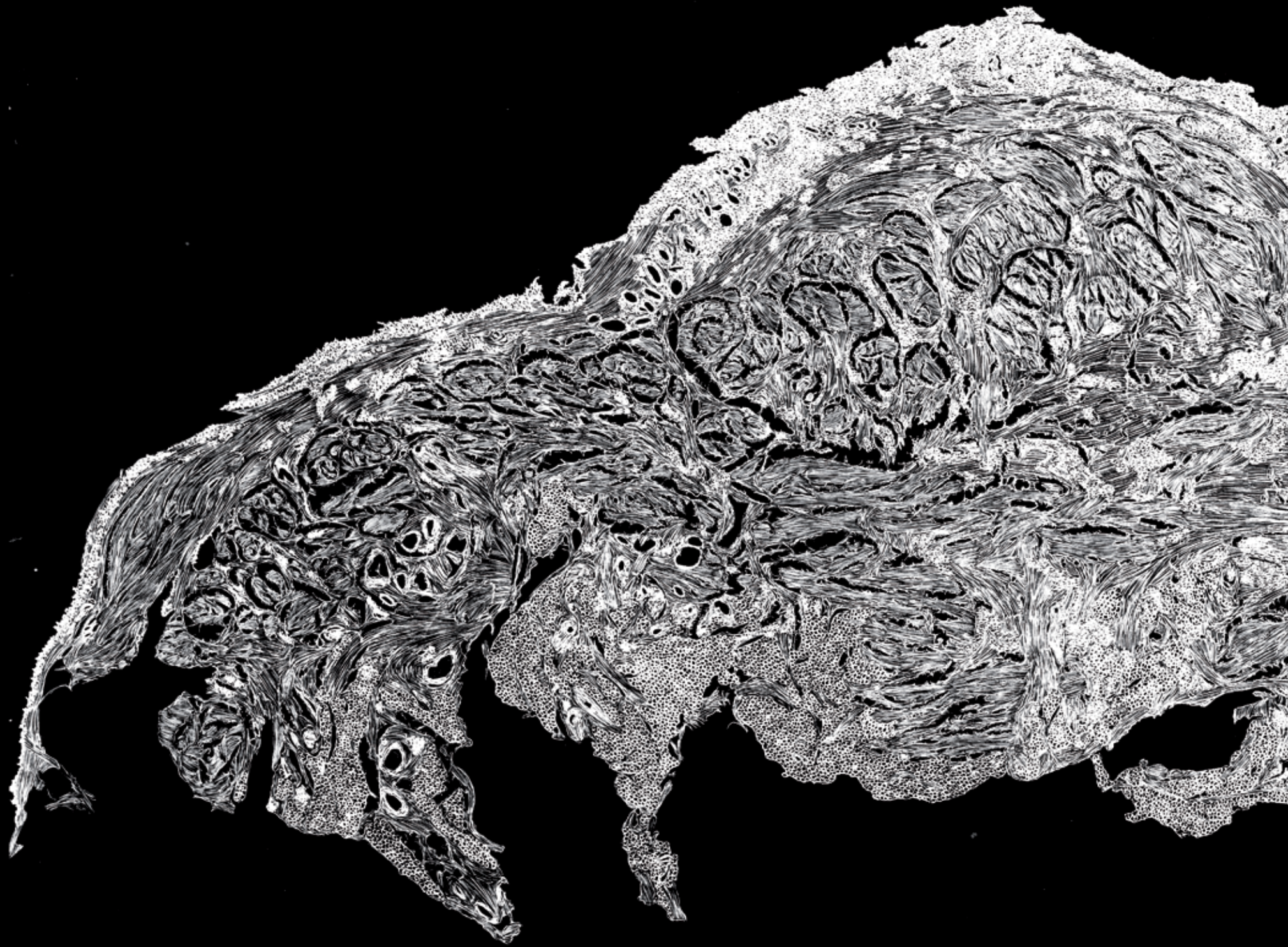


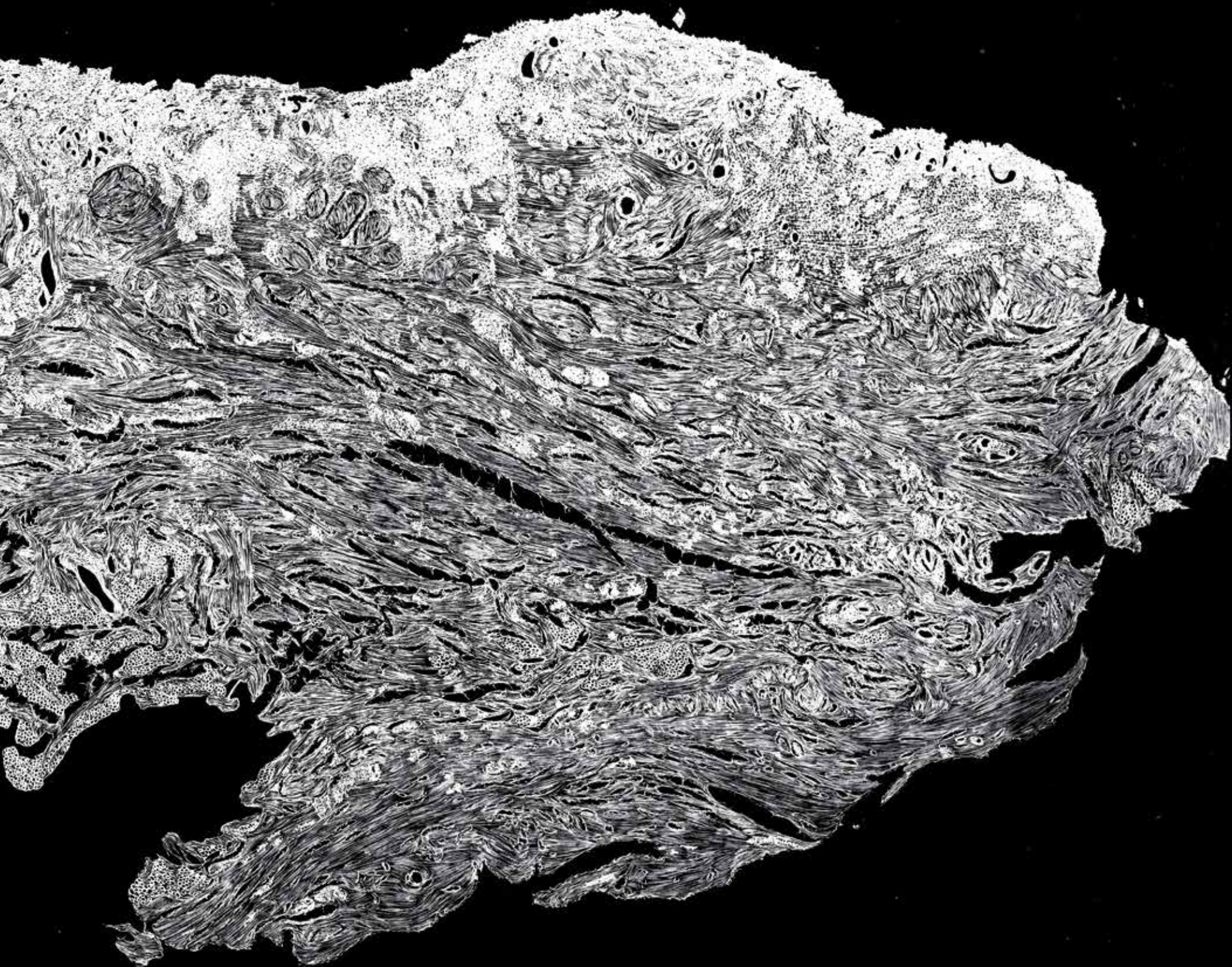
JOSÉ MARÍA GIL-VERNET SEDÓ

THE ART OF TRANSFORMING SCIENCE

SALVADOR GIL VERNET'S MODERN UNDERSTANDING OF UROLOGIC ANATOMY

A handwritten signature in black ink, appearing to read "Salvador Gil Vernet", with a long, sweeping underline.





**To my wife Marian and my children Pepe, Adriana and Elisa for their priceless support to this project.
For my grandfather Salvador Gil Vernet, in memoriam.**

