

Coloproctology 1
Series Editor: Carlo Ratto

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Colon, Rectum and Anus: Anatomic, Physiologic and Diagnostic Bases for Disease Management

 Springer

Coloproctology

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Coloproctology is a modern discipline covering a vast area of medicine, including all diseases and disorders of the colon, rectum, and anus. Physicians and non physician personnel are very interested in the field owing to the high prevalence of these clinical conditions in the general population, the severity of secondary symptoms and/or disabilities, the diagnostic and therapeutic issues, and the personal and social implications. In particular, a variety of specialties and subspecialties are involved in the clinical management of colon and anorectal diseases/disorders, which frequently entails a multidisciplinary approach. This book series will provide detailed coverage of a wide range of topics in Coloproctology, focusing particularly on recently introduced and emerging diagnostic and therapeutic techniques. Each volume will be a reference work on a specific disease or disorder. The core aim is to provide a sound and productive basis for clinical practice, and to this end some of the most highly regarded experts worldwide will contribute as co editors and authors. The series will also help researchers and all those interested in the field to identify key issues in Coloproctology in order to foster the development and implementation of further new technologies.

More information about this series at <http://www.springer.com/series/13364>

Carlo Ratto • Angelo Parello
Lorenza Donisi • Francesco Litta
Editors

Colon, Rectum and Anus: Anatomic, Physiologic and Diagnostic Bases for Disease Management

With 181 Figures and 54 Tables

 Springer

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Foreword

The scientific publisher Springer is bringing out a new series of books on Coloproctology with Professor Carlo Ratto as the Editor. It will consist of several volumes dealing with broad subdivisions of the speciality with chapters written by internationally acknowledged experts in the field. As in all other areas of medicine, coloproctology has progressed to an extraordinary degree over the last 10 years.

While dealing with recent developments and the innovations that have occurred, the first volume maintains an emphasis on clinical assessment and decision taking. One of its themes is the integration of the results of different investigations and other forms of objective assessment with the clinical picture to allow the construction of treatment strategies applicable to the individual patient.

The book consists of four parts including an Introduction to Coloproctology, Anatomy, Physiology, and Diagnosis. Its emphasis is on proctology, and besides dealing with the actual diseases, there is a great emphasis on the clinical evaluation of anorectal disorders and their investigation. In a speciality where the diagnosis is made by clinical evaluation in over half the patients, the inclusion of a chapter describing the office visit in detail is very informative and will be most valuable to readers. The book deals with the anatomy and physiology of the colon and rectum, the instruments used in proctological practice, and the approach to investigation. The quantification of symptom severity is considered in a chapter on scoring systems. Data collection and analysis are dealt with in detail, and there are several chapters on physiological investigation, radiological imaging particularly ultrasound, and endoscopy. The chapters on electrophysiology of the pelvic floor and ultrasound and physiology of the rectum and anus are written by experts who have been at the forefront of research into these fields. Changes in practice are reflected by a chapter on technical advances in imaging which have resulted in changing concepts in the management of rectal cancer and organ preservation in this important disease in the light of recent developments.

Subsequent volumes will deal individually with all important proctological conditions such as hemorrhoids, anorectal sepsis, incontinence, and more. Others will focus on the major topics of inflammatory bowel disease and benign and malignant neoplasia.

This first volume of the series will be of great value to established specialists and trainees in this important field.

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Preface

Coloproctology is an amazing field of modern medicine that fascinates many surgeons, but also many others in the medical field. The evolution of knowledge and continuous progress in technologies has significantly changed this discipline over the last 20 years, and it is difficult to define its “state of art” today. To address this continuum of advances in this fascinating field, our book series is being published in both an electronic and printed format, allowing us to avoid trying to pinpoint the progress of coloproctology at this point in time (which would result in the information being “old” in a few months). Thanks to the “Major Reference Works” formula, in which living editions of reference works are updated by the publisher (Springer) as scientific developments warrant, readers can access further evolutions of each chapter after publication of the print edition by consulting the updated electronic contents.

