



Josias Weitbrecht, the founder of syndesmology, and the history of the retinacula of Weitbrecht

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Abstract

“*Syndesmologia sive historia ligamentorum corporis humani*”, published in 1742 by a German anatomist Josias Weitbrecht (1702–1747), who for a long time lived and worked in St. Petersburg, is the first comprehensive textbook of syndesmology. The accuracy and quality of the accompanying illustrations are fascinating, even after almost 300 years. Weitbrecht was also the first to describe the synovial folds of the hip joint, later named after him as the retinacula of Weitbrecht. This eponym appeared in the first half of the nineteenth century in the studies of femoral neck fractures published in the UK. In the study of syndesmology, Weitbrecht was followed by a number of outstanding authors of that time, such as Meckel, Barkow, Arnold, Henle, Humphry and Fick.

Keywords Weitbrecht · Syndesmology · Arthrology · Retinacula of Weitbrecht · Synovial folds of the hip

Introduction

The textbook “*Syndesmologia sive historia ligamentorum corporis humani*” published in 1742 by Josias Weitbrecht (JW) had a substantial impact on the development of arthrology [42]. Today, the book is only known to a few insiders and the author’s name can be recalled only from several eponyms, the retinacula of Weitbrecht in particular [19]. The author’s personality and the story of his book are of sufficient interest to warrant more detailed consideration.

Josias Weitbrecht

JW was born on 20 October 1702 in Schorndorf (Württemberg, Germany). He studied natural sciences at the University of Tübingen, where he gained the degree Master of Philosophy. In December 1721, he went, together with a French anatomist and surgeon Joseph-Guichard Duverney (1648–1730), to St. Petersburg. Before the establishment of the St. Petersburg Academy of Sciences (1725), he worked in the Institute of Comparative Anatomy (for 200 rubles a year) and from 1726 he also taught arithmetic. From 1727 he began to concentrate only on anatomy, under Duverney’s supervision [32]. In 1729, he completed *Compendium anatomicum*—a description of an anatomical collection of the Dutch anatomist Frederik Ruysch (1638–1731), including 2000 embalmed specimens [26]. The collection was bought by the Russian Tsar Peter the Great (1672–1725), in 1717, for his Kunstkamera in St. Petersburg (today there are still about 900 of them deposited in the Peter the Great Museum of Anthropology and Ethnography in St. Petersburg).

In 1731, JW was appointed a member of the Academy for Physiology (with a salary of 460 rubles and later 860 rubles). Probably due to his rather controversial personality traits, JW did not interact well with other people and had several conflicts with his colleagues in the Academy. In 1736, based on his dissertation thesis “*De febrili constitutione petechizante*”, JW was awarded the degree of Doctor

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of Medicine at the University of Königsberg (now called Kaliningrad). In 1742, he published his masterpiece “*Syndesmologia siue historia ligamentorum corporis humani*”.

In 1743, JW’s contract with the Academy expired and was not renewed. However, for another 3 years he was allowed to stay in his position based on a freelance contract. In September 1746, he was dismissed from the Academy. Thanks to intervention of the count Alexei Grigorjewitsch Rasumowski (1709–1771) the contract was renewed and JW was re-appointed a member of the Academy in January 1747. However, due to his poor health, sapped by the hardships of life, JW died shortly after that, on 28 February 1747, leaving behind him his wife Katharina Sophia with two daughters and two sons. The fifth child was born after his death. The family then returned back to Germany and their further fate is not known.

JW was one of the most prominent anatomists of that time, with an all-round education and an excellent style of the Latin that he used in his works. His major work is “*Syndesmologia siue historia ligamentorum corporis humani*”. In addition to “*Syndesmologia*”, JW published about 21 longer or shorter reports in the Memoirs of the St. Petersburg Academy (*Mem. de l’Acad. Imp. des sc. de St. Petersburg*), where he described individual ligaments, muscles, autopsy findings and anatomical variants. JW dealt also with physiological issues as shown by his study “*De circulatione sanguinis cogitationes physiologicae*”, focused on the system of blood supply in view of blood circulation in small blood vessels. In winter 1738, he recalibrated the Delisle thermometer to a new temperature scale and, as a result, the Delisle thermometer remained in use for almost 100 years in Russia. JW also contributed several popular science articles to the St. Petersburg Newspaper Supplement. His short autobiography can be found in the archives of the St. Petersburg Academy [24, 38, 43].

“*Syndesmologia*” and its story

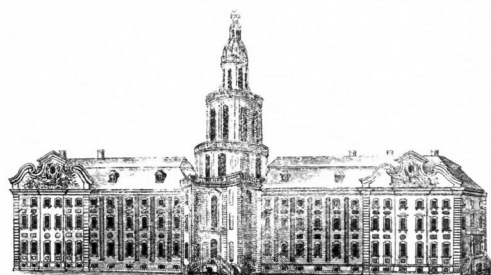
The textbook “*Syndesmologia siue historia ligamentorum corporis humani*”, the result of the author’s long-term efforts, is an in-depth and a reliable description of all ligaments and joints of the human body, verified by his own autopsy findings. It was published in St. Petersburg in 1742 and included 278 pages, 26 tableaus with 82 figures and their description (Fig. 1) [42].