CREDITS

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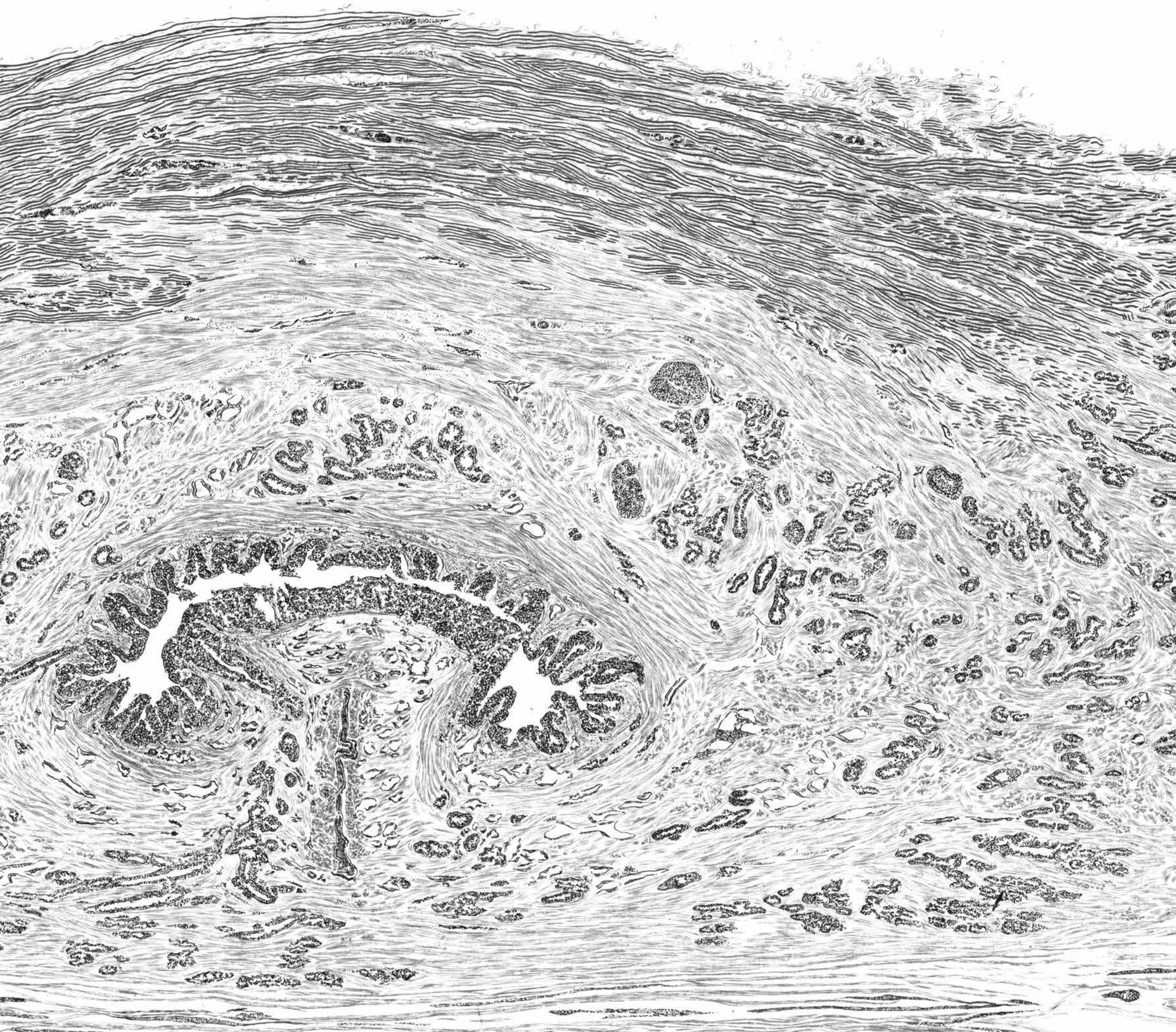
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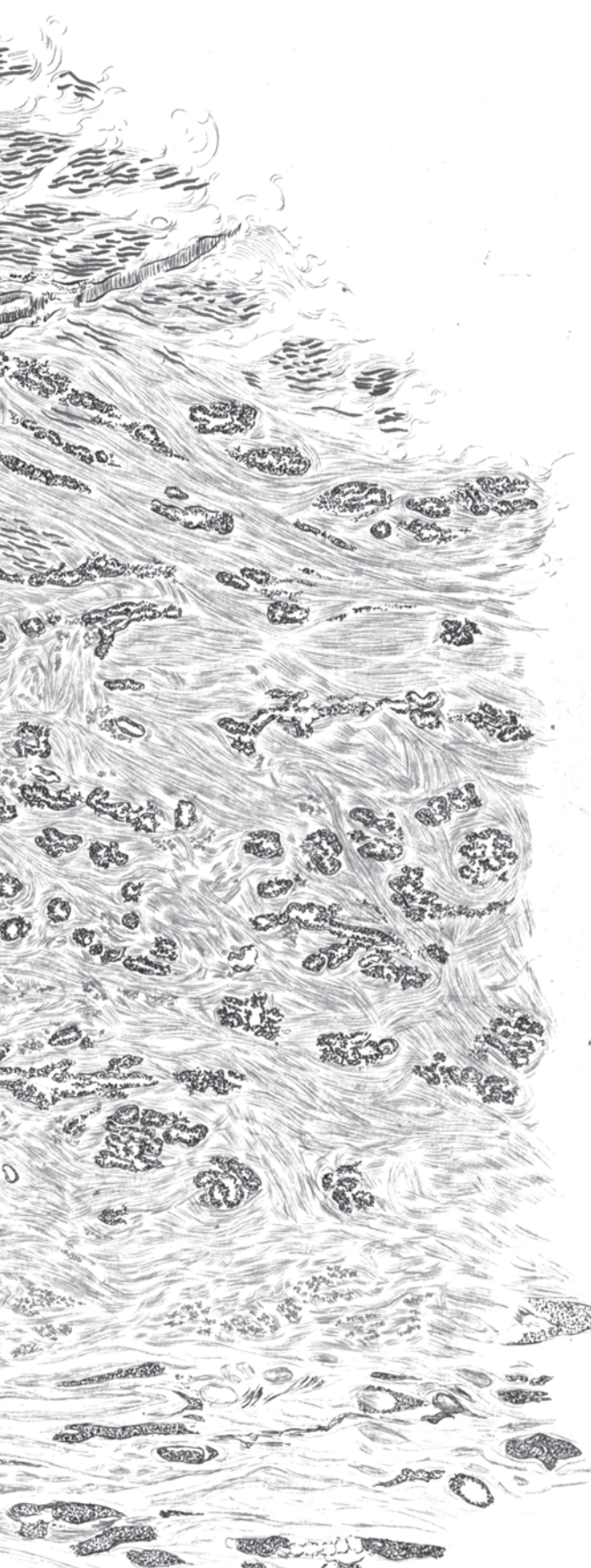
