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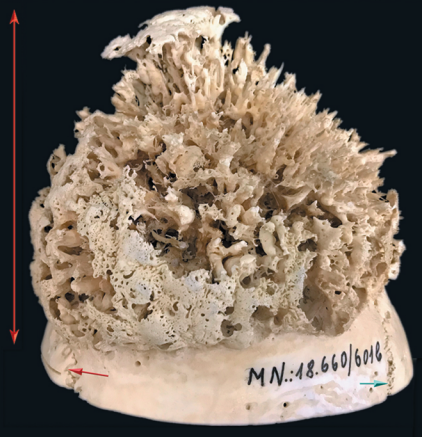
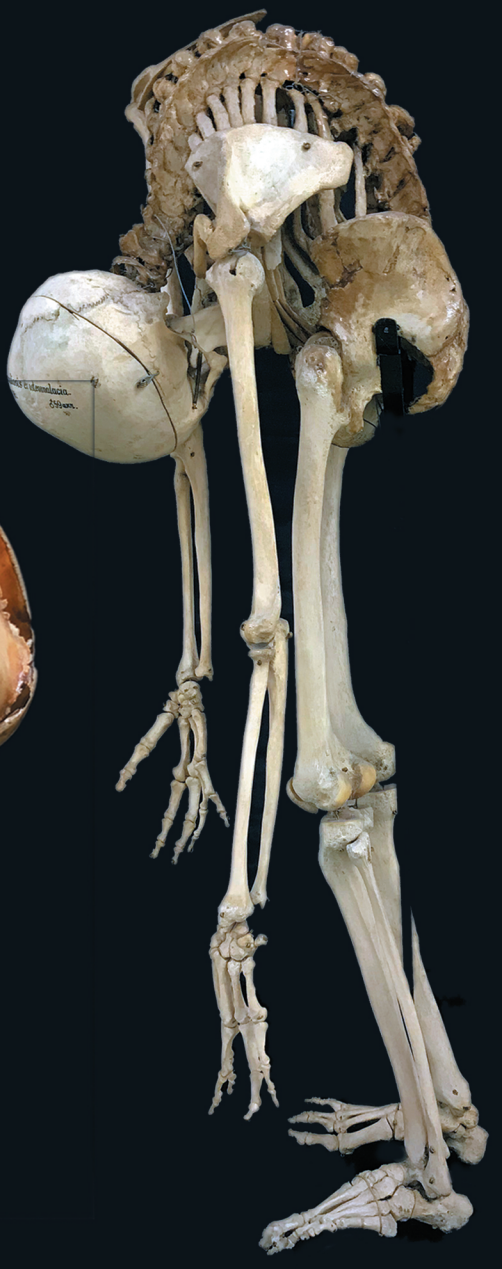
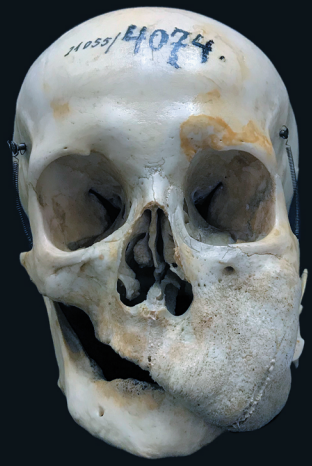
A Photographic Comparative Atlas of the Pathological and Anatomical Collection of the Fool's Tower

Robert W. Mann
Eduard Winter







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By

ROBERT W. MANN, PH.D.

and

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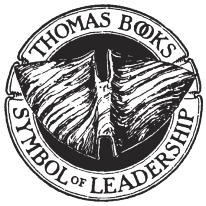

CHARLES C THOMAS • PUBLISHER • LTD.
Springfield • Illinois • U.S.A.

Published and Distributed Throughout the World by

CHARLES C THOMAS • PUBLISHER, LTD.
2600 South First Street
Springfield, Illinois 62704

ISBN 978-0-398-09410-2 (hard)
ISBN 978-0-398-09411-9 (ebook)

Library of Congress Catalog Card Number: 2023011009 (print)
2023011010 (ebook)

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Printed in India
MX-M-5

Library of Congress Cataloging-in-Publication Data

Names: Mann, Robert W., 1949- author. | Winter, Eduard, author.
Title: The incredible bones of the Narrenturm : a photographic comparative atlas of the pathological and anatomical collection of the Fool's Tower / by Robert W. Mann and Eduard Winter.
Description: Springfield, Illinois : Charles C Thomas, Publisher, Ltd., [2023] | Includes bibliographical references and index.
Identifiers: LCCN 2023011009 (print) | LCCN 2023011010 (ebook) | ISBN 9780398094102 (hardback) | ISBN 9780398094119 (ebook)
Subjects: LCSH: Bones--Diseases--Atlases. | Human skeleton--Atlases. | Paleopathology. | Physical anthropology. | Naturhistorisches Museum (Austria). Narrrenturm--Catalogs
Classification: LCC RC930.4 .M34 2023 (print) | LCC RC930.4 (ebook) | DDC 616.7/100222–dc23/eng/20230616
LC record available at https://lccn.loc.gov/2023011009
LC ebook record available at https://lccn.loc.gov/2023011010

Dedicated to the memory of Nirut Jamklai (1970-2019), beloved father, husband, son, brother and friend.