The work is divided into seven sections, including a general description of ligaments; joints of the upper limb; head; trunk (spine and pelvis); lower limb; ligaments of soft tissues (e.g. dura mater, external eye, larynx, liver, etc.); the last, seventh section contains the legends to the figures.

The illustrations are presented on 26 tableaus with 82 steel engravings. The artists were Andreas Grechow and his

SYNDESMOLOGIA SIVE HISTORIA LIGAMENTORVM CORPORIS HVMANI

QVAM
SECVNDVM OBSERVATIONES ANATOMICAS
CONCINNAVIT
ET
FIGVRIS AD OBIECTA RECENNTIA ADVMBRATIS
ILLVSTRAVIT
IOSIAS WEITBRECHT D. M.
ACADEMIAE SCIENTIARVM PETROPOLITANAE MEMBRVM
ET TROFESSOR PHYSIOLOGIAE.



PETROPOLI, EX TYPOGRAPHIA ACADEMIAE SCIENTIARVM.
ANNO MDCCXLII.

Fig. 1 Title page of Weitbrecht’s “*Syndesmologia*” [43]

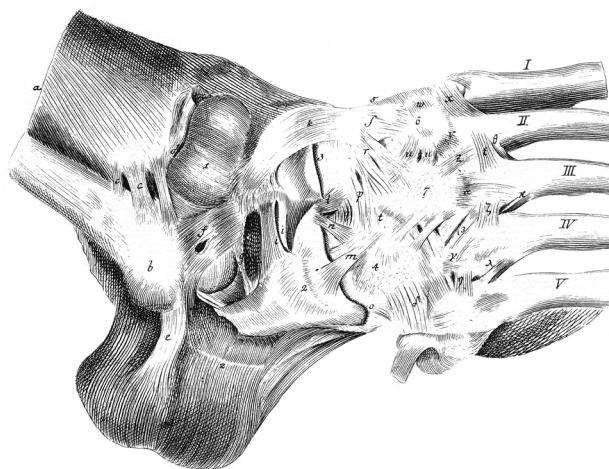


Fig. 2 Steel engravings of ligaments of the ankle and the foot from Weitbrecht’s “*Syndesmologia*” [43]

two pupils, Gregorius Katschalow and Iohannes Sokolow. All the illustrations are highly impressive, primarily for their comprehensiveness, accuracy and attention to detail. An example may be the ankle (Fig. 2) where the shape of

the anterior tibio-fibular ligament exactly corresponds to the recent studies [10]. A number of views presenting individual articular structures have been used as standards in the anatomical literature until today, although their names, particularly those of ligaments, differed significantly from the current anatomical terminology.

Another extraordinary aspect of the textbook is its typography, with more than ten different font styles and sizes. Each paragraph is followed by references to works of individual authors, including a brief commentary. References to figures can be found on the page margins. Each double-page ends in a footnote that contains a word representing the first word of the following page. A list of errata is included at the beginning of the textbook.

Syndesmologia soon became famous internationally. The first French version, translated by Pierre Tarin, was published as early as in 1752, under the title “*Desmographie ou Description des Ligaments du Corps Humain. Durand, Libraire Rue St. Jaques á Griffon, Paris 1752*” (Fig. 3).

The German edition was quite delayed despite the fact that the Weitbrecht’s brother Johann Jacob Weitbrecht, a bookseller in Greifswald, acquired a certain number of copies of the Latin edition and the publication rights for the German version from the Academy as early as in 1760. The German version was based on the French translation and appeared as late as in 1779 under the title “*Weitbrecht Josias: Syndesmologie, oder Beschreibung der Bänder des menschlichen Körpers und einem vollständigen Auszug gebracht und mit allen darzu gehörigen Figuren versehen. König, Strassburg 1779*”. The translator is not known but it might be Chr. Krause from Leipzig [34].

The English version was published in 1829. It was translated by a prominent Dublin anatomist and surgeon, Robert Harrison (1796–1859), under the title “*Syndesmologia, or Description of the Ligaments of the Human Body by Josias Weitbrecht*” (Hodges and Smith Dublin 1829).

Kaplan [43] compared the three translations and found out that the French one was reduced from the original 278 to merely 144 pages, in addition with numerous mistakes. The number of figures that were obviously carefully redrawn from the original, although at a lower quality, was also reduced. The German translation was based on the French version. The English version had only 62 pages and included additional short comments on the function of individual ligaments.