The purpose of this project is to provide a panoramic view of the topic, ranging from the basics (including anatomy and physiology of the colon, rectum, and anus, oriented at immediate application in diagnosis and treatment) to principles of patient management. The first volume is dedicated to the basic anatomy, physiology, and principles of diagnosis in order to offer the keys of access to this specific discipline. Due to the variety of different clinical conditions, the following volumes of *Coloproctology* have been structured as several monographic books, dedicated to hemorrhoids, anal fistula and abscess, fecal incontinence, constipation and obstructed defecation, chronic inflammatory bowel diseases, miscellaneous benign colorectal and anal diseases, and neoplasms of the colon, rectum, and anus. Functional disorders, inflammatory diseases, benign neoplasms, malignant tumors, infectious diseases, and miscellaneous abnormalities and disorders affecting the colon, rectum, and anus are also all addressed.

Each book aims to discuss the main open questions regarding the pathophysiology and diagnosis of each topic along with current points of view, thereafter debating the actual strategies for treatment. Wherever the choice between a variety of diagnostic and therapeutic options would be controversial, a “virtual round table” has been set up, giving readers the pros and cons of different leading opinions. As would be expected, the panel of contributors is of the highest worldwide scientific level, reflecting the best clinical practice on each topic, and ranges from surgeons to gastroenterologists, oncologists, radiotherapists, radiologists, internists, specialists in abdominal and pelvic diseases and disorders, etc. When appropriate, an updated review of the

literature is summarized in tables within the chapters, and a number of figures provide useful examples of cases diagnosed using different modalities of imaging and treated with different surgical approaches.

This book series aims to be a reference for not only coloproctologists, but for all specialists involved in the management of disorders and diseases of the large bowel and anus, medical students, and other professionals training in healthcare.

Finally, we are delighted that our *Coloproctology* book series is accessible to a wide audience through SpringerLink (<http://link.springer.com/>), the publishing platform for Springer's major reference works.

Carlo Ratto, M.D., FASCRS
Angelo Parello, M.D.
Lorenza Donisi, M.D.
Francesco Litta, M.D.

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He was graduated in Medicine and Surgery at the Catholic University of Rome in 1987.

He is Researcher at the Department of Surgical Sciences, Catholic University, Rome.

His clinical practice, at the University Hospital “A. Gemelli” concerns particularly the colo-recto-anal disorders and diseases. He is the Chief of Proctology Unit.

He is actively involved in research on:

- Anorectal physiology, in particular concerning anorectal manometry, electrophysiology studies, and endoanal ultrasound in benign anorectal disorders. In particular, he is actively involved in the clinical application of three-dimensional endoanal ultrasound.
- Fecal incontinence and constipation, in particular concerning pathophysiology and treatment with traditional and novel therapeutic modalities (sphincteroplasty, graciloplasty, sacral neuromodulation, bulking agents).
- Hemorrhoids, in particular concerning pathophysiology and treatment with traditional and novel therapeutic modalities (THD procedure).
- Fistula-in-ano, in particular concerning the assessment of fistula and abscess with endoanal ultrasound related to surgery results.
- Rectocele, in particular concerning pathophysiology and modalities of clinical presentation and treatment options.
- Anal cancer, in particular concerning staging and restaging of the tumor and integrated therapies (chemoradiation).
- Colorectal cancer, in particular concerning diffusion modalities of the tumor and prognosis, integrated therapies (surgery, chemoradiation, intraoperative radiation therapy), and molecular biology.

He is author of a number of scientific publications on international journals and has presented results of his research at national and international scientific meetings.

He is Editor of the book entitled *Fecal Incontinence. Diagnosis and Treatment*, Springer Ed., May 2007.

He is active member of:

- American Society of Colon and Rectal Surgeons (ASCRS), Fellow
- European Society of Coloproctology (ESCP)
- Italian Society of Colorectal Surgery (SICCR)
- International Anal Neoplasia Society (IANS)

He was National Scientific Secretary of the Italian Group for Sacral Neuromodulation (GINS).

He was Delegate of Italy to the European Society of Coloproctology (ESCP).

He was General Secretary of the Italian Society of Colorectal Surgery (SICCR), 2006–2007.