PREFACE

This book is the culmination of decades of personal and scientific curiosity, inquiry, and study of the human body, specifically, its internal architecture: the skeleton. The human body's ability to adjust to insults resulting from disease, genetics, development, the environment, and trauma is beyond 'incredible.' It is more closely akin to the miraculous. Many of these insults are life-changing; some are life-ending. The term "incredible" here applies to the rarity, severity, or unusual location of insult and/or resorption. Equally important is the ability of these bones to educate scientists about the body's capabilities to mitigate the effects of disease and trauma, and of genetic and environmental factors.

Incredible Bones is based on the perspective of two experienced scientists. Their shared goal is to better understand the human skeleton and to compile an accurate photographic and historical document of a small portion of the vast osteological collection at the Narrenturm Museum. Commonly referred to as the "Fool's Tower," the Narrenturm is located in Vienna, Austria (Figures 1-6). This comparative atlas records and shares some of the most incredible skeletal malformations and the wide range of variability and severity that can afflict the human skeleton, before and after the advent of antibiotics. It captures examples of disease, malformations, and trauma with little or no surgical or medical intervention and reveals their natural progression, often, without treatment. It is not intended to be a comprehensive atlas of medical or anatomical curiosities.

The format of a photographic atlas was selected to provide examples of disease, trauma, and genetic and congenital malformations that can be used by a diverse audience as exemplars. Exemplars by definition are examples or illustrations of "…something set before one for guidance or imitation" (Merriam-Webster 2011). This book specifically targets the medical, anatomical, archaeological, and anthropological communities who have already, or may encounter similar skeletal conditions. Hopefully, the exemplars in this atlas will assist practitioners in making more accurate interpretations and in making better differential diagnosis of human skeletal remains, whether ancient, modern, or contemporary.

This atlas will also serve as a resource for scientists, oftentimes paleopathologists, in the process of excavating, analyzing, interpreting, and accurately reconstructing skeletal remains in historical contexts. While the Narrenturm contains many "eye-catching and sensationalistic specimens," the subjects included in this atlas were selected because their relevant boney elements were visible for examination, or they conveyed the soft-tissue features of a particular disease or other skeletal condition.

The exemplars, or as we refer to them "the silent teachers," in this book are intended to teach, not so much through words, but through their presentation and contribution of a particular condition in its full form and detail. While they may be stripped of their flesh, these teachers retain their dignity and humanity as valued individuals throughout their afterlife teaching

career. Encountering a skeletal condition, whether through archaeological excavation or in consultation with medico-legal authorities, is but the first step in the complicated and often lengthy process of identifying and interpreting a skeletal condition. One of the best ways to accurately identify a disease, trauma or injury, or developmental condition is by comparison with exemplars that are accompanied by historical documentation such as patient records and museum accession cards in conjunction with historical reports, books and textbooks. Reading about a disease, however, is typically not as useful as actually seeing the features and effects of the disease in documented cases.

The skeletal exemplars selected for *Incredible Bones* were chosen to illustrate some of the more severe and unusual manifestations of diseases and malformations, as well as their severity in expression or form. Information written on each individual or museum accession cards is provided in German and, when possible, translated into English using current terminology and interpretations. Many, if not most, of the bones are from individuals of known biological age, sex, cause and date of death, and existing disease or developmental malformation. The information on these individuals is neither consistent nor complete. The vast majority of individuals depicted in this book were not patients in the Narrenturm. Most were transferred to the Narrenturm from hospitals, museums, universities, and physicians who were no longer able to care for them. Today's modern medical systems suffer from inadequate, inconsistent, incomplete, and incompatible record systems. The patient information provided from the Narrenturm is presented in the photo captions. The individuals presented in this atlas were undoubtably as frustrated then as we are today.

Most books that rely on contemporary examples of disease, development, and trauma using small color or black and white photographs provide readers with limited detail or information. Our level of interpretation is based on the "evidence" presented to us visually. *Incredible Bones* presents large, full color photographs augmented with diagnoses based on historical records and sometimes patient histories. Each description and interpretation (diagnosis as it were) in this book are based on medical diagnosis prior to or at the time they were received at the Narrenturm. Additionally, these interpretations are augmented by contemporary diagnoses, perspectives, and descriptions by the first author. The first author, Dr. Bob Mann, has worked in physical and forensic anthropology, anatomy, and skeletal pathology for more than 40 years. He has examined human remains at more than 30 universities, medical schools, hospitals, and osteological collections from around the world, encompassing collections in the United States, Southeast Asia, Europe, and South Africa. The second author, Eduard Winter, is curator of the anatomical and historical documents, including autopsy records, and collections in the Narrenturm spanning more than 15 years. Both authors have extensive experience in the scientific examination of human remains.

Each photograph in *Incredible Bones* is intended to "show" the reader a level of detail and clarity usually only gleaned through physical examination. This detail is difficult, if not impossible, to achieve in written presentation or published form. In effect, the authors have sought to bring the museum to the

reader, not the reader to the museum. Bones of individuals and images were chosen and photographed to show the smallest detail and present as many views and perspectives as necessary to properly document and examine/interpret the specimen for the reader. The authors use high quality and sometimes larger than life photographs so that readers can interpret what they are seeing and perhaps even identify subtle details not provided by the authors. The emphasis is on quality, detailed photographs. Captions provide one perspective of the subject – there are potentially many others and readers are encouraged to focus on those that pique their interest or suit their research. Readers can also compare disease conditions in this book with those they have seen in other anthropological, anatomical, or medical setting. *Incredible Bones*, therefore, serves as a comparative and exploratory photographic atlas of skeletal conditions not usually seen in daily practice or even in most skeletal assemblages, collections, or museums. This photographic atlas is a window to the past and is unique in that many of the bones are not on exhibition at the Narrenturm. As a result, this book provides readers with a behind-the-scenes perspective of some of the most extreme and thought-provoking examples in the Narrenturm pathological-anatomical collection. This book is not intended to present every disease, malformation, anomaly, trauma, or birth defect, but a carefully selected sample from the vast museum collection. Unless stated otherwise, all photographs were taken by the first author.