As a result of the decline of Latin as a language of educated people, and the absence of anyone capable of re-editing the original Weitbrecht’s book, it was gradually forgotten by the broader medical public. Attention began to focus on textbooks written in national languages. Nevertheless, Weitbrecht’s work was cited in a number

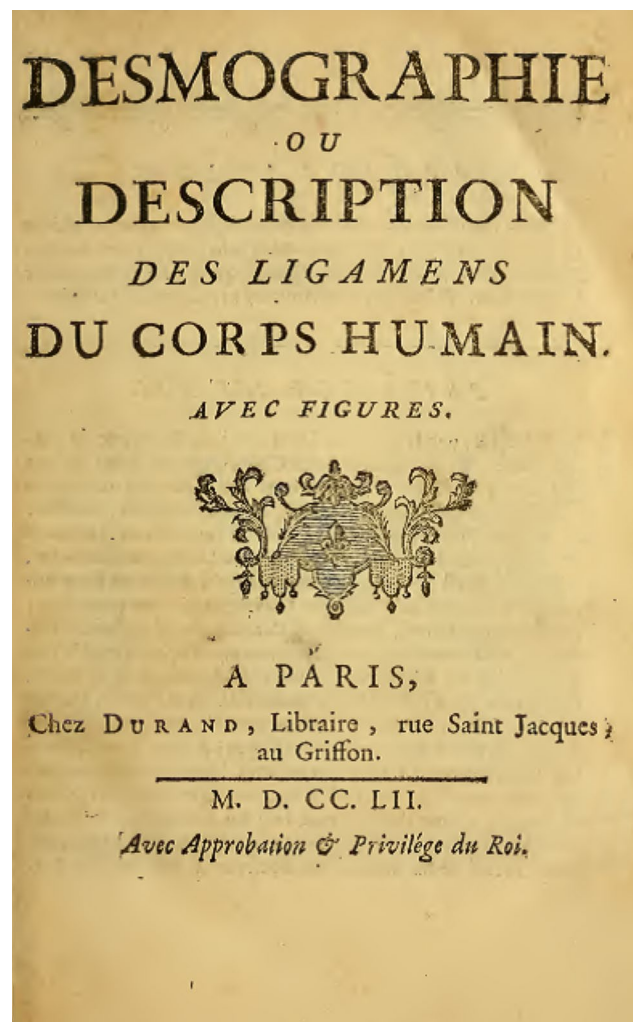


Fig. 3 Title page of the first French translation of the Weitbrecht’s “Syndesmologia” [43]

of anatomical textbooks throughout the entire nineteenth century. In the first half of twentieth century, the book fell into oblivion and was re-discovered as late as in 1969.

In 1969, the Saunders Publishing House published the English version of the book translated from the Latin original by Emanuel B. Kaplan (1894–1980), an outstanding American orthopedist and anatomist of the Ukrainian origin, who spoke five languages [37]. Before that, in 1949, Kaplan translated *Duchenne’s Physiology of Motion* from French into English. He came across the original of the Weitbrecht’s book during his study of eponyms of ligaments of the knee joint in quite an intricate way, which he described in the preface of the English version. There he presented also the author’s personality and life, and the circumstances under which the book and its translations came into being. Part of the unabridged translation was also the original complete set of illustrations [43].

Weitbrecht's followers and their works

Weitbrecht's *Syndesmologia* had inspired a number of other authors, particularly his German compatriots, to write similar works. The most prominent among them were J. F. Meckel, H. K. L. Barkow, F. Arnold, F. G. J. Henle, G. M. Humphry and R. Fick.

Johann Friedrich Meckel Jr. (1781–1833), an outstanding German natural scientist and anatomist, published a four-volume textbook of anatomy *Handbuch der menschlichen Anatomie* in German in 1815–1820. In the second volume (664 pages) of 1816, Meckel dealt in detail with anatomy of the joints, with frequent references to Weitbrecht [30]. As a matter of interest, Meckel presented there one of the oldest descriptions of the tibiofibular interosseous ligament, that he called “*lig. tibia-fibulare superius*”. A great disadvantage of the book is the absence of illustrations.

Hans Karl Leopold Barkow (1798–1873) was another German anatomist, from Breslau (now Wroclaw in Poland). In 1842, he published *Syndesmologie oder Lehre von den Bändern* (121 pages) [7, 41]. In the preface, he highly appreciated the Weitbrecht's textbook, which had an obvious effect on the structure of his book. One of the positives of Barkow's book is a detailed description and statistical data on the incidence of individual structures and the number of specimens studied. It also shows an apparent shift of the terminology towards the standards used today. A drawback of this otherwise very good work is again the absence of illustrations.

Friedrich Arnold (1804–1890), a prominent German anatomist at the University of Heidelberg, published in 1842 a large-format atlas containing seven lithographic tableaux with a number of drawings of all the joints of the human body—*Abbildungen der Gelenke und Bänder des menschlichen Körpers* (Fig. 4) [5]. The author dedicated the book, which was published exactly 100 years after *Syndesmologia*, in memory of Josias Weitbrecht. The quality of the lithographs capturing

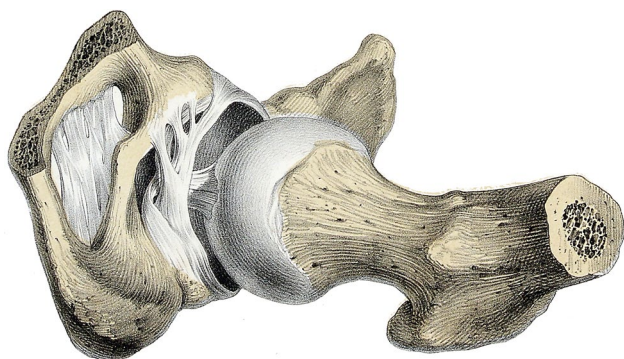


Fig. 4 Lithography of the hip joint—after Arnold [5]

a number of minor ligaments (such as interosseous ligaments of the wrist and foot) is extraordinary. Several years later (1845–1851), Arnold published a three-volume anatomical textbook *Handbuch der Anatomie des Menschen mit besonderer Rücksicht auf Physiologie und praktische Medizin* [6]. A detailed description of bones and joints was presented on 236 of a total of 1358 pages.

