis were later published in English (Gunga and Kirsch, 1995: 168–171, 172–176).

The following chapters will deal with the reconstruction of the biography of Zuntz, of his scientific work, and of the influence these disciplines had on the early development of high altitude physiology and aviation medicine. The following questions will be addressed:

- Were the results of Zuntz's research in Berlin his achievement alone?
- Where did his work rank both in a national context and abroad?
- Was there already a clear awareness of the problems requiring research on aviation medicine in Germany before 1930, on the basis of which this branch of research was able to unfold over the following years?
- If so, what form did this awareness take, and what part did Zuntz play in its development?

These are the principal questions guiding the present book.

## Notes

1. The medical historian Rolf Winau was born on February 25, 1937. Under his leadership, the Institut für Medizingeschichte (Institute for the History of Medicine) at the Freie Universität Berlin (Free University of Berlin) became one of the largest institutes in Germany in this field. After being awarded the degrees of Doctor of History and Doctor of Medicine, Winau was appointed Professor at the Free University of Berlin in 1976. Together with Gerhard Baader and other members of his staff, he wrote many books and a large number of articles on the history of pharmacology, biologism, and medicine under National Socialism, as well as on the history of medicine in Berlin. He published a total of 219 books and articles between 1965 and 2005. After the Berlin Wall fell in 1989, Winau actively participated

in restructuring the different university institutions in Berlin. In particular, he was involved in founding the Zentrum für Human- und Gesundheitswissenschaften der Berliner Hochschulmedizin (ZHGB, Berlin Center for Humanities and Health Science). He was appointed as its founding rector in 1997 (Winau, 2005). R. Winau retired in March 2006 and died on July 15, 2006 in Berlin. His funeral, attended by many friends and companions and reported on widely in the media, was held on July 28, 2006, at the cemetery of St Matthias Church.

# 1 Biography

## 1.1 Genealogical overview

Nathan Zuntz was born in Bonn on October 6, 1847 (City Archives, Bonn). His father was the Bonn merchant, Leopold Zuntz. His mother Julie, née Katzenstein, had been born and raised in Kassel.

Nathan Zuntz's forefathers originated from Zons am Rhein, a city located on the River Rhine formerly known as Zuns (Figure 1.1). It was located on the left shore of the Rhine, about 20 km northwest of Cologne. Deeds record that, starting in 1372, the village of Zuns – originally under the control of the archbishop-elector of Cologne – was authorized to levy a toll on ships transporting cargo on the river, referred to as the *Rheinzoll* (Rhine toll), and it was granted its town charter in 1373. Zons was incorporated into Dormagen in 1975 as the city district *Feste Zons* (Zons Fortress).

Towards the end of the fifteenth century, the Jew Pesach von Zons (†1488) settled in Frankfurt am Main together with his wife and son, Michel. At that time, it was not unusual within Jewish families that the name of the home town be added to the first name. However, the name "Zons" left room for ambiguity, given that it existed in a number of variations and diverse spellings. Thus, the generations succeeding Pesach were recorded under the name of Zunz instead of Zons. Additional confusion results from the fact that the spellings Zunz and Zuntz were sometimes even used in parallel.[1]

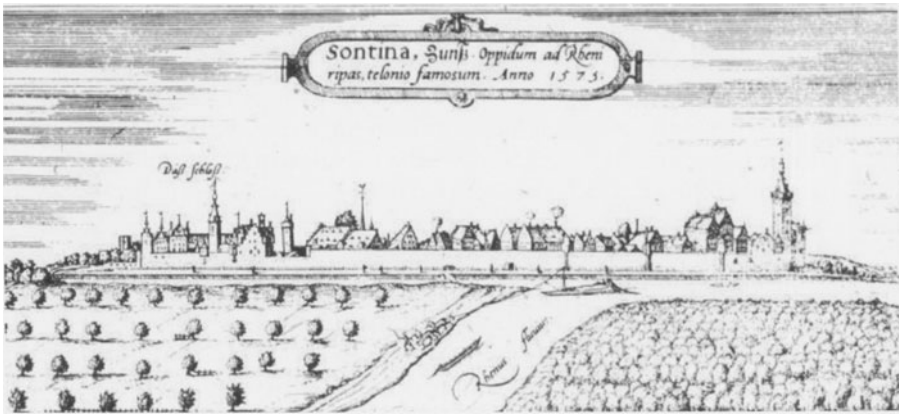


**Figure 1.1** Historical picture of the town Zons anno 1575.
(Blüm-Spieker, 1984, p. 7)

The Zunz family remained settled in Frankfurt, where they earned their livelihood primarily as small merchants. Like all Jews in Germany at this time, they were subject to various restrictions and regimentations affecting their choice of occupation so that hardly any professional opportunities outside of merchant trading and banking were open to them.