The format of *Incredible Bones* utilizes a regional approach to the human skeleton with each chapter beginning with the cranium and ending with the feet, a "head to toe" approach. Using a regional approach to the skeleton based on broad categories of conditions that include, for example, tumors and neoplasia, enables the reader to search for a skeletal condition without first having to know the name of the disease, anomaly, or other condition they are seeking to identify. Unlike textbooks divided into chapters based on specific diseases such as tuberculosis, syphilis, or leprosy, regional categories relying on the skeletal elements in question minimizes the necessity of identifying a disease *a priori*. Most so-called minor anatomical variants including foramina, metopic suture, and sutural ossicles that are commonly encountered in clinical, radiological, and anthropological examinations were not included in this atlas. There already exists a vast literature covering these topics.

R.W.M.
E.W.

INTRODUCTION AND HISTORY OF THE NARRENTURM ("FOOL'S TOWER")

History, like a river, flows through time and space. To appreciate the Narrenturm today it helps to understand a little of its past. The Narrenturm belongs to Vienna, and Vienna belongs to the Danube.

The Danube begins its journey from the confluence of two tributaries in the Black Forest of Germany. It winds its way through ten countries and, 1700 miles later, empties into the Black Sea via the Danube Delta in Romania and Ukraine. It defines the borders of several countries and flows through four capital cities of Europe - one of which is Vienna.

Like many other cities of Continental Europe, Vienna traces its origin to ancient Roman times. In the first century A.D. Imperial Rome appreciated the military significance of this river on its frontier and established a military outpost, now occupied by the Vienna city center. This cantonment was one of many like it that comprised the Danube Limes, that is, the Roman military frontier. The camp grew into a Roman settlement known as Vindobona. The first mention of its current name appears in the ninth century. By the 11th century it had become a trading center. Today the streets of the Inner Stadt (the First Municipal District) reveal the locations of the first Roman walls and moats. Vienna has a long history as a military town and fortification.

Trade produces growth, and immigration exposes inhabitants to more than new cultures, languages, religions, and skills. Vienna has been no stranger to sickness and disease. The city has been devastated repeatedly by severe plague epidemics between the 14th and early 18th centuries. By 1500 the city had some 20,000 inhabitants; by 1754 their number had increased to 175,000. Vienna has had to cope with a veritable population explosion, and the attendant malaises that accompany rapid societal growth.

During this period, anomalous people in need of medical help or those perceived as a public nuisance were locked away in confinements in order to "protect society" and to remove them from public view. Many individuals were incarcerated not because they had committed a crime but because society desired that they be invisible. The public didn't want to see, hear, or deal with the impaired or the impoverished. Detention served to silence both criminals and patients, and assuage the public sensibilities. Incarceration afforded neither treatment nor rehabilitation, but served only to remove the undesirables from society – simply said, they were located "out of sight, and out of mind."

By the mid-eighteenth-century Vienna was witness to revolutionary changes. It was the Age of Enlightenment. Among "the Enlightened Monarchs" (known to others as "the enlightened despots") was the Holy Roman Emperor Joseph II of Austria, son of Maria Theresa and regent from 1780 until his death in 1790. Joseph's contemporary enlightened monarchs included Fredrich the Great of Prussia, Catherine the Great of Russia, and Leopold II of Tuscany.

During his journeys of enlightenment, Joseph II became acquainted with innovations in the field of general nursing, especially in France. He was

particularly impressed by the Hôtel Dieu in Paris. Located on the banks of the Seine near Notre-Dame and founded in 651 A.D. by Saint Landry, it is reputedly the oldest, continuously-operated hospital in the world. By the mid-1780s the Hôtel Dieu was already renowned as an educational and training hospital.

Inspired by what he observed in Paris, Emperor Joseph II sought to reform the Austrian health system. Specifically, he set two broad objectives to improve Austria's treatment of the sick and medical science:

- The establishment of a central hospital.
- The reformation of medical studies. To this end, the Josephinum was opened in Währingerstraße in 1785 as the "medical-surgical academy." The Josephinum still exists today, and it houses the museum of the Institute for the History of Medicine.

Under Joseph's reign Vienna's General Hospital, the Allgemeines Krankenhaus (AKH), opened in 1784, as did Vienna's first insane asylum, the Narrenturm. The General Hospital, site of today's university campus, was built on the grounds of Vienna's former Großarmen-und Invalidenhaus, which was constructed in 1693-97 on the orders of Emperor Leopold I (1640-1705). By 1683, after the second Turkish siege of Vienna, the city of Vienna and its immediate surroundings, were occupied by many homeless, refugees, and invalids. These individuals sought shelter in the newly built poorhouse, the Invalidenhof.