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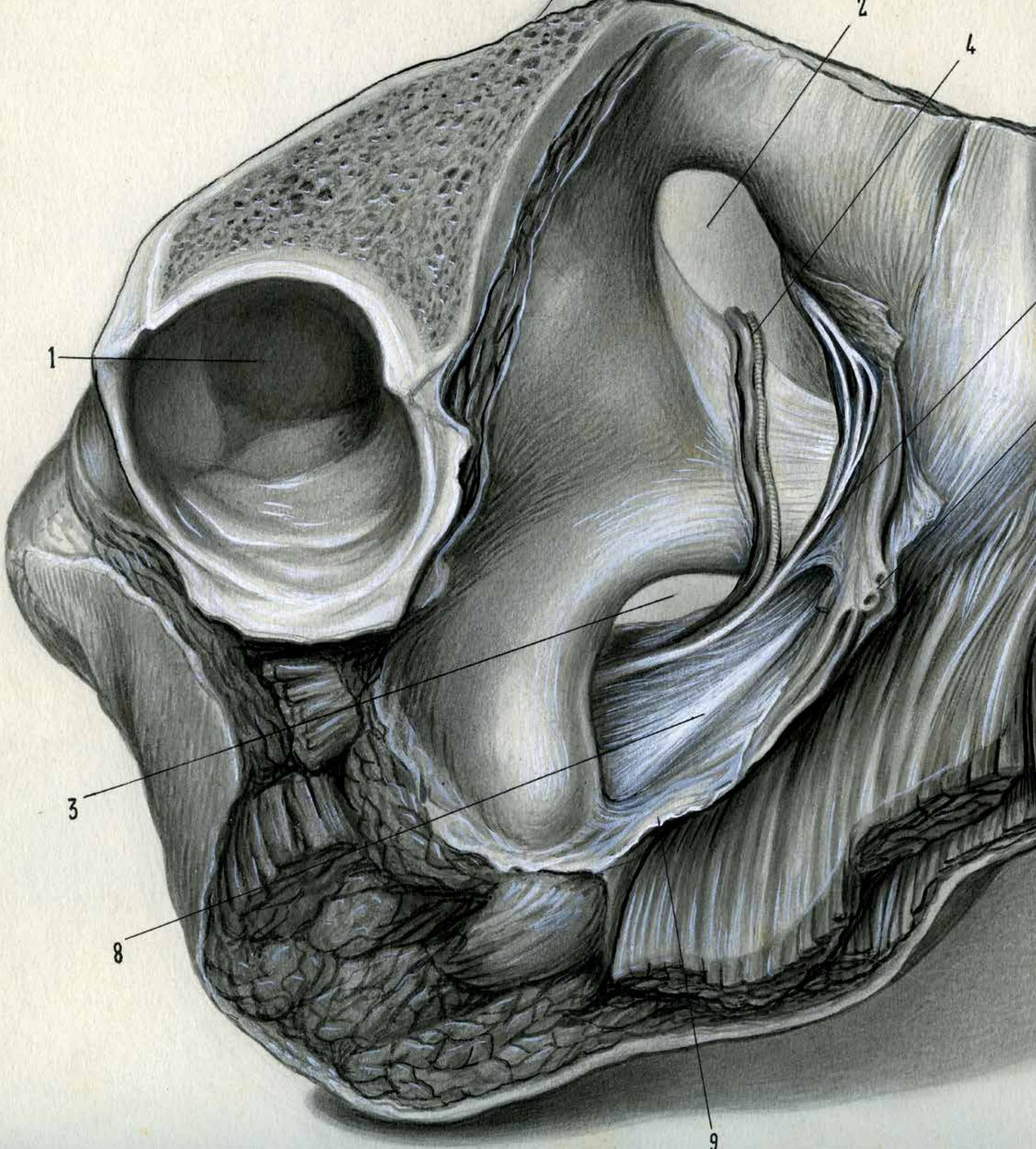
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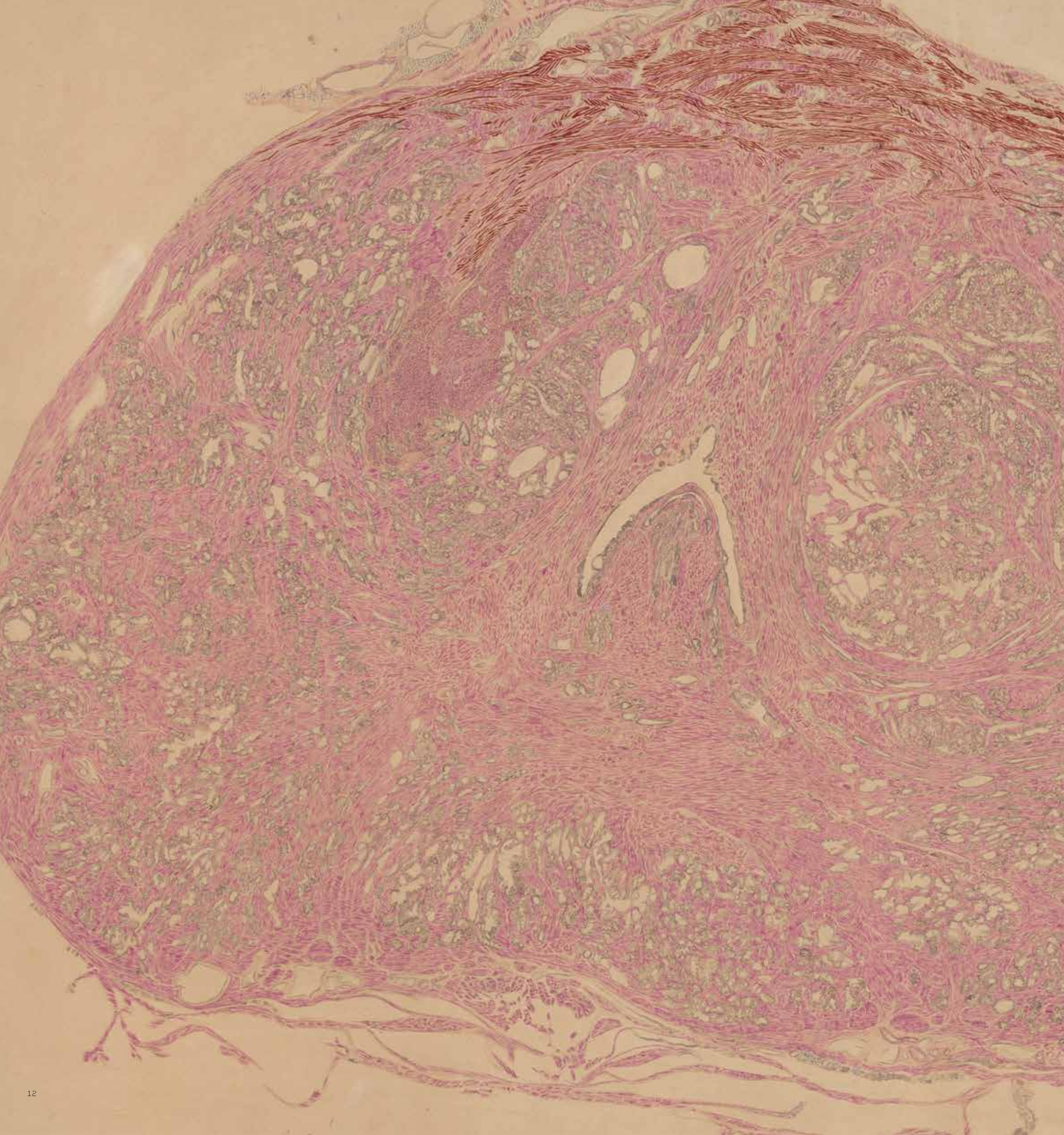