In 1813, Nathan Zuntz's grandparents, the merchant Amschel Zuntz (1778–1814) and Rechel Hess (1787–1872), were married in Frankfurt. Rechel came from Bonn, where her father had operated a coffee and colonial goods shop since 1783. The marriage was brief: just a few days after the birth of his son, Leopold, in September of 1814, Amschel Zuntz died. His young widow took her child and moved back to her parents in Bonn. Rechel Zuntz was described as a "fanatically pious Jewess," and thus it was important to her that her son be taught Hebrew at an early age and become familiar with the Talmud. Consequently, Jewish rules and customs were also strictly observed in the Zuntz household – habits which Leopold retained throughout his entire life, even though he distanced himself from the Jewish religion in later years. Despite the fact that Leopold Zuntz was interested in literature and philosophy even as a youth, and expressed the desire to become a scholar, his assertive mother demanded that he become a merchant, and thus he completed a corresponding apprenticeship. After the death of her father Rechel took over his shop in 1837, establishing, with her son (Lehmann-Brune, 1997, pp. 179–180), the company "A. Zuntz seel. Wb." This name was later slightly altered to A. Zuntz sel. Wwe. (*des seligen Amschel Zuntz Witwe* – widow of the blessed Amschel Zuntz) to reflect modern spelling.

By the time Leopold married Julie Katzenstein in 1846, he had already been entrusted with much of the management of the business. At this point in time, coffee-bean roasting had already become the main focus of the company's business. Although the company later grew in size and gained quite a reputation, its economic situation during the first decades of its existence was always precarious. The remarkable rise of the company did not begin until the 1870s, when Leopold Zuntz's sons and grandchildren entered the company's management. The first store in Berlin was opened in 1879, and ten years later another branch was inaugurated in Hamburg. "Zuntz Kaffee" developed into a well-known brand, and in 1893 the company was awarded the coveted title of a supplier of the Imperial Court (*kaiserlicher Hoflieferant*). Following the Berlin Industrial Exhibition of 1896, at which the Zuntz pavilion – an interesting structure in terms of its architectural design – offered a cup of coffee with pastry for ten *Pfennig*, the company became very popular in Berlin. Since the idea of the "cheap cup of coffee" had enjoyed such success, the first coffee sales outlet with a coffee bar was opened at Berlin's Spittelmarkt; this was similar to the "coffee to go" outlets found throughout the world today. Additional Zuntz coffee specialty shops with coffee bars were rapidly opened in all major streets of Berlin, Potsdam, Dresden, Hanover, and Cologne. At the same time, business operations had expanded, and the company was importing tea from India and Ceylon.

Following World War I, the company grew by leaps and bounds: by the end of the 1920s, "A. Zuntz sel. Wwe." was a flourishing company with 800 employees, numerous stores and its own cafés. In 1925 the famous company emblem was also developed – the *Biedermeier* woman with the wide-brimmed bonnet tied down around her face (Figure 1.2). However, the rise to power of the National Socialists in 1933 brought far-reaching changes: in the course of the discrimination against Jews in Germany and their economic disempowerment, the business was forcefully "arianized" and the last principal stockholder, August Zuntz, emigrated to England.

After the end of World War II, a member of the Zuntz family once again assumed management of the company, bringing about its gradual revival. In the early 1960s, the company employed a staff of 300 in Berlin and 80 at the Bonn branch. On October 26, 1962, the company's 125th anniversary was celebrated in grand style and the coffee house "Zuntz im Zentrum" was opened next to the famous Café Kranzler on Berlin's Kurfürstendamm. In the late 1970s, A. Zuntz sel. Wwe. was sold to the companies Dallmayr and Darboven (Lehmann-Brune, 1997, pp. 182–197).


**Figure 1.2** The famous company emblem "A. ZUNTZ SEL. WWE" showing a woman with the wide-brimmed bonnet tied down around her face (*ca.* 1925).
(Lehmann-Brune, 1997, p. 197)

## 1.2 Childhood and youth

When Leopold Zuntz married, his mother Rechel extended her influence to include his family life, living in the same house as her son and his quickly growing family. Between the years 1849 and 1863, Nathan's ten siblings – Albert, Carolina, Jeanette, Emma, Simonetta, Anna, Joseph, David, Mathilde, and Siegmund Richard – were born (Figure 1.3). All the children were raised in strict observance of religious principles, not least out of consideration for Leopold's mother. She was the one who gave Nathan Hebrew lessons when he was only four years old, and who ensured that Jewish rules were followed precisely. The degree to which the atmosphere in the Zuntz house was influenced by the pious and stringent Rechel is particularly vivid in the complaints voiced by Julie Zuntz, who felt compliance with Jewish dietary laws to be quite a challenge. In contrast to his mother, Leopold Zuntz is described as a weak and sickly person. He was also plagued by financial worries, as the profits generated by the coffee-bean roasting shop were meager and only sufficed for a very simple and frugal life for his large family.