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From 2004 to 2010, he was resident in General Surgery at Catholic University of Rome, which he attended with particular interest directed to diagnosis and treatment of coloproctologic diseases.

His clinical practice is mainly directed to diagnosis and treatment of colorectal-anal diseases, and he is an expert in performing both anorectal and pelvic floor diagnostics tests (e.g., anorectal manometry and endoanal and transrectal ultrasound) and treatment (e.g., transanal hemorrhoidal Doppler-guided dearterialization for hemorrhoidal disease, sacral neuromodulation for fecal incontinence and constipation).

He collaborated in the development of a novel minimally invasive surgical approach to treat fecal incontinence – THD implant Gatekeeper – now available for use in the world.

He is active member of the Italian Society of Colorectal Surgery (SICCR), and in 2007–2008 was member of the Guidelines Commission on behalf of this Society.

He was teacher and tutor in many national and international courses conducted in Italy and in other European countries.

He is author of several scientific publications on international journals, author of several chapters in books, and has presented results of his research at national and international scientific conferences.



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She is involved in studying the anorectal and pelvic floor physiology, by using tests as anorectal manometry and three-dimensional endoanal and transrectal ultrasound.

She is author of several scientific publications on international journals, author of several chapters in books, and has presented results of her research at national and international scientific conferences. She is a teacher in a series of national and international courses on the management of coloproctologic diseases.

She is active member of the Italian Society of Colorectal Surgery (SICCR) and is member of the Communication Commission of this Society.



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His research activity is mainly based on the evaluation and treatment of patients affected by fecal incontinence, constipation, anal fistula, hemorrhoidal disease, obstructed defecation, and inflammatory bowel diseases (Crohn’s disease, ulcerative colitis), with studies concerning the pathophysiology and the surgical treatment by means of traditional and new minimally-invasive therapeutic options.

He is author of several scientific publications on international journals, author of several chapters in books, and presented results of his research at national and international scientific conferences. He is teacher in a series of national and international courses on the management of coloproctologic diseases.

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A Surgeon for the Pelvic Floor: Dream or Reality?

Tracy Hull

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Abstract

As surgeons, we have evolved from barber surgeons to superspecialists. In the future, the pelvic floor surgeon will be even more specialized and most likely cross-trained so there is true understanding of all aspects of pelvic floor disease. Probably more importantly, there will be a team for the pelvic floor, and pelvic floor problems will be addressed by a true multidisciplinary team with the surgeon as a major stockholder in this process. All aspects of care will evolve to comprehensively consider the entire pelvis along with the entire GI tract and nervous input. This chapter reflects my crystal ball for the future care of our pelvic floor patients.

As surgeons, we all started as barber surgeons. Our tools were used to cut hair and then perform surgical procedures. As medical and surgical knowledge was advanced, we broke away from our barber heritage and concentrated on our surgical skills. Initially, surgeons were all generalists operating on the entire body. But the body is complex, and vast quantities of knowledge were deciphered for each specific region or organ system. With time, the combination of knowledge and technical demands were overwhelming for a true general surgeon, and therefore our predecessors began to focus their skills toward specific organ systems or regions. Thus, specialists were born. However, humans are curious and always striving to learn more and improve.

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Our knowledge and tools have exponentially advanced over the past 50 years, and superspecialists were needed as the problems continued to become more complex.

The pelvis is one of those extremely complex regions of the body. It is unique being a box made from the boney pelvis with a floor made of muscle. Piercing that muscular floor are the urinary and bowel systems in men and women (additionally the vagina in women). We have learned that all of these pelvic systems are interrelated. Changes or compromise in one area can lead to a problem in another area. For optimal pelvic health, all regions must work individually and together as a unit. When looking at the treatment of pelvic disorders, we are at a crossroads that is steering us toward further specialization by the current health care specialists that treat this area of the body. The multiple surgical specialists that have a stake in its treatment include general surgeons, colorectal surgeons, gynecologists, urologists, and some other branches. Each of these disciplines many times work in isolation when assessing and treating *their* compartment of the pelvis. Ironically, this contradicts the pelvis being a unit with each compartment – anterior, middle, and posterior – interrelated. Additionally at many current symposiums and educational meetings, it is promoted as being essential for all healthcare providers treating pelvic disorders to work together and treat the pelvis as one entity. However in practice, this does not seem to be a uniform reality. Therefore, the future of pelvic healthcare requires this area be treated by a multidisciplinary team (just like occurs with rectal cancer) in order to provide optimal care. This will require surgeons treating disorders currently designated as “pelvic floor problems” to think broadly and in concert with all providers that participate in treatment and care for this region of the body.