EDITOR'S NOTE

Four years have passed since I first walked in the surgery of Dr. José María Gil-Vernet Sedó. That day I was to discover that illustration –the format I had been working with for several years– can provide much more than a mere aesthetic pleasure. Dr. Gil-Vernet was buried in plates filled with coloured shapes and abstract figures, images that, then, I guessed corresponded to different types of coastlines. I stayed entranced staring at those disturbing images forgetting that what had brought me there was an awful pain caused by a renal colic. Instead, José María and I struck up a hilarious dialogue in which illustrations, science and urological anatomy intertwined in such a way that resulted in this book.

I debut today as an editor and I have the honour to do it hand-in-hand with one of the more outstanding scientists in urological research that this country has produced. And, even though I have not had the pleasure of meeting the master Salvador Gil Vernet personally, I have come to know deeply his grandson, José María, the author of this book and a great friend. The two of us have travelled a long journey, firstly to collect, and then provide a narrative sense to the work we present today. The *Salvador Gil Vernet Collection of Urological Drawings* is a sample of the enormous work his grandfather did in this field. His research and achievements are being applied in the current urological practice and the discoveries he made since 1930 in the study of the male urogenital system opened a new perspective on the morphological and anatomopathological study of the urogenital overlap.

Editing this book has given me the opportunity to understand what kind of passion leads a scientist to devote his life to research, I could feel the humility that science applies to correct itself over and over again, and finally, I had the privilege of working alongside a man able to pierce your heart with his love for science, a person who changes the look when he talks about his profession, a friend that just by keeping you company would infect you with his passion for the human nature.