Friedrich Gustav Jakob Henle (1809–1885), another renowned German anatomist working primarily in Göttingen, published in 1855 a textbook on anatomy—*Handbuch der systematischen Anatomie des Menschen*. The first volume deals with the anatomy of bones and joints that are described in great detail on 183 pages, and amply documented by faithful anatomical drawings [23].

George Murray Humphry (1820–1896), one of the best known English anatomists of that time, published in 1858 a very detailed 620-page book—*A treatise on human skeleton including joints*, accompanied by a number of instructional illustrations [25]. One of them also shows synovial folds of the hip. In the same year, i.e. in 1858, the first edition of Gray's Anatomy was published, which, however, contains a rather modest description of bones and joints [20].

Rudolf Fick (1866–1939) was a member of a famous family of anatomists. He worked at a number of universities, ranging from Würzburg to Berlin. Between 1904 and 1911, during his stay in Leipzig and Prague, he published a monumental, until today unsurpassed in terms of comprehensiveness, three-volume textbook on arthrology *Handbuch der Anatomie und Mechanik der Gelenke* [15–17]. The first volume presents on 512 pages a very detailed description of the joints of the spine and limbs, amply documented by anatomically highly faithful drawings [15]. The remaining two volumes deal with the function of joints (Gelenkmechanik) [16, 17]. The global spread of the book, that has lost nothing of its relevance today, was hindered by the absence of an English translation. In spite of that, it holds true that those who intend to study the anatomy of joints, should start with Fick's textbook.

At the end of this historical line, starting with the Weitbrecht's “*Syndesmologia*”, is the book *Praktische Anatomie*, published by Titus von Lanz (1897–1967) and Werner Wachsmuth (1900–1990). The first two volumes, i.e. *Arm* [27] and *Bein und Statik* [28], were published in 1935 and 1938, respectively. Anatomy is presented there in view of clinical needs. These two books belong to the first modern clinical textbooks of anatomy of the musculoskeletal system.

Weitbrecht's successors in St. Petersburg

The immediate successor to Weitbrecht's post of the Chair of Anatomy in St. Petersburg Academy cannot be traced, but those following include two outstanding personalities, N.I. Pirogov and W. Gruber.

Nikolaj Ivanovič Pirogov (1810–1881), a prominent Russian surgeon, was, in 1841, appointed professor and head of the Department of Surgery in St. Petersburg Academy. In 1844, he prepared, together with his colleagues, a construction project of a new *Institute of Practical Anatomy of the Medical Surgical Academy*, that was opened in 1846 and Pirogov was appointed its head. Part of this Institute was also an experimental department. Pirogov did not perceive anatomy as a descriptive discipline, but rather as a body of information that would allow surgeons to improve their professional skills. In this sense, he also conceived his first work on anatomy “*Chirurgische Anatomie der Arterienstämme und Fascien*”, presenting topographic anatomy of arteries, their ramifications and relationships to fasciae; also recommending optimal surgical approaches to arteries. His work culminated in the publication of an atlas of anatomical sections “*Anatome Topographica sectionibus per corpus humanum congelatum*”. This four-volume work, which came into being between 1851 and 1859, has more than 600 pages and 216 tableaux, with 995 drawings, capturing individual regions in three basic anatomical planes [33]. The drawings are based on sections of frozen human cadavers. As a result, Pirogov got a good grasp of, and described, the mutual relationships between organs, altered during autopsy. Pirogov stayed in St. Petersburg until 1858, when he left for Kiev [13].

Wenzel Leopold Gruber (1814–1890), born in the Pilsen region (Bohemia), was prosector for normal anatomy at the Charles-Ferdinand University in Prague in 1842–1847. Although well-qualified, he was unable to gain a professorship in his own country. In 1846, he met Pirogov in Prague, and, through his initiative, he was invited to become the first prosector for normal, practical and pathological anatomy at the Medical Academy in St. Petersburg, where he arrived in 1847, i.e. 100 years after JW died. For about 30 years, between 1855 and 1887, Gruber was in the position of the head of the department of practical anatomy of the Academy. Gruber played an active role in the establishment of the Institute of Anatomy and Physiology in St. Petersburg and founded a museum there. During 41 years, Gruber published almost 500 scientific works, about half of which include descriptions of anatomic anomalies [21]. Remarkable was his contribution as a teacher, as he was involved in the education of more than 8000 Russian physicians. His inheritance served as a foundation providing grants to the Russian medical students. Gruber’s bust can be seen in the St. Petersburg Institute of Anatomy to this day [31].

Retinacula of Weitbrecht

A number of anatomical structures bear Weitbrecht’s name—W. cartilage (discus acromioclavicularis), foramen ovale W. (shoulder), chorda obliqua W. (forearm), ligamenta meniscofemoralia W. (knee). The best known are synovial

folds of the hip, called the retinacula of Weitbrecht. Weitbrecht described them as follows ... *internal fibres of capsular membrane, which do not extend as far, are reflected for insertion around the neck of the femur and ascend towards its head where joins the perichondrium....* (Fig. 5).