The existing Großarmenhaus closed in 1782, and was selected as the site for a central hospital. In 1783 Joseph II announced a competition by court decree, asking Viennese physicians to submit proposals for the sensible conversion of the Großarmenhaus into a large hospital. The winner of this competition was offered the post of director of the General Hospital. Not surprisingly, the winner was Josef Freiherr von Quarin, the emperor's personal physician. He was assuredly the person most familiar with the emperor's concepts of reform.

The large Viennese hospital was based on the Parisian model and was the first of its kind in the German-speaking world. All of the buildings of the Großarmenhaus were adapted to suit contemporary needs. The only new building was the Narrenturm, or as it was called at the time, the "Tollhaus" (i.e., lunatic asylum or madhouse). Its official name was k. k. Irrenanstalt zu Wien (k. k. stands for kaiserlich-königlich i.e., imperial-royal). To the locals it quickly became known as the "Fool's Tower." Joseph II financed the building from his private fortune. Josef Gerl was appointed as the architect for the Narrenturm. Herr Gerl designed a five-story structure in the shape of a tower with an open center. It had a familiar look to the residents of Vienna. Due to its appearance, and probably because of the Viennese fondness for culinary delights, the Viennese mockingly called the building the "Emperor's Gugelhupf" (i.e., the emperor's "Bundt cake.") Even today, the term "Guglhupf" is still used in Viennese for a psychiatric institution.

The Narrenturm stood somewhat apart from the rest of the hospital complex. This physical separation meant that the local population had unchecked access the grounds. Consequently the "Fool's Tower", or rather the patients within, became a kind of public amusement. To protect the patients,

the director of AKH, Vienna's General Hospital, Dr. Johann Peter Frank, had a wall erected around the tower in 1796. The wall kept onlookers at bay and afforded patients limited outdoors space, in addition to the existing small inner courtyards. Two courtyards were established: the men's courtyard facing the AKH, and the women's courtyard located on the other side of the tower.

The Narrenturm was informally opened on 19 April 1784. The first patients were transferred from two facilities: 66 people were relocated from the Versorgungshaus zu St. Marx, built in 1394 and considered the oldest hospital in Vienna; and 43 people were moved from the Spanisches Spital (the Spanish Hospital) founded in 1717. The ceremonial opening of the AKH did not take place until four months later, on 16 August 1784.

The Narrenturm was the first building erected solely for the purpose of psychiatry. In the course of the 18th century, the field of psychiatry gradually matured into an independent science. The Age of Enlightenment kindled a generally more humane treatment of the mentally ill, at least by the standards of the time. Of course, the term "mentally ill" is fairly ambiguous. In the 18th century "being insane" was not recognised as an illness. Rather, the patients' disorders were frequently ascribed to their own culpability i.e., their conditions resulted from their dissolute living conditions and their refusal to submit to social norms. Alternative diagnoses were worse – demonic possession. They were generally consigned to the larger faction of the "poor," the "outcasts," and those who languished outside society. Accordingly, they were treated just like other outcasts, like criminals. These unfortunates ended up in prisons, were locked away in cellars, or even exhibited for amusement at fairs. Furthermore, until the end of the 18th century it was alleged that mental disorders were incurable and that the only remedy was restraint and confinement. The idea that the mentally ill were in fact sick individuals who needed "treatment" gradually gained acceptance by the end of the century. The establishment of a separate institution for this group of castaways on the grounds of the hospital can certainly be seen as progress, certainly in a humane sense. Of course, today's standards of compassionate medicine should not be applied here. For example, decrees of the time speak of "forging" the unruly lunatics (that is, reforming the individual and making them compliant), and remnants of chains have been found in some cells. The patients were treated according to the humoral pathology that was common at the time. Humoral pathology was based on the idea that the human body has four important "humors," or fluids: blood, phlegm, black bile and yellow bile. Consequently, fashionable treatments included: the administering of enemas, bloodletting, vomiting therapies, and cold-water cures. No less a figure than King George III of Great Britain and Ireland was subjected to these primitive treatments. Not half way through his 60-year reign (1760-1820), George experienced episodic mental illness, characterized by acute mania. The King was physically restrained and caustic poultices were applied to draw out the "evil humors." By 1811, George has become permanently insane and he lived out his remining years "in seclusion." One must bear in mind that this new Narrenturm preceded by one hundred years the revolutionary psychodynamic theory proposed by another Austrian neurologist. It was 1881 when Sigmund Freud, the

founder of psychoanalysis, practiced in Vienna and then penned his "The Interpretation of Dreams" in 1900.

The demand for space at the Narrenturm soon exceeded capacity and additional accommodations were required. Thus the "Lazareth" at the end of Währingerstraße, originally built as a plague hospital and used as a military hospital since 1766, was assigned to the Narrenturm as its own department in 1803. Here, "curable" and "calm" lunatics were accommodated. Another department was the so-called "Dreiguldenstock," which was established in the northernmost part of the AKH. Here, as the name suggests, the wealthier lunatics, those who could pay 3 guilders per day, were admitted. They received special care and meals.

In 1848-53 the new Lower Austrian State Lunatic Asylum was built at Bründlfeld (Vienna). In 1870, Bründlfeld established the first psychiatric university hospital. Additionally, Bründlfeld instituted a completely new concept of hospital accommodation. While the cell corridor system (i.e., individual or pair detention) prevailed in the Narrenturm, Bründlfeld arranged group units or guard rooms. This facility was ultimately demolished in 1974 to make way for the new AKH's construction. The new AKH was officially opened on 7 June 1994.