FOREWORD

It gives me tremendous pleasure to write this foreword to the first edition of *The Art of Transforming Science*. I am in my office in the Cancer Center here in San Antonio leafing through the catalogue of the *Salvador Gil Vernet Urological Drawing Collection* (2009) while immediately adjacent to it is the 1944 edition of *Patología Urogenital, Tomo I, Cáncer de Próstata*. Facing page 46 in the latter is an extraordinary fold-out drawing of a whole mount section of a prostate with coexistent benign prostatic hyperplasia and cancer. On pages 98–99 of the more recent volume, I learned that the artist in 1944 was F. Ruano.

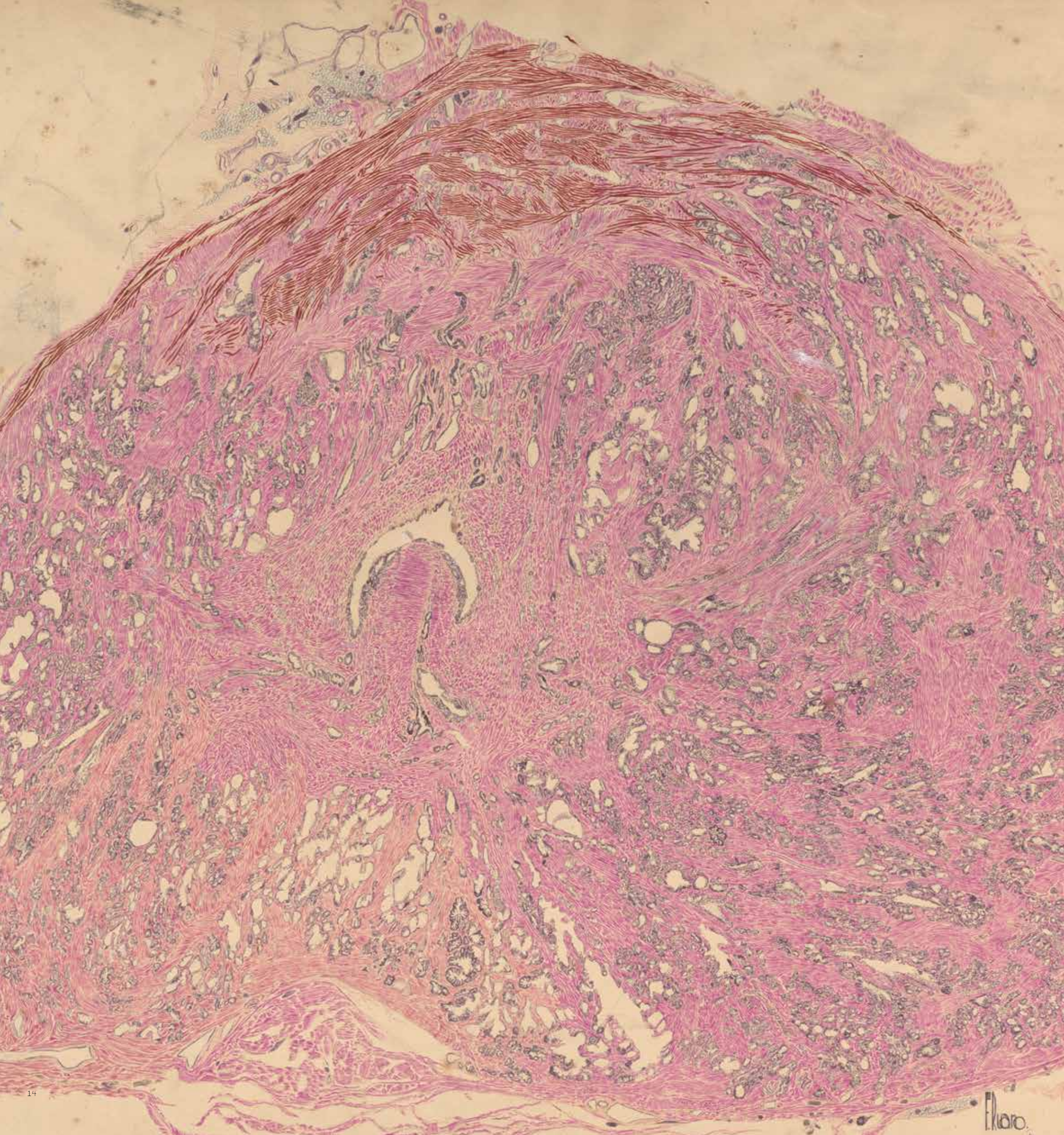
As we look at these drawings, we have to put ourselves into the lives and careers of Dr. Salvador Gil Vernet's protégés. At one level, we can see these illustrations as objective representations of the anatomy and pathology of the prostate: the focus of prostate cancer in the left peripheral zone in the figure I am examining right now can be easily seen with the adjacent, intact prostatic capsule. On another level, we should place these illustrations in the context of the time, i.e., long before the discovery and use of the prostate-specific antigen, when such small tumors were an anomaly and most cancers were extensive or metastatic at diagnosis.

Perhaps a better way to understand these illustrations is through the lives of the illustrators: scientists and physicians who were drawn to one of the most prestigious urologic institutes in the world for the opportunity to work with a physician–surgeon–scientist–anatomist, a combination that was rare before (except perhaps Leonardo da Vinci) and has not been seen since that time. These individuals learned the art and science of urology with a focus on the prostate, an organ that would become perhaps the greatest emphasis of urology sixty to seventy years later, and then took this education around the world to create a specialty that sets the standard among all others.

As you look at these drawings, learn from them and enjoy them. However, above all, please reflect on the lives of the remarkable individuals who gave them to us to consider for decades if not centuries to come.

IAN M. THOMPSON, JR, MD

Director, The Cancer Therapy and Research Center.
University of Texas, Health Science Center, San Antonio, Texas, USA





PREFACE

The anatomical drawings of Leonardo da Vinci, Michelangelo, Raphael, Titian, Verrocchio, etc., are probably the most universal and famous examples of how anatomical knowledge was transmitted down the years through drawings. Interest in the field originated from the desire to study human anatomy directly from cadavers, which demands a true and accurate representation of the human form, contributing to knowledge of artistic creation and progress in medical science, thus freeing it from superstition and empirical practice.