Neither the history of the eponym “retinacula of Weitbrecht”, nor the history of their study has yet been described. As a number of authors of major syndesmologies were of German origin, it would be logical to expect that the eponym came into being in the German anatomical literature. But this is not the case. Although all the above-mentioned Weitbrecht’s German successors repeatedly referred to his textbook, synovial folds were mentioned either only briefly in their works, or not at all.

The first to deal with synovial folds of the hip joint in a greater detail, after Weitbrecht, were the British anatomists and surgeons in the first half of nineteenth century, who studied fractures of the proximal femur. They used post-mortem joint specimens of femoral neck fractures to examine the condition of the joint capsule and intra-articular

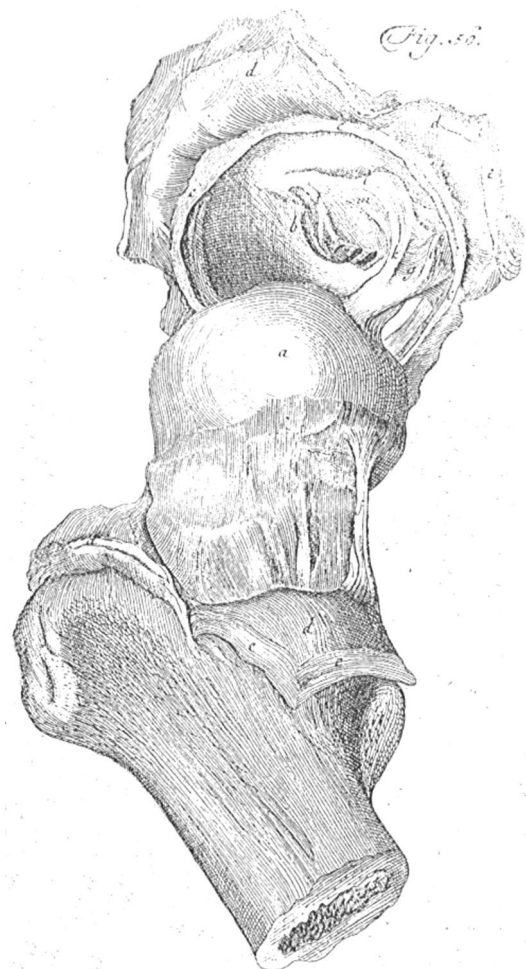


Fig. 5 Synovial folds of the hip joint after Weitbrecht [43]

structures of the hip joint. Synovial folds were for the first time mentioned by Astley Paton Cooper (1768–1841) in 1823 [12]. In his textbook, he discussed their importance in femoral neck fractures, both in mechanical terms and from the viewpoint of the blood supply to the femoral head. He also documented them by drawings showing both the superior (lateral) and inferior (medial) retinacula, including blood vessels passing within them (Fig. 6). However, Cooper did not mention Weitbrecht.

The first mention of Weitbrecht in connection with synovial folds that we found was in the Cyclopaedia published by Robert B. Tod (1809–1860) in 1839 [40]. Henry Hancock (1809–1880), [22] as well as Robert Adams (1795–1871), [1] pointed out there the priority of Weitbrecht's description. Robert Adams, a famous English anatomist and surgeon from Dublin, stated literally “longitudinal plicae or folds; some of the lowest and most distinct of these are denominated by Weitbrecht's retinacula”.

Another mention of retinacula ascribed to Weitbrecht can be found in the study dealing with proximal femoral fractures, published by another outstanding Dublin surgeon Robert William Smith (1807–1873). In 1840, Smith described their role in femoral neck fractures as follows: “The most important of these is reference to the condition of the longitudinal folds of fibro-synovial membrane, which invest the neck of the bone; they have been termed ‘retinacula’ by Weitbrecht, and constitute, in the normal

state, a cylindrical sheath of considerable strength...”. In the description of 42 cases of proximal femoral fractures he focused on the condition of these synovial folds [35]. In his textbook, published in 1850 [36], in the chapter dealing with proximal femoral fractures, Smith already uses the term “cervical ligament of the femur—‘retinacula’ of Weitbrecht”.

The interest of British surgeons in the synovial folds of the hip was motivated by their long-term study of proximal femoral fractures. Cooper, Adams and Smith, all of them



Fig. 7 Retinacula of Weitbrecht—a postmortem specimen of a femoral neck fracture after Smith [35]