“Pelvic floor surgeons” may become true multidisciplinary surgeons. They could draw from the experience of each compartmentally trained surgeon (colorectal and general from the posterior compartment; obstetrical/gynecologists and urogynecologists from the middle compartment; and urologists and urogynecologists from the anterior compartment). This type of surgeon

would be broadly trained and able to treat and operate on all aspects of the pelvis. Another option which may be more likely is that they will lead a genuine integrated multidisciplinary team with a common goal to provide expert care for the entire pelvis.

While nobody knows how we will care for these patients in the future, I have taken this opportunity to think of my “wish list” and look into my crystal ball. The following are my thoughts about idealistic future care for our pelvic floor patients.

1 The Office Setting

In the near future, surgeons will be only a part of this “pelvic team.” When patients make an appointment, a specially trained nurse will contact the patient and review all symptoms, problems, previous testing, and previous treatments. Since all health care records will be computerized in the future, a patient will have a copy of all personal health records and can forward the appropriate information to this nurse. Additionally, the nurse will request that the patient log onto the computer and complete a series of questionnaires that cover routine health questions including other medical conditions, past surgeries, medications, and obstetric, social, and family history. Specific in-depth questions about bowel, bladder, and sexual function, pain, activity level, pelvic symptoms, and quality of life scores will also be part of this computerized intake process. The program will be set up so the data will automatically download onto the research system to allow all patients to be followed for research purposes. Then, the nurse can gather all previous testing and treatment results and review the questionnaires, ensure they are fully completed, and plan for possible testing that will be needed when the patient is seen. This will all occur before the patient reaches the clinic/office.

The clinic/office will be a self-contained area with friendly staff to put patients at ease since discussing problems in this area of the body can be embarrassing for patients. The décor will also promote a calm atmosphere. Literature and

pamphlets available for patients to read while waiting for their appointment will focus on diet, exercise, nutrition, and strategies to promote physical and emotional health.

When the patient is seen in an exam room, all the outside information and results of the questionnaire will be available. A pelvic floor medical doctor or advanced midlevel provider (who has completed specialized training in pelvic floor pathology) will review the records and results with the patient and fill in any gaps in the information. Then, a focused physical exam will be done that includes an in-depth examination of the entire pelvis as patients may have unrecognized problems in one area which will lead to symptoms in another.

2 Testing and Planning

After the entire history and physical examination is completed, the pelvic medical specialist will order appropriate testing as needed. In the case of ambiguity, the surgeon and other team members will be consulted to review the history and physical findings and weigh in on the testing needed.

In the future, testing will also incorporate the entire pelvis (and actually body) as a whole unit. The MRI and defecating proctogram will be combined into a PETogram. This will look at defecation, voiding, and simulated sexual encounters using technology that allows the correlation of function and brain stimulation. All testing will be done in the physiological position (i.e., sitting for defecation and voiding). The scan will utilize technology more closely related to an MRI than a traditional defecating proctogram to decrease the radiation exposure. Sensors will also be placed on strategic areas in the pelvis to pinpoint muscle movement. Brain activity will be captured by a helmet that the patient wears. Afferent and efferent nerve impulses will also be captured with sensors attached to the skin over the spine and posterior tibial nerve. Sensors will also be placed in the bladder, urethra, vagina, anus, and rectum which will allow correlation when the patient is resting, asked to squeeze, and strain. Since the

entire GI tract can affect bowel function (fecal incontinence, flatus production and control, and constipation), this will be also assessed by tiny nanosensors that the patient will swallow prior to the test. These temporarily attach to the mucosa in various portions of the GI tract and collect data regarding pressure, microbiome of the area, and coordination. All this will be correlated by a computer that has been programmed to incorporate these data points and assess for dysfunction. The patient will also be placed upright to simulate exercise and coughing – again looking to see how the pelvis and brain work together. While some forward thinkers hope this data will be able to be collected totally by nanosensors injected into the bloodstream or simply by moving a wand over the body, these advances in testing will not be a reality for another 50 years.