Nathan, the first-born child, was of a delicate constitution and consequently did not begin school until seven years of age, attending the grammar school in Bonn in 1854. Nevertheless, he was a good pupil, thirsting for knowledge so strongly that Leopold allowed his talented son to take additional Latin lessons. In 1858, Nathan Zuntz enrolled in the sixth grade (*quinta*) at the local high school (*Gymnasium*). His father approved of this step and always supported his son in his desire to learn, yet he couldn't protect Nathan against the initial difficulties he experienced at the new school. In contrast to his well-off classmates, he often had to help out with household chores and in the store after school; in addition, he was shy and often ill. His daughter Emma Zuntz noted:

> *Nathan celebrated his Bar Mitzvah at thirteen years of age. A comprehensive instruction in the Jewish [theological] teachings preceded the ceremony ... This Bar Mitzvah of the first-born son was a large family celebration.*

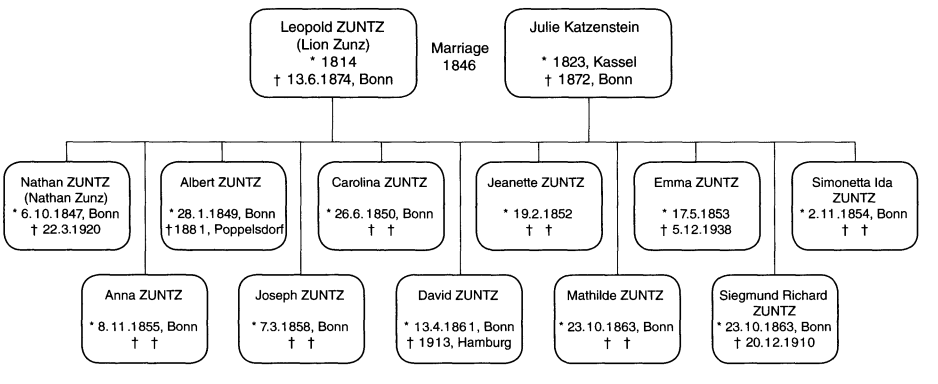


**Figure 1.3** The siblings of Leopold Zuntz (1814–1874) and Julie Katzenstein (1823–1872).

> *The boy thanks his honored teacher in a long speech held in Hebrew. That was the future professor's first oratorical success.*
>
> *(Emma (Sarah) Zuntz, undated, pp. 9–10)*[2]

In 1863 – shortly before passing his *Abitur* (final high school examination) – Zuntz stopped attending high school and began an apprenticeship as a banker in Bonn. The reasons behind this decision remain a mystery, and may possibly never be resolved. According to von der Heide (1918, p. 332), the decision was made at the urging of relatives. They would have taken it as a matter of course that the oldest son would complete a merchant apprenticeship and later assume the family business. However, Zuntz's training at the Bonn bank was brief; after only a few weeks he was forced to give up the apprenticeship position because "he behaved poorly by spilling an inkwell over the record book and was subsequently released on grounds of inaptitude." Apparently his father stood steadfastly by his side in the matter, and did everything within his power to ensure that his son could return to the *Gymnasium*. Later, it was Nathan's younger brother, Albert, two years his junior, who was trained as a merchant and appointed by his father as successor to the company.

After returning to high school in Bonn, Zuntz passed his *Abitur* in the autumn of 1864 at the age of seventeen. He did not mention the brief interruption of his high school period either in the *curriculum vitae* set out in the appendix of his dissertation or in his handwritten resumé of 1870.

## 1.3 Professional and scientific development

### *1.3.1 The years in Bonn until 1880*

After having obtained the necessary qualifications to attend a higher institute of learning, Zuntz enrolled at the University of Bonn,

> *and soon after was accepted as a student by the then rector magnificus Prof. Bauerband and registered by the Dean of the local faculty, Prof. Pflüger, in his album of students. During the following 8 semesters he studied medicine. His teachers were Messrs. Binz, Busch, Doutrelepont, Finkelnburg, Greef, Hildebrand, Landolt, v. Lavalette, Naumann, Obernier, Pflüger, Pluecker, Preyer, Rindfleisch, Ruehle, Saemisch, Schaafhausen, Max Schultze, Schroeder, Veit, M. I. Weber.*
>
> (Curriculum vitae, *N. Zuntz, July 6, 1870, Archives of the Rheinische Friedrich-Wilhelm-University Bonn)*

October 6, 1864, can be determined as the date on which Zuntz enrolled as a student – his eighteenth birthday –, and August 13, 1868 as the date on which he left university.[3] It has not been possible to find any other documents pertaining to Zuntz's studies at the university (for example, on the seminars or courses he attended), and nor is any information available on his degree except for the certificate recording that N. Zuntz was awarded the degree of Doctor

of Medicine.[4] Therefore, any biographer must depend on the *curriculum vitae* Zuntz wrote in 1870 and on the undated handwritten notes of his daughter Emma (Sarah) Zuntz, which she wrote for her children who wanted to know more about their grandfather, for information on this phase of his life. She noted:

> *[His] time as a student at university was different from the happy and carefree [times] we experienced, who did not know the troubles of life. But it was a wonderful time of growth and development. His father was very concerned about how his delicate, sensitive son was going to deal with the frights of anatomy. On the advice of more experienced people, he demanded that Nathan learn to smoke, to which he had an insurmountable aversion. As it turned out, he could tolerate the smell of corpses if only he could stop smoking. As early as the second semester, the young student became an anatomist, earning the tidy [sum] of 100 Marks per semester, and was laying the foundations of his precise knowledge of the human body. [His] father took great and loving interest in his work and influenced his development. During the phase in which young doctors, intoxicated with their new insights, could easily become materialists focussing only [on one thing], he read Spinoza's writings with his son and broadened his perspective from the small details to look at life's grand and eternal issues. Until his death, he remained the young scholar's best friend, his shining example.*
>
> *(Emma (Sarah) Zuntz, undated, pp. 10–11)*