Beginning in 1866, patients were moved from the Narrenturm to other institutions (Landesirrenanstalt am Bründlfeld, and Ybbs) and in 1869 the last patients had left the Narrenturm tower. After 1870, the Narrenturm was used to house the AKH's service rooms. After the turn of the 20th century service flats were set up here for the AKH's nursing staff and doctors. In 1971, the Pathological Museum moved into the Narrenturm and was initially housed in 25 cell rooms on the B floor. Gradually, additional individual rooms and floors were allocated for use by the museum. In November 1993, the last workshops and service flats were moved out. Since 1993, the entire tower has been used exclusively as a museum. Today the Narrenturm is a national registered building and is now owned by the University of Vienna. In 1993 the old AKH was donated by the City of Vienna for use as a university campus.

Born of military necessity on the banks of the Danube in Roman times, Vienna continues to breathe new life into the fields of anthropology, culture, forensics, history, and medicine. Today the Narrenturm is officially known as the Pathologisches-Anatomisches Bundesmuseum, or the Vienna Pathological-Anatomical Museum. This exceptional institution thrives under the auspices of the National Historical Museum of Vienna. The Narrenturm houses pathological and developmental anomalies previously curated or housed in universities, hospitals, and museums throughout Austria. Its unique collection has grown to more than 50,000 elements. The Narrenturm unarguably houses the largest collection of pathological human remains in the world. It contains a permanent record, inscribed in bone, of Vienna's history. And yet to this day, despite its irreplaceable and inimitable value, it continues to be known as the "Fool's Tower."

Our goal in creating this atlas is to safeguard Vienna's rich past and to reassure researchers that it has a future.

Figure 1. The five-story Narrenturm (Fool's Tower) in Vienna, Austria as it appeared in 2018.

Figure 2a-b. Some of the wet specimens in glass containers and locked medical cabinets housing skeletal elements and one of the many articulated skeletons in 2018.

Figure 3. One of the decorative doors in the Narrenturm and the newly designed elevator.

Figure 4a-b. Some of the many hallway exhibitions and locked medical cabinets in the Narrenturm with its original vaulted ceiling and flooring in 2018.

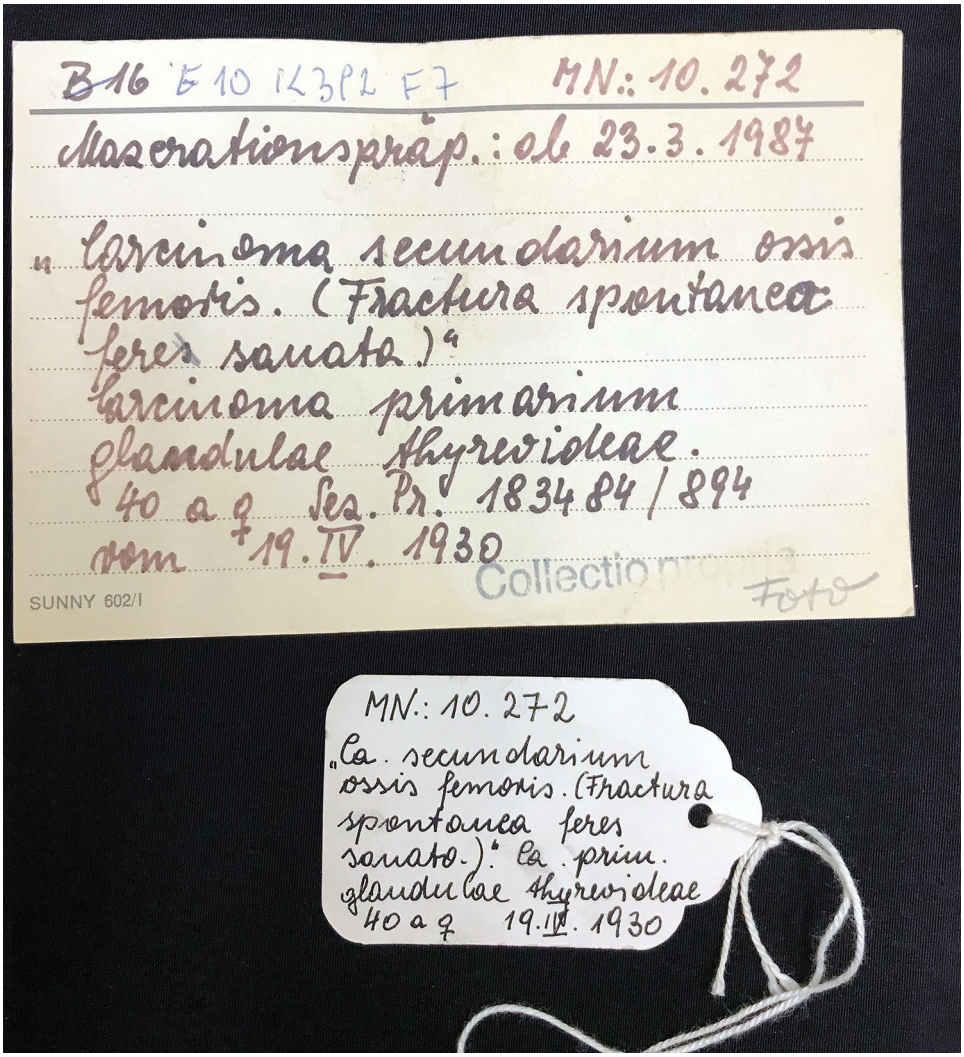

Figure 5. An example of one of the museum cards and paper tags that accompanies and provides an overview of each skeleton or skeletal element housed in the Narrenturm. This card and tag are for a 40-year-old female who sustained a fracture of the femur, secondary to thyroid cancer and died in 1930. Most museum specimens are accompanied with more detailed historical, medical, or patient histories.