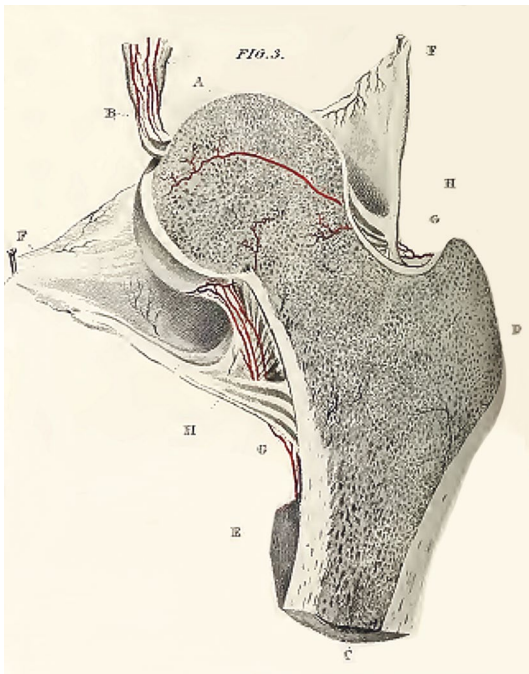


Fig. 6 Synovial folds of the hip joint and blood supply to the femoral head after Cooper [12]



Fig. 8 Medial synovial fold of the hip joint after Amantini [2]

members of Trinity College Dublin, presented, in the first half of nineteenth century, a number of fundamental findings about these fractures, that are still valid today [8, 9]. A significant contribution to the body of knowledge about synovial folds of the hip was made by Harrison's translation of Weitbrecht's *Syndesmologia*. Richard Harrison, a prominent anatomist and surgeon from Dublin, was also a member of Trinity College.

The history of description of individual retinacula is also interesting. Weitbrecht did not specify the number of folds; Cooper depicted two folds, the medial and the lateral ones; and Smith added to these two folds, on postmortem specimens, a third, the anterior fold (Fig. 7).

The first to mention the existence of three retinacula of Weitbrecht was most probably McAlister in 1889 [29].

In 1888–1890, Amantini published a detailed study of the medial synovial fold (medial retinaculum), that he called *plica pectineo-foveolaris* (piega pettineo-foveale) [2, 3]. The description of the plica was very detailed and the author also injected contrast medium into the blood vessels passing through it. On the basis of his findings he discussed the importance of the plica to the blood supply of the femoral head under normal circumstances and in case of a femoral neck fracture (Fig. 8). Amantini also dealt with the incidence and shape of the plica in various animal species (horse, seal,

frog etc.). In addition, he analyzed in detail the available literature and noticed that the synovial plicae of the hip joint were not mentioned by any of the prominent anatomists, except for Henle who published his drawing of the medial fold as early as in 1856 (Fig. 9) [23].

The first brief description of all three retinacula was published by Fawcett [14] in 1895. In 1904, Frazer [18] presented a detailed description of the superior retinaculum.

Of the German authors, synovial folds of the hip were dealt with in greater detail only by Rudolf Fick. In 1904, he presented a precise description of the medial retinaculum and called it *Amantini's pectineo-foveales fold* [15]. The same eponym was used in 1911 by a famous French anatomist Leo Testut (1849–1925), who also provided a detailed drawing of the fold in his textbook (Fig. 10) [39]. In 1917, Walmsley [41] discussed the microscopic structure of the retinacula and their function. Braun [11], in 1921, denoted synovial folds as "*ligamenta cervicis (or Retinacula)*" and pointed out their role in femoral neck fractures.

A detailed description of all three retinacula appeared, however, as late as in 1927, namely in the German literature, where the Russian anatomist *Anseroff* [4] published an extensive and, in many aspects, hitherto-unsurpassed study dealing with synovial folds of the hip joint. He was the first to present a thorough description of all three folds and their variability (Fig. 11). This

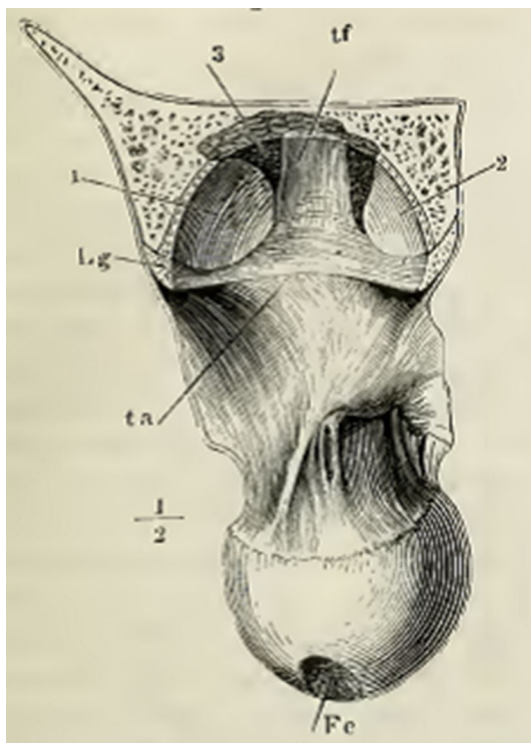


Fig. 9 Medial synovial fold of the hip joint after Henle [23]