Further on, Emma (Sarah) Zuntz continued:

> *At the time, universities and colleges were not yet overrun by students and individual students did not disappear in the masses. The anatomist Schulze and the clinician Ruehle soon noticed the extraordinarily gifted young Zuntz. It was Schulze who arranged for him to make the acquaintance of Pflüger, who was later to become his brilliant master and teacher. Schulze sent the young student to the* Physiologisches Institut *[physiological institute] with an abnormal, excellently dissected brain, and there the first of many stimulating discussions began, which later informed so much of both of the men's work. Zuntz was also popular among his fellow students, in spite of the fact that he could not be a part of their jolly high jinks because of his lack of means. He always found hiking companions for his trips into the Siebengebirge mountains, even though he never stopped at a tavern. He considered himself to be extraordinarily blessed that he was allowed to study and to do research while Albert (his brother) was preparing to support [his] father in their grandfather's firm, [and felt this so strongly] that he would have considered it sinful to spend even one penny on something as frivolous as his personal pleasure. As a youth among his youthful friends, he had already developed that peculiarity that I was always aware of as his child. He, to whom the friendship and trust of people came so easily – he did not need it. They were the ones to seek him out, they could not do without his calm and rational thinking, his selflessness. He found his closest relationships in the Levi family. There he, the most unmusical of all people, became an intimate friend of the famous cellist, Jacques Rendsberg.*
>
> *(Emma (Sarah) Zuntz, undated, pp. 11–12)*

Zuntz was made Schultze's[5] assistant in the course of the fourth semester of his studies. He particularly emphasized the guidance Schultze gave him on working with the microscope during this period. Zuntz writes that during his final four semesters he spent most of his free time in the university's physiological laboratory. Pflüger "was so very kind" to help him there (*Curriculum vitae*, N. Zuntz, July 6, 1870). Later, Zuntz dedicated a copy of his dissertation he gave to his teacher "with respect and gratitude" (Zuntz, dissertation 1868), as he did with his book on *Höhenklima und Bergwanderungen in ihrer Wirkung auf den Menschen* (The Effect of High Altitude Climate and Mountain Hiking on Human Beings) (Zuntz *et al.*, 1906), which he gave to Pflüger on the occasion of the latter's fiftieth anniversary of his doctoral degree. In the course of his final two semesters, Zuntz worked as an *Unterarzt* (resident physician) under Ruehle at the *Medizinische Klinik* (Medical Faculty of the University Hospital) in Bonn. He wrote that, in this position, he had "more opportunities to work with the practical aspects of our science" (*Curriculum vitae*, N. Zuntz, July 6, 1870).

After passing his *Rigorosum* (oral examination for the doctorate) with the grade *summa cum laude* (N. Zuntz, Certificate of Doctor of Medicine, July 31, 1868, Archives of the Rheinische Friedrich-Wilhelm-University Bonn), Zuntz was awarded the degree of *Doctor Medicinae et Chirurgiae* from the University of Bonn by Schultze on July 31, 1868. His inaugural dissertation was published under the title *Beitraege zur Physiologie des Blutes* (Contributions on the Physiology of Blood) (N. Zuntz, Certificate of Doctor of Medicine, July 31, 1868). In December 1868, Zuntz passed the state examination and was licensed to practice as a physician (von der Heide, 1918, p. 332). Immediately after having received the license, Zuntz substituted for a fellow doctor who had fallen ill, working in a large rural medical practice near Bonn.[6] Von der Heide states this practice was located in Oberpleiss am Siebengebirge (*Curriculum vitae*, N. Zuntz, July 6, 1870).

Emma (Sarah) Zuntz described the situation for Zuntz as follows:

> *Ruehle and Pflüger both offered the position of assistant to him. After a prolonged inner struggle, he decided to work for Pflüger, but did not commit himself right away because he first wanted to spend one winter in Berlin to continue his professional training. He earned the money for this by [working] as a country doctor. Grandfather often told me about his first practice and made fun of [himself as] the young doctor. The roads across country were long and any trip was an arduous undertaking, so that in some cases, the farmers would send a horse. He had never ridden [before] and he felt as unsure of himself on the back of a horse as he did in the practice. In the city, he had been able to ask for advice from his teachers in any difficult case, [but] here he had to depend on his own knowledge and his own initiative. However, his farmers were very pleased with him. He performed complex operations under extremely difficult conditions. To cite but one example, a cesarean operation took place in a barn by the light of an oil lamp and without any help in administering anesthesia. Even when he had reached old age, he still shuddered at the thought of the responsibility he had been given, at an*

*age when our boys were just leaving school. But the difficult time passed and the young doctor traveled to Berlin.*

*(Emma (Sarah) Zuntz, undated, p. 13)*

Zuntz practiced in Oberpleiss am Siebengebirge until September 1869, when he terminated his activities as a country doctor and went to the Charité and other institutions in Berlin for the winter semester.[7] There, he attended clinical courses and seminars held by Graefe, Frerichs, Virchow, Westphal and Traube. He writes that he spent time in their institutes and pursued mathematical studies (*Curriculum vitae*, N. Zuntz, July 6, 1870). According to Emma (Sarah) Zuntz, he was impressed by Traube but a little bit disappointed by Virchow:

*Of [all of] the famous professors of medicine, Traube made the greatest impression on Nathan. He attended his lectures each day and was allowed to take part in all of his ward rounds. On the other hand, Virchow did not fully do justice to the expectations that he had associated with this great name. But while studying with Virchow, he did become acquainted with Senator, with whom he worked on fever curves. He felt his most enjoyable times in Berlin were spent in the company of his aspiring fellow students of medicine. The young doctors, nearly all of whom made a name for themselves and became famous, founded an association. They met in the small rooms they had rented, sitting on the host's bed, table and chair. One of them would present the recently published papers, or describe his plans for the future. These meetings were the breeding ground for the* Berliner Physiologische Gesellschaft *[Berlin Physiological Society]; grandfather was its chairman for a long time. These scientific evenings were very serious and dignified. But youthful cheer also came into its own in the raisonneurs' bar (and tavern) society. While the same people were in attendance, it was wit and jokes that ruled the evenings, and if anyone had any weaknesses he was mercilessly teased. The food was very simple. Everyone brought their own supper, in their coat pocket, and then they shared and traded. One evening Zuntz saw beautiful apples lying in a basement close to the meeting place. Oh, he thought, I will bring dessert; the others will have brought enough staples. But as they all emptied their pockets, nothing but apples rolled in every direction that evening. Everyone had had the same brilliant idea.*

*(Emma (Sarah) Zuntz, undated, pp. 15–16)*

When he returned from Berlin, Zuntz began working as Pflüger's assistant in Bonn on April 1, 1870 (*Curriculum vitae*, N. Zuntz, July 6, 1870). It can safely be said that, by his work in neurophysiology and metabolic physiology, Pflüger[8] had the strongest influence on Zuntz as a young man. He opened the doors for Zuntz to a scientific career at the university, and likely found Zuntz to be one of his most talented and versatile students. When Zuntz completed his medical studies in 1868, the *Chemisch-physikalische und physiologische Laboratorium der Königlich Landwirthschaftlichen Akademie Poppelsdorf* (Chemico-Physical and Physiological Laboratory of the Royal Agricultural Academy of Poppelsdorf) near Bonn had just been established in the previous year, as had the Institute for Chemistry run by Kekulé (Figure 1.4).[9]

**Figure 1.4** *Die Königliche Landwirthschaftliche Akademie Poppelsdorf* (The Royal Agricultural Academy Poppelsdorf) around 1868.
(Archives of the Rheinische Friedrich-Wilhelm-University, Bonn)

In 1872, the Anatomical Institute was moved from the building at the *Hofgarten* castle grounds (which now houses the *Akademisches Kunstmuseum*) to Poppelsdorf.[10] In Bonn the subjects Anatomy and Physiology had been taught separately since 1859, and Pflüger had been appointed to the newly-created chair for Physiology while still a young scholar.[11] This was how, in the course of the next two decades, a center for natural science developed in Poppelsdorf near Bonn from the simplest of beginnings.

Following his return from Berlin, Zuntz became Pflüger's assistant on April 1, 1870, after he had already published several scientific treatises on the acid–base balance of the blood – some of them together with Pflüger.[12]

Only two months after beginning work as an assistant, on July 4, 1870, Zuntz filed an application with Beseler, the University Curator, for permission to begin the *Habilitation* procedure – in which several formal requirements must be met in order to become a university lecturer – in the field of physiology.[13] It is very likely that Zuntz would have been supported by his doctoral advisor Pflüger, who held his former student and current assistant in high esteem regarding his scientific qualifications. In a recommendation in support of Zuntz's *Habilitation* project, he wrote:

> *I know Dr. Zuntz very well, who has worked at the Physiological Institute for four years. He is a very hard-working, knowledgeable and talented young man who has already made findings and gained insights that are* widely *recognized as valuable facts and laws and have been included in all physiology textbooks. In promoting him, we will gain a force that we will be sure to value.*[14]

On July 7, 1870, Zuntz's application was accepted by the University Curator (Letter from the University Curator to N. Zuntz, July 7, 1870, Archives of

the Rheinische Friedrich-Wilhelm-University Bonn). On July 9, 1870, Zuntz addressed a letter to the Dean of the Faculty of Medicine, Rindfleisch, requesting "most humbly that you recommend my admission to the *Habilitation* procedure in order to become a university lecturer in the high Faculty of Medicine" (Letter from Zuntz to the Dean of the Medical Faculty, July 9, 1870, Archives of the Rheinische Friedrich-Wilhelm-University Bonn). Zuntz's letter to the Dean closed with the statement that he intended to study physiology and physiological chemistry, and that he wished to lecture in these subjects.[15] His inaugural lecture was given before the faculty that same month, on July 29, on the subject "*Die Ursache der Atembewegungen*" (The Causes of Respiratory Movements) (Letter from Dean Rindfleisch to the University Curator Beseler, October 1, 1870, Archives of the Rheinische Friedrich-Wilhelm-University Bonn). Following the lecture, a colloquium was held "to the greatest satisfaction of the faculty" (Letter from Dean Rindfleisch to the University Curator Beseler, October 1, 1870), "so that Dr. Zuntz was unanimously admitted as a lecturer."