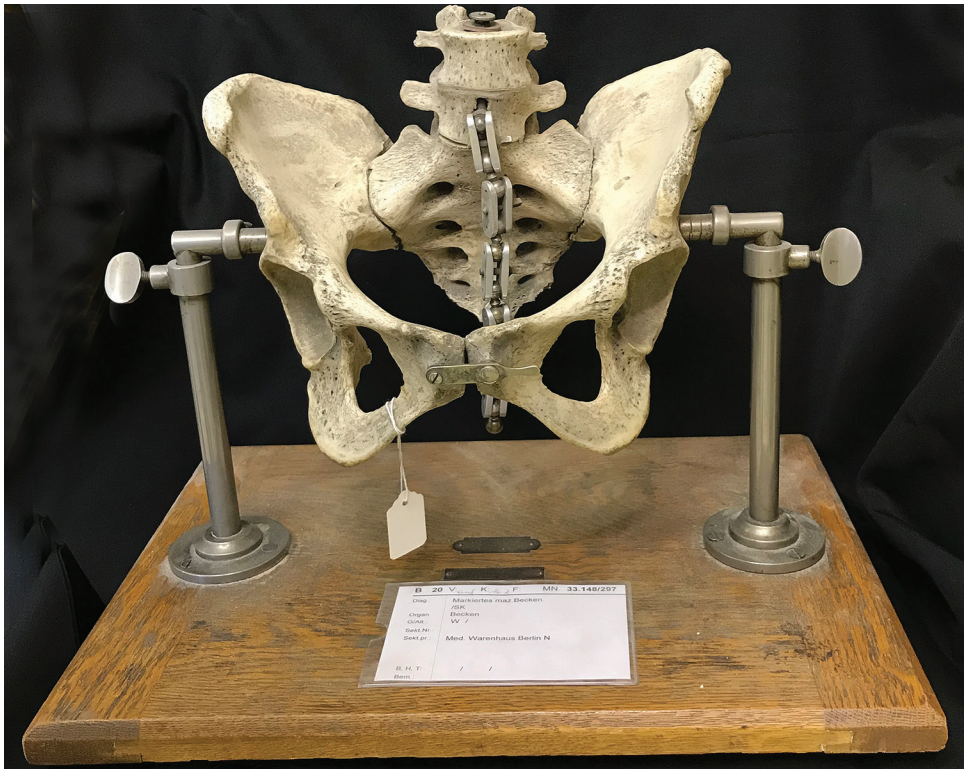

Figure 6. Display of a normal female pelvis from the Medical Warehouse in Berlin, Germany. The pelvis is elaborately mounted so that it can be rotated for closer examination.

ACKNOWLEDGMENTS

The authors thank Dr. Beatrix Patzak, Dr. Verena Hofecker, Mag. Anatole Patzak and Dragica Simecek and from the Natural History Museum, Dr. Katrin Vohland and Mag. Markus Roboch for their support, as well as Prof. Renate Kain from the Medical University of Vienna. We would also like to thank retired pathologist Prof. Feigl.

Additional consultation was provided by other specialists to include orthopedic surgeon Paul Moroz MD; clinical pathologist Helen Thompson MD of the John A. Burns school of Medicine University of Hawaii; forensic odontologist J DeMeo, DDS; dermatologist Douglas W. Johnson MD; and forensic osteologist Sittiporn Ruengdit, PhD of the Department of Forensic Medicine, Chiang Mai University School of Medicine, Thailand. Hanna Polasky assisted with a search of the literature for some exemplars. We are thankful to our editors Professor John R. DeFreytas and Sherrye L. Landrum who took our original manuscript cut it to the bone, eliminated bones of contention, and then fleshed it out to become the book you now hold.

CONTENTS

THE INCREDIBLE BONES OF THE NARRENTURM

Chapter 1

CONGENITAL AND DEVELOPMENTAL MALFORMATION

Skull

Figure 7. Bipartite/divided left parietal bone (arrow) in a fetus with an encephalocele in the occipital region, a rare congenital birth defect occurring in approximately 1 in 3,000 to 1 in 10,000 live births (Markovic et al. 2020; Sheikh et al. 2014) resulting in leakage of cerebrospinal fluid and herniation of the brain. Bipartition, the formation of an accessory suture in the skull, is rare (Weidjik et al. 2016), may be misidentified as a fracture (Mann and Hunt 2019), and occurs as a result of a secondary center of ossification (Mann et al. 2016). The simultaneous occurrence of these two conditions as in this individual is exceptionally rare.