Virtual simulation assessing sexual responses and changes in pain perception will also be a feature of this new testing device. Instead of nanosensors, nanostimulators will be utilized for this aspect of testing.

Because the genetic makeup of the pelvic tissues influences their susceptibility to injury or dysfunction, tissue biopsy of the rectum, anal muscle, levator muscle, bladder, urethra, vagina, uterus, and other structures will be obtained as indicated utilizing a sharp but flexible needle about the size of a human hair. When there has been an acute injury such as during childbirth or surgery, stem cells which correct this defect or problem will be grown and injected into the appropriate tissue area to aid healing or correct genetic issues.

After all past and current records and testing are completed, patients will be discussed in the multidisciplinary management conference. This will consist of a team of health care providers including the specialist provider who did the initial history and physicians, nurses, surgeons (colorectal, gynecological, urogynecological, urological), physical therapists, radiologists, nutritionists, sexual therapists, gastroenterologists (specializing in bowel disorders), pain management doctors, social workers, psychologists, geneticists, and trainees. Individually patients will be presented and their testing reviewed as a

group. Some patients will have relatively straightforward problems, and a treatment plan can be recommended. Others will be complex, and all meeting attendees may be required to provide input and recommendations for care. Detailed notes will be taken and a summary provided for each patient's chart. Then, the patients will be seen again in the clinic with the appropriate providers and the recommendations explained. Appointments will be made that complement the recommended treatment course.

3 Follow-Up

Since most treatment recommendations will continue to be initially nonsurgical in the future, the patient will participate in the treatment algorithm recommended by the group. Progress will be charted on an individual data tablet which will automatically download into the patient's chart. Patient adherence and improvement will be assessed. Repeated discussions will be undertaken in the multidisciplinary group when patients do not sufficiently improve, and the next phase of treatment will be initiated.

4 Operating Room

The operating room of the future will be quite different from what we have now. Patients will be positioned in a special device that will allow repositioning to optimize whichever area of the pelvis is being addressed. For instance, if the prone position is needed for an anorectal issue and then the patient needs to be repositioned to lithotomy, this device will allow the patient to be moved while protecting the endotracheal tube and pressure points. This will also allow positioning and easy repositioning for abdominal procedures.

When indicated, a 3-D pelvic model showing the deficient area of the pelvis will be displayed on a screen over the OR table. While operating, the surgeon will be able to manipulate the model to assist in visualization of the problem.

Since surgeons will be trained across surgical specialties in the pelvis, coordination in the OR

will be much easier. Gone will be the problems of positioning for each area of the pelvis because the patient can simply be rotated. Procedures will be rehearsed and planned using the 3-D model so the movements of each surgeon will have been planned and thus there will be more efficient use of the OR time. Most surgery will be done by a hybrid laparoscopic approach that promotes better ergonomic health for the surgeon but allows for improved wrist mobility. The surgeon will be at the table and not removed to another area. Three-dimensional viewing will be possible due to new technology in eyewear the surgeon will wear. The camera will directly transmit the image to this eyewear (this will be a direct offshoot from the google glass technology). Tactile feedback will also be possible due to sensors that attach to the fingers and transmit this sensation from the tip of the instrument to the surgeon.

There will still be patients that have adhesions or other reasons that require the old-fashioned "open" approach. Since trainees will have limited experience in open surgery, fellowships in open surgery will be offered (very much like the minimally invasive fellowships of the early 2000s were needed to propel surgeons into mainstream minimally invasive approaches). Surgeons trained in the "open" approach will be more generalists and less specialized across all aspects of the pelvic floor since there will be fewer open cases versus the minimally invasive ones. By nature since these patients require an open approach, they naturally may be more complex, and the added fellowship training in areas such as adhesion dissection will be invaluable. The open and minimally invasive surgeons will therefore need to work as a team combining their skills in caring for these patients.