The outbreak of the Franco-Prussian War of 1870/1871 caused an interruption to the young scientist's career. According to von der Heide, Zuntz volunteered for medical service in the Bonn military hospital (von der Heide, 1918, p. 332). He had most certainly not forgotten his practical medical skills in the meantime, since he had been working as a consultant doctor alongside his work at the university following his return to Bonn from Berlin (Loewy, 1922, p. 3). The years that followed must have placed Zuntz under extraordinary strain in terms of his career and family. Emma (Sarah) Zuntz noted:

> *She [his wife] was not unaware of the problems her husband was having at work; her quick mind helped her understand the situation. Pflüger took great pleasure [in the company of] his favorite student's wife and enjoyed sharing his plans and thoughts with her. It was a merry company in the small university town and Frieda (his wife) enjoyed it to the full. For her husband, whose scientific research and large practice kept him breathlessly busy, it was almost too much of a good thing. Consequently, he fell asleep in a corner one evening while his wife was dancing, until Pflüger woke him and teased him about his lack of wakefulness and jealousy. Nathan was far from having such thoughts; how he enjoyed the cheerfulness of his young wife. The household was indeed run in an original way: everything the young professor earned he threw into a money box, and the housewife took what she needed. And if they were ever low on funds, then they dined on* Blutwurst *[blood sausage] and potatoes without the jolly mood suffering.*
>
> *(Emma (Sarah) Zuntz, undated, p. 26)*

In late 1872, Zuntz took a position as a teacher at the *Königliche Landwirtschaftliche Akademie Poppelsdorf* (Royal Agricultural Academy Poppelsdorf).[16] His mother died the same year; and his father, Leopold Zuntz, died two years later in 1874.[17] This meant that Zuntz was responsible for his younger siblings[18] along with his own family, having married Friederike/Frieda Bing in 1874 (L. Zuntz, 1926, pp. 201–202) (Figure 1.5). Furthermore, Pflüger

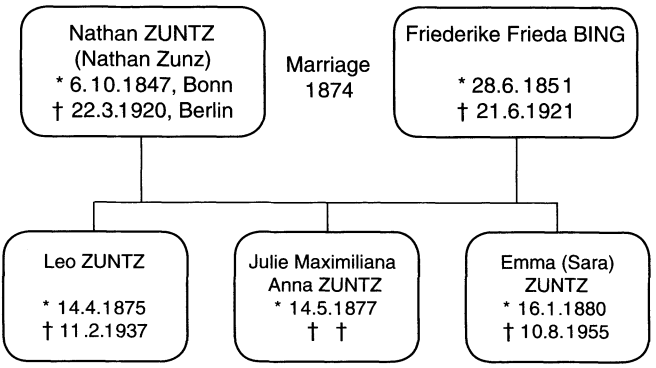


**Figure 1.5** The siblings of Nathan Zuntz (1847–1920) and Friederike Frieda Bing (1851–1921).

had petitioned that Zuntz be promoted to *ausserordentlicher Professor* (full professor without tenure) at the Physiology Department of the Medical Faculty in spring of 1874 (Letter from Pflüger to the faculty in Bonn, February 7, 1874, Archives of the Rheinische Friedrich-Wilhelm-University Bonn). While, in his opinion on Zuntz written in 1870, Pflüger had focused on his assistant's scientific qualities, this letter to the department is an interesting source for understanding how Pflüger judged Zuntz's personal traits and character:

> *Dr. ZUNTZ is a talented, knowledgeable scholar who submits solidly researched work. He has proven himself to be a useful and valuable member of our faculty, which is why I believe that he deserves to be recognized and encouraged by us. Considering that his [family] situation has forced him to run a time-consuming medical practice to earn his living, and that in his role as the 1st Assistant he has provided guidance to the physiology [department's] students in preparing their scientific papers with great sacrifice and intelligent care, and moreover that without his contribution my research protocols could not have been prepared, then one must acknowledge that in their number and as regards their scientific value, Dr. ZUNTZ's publications are worth double, in particular since he has written them in only a few years' time.*
>
> *(Letter from Pflüger to the faculty in Bonn, February 7, 1874)*

The opinion sets out a list of Zuntz's publications and those term papers to which he contributed "a commendable share" (Letter from Pflüger to the faculty in Bonn, February 7, 1874). It bears noting that Pflüger referred to Zuntz's dissertation as a "work that has become famous."

> *Finally, where Dr. ZUNTZ's abilities as a teacher are concerned, he has explored almost all fields of physiology and is much appreciated by the students.*
>
> *Without any doubt, his activities as a lecturer would play an even greater role at the department if the students here had more time to attend lectures*

*that are not directly required for completing [their] medical studies at university.*

*For these reasons and in view of the fact that Dr. ZUNTZ has now been a lecturer without tenure for more than three years, and has furthermore constantly distinguished himself by his truly scientific mind, by the purity of his character and his loyalty to his colleagues, I hereby petition that the high faculty support and favorably advance the promotion of our lecturer and my first assistant of many years' standing to* professor extraordinarius *with his Excellency, the* Minister fuer geistliche, Unterrichts- und Medicinal-Angelegenheiten *[Minister for Intellectual, Instructional and Medical Matters].*

*(Letter from Pflüger to the faculty in Bonn, February 7, 1874)*

His colleagues at the university approved Pflüger's petition. Rindfleisch added a commentary to the letter, stating that Zuntz was "a true asset" of the faculty and to science in general.