The legendary figure of Andrea Vesalius (1514-1564), born in Brussels as Andries van Wesel, is considered the father of modern anatomy. His book *De Humani Corporis Fabrica Libri Septem* (On the Structure of the Human Body), published in 1543, was dedicated to King Carlos I of Spain and Fifth Emperor of the Holy Roman Empire, in whose court he practiced as a physician. In this book he rejected galenic knowledge, which was plagued with errors, and instead described human anatomy based on personal observations from cadavers, which were masterfully transcribed onto paper by the artist Jan van Calcar, who was a disciple of Titian. From this moment onward, anatomical and scientific drawing gained currency, which even the advent of photography has failed to supplant. Instead, the two media alternatively have competed and/or complemented each other until modern times, when technology has allowed them to become two and three dimensional representations, providing teachers and researchers with a dynamic, solid and valuable instrument that can be adapted to many different techniques and requirements.

In Spain, in the Department of Human Anatomy of the School of Medicine at the University of Barcelona, scientific drawing lent solid support to the ground-breaking work of Professor Gil Vernet (1892-1987), who studied more than 30,000 preparations of anatomic sections, using the methods described by Otto Kalischer (1842-1910). He delved into the complex world of microscopic

anatomy of the prostate, the musculature of the perineum, bladder, prostate and urethra, and the innervation of the pelvic viscera, as well as the study of urogenital pathology. This intriguing and titanic task would gain international recognition.

In my opinion, two specific features ensured that these findings would be extraordinarily valuable. Firstly, the inclusion of embryo in addition to adult preparations allowed the most elemental version of the anatomic structure and its complex progressive development to be studied, reminiscent of the work of that great aragonian, Don Santiago Ramon y Cajal, on the nervous system.

Secondly, this method of histotopographic section allowed Professor Gil Vernet to explore a domain that could be called microscopic dissection. He revealed the tissues in their natural state before they were touched by the scalpel, an intermediate step between the microscopic and the macroscopic domains, where the dissector may “find what he desires to find”, which can lead to the occasional paradox encountered by surgeons when they find details different from those usually described.

In summary, the above-mentioned features demonstrate the arduous and immense task undertaken by our compatriot, providing fascinating and important scientific contributions to the scientific community that gained international prestige. However they also reveal that this work, performed in a country whose culture is rarely conducive to research and where there is a scarcity of resources in universities, was only possible thanks to this anatomist’s tenacious and hard work in the service of his scientific vocation. As he often told me: “Professor Ruano, scientific inspiration does not exist if not accompanied by cerebral sweating”. His comments recall those of the cleric Jaume Balmes: “Inspiration does not enlighten the lazy”.

PROFESSOR DOMINGO RUANO GIL

Emeritus Professor of Human Anatomy and Embryology at the Faculty of Medicine at the University of Barcelona



**THE
CHARACTER**

“... It must be kept in mind that scientific problems never come to an end. The work that all of us, every one of us carries out, is nothing else but the continuation of the work done by those who came before us; and others in turn will come who will continue it, rectifyng and improving it, and so on indefinitely, because science has no end.”

Salvador Gil Vernet (1968)



Sal Gil Vernet

BIOGRAPHY

Born in Vandellós, a small town in the province of Tarragona (Spain) on August 10th, 1892 during his childhood he was passionate about the natural sciences, and showed a great enthusiasm for botany. In 1909 he entered the School of Medicine at the University of Barcelona, from where he graduated on June 30th, 1915. In 1920 he was appointed Assistant Professor of Anatomy and in 1928 he became Professor in the Anatomy Department at the University of Barcelona, also performing functions as Director of the Professional School of Urology at the Hospital Clinic of Barcelona. He received the *Pedro Virgili Surgery Award* from the Spanish Royal Academy of Medicine and the *Antoine Portal Award* from the National Academy of Medicine of France in 1965. He was elected president of the *Société Internationale d'Urologie* (SIU) from 1967 to 1973. He was nominated for the Nobel Prize on several occasions, by national and international scientific associations. He was elected Honorary President of the Spanish Association of Urology in 1967 and Honorary Member of the Spanish Royal Academy of Medicine in 1977. He received an Honorary degree from the University of Toulouse and was elected Honorary Member of the Societies of Urology of France, Italy, Greece, Mexico and Colombia. He was a visiting lecturer at Columbia University, and at the Universities of Chicago, Buenos Aires, Bogota, Toulouse, Tokyo, Amsterdam, Johannesburg, Munich and the Autonomous University of Mexico. In 1986 he received the *Narcis Monturiol Award* from the Government of Catalonia. Salvador Gil Vernet died in Barcelona on October 24th, 1987.



Al nostre Mestre d'Anatomia Dr. S. Gil Vernet, en record de les
llicions donades al "Corralet" del Hospital de la Creu
Barcelona gener 1918 - Dr. R. Arqués

Salvador Gil Vernet with his students in a practical class of anatomy.

The text says: "To our Professor of Anatomy Dr. S. Gil Vernet, in remembrance of the lessons given in the *corralet* (yard) at St. Creu Hospital, Barcelona, January 1918. Signed by Dr. R. Arqués."

SCIENTIFIC WORK

In 1917 Salvador Gil Vernet described a new technique for sacral epidural anesthesia for prostate surgery based on his studies on pelvic neuroanatomy. In 1919, in cooperation with Dr. Francisco Gallart (1880–1960), Gil Vernet were the first to study the abdominal neural plexus and offer a description of the inferior mesenteric ganglion in men. In 1926 Gil Vernet described the fusion of the vagus nerves and the formation of the esophageal plexus. Beginning in the 1920s, his research was focused on the topographic anatomy, surgical techniques and pathological anatomy of the male urogenital system, to the exclusion of the kidney or proximal ureter, and especially centered on the prostate gland. By using the histotopographical method of serial anatomical sections as described by Otto Kalischer (1842–1910) (1), he achieved outstanding new perspectives on the morphological and pathological study of the urogenital system. His comprehensive work, including dozens of thousands of histotopographical samples from the embryo stage to the adult, allowed Gil Vernet to perform a meticulous microscopic dissection of the prostate, the vesico–prostatic–urethral musculature and the innervation of the pelvic visceral area, as well as studies on the pathological complexes of the urogenital region.