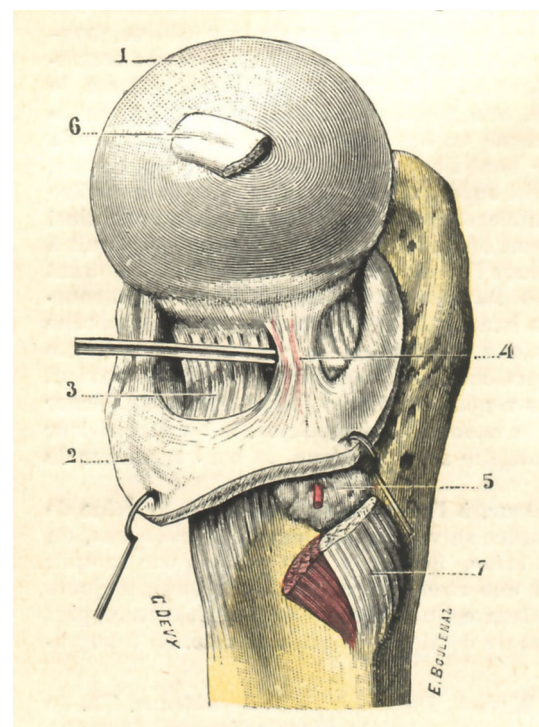
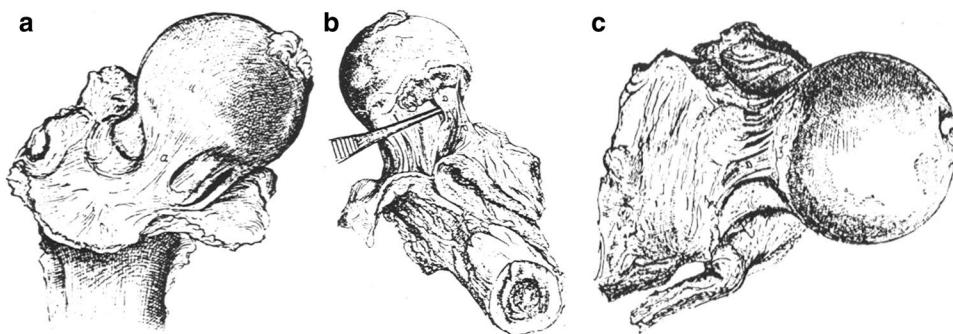


Fig. 10 Amantini's fold of the hip joint after Testut [39]

Fig. 11 Synovial folds of the hip joint after Anseroff. **a** Anterior fold, **b** medial fold, **c** lateral fold [4]



study is extraordinary in terms of both human and animal specimens dissected (apes, dogs, lions, horses etc.). Anseroff did not use the term *retinacula*, but “Synovialfalten” (synovial folds). In the description of the medial fold he mentioned the eponym Amantini’s fold. In addition, he pointed to a number of similar studies that were published in Russian at the beginning of the twentieth century. Nevertheless, he did not refer to the Weitbrecht’s *Syndesmologia*.

Conclusion

The Weitbrecht’s book is the first comprehensive textbook of syndesmology. The accuracy and quality of the accompanying illustrations are fascinating, even after almost 300 years. Weitbrecht was the first to mention synovial folds of the hip, which is memorialised today by the eponym “retinacula of Weitbrecht”. This eponym appeared in the United Kingdom in the first half of nineteenth century in connection with the research of femoral neck fractures.

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Author contributions JB: project development, manuscript writing/editing. ON: data collection, manuscript writing/editing.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

- Adams R (1836–1839) Hip-joint, abnormal conditions. In: Todd RB (ed) *The cyclopaedia of anatomy and physiology*, vol II. Longman, London, pp 808
- Amantini C (1888–1889) Una men nota ripiegatura sinoviale dell’ articolazione dell’ anca (piega pectineo-foveale). *Ann Univ Libera Perugia Anno IV* 1°:47–76
- Amantini C (1890) Di una men nota ripiegatura sinoviale dell’ anos (piega pectineo-foveale). *Contributo anatomico allo studio della frattura intra-articolare del collo del femore. Acta Med Chir Perugia* 2:3–10
- Anseroff NL (1929) Die Synovialfalten (Binnenbänder) des menschlichen Hüftgelenkes. *Z Anat Entw Gesch*; 89:580–605
- Arnold F (1842) *Abbildungen der Gelenke und Baender des menschlichen Körpers*. P. Baltz, Stuttgart
- Arnold F (1845–1851) *Handbuch der Anatomie des Menschen mit besonderer Rücksicht auf Physiologie und praktische Medicin*. Herder’sche Verlagshandlung, Freiburg
- Barkow H (1841) *Syndesmologie oder Lehre von Bänder*. GP Aderholz, Breslau
- Bartoníček J (2002) Internal architecture of the proximal femur—Adam’s or Adams’ arch? Historical mystery. *Arch Orthop Trauma Surg* 122:551–553
- Bartoníček J (2002) History of fractures of the proximal femur. Contribution of the Dublin surgical school of the first half of 19th century. *J Bone Jt Surg* 84-B:795–797
- Bartoníček J (2003) Anatomy of the tibiofibular syndesmosis and its clinical relevance. *Surg Radiol Anat* 25:379–386
- Braun H (1921) *Anatomie des Menschen. Erster Band—Bewegungs Aparat*. Springer, Berlin, p 528
- Cooper AP (1823) *A treatise on dislocations, and on fractures of the joints*, 2nd edn. Longman, London
- Eliška O, Knobloch J, Stingl J (2017) Nikolaj Ivanovič Pirogov, chirurg a anatom. *Čas Lék Čes* 156:214–221
- Fawcett E (1895) The retinacula of Weitbrecht. What is their function? *J Anat Phys* 30:53–58
- Fick R (1904) *Handbuch der Anatomie und Mechanik der Gelenke. Erster Teil: Anatomie der Gelenke*. Jena, Fischer
- Fick R (1910) *Handbuch der Anatomie und Mechanik der Gelenke. Zweiter Teil: Allgemeine Gelenk- und Muskelmechanik*. Jena, Fischer
- Fick R (1911) *Handbuch der Anatomie und Mechanik der Gelenke. Dritter Teil: Spezielle Gelenk- und Muskelmechanik*. Jena, Fischer
- Frazer E (1904) The insertion of the pyramidalis and obturator internus, and formation of the posterior circular capsular fibres and upper retinaculum of Weitbrecht. *J Anat* 38:170–185
- Gojda J, Bartoníček J (2012) The retinacula of Weitbrecht in the adult hip. *Surg Radiol Anat* 34:31–36
- Gray H (1858) *Anatomy descriptive and surgical*. John W. Parker and Son, London
- Gruber W (1887) *Verzeichniss der 1844–1887 veröfentlichten Schriften von Dr. W. Gruber*. St. Petersburg
- Hancock H (1836–1839) Hip joint, normal condition. In: Todd RB (ed) *The cyclopaedia of anatomy and physiology*, vol II. Longman, London, p 778