Five months later, on July 29, 1874, the Medical Faculty was informed that Zuntz had been appointed *ausserordentlicher Professor* (full professor without tenure) by the responsible minister (Letter from the *Minister fuer geistliche, Unterrichts- und Akademische Angelegenheiten* addressed to the Faculty of Medicine in Bonn, July 29, 1874, Archives of the Rheinische Friedrich-Wilhelm-University Bonn). Zuntz's appointment as Prosector at the Anatomical Institute of the University of Bonn followed in the fall of 1874 (von der Heide, 1918, p. 333).

During these years, Zuntz had issues of his own that he had to deal with:

*The friend (of his wife) had a brilliant, but unhappy nature. She and her husband (Oppenheim family) were skeptics. In their manner of thinking, they negated and picked apart all existing values. [It was] a dangerous game that they sometimes even played in real life. Nathan, whose life so solidly rested on duty, work and his love of mankind would have dearly preferred to keep his wife away from these dangerous influences. But he himself was unable to completely evade the dangerous charm that the Oppenheim couple exuded. This was the* Gruenderzeit *[the historical "period of promoterism," of rapid industrial expansion in Germany between 1871 and 1873]. Oppenheim wanted to become rich quick, and all of his friends were to share his luck with him. Later Nathan was not sure whether he himself had believed in his friend's plans – most people thought he was nothing but a brilliant swindler – in any case Oppenheim fraudulently fell into bankruptcy, and Nathan lost a share of his assets just shortly before his second child was born. He earned enough to recover from the financial loss soon enough, but the damage this did to his faith in others was serious to someone who thus far had blindly trusted his fellow man. Add to this his great concern for the poor wife Anna (Oppenheim), who, in her distress and panic resorted to morphine, from which she suffered an unhappy death. These tragic events certainly were a factor affecting Frieda's (Nathan's wife) health. Though she pulled herself together in her husband's presence, her agitated nature and the volatility of her character increased more and more. She struggled against this, not wanting to be pulled down into the depths of the black night, but fate took its*

*course. The heavy thoughts took her in their vise and Nathan had to commit his beloved wife to a mental institution in Nassau with the sad knowledge that she was carrying his child.*

*(Emma (Sarah) Zuntz, undated, p. 27)*

Much later, he gave his daughter the following explanation as to how he was able to overcome all these difficulties: "As a growing girl I once asked father what made his life so happy despite all the difficulties. He answered, work and love" (Emma (Sarah) Zuntz, undated, p. 31).

Zuntz's son Leo was born in the spring of 1875 (Birth certificate no. 340, April 14, 1874, City Archives, Bonn), and was later to become a physiologist and doctor like his father. Zuntz's two daughters Julie Maximiliana Anna (Birth certificate no. 449, May 14, 1877, City Archives, Bonn) and Emma (Sarah) were born in the following years in Bonn (Figure 1.5), before the family moved to Berlin. Emma (Sarah) Zuntz noted:

*Nathan was not someone who liked to occupy himself with small children. He had become a father at such a young age; he knew we would be well taken care of by Aunt Lisa, and so he entered into a close, personal relationship with us relatively late [in life]. In my early childhood he stood over me like an avenging god. I often teased him and told him that I was always relieved to hear the front door close behind him when he went on one of his frequent trips. This memory shows me how badly he suffered under my mother's fate. We were more of a burden to him than a joy because the fear always tormented him that one of us might have to accept her unfortunate heritage. Our entire relationship was to serve to strengthen our nerves.*

*(Emma (Sarah) Zuntz, undated, p. 39)*

Zuntz's continued professional development in Bonn can be summarized as follows. In the fall of 1872, Zuntz began to expand the experimental station at the *Königliche Landwirtschaftliche Akademie* (Royal Agricultural Academy), which had been founded in 1856, for his zoo-physiological experiments while continuing his scientific work with Pflüger at the university.[19] The laboratory and offices – which later became Pflüger's Physiological Institute in 1878, and which some colleagues at the university felt was too large[20] – were where Zuntz pursued his early research in his home town. Because of his work as a teacher of zoo physiology at the Royal Agricultural Academy in Poppelsdorf and his simultaneous function as Prosector for Anatomy at the University of Bonn, Zuntz acted as the link connecting the research at the university with its scientific focus and the practical orientation of the Academy.

Nonetheless, everyone at the Poppelsdorf Academy was aware that the university had a positive and encouraging influence on it. Von der Goltz, who acted as director of the Agricultural Academy in Poppelsdorf for a time, later remarked in a ceremonial address:

*The Academy always felt it was a very special advantage that it was so closely tied, both in the actual sense of the term and in its metaphoric sense, with the Rhenish Friedrich-Wilhelms-Universitaet. All of us who are familiar with the*

> *circumstances are fully aware of the many great advantages and benefits, the intellectual stimulation and promotion that the teachers and students of the Academy enjoyed.*
>
> *(von der Goltz, 1898, p. 250)*

It had been a well-known fact, at least since the 1860s, when Liebig had published his vehement criticism of the educational standards existing at the agricultural academies,[21] that universities and agricultural academies in Germany urgently needed to collaborate. Historical events show that Zuntz successfully took it upon himself to act as mediator in this difficult situation.