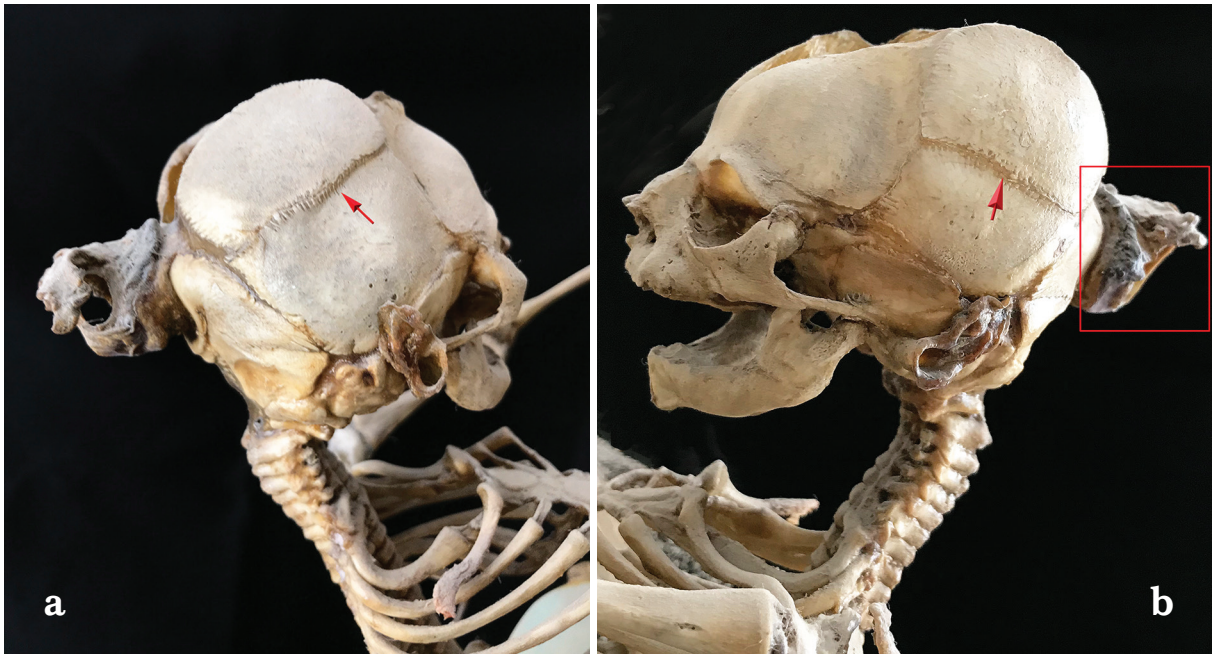

Figure 8a-b. (a) Right and (b) left lateral views of bipartite bones, sometimes referred to as the sub-sagittal suture (arrows) (Sanchez et al. 2010) dividing the parietal bones into superior and inferior halves, possibly resulting in plagiocephaly in a fetus. The parietal bone typically ossifies from a single center and rarely from two centers that fail to unite as in this fetus (Mann et al. 2016). Unilateral bipartite, sometimes referred to as divided parietal bone, is one of the rarest bipartitions in the human skull occurring at a frequency of 3 in 25,000 radiographs (Shapiro 1972), or about 1 in 8,300 crania. The frequency of bilateral bipartite bones is unknown but is exceptionally rare. Note that the dura mater containing cerebrospinal fluid and brain matter has herniated (encephalocele) through the occipital region (rectangle).