In 1944 Gil Vernet published *Cáncer de Próstata* (2), the first volume of *Patología Urogenital*, which is considered the most outstanding Spanish contribution to studies in urology. The work had great international impact, highlighting the importance of diet, race and genetics in the development of prostate cancer and showing that malignant neoplasms usually originate in the prostate gland itself and not in areas of benign prostate hyperplasia. The chapter entitled *Anatomía Quirúrgica Prostatoperineal*, based on Salvador Gil Vernet's perineal anatomy research, proved that the so-called deep transverse perineal muscle was in fact the dorso–caudal extension of the external urethral sphincter, which surrounds the bulbourethral glands. His research also provided a meticulous and complete analysis of the nucleus of the perineum.

Gil Vernet's work on the neuroanatomy of the pelvic plexus describes the neurovascular bundles of the prostate. He observed that the terminal branches of the plexus, containing the cavernous nerves, border the posterolateral walls of the prostatic cell and of the membranous urethra, the nerves on each side converging on the anterior and lower part of the external sphincter at the level of Henle's ligament, finally attaching to the cavernous arteries. In his own words: "At every one of the four corners of the rectangle that makes up the prostatic cell, a neurovascular bundle is observed, and those are the bundles which carry the vessels and nerves intended for innervation and irrigation of the prostate, membranous urethra and the cavernous nerves, enabling erection".

Biología y Patología de la Próstata (3) was published in 1953. This second volume of Gil Vernet's greatest work showed for the first time that the prostate is not a homogenous gland but actually consists of two main regions in accordance with the collecting ducts: the cranial gland and the caudal gland, both separated by the intermediary gland.

Gil Vernet observed that benign hyperplasia developed in the areas near the supramontanal urethra, that is, in the cranial and intermediary gland, and that carcinoma develops in the caudal gland.

Charles B. Huggins (1901–1997), winner of the Nobel Prize in Medicine in 1966, cited this major work: "The Gil Vernet Phenomenon wherein the human prostate is separated into two physiologically and oncologically different divisions, is of permanent value. It is a wonderful discovery".

This first regional anatomical model of the prostate, the paradigm for the model still used today. A number of English-speaking authors reproduced this model thirty years later considering it their own original work. *Enfermedades de la Próstata* (4), the last volume in the *Patología Urogenital* series, was published in 1955. Charles B. Huggins said of this book: "It has made a great impression on me, his work on the prostate is most instructive and can be used as a reference work for numerous generations of students".

Gil Vernet's research on the vesical and prostatic–urethral musculature is especially outstanding. He described the different layers of the detrusor muscle and its role in continence and urination. His studies on the morphology and function of the so-called internal vesicourethral sphincter, a highly controversial topic among anatomists in the nineteenth and twentieth centuries, were illuminating. He described this sphincter as an individual muscle with an important genital role, as it impedes seminal reflux to the bladder when it contracts during ejaculation. Gil Vernet also proved the existence of the so-called posterior prostatic–urethral muscular bundle in the inframontanal prostatic urethra. He gave this muscular column, which determines the area called the urethral crest, special functional significance. Gil Vernet believed that when this muscular bundle contracted during ejaculation, it facilitated the dilation of the inframontanal and membranous prostatic urethra.

Notable among studies of the membranous urethra is his work on the smooth and striated musculature, which includes the external urethral sphincter as well as its innervation. A detailed study of the morphology of the external urethral sphincter is carried out for the first time in the 20th century. This sphincter is described as a tubular structure surrounding the membranous urethra and prostatic apex, devoid of bone insertions, contradicting the erroneous previous assumption that this sphincter was in a transversal disposition as a sandwich muscle with insertions in the ischio–pubic branches.

Morphology and Function of Vesico-Prostatic-Urethral Musculature (5) was published in 1968 and became Gil Vernet's greatest work in the English language, enabling his writings to be circulated in the English-speaking world. This work is a compilation and expansion of his previously published studies in *Patología Urogenital*, which is still widely regarded as a reference work in anatomophysiological studies of the male urogenital system.