When Thiel,[22] the provisional director and *Geheime Regierungsrat* (privy higher executive officer) of the newly founded *Landwirtschaftliche Hochschule* (Agricultural College) in Berlin, had to suggest a candidate for the chair in the field of veterinary physiology to the ministry responsible, he chose Zuntz. Thiel's decision may have been strongly influenced by the fact that Zuntz had previously advocated combining scientific research and practical experience, and that the tasks and problems extant in Berlin had a similar structure, requiring that the professor appointed to that chair be able to cooperate with others in an interdisciplinary manner.

The administrative part of this procedure in terms of university policy indicates that, in founding an independent Institute of Veterinary Physiology at the Agricultural College, the political circles responsible understood that veterinary physiology and the research done in this field were very important and needed to be promoted in every possible way (Wittmack, 1906, p. 160). In the course of his last years in Bonn, Zuntz published six further papers and studies that essentially dealt with the physiology of blood, of circulation and of the respiratory system. His *Beitraege zur Kenntniss der Einwirkungen der Athmung auf den Kreislauf* (Notes on the Effects that Respiration has on Circulation) (Zuntz, 1878d, pp. 374–412) are particularly noteworthy in this regard. They bear witness to the fact that, even at a very early stage, Zuntz took an interest in matters of respiratory physiology under varying circumstances in terms of barometric pressure and oxygen content. Zuntz stated that the first experiments he performed in the field of respiratory physiology were done in collaboration with Pflüger in Bonn (Zuntz, 1878d, pp. 374–412), just after Waldenburg had published his first studies on the pneumatic therapy of lung disease (Waldenburg, 1873, pp. 465–469). Around 1860, it became known in Germany that increasing barometric pressure in pneumatic cabinets had a therapeutic effect on people suffering from lung disease (Liebig, 1885, p. 292). These first indications were only dealt with in France in the early 1870s, when Bert began his experiments in pneumatic cabinets, which he summarized in the work that made him famous, *La pression barométrique* (Barometric pressure) (Bert, 1878).

The scientific community in Germany entered into a heated dispute as to whether or not the therapy developed by Waldenburg was effective.[23] Zuntz made himself heard in this debate. For him, the search for a method that could be used to therapeutic effect in clinical practice was the primary reason for

studying this field (Zuntz, 1878d, pp. 374–412). Just before he had concluded his experiments on the effects that modifying air pressure had on the organism, the studies by Drosdoff and Botschetschkaroff were published on this matter (Drosdoff and Botschetschkaroff, 1875, pp. 65–67). Zuntz saw his criticism of Waldenburg's thesis vindicated by their work and therefore decided not to publish his own experimental results, as he wrote later (Zuntz, 1878d, pp. 374–412).

In the meantime, the fall of 1880 had seen the appointment negotiations for the newly founded *Landwirtschaftliche Hochschule* (Agricultural College) in Berlin enter into full swing. On September 22, 1880, Thiel submitted his petition to Lucius, the *Staatsminister fuer Landwirtschaft, Domaenen und Forsten* (Minister of Agriculture, State-owned Domains and Forests), that Zuntz be appointed to the Chair of Veterinary Physiology (Letter from Thiel to Lucius, September 22, 1880, No. 20075, fol. 45, Secret Central Archives).

After Thiel had paid several visits to Zuntz in Bonn in order to convince him to move to Berlin (von der Heide, 1918, p. 333), Zuntz declared in a letter dated December 20, 1880, that he was prepared to accept the appointment to the chair provided the following demands were met (Letter from Zuntz to Thiel, December 20, 1880, No. 20075, fol. 65–66, Secret Central Archives):

1. Wages of 7500 Marks per annum
2. Subsidization of his rent
3. Payment of the costs of his move
4. One assistant
5. Provisional workspaces in Berlin (apparently, his actual laboratory and office were not yet ready for occupancy).

On December 27, 1880, Zuntz received a preliminary notice from Lucius regarding his being appointed to the Chair of Veterinary Physiology. In this letter, the ministry accepted the demands that Zuntz had formulated and stated that he was to take office on April 1, 1881 (Letter from Lucius to Zuntz, December 27, 1880, No. 20075, fol. 67, Secret Central Archives). Zuntz referred to this letter from Lucius and accepted the appointment to the chair on December 31, 1880 (Letter from Zuntz to Lucius, December 31, 1880, No. 20075, fol. 68, Secret Central Archives). At this stage, the notice of his appointment to the chair could only have been issued as a preliminary notice, since it had not yet been established whether the university in Bonn was going to release Zuntz as per April 1, 1881 (Letter from Lucius to Zuntz, December 27, 1880). The negotiations as to that matter must have taken place in the course of January 1881, because Zuntz confirmed to Minister Lucius on February 5, 1881, that he finally and conclusively accepted the appointment to the chair of the Agricultural College in Berlin (Letter from Zuntz to Lucius dated February 5, 1881, No. 20075, fol. 82, Secret Central Archives).

It should be noted that – at least as far as the documents archived in the *Geheimes Staatsarchiv Preußischer Kulturbesitz* (Secret Central Archives)