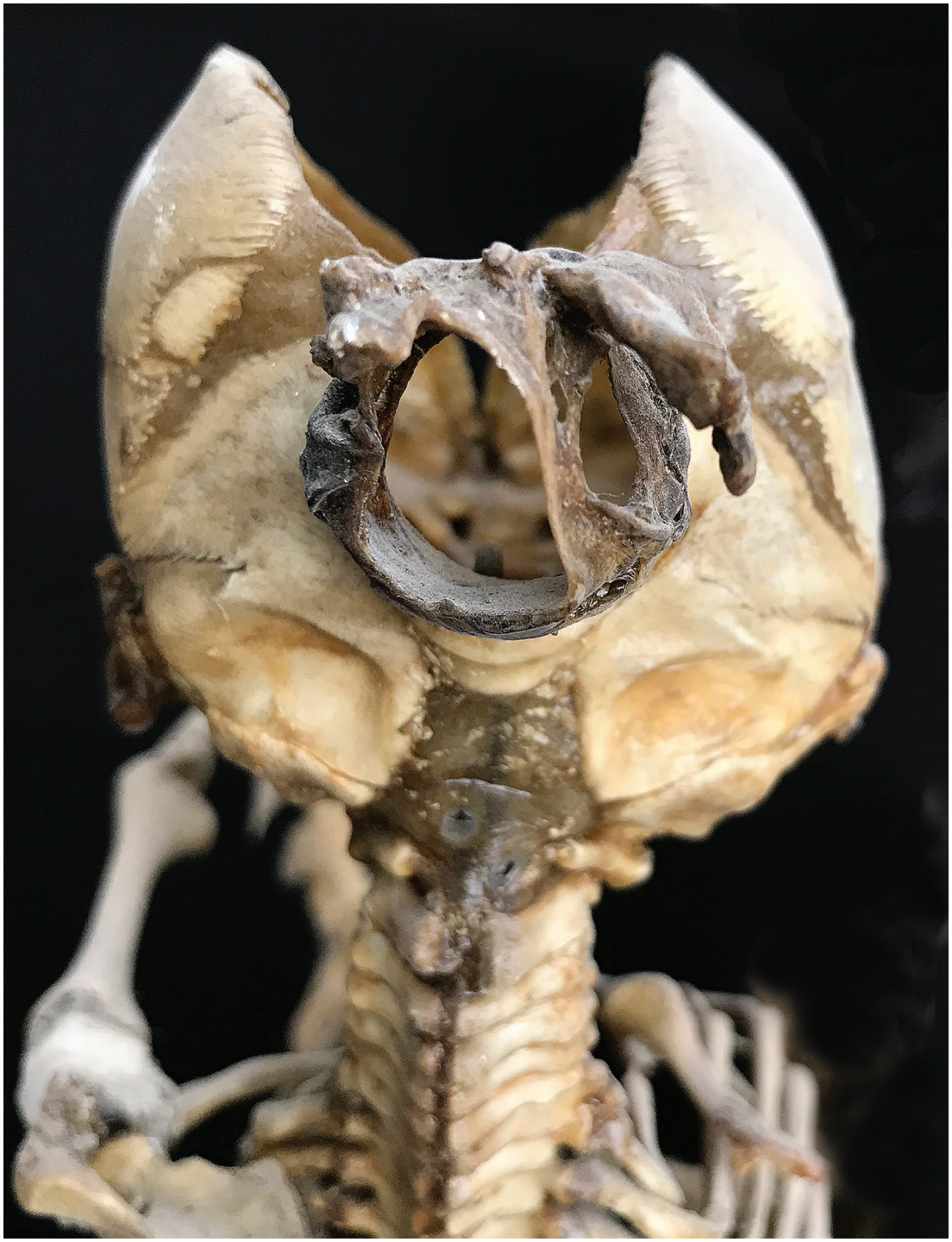

Figure 9. Posterior view showing an encephalocele, with herniation of dura mater through the occipital region in a fetus. Encephalocele is a condition within the spectrum of neural tube defects and a rare birth defect consisting of cerebral tissue, sometimes with a partial or complete meningeal covering, through a defect in the skull (see Sheikh et al. 2014).

Figure 10. Craniopagus conjoined twins (classified as partial Vertical II) fused at the skull (Stone and Goodrich 2006) (MN81.359/4426) who died in 1884. This rare congenital malformation due to incomplete embryonic separation is more common in females and has been reported as occurring once in about every 2.5 million live births (O'Connell 1976; Edmonds and Layde 1982). Conjoined twins are identical twins who are connected physically and, in these two individuals, shared part of the skull and brain tissue. Approximately 25% of craniopagus twins survive and may now be considered for surgical separation (Kaufman 2004). See Stone and Goodrich (2006) for classification of craniopagus twins.

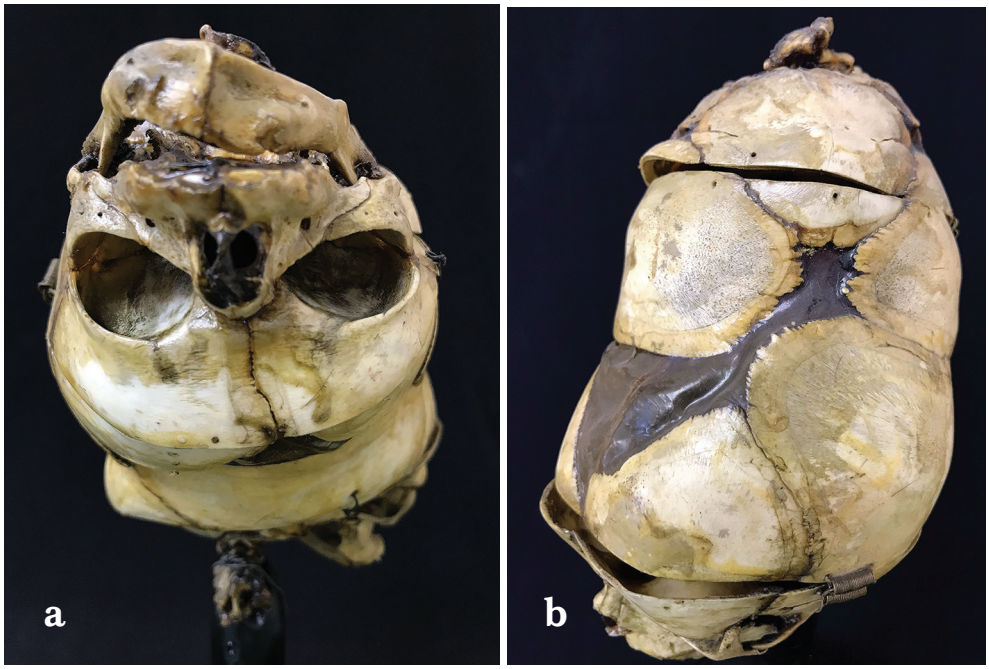

Figure 11a-b. Craniopagus conjoined twins, classified as partial Vertical II, fused at the skull (Stone and Goodrich 2006) who died in 1884 (MN81.560/4426). This rare congenital malformation of unknown etiology is more common in females and has been reported as occurring once in about every 2.5 million live births (O'Connell 1976; Edmonds and Layde 1982). Conjoined twins are identical twins who are connected physically and, in these two individuals, shared part of the skull and brain tissue. Approximately 25% of craniopagus twins survive and may now be considered for surgical separation (Kaufman 2004).