23. Henle J (1856) *Handbuch der systematischen Anatomie des Menschen*. Erster Band, zweite Abhandlung. Braunschweig, Friedrich Vieweg und Sohn, Bandlehre, pp 123–125
24. Hirsch A (1934) *Biographisches Lexikon der hervorragenden Ärzte aller Zeiten und Völker*. 2. Auflage, durchgesehen und ergänzt von Wilhelm Haberling, Franz Hübotter, Hermann Vierordt, Band 5. Urban & Schwarzenberg, Berlin und Wien
25. Humphry George Murray (1858) *A treatise on human skeleton including joints*. Mc Millan and Co, Cambridge
26. Ijpma FF, Radziun AB, Mulder WJ, Driessse-van het Reve JJ, de Rooy L, Griffioen FMM, Oostra RJ, Chistov YK, van Gulik TM, Bleker OP (2014) The anatomical collection of the anatomical specimens of the Kunstkamera in St Petersburg and Ruysch's original descriptions of his collection. In: Ijpma F (ed) *The anatomy lessons of the Amsterdam guild of surgeons*. Entschede, Gildeprint
27. Lanz T, Wachsmuth W (1935) *Praktische anatomie, arm*. Springer, Berlin
28. Lanz T, Wachsmuth W (1938) *Praktische Anatomie, Bein und Statik*. Springer, Berlin
29. McAlister A (1889) *Textbook of human anatomy systematic and topographical*. Charles Griffin and Company, London, p 179
30. Meckel JF (1816) *Handbuch der menschlichen Anatomie*. Zweiter Band. Besondere Anatomie. Knochenlehre, Bänderlehre, Muskellehre, Halle und Berlin, pp 364–366
31. Naňka O (2015) Wáclav Leopold Gruber (1814–1890). *Čas Lék Čes* 154:95–97
32. Peltier LF (1984) Joseph Guichard Duverney (1648–1730). *Champion of applied comparative anatomy*. *Clin Orthop Rel Res* 187:308–311
33. Pirogov NI (1859) *Anatome Topographica sectionibus per corpus humanum congelatum*. Jacobi Trey, Petropolis
34. Pierer JF, Choulant L (1827) *Medizinisches Realwörterbuch zum Handgebrauch praktischer Aerzte und Wundärzte und zu belehrender Nachweisung für gebildete Personen aller Stände*. 7. Auflage 1. Abteilung Anatomie und Physiologie, Siebenter Band. Literatur-Comptoir, Ultenburg, p 818
35. Smith RW (1840) *Observation on the diagnosis and pathology of the fractures of the femoral neck*. *Dublin J Med Sci* 18:1–70
36. Smith RW (1850) *A treatise on fractures in the vicinity of joints, and on certain forms of accidental and congenital dislocations*. Hodges and Smith, Dublin
37. Spinner RJ, Dellon AL (2018) Emanuel B, Kaplan MD (1894–1980): a legendary anatomist and hand surgeon. *Clin Anat* 31:1104–1108
38. Stieda L (1896) Weitbrecht, Josias. In: *Allgemeine Deutsche Biographie (ADB)*. Band 41. Duncker & Humblot, Leipzig, pp 618–620
39. Testut L (1911) *Traité d'anatomie humaine*. Tome premier Ostéologie–arthrologie–myologie, 6th ed. Octave Doin et fils, Paris, pp 598, 607
40. Todd RB (1835–1836) *The cyclopaedia of anatomy and physiology*. Longman, London
41. Walmsley T (1917) *A note of the retinacula of Weitbrecht*. *J Anat* 51:61–64
42. Weitbrecht I (1742) *Syndesmologia siue historia ligamentorum corporis humani*. Typographia Academiae Scientiarum, Petropoli
43. Weitbrecht J (1969) *Syndesmology (English translation)* Kaplan EB (ed). Saunders, Philadelphia