5 Post-op Care

The postoperative care will also be a coordinated effort. Many procedures will be same-day surgery as new medication will be given that accelerate the healing process and reduce postoperative tissue trauma and swelling. There will always be infirmed patients that require hospitalization, but with preoperative planning and optimization,

these will be few. After the patient is discharged, preventative strategies will be implemented and taught or reinforced with the patient via the physical therapist, occupational therapist, nutritionist, personal trainer, and others.

6 Preventative Care

Preventative care for bowel, bladder, and sexual health will also receive more focus in the future. Starting in primary school, children will be assessed and taught the best way to eat and exercise according to their physical makeup. For instance, if their personal assessment shows a high probability they will be prone to rectal prolapse in the future, they will be counseled to avoid strenuous weightlifting or other activity which can also predispose to this problem. The individual makeup of their bacterial flora and gut mucosal mechanisms will be analyzed to recommend the optimal diet strategy to prevent many diseases including those associated with immune mechanisms such as irritable bowel syndrome.

One area that deserves special mention is childbirth injury. All women with demonstrable injury after childbirth will have immediate harvest of cells in order to produce “healing cells” made from their own genetic tissue. These cells will be grown and then within 36 h injected into the injured area to promote tissue regrowth and mitigate nonfunctional scar tissue.

7 Research

Research and hard work has gotten us to this future point in the care of patients with pelvic floor problems. It has also allowed us to implement preventative strategies starting at a young age. All patients will be part of a health database and their data reviewed so no patient is lost to follow-up. This will allow complete records and data collection.

To continue to push forward and progress, future research will be more global and include teleconferences with centers all over the globe. Prospective randomized trials will be a main

focus and the ability to generate a three-dimensional model of the pelvis will assist in the preop and post-op assessment of repair. Functional improvement will be assessed with true validated questionnaires. All results, both positive and negative, will be published and available to guide future research and ideas.

8 Practical Application

I was asked to comment on a 32-year-old P2G2 woman who is actually the daughter of a surgeon (friend of mine). She was seen in her local ER due to progressive problems defecating and an inability to void. A foley was placed and 3,100 cc of urine drained from her bladder. She had not moved her bowels for 10 days. She was admitted to a gastroenterologist’s private service and an IV started. Her complete blood count, electrolytes, and urinalysis were unremarkable. She was given small quantities of an oral laxative and a urology consult obtained. There was no vaginal or digital exam done. A CT scan showed that her colon was filled with stool, and an MRI showed no spinal lesions. Two days later, she had a cystoscopy that showed a large bladder but no lesions. On hospital day 5, a gynecology consult was obtained. This woman still has not moved her bowels, and no digital exam has been done. The vaginal exam showed laxity of the anterior wall of her vagina with prolapse of what was felt to be the bladder toward the introitus, a mild rectocele, and a cyst on her cervix. Still no digital exam was done. She continues to receive oral laxatives.

At this stage (hospital day 7), her father sent me her records and asked me to comment (she remained hospitalized nearly 10,000 miles away in another continent). I was amazed that the GI doctor, gynecologist, and urologist never spoke directly to one another. She has now gone 17 days with no defecation, she states she is distended and has some cramps, she is anorexic, and still no digital exam has been done. She could not hold an enema, and therefore this treatment was abandoned. She is straight cathing as her bladder does not empty, and she is understandably very discouraged.

This is a true story about a patient with these pelvic floor problems that occurred while I was writing this chapter. It exemplifies the need for teamwork assessing pelvic floor problems. In this woman's case, at the least a thorough physical exam and collaborative discussion was needed to attempt to sort out her problem. This poor patient's situation highlights why we need to train pelvic floor doctors of the future who act and work together in the best interest of this group of patients. This *must* become a reality

and move beyond the discussions which mostly occur at intellectual meetings. All healthcare providers with a stake in treating pelvic floor problems must be aware of the diagnostic power they would possess working as a group. Modern multidisciplinary centers need to actually be set up and staffed with a team of providers with an interest in collaborating and treating these patients. It is time to move beyond the dream and make this a reality.

Part I

Anatomy