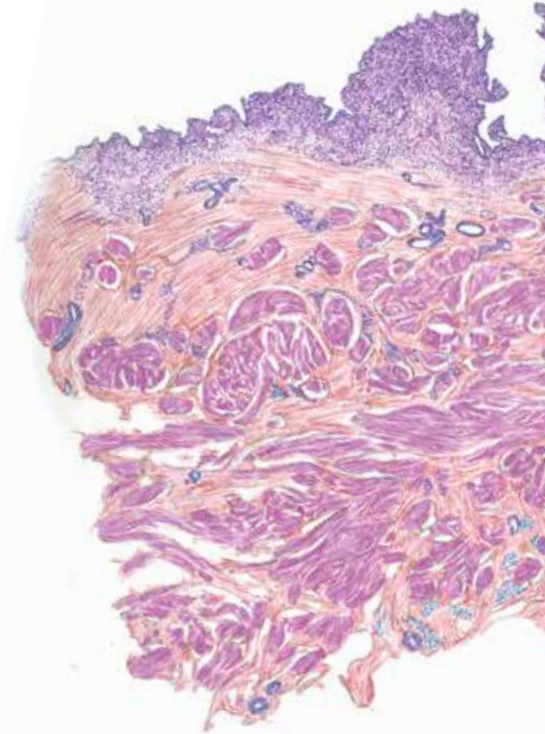
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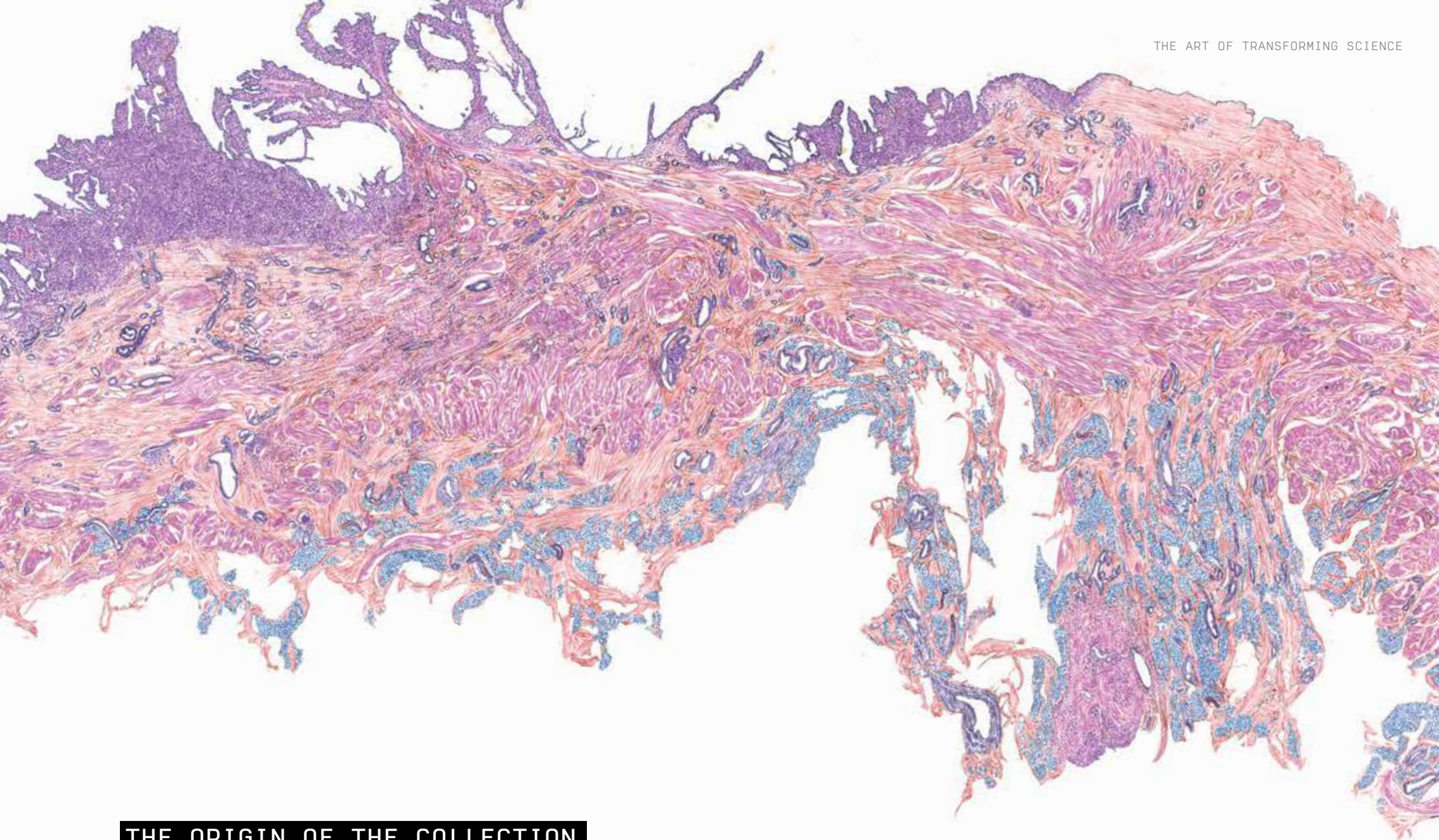
URO

FOR GIL VERNET
COLLECTION OF
LOGY DRAWINGS

“A good drawing, like a good microscopic preparation, is a piece of reality, a scientific document that indefinitely conserves its value, the review of which always proves beneficial, regardless of the many interpretations it may have generated.”

Santiago Ramón y Cajal (1899)





THE ORIGIN OF THE COLLECTION

At the beginning of the twentieth century, both descriptive and topographic anatomy had reached their maturity, and at their peak only small advances were anticipated.

However, in the field of urogenital anatomy there were still unresolved questions regarding the muscles and aponeuroses of the perineum, pelvic autonomic nervous system, the arrangement of the detrusor muscle fibers, the bladder neck and posterior urethra, and the anatomy of the prostate gland.

In his dual role as anatomist and urologist, Salvador Gil Vernet observed that his surgical findings did not correlate with descriptions in the classical topographic anatomy treatises published in the mid-nineteenth century. This contradiction prompted him to an exhaustive and precise study of male urogenital anatomy extending over more than forty years, in which Gil Vernet delved with great discipline into the embryology and anatomy of the prostate. His findings were crucial to comprehending pathological processes and to designing groundbreaking surgical techniques.

The diligent and vocational morphologist, faithful to the Brausian anatomic paradigm (6), sought to explain not only the *what* and *why* but also the *what for* of functional urogenital anatomy, thereby opening the way to urologic clinical anatomy. Using structural knowledge of the pelvic and perineal regions and disentangling the complexity of the pelvic nervous plexus, he intended to

bring to life the vesico-prostato-urethral neuromuscular system to explain the physiologic processes of urination, erection, and ejaculation. His intense labor in the field of urogenital pathology created a prodigious collection of urological pathology specimens, with emphasis on benign prostatic hyperplasia, cancer of the prostate, prostatitis, and urogenital tuberculosis.

All of this anatomic, uropathologic and surgical work was illustrated in a series of drawings created over thirty years (1940–1970) and utilized in numerous publications, compilations and communications in conferences, as well as in the works *Patología Urogenital* and *Morphology and function of vesico-prostato-urethral musculature*.

In the 1980s, remodeling of the Faculty of Medicine caused a considerable portion of this graphical material to be scattered and damaged, if not looted. Fortunately, since 2005, a large number of drawings and sketches could be collected, catalogued, and restored, amounting to a total of 604 items, which now comprise the *Salvador Gil Vernet Collection of Urology Drawings*.

Based on their authorship and technical and thematic characteristics, we have subdivided the illustrations selected for this edition into two large groups. The first includes those signed by the medical illustrators R. Alemany and F. Nuñez. The second includes those created by second-year students in the Faculty of Medicine who served as interns in the Uroanatomy Laboratory.

