Master of Anatomy

In the first years of the last century France was preeminent in medicine and one of its brightest stars was Marie-François-Xavier Bichat, the creator of descriptive anatomy and one of the fathers of modern histology. ▪ He bridged the transition between the vague and often absurd notions about the body of previous centuries and the precise knowledge of organs and tissues that is the basis of modern medicine. ▪ BEGINNINGS. Bichat was born in Thoirette, a small

village in the mountainous region of the Jura on November 14, 1771, the first of four children of Jean-Baptiste Bichat, a graduate of the faculty of medicine of Montpellier. The boy was baptized at Thoirette, in the home of his grandfather, the prosperous proprietor of a large domain of fine meadows and vineyards; he was raised in Poincin, in the province of Ain in central France where his father practiced medicine and served as village mayor.

The Bichats were a well-to-do family of merchants and priests who gave careful attention to the education of their children. Xavier was a precocious boy of sound judgment who enjoyed long walks with his father through the pine forests where they collected rare plants. The boy was an avid fisherman and hunter, but his interest was not in sport but dissection.

In 1781 Bichat was sent to the Collège of Nantua to study the humanities; he completed the course in rhetoric and was then sent to the Seminary of Saint-Irénée in Lyons where he studied philosophy and physics. At the age of 20 he became a pupil of Marc-Antoine Petit, who gave courses in anatomy and surgery at the Hôtel-Dieu hospital in Lyons. At that time he was a lighthearted and happy-go-lucky student.

On the night of May 29, 1793 revolutionary violence erupted in the provincial town of Lyons. Bichat took part in a battle that cost the lives of 800 men; the moderates took control of the city and defeated the fanatic Jacobins who then controlled the National Convention in Paris. Orders came from Paris that 33 moderate deputies (Girondists) were to be arrested, but Lyons defied the capital and executed two of the leaders of the Jacobin party.

An outraged National Convention ordered the Army of the Alps to march against Lyons and bring the rebellious city to its knees. Bichat took part in the defense of the city; with a column of men he marched to Saint-Etienne to procure guns, but on August 7 the Girondists were crushed and Lyons was devastated by the Revolutionary troops.

When Bichat returned to his home in Poincin in 1793 the Reign of Terror was in full swing and the first Committee of Public Safety decreed a *levée en masse* (general conscription) to drive foreign powers from France.* Bichat noted that

*At the time France was at war with half of Europe.

The town of Lyons at about the time of the French Revolution. Bichat took part in the town battles.

A revolutionary tribunal in Lyons where moderates and extremists fought for supremacy. Bichat served as surgeon in the revolutionary army.

it was a time "when every murky passion, fear, gloom and revengefulness seemed to be hovering over France."

Some 600 physicians and surgeons had been killed at the front and the army was forced to rely on young medical students to take their place. Bichat was conscripted into the Army of the Alps with the rank of surgeon and sent to an army hospital in Bourg, north of Lyons. He stayed there six months then made his way to Paris where he planned to continue his medical education.

PARIS. When Bichat arrived in the capital in 1794 French medicine was painfully emerging from a period of chaos. The year before, the National Convention, under the banner of *égalité*, had swept away all the faculties in France and proclaimed the freedom of all professions. The result was a crisis in the hospitals and a field day for the hundreds of quacks who swarmed throughout the nation. The Directoire in 1794 recognized the danger and, under the guidance of such prominent scientists as Pinel, Guillotin and Fourcroy, the Ecoles de Santé were reestablished. Attached to them were specialized hospitals equipped with laboratories. The professors, chosen by competitive examinations, were encouraged to adopt the most advanced methods in treatment and teaching. Lectures were given in the vernacular and scholarships were provided for able but needy students.

One of Europe's most distinguished surgeons, Pierre Joseph Desault, became director of the surgical clinic of the Paris Ecole de Santé. Bichat attended his lectures regularly but might have remained unknown to Desault had he not offered to take the place of a more advanced student who was to read a résumé of the previous day's clinical lecture. Without notes Bichat gave a brilliant exposition on the treatment of a fractured collar bone and the technique of ligating blood vessels for aneurysms. The students listened in absolute silence and broke into applause at the end of the lecture.

Desault was impressed by the clarity and precision of his student and invited Bichat to work with him. It became a close relationship; Desault took Bichat into his home and made him editor of his *Journal de chirurgie*. A year later, on June 1, 1795 Desault died; he had been delirious with a high temperature for two days. His wife asked Bichat to stay on; Bichat never married and the Desault apartment was to be his home until his own death seven years later.

As a memorial to his patron, Bichat wrote an account of Desault's life and work, and completed the fourth volume of his *Journal de chirurgie*. In 1796 he founded the Société Médicale d'Emulation de Paris, a forum where young physicians could discuss the problems of medicine in the spirit of free enquiry; young René Théophile Hyacinthe Laennec, inventor of the stethoscope, was one of the first members.

In the same year he gave a private course in anatomy to which he later added demonstrations in physiology, using animal vivisection. He lectured on diseases of the bone, the techniques of surgery and wrote memoirs on the synovial membranes, their organization and relationships.

In 1799 he established a dissecting amphitheatre at 18 rue des Carmes and in one winter dissected some 600 cadavers. He obtained the bodies from local cemeteries and for each group he had to obtain a new permit from the department of health. The age and sex of the bodies, the method of delivering them to the amphitheatre, their disposal and the cleanliness of the rooms, were all subject to very strict regulation by the city's health department.

Bichat often slept in the house on the rue des Carmes, working late into the night dissecting or writing up his notes on experiments. A colleague thus described Bichat: "Incapable of anger or impatience, he was as easily accessible in the moments of his laborious pursuits as during his leisure hours. His generosity made him always a liberal friend to those of his pupils, who, far from their families, were in want of funds. It was impossible to

The Hôtel-Dieu hospital in Paris where Bichat did much of his research and experimental work. Below the young Bichat with his master Pierre Desault.

find more frankness and candor, or one who would more readily sacrifice his own opinions when a solid objection was presented to him." Always in frail health, Bichat suffered a hemoptysis in 1799. As if he had a premonition of his early death he worked in what a fellow physician described as "febrile haste," although this did not affect the quality of his work.

TISSUE RESEARCH. It was during this period that Bichat abandoned surgery to devote himself entirely to physiology. He was appointed physician to the Hôtel-Dieu hospital in Paris which provided him with new horizons for research and experimentation. Between 1799-1801 he published *Traité des membranes, Recherches physiologiques sur la vie et la mort, Anatomie générale appliquée à la physiologie et la médicine,* and the five-volume *Anatomie déscriptive*, completed by his pupils.

In his preface to *Physiological Research on Life and Death* Bichat gives credit to his precursors and explains his method and point of view. Books, he wrote, "resemble each other, either in facts which they contain, or in the style in which they are written. The comparison of facts is easily made; it will show perhaps that many of those which I offer were wanting. As to the method, I have endeavored equally not to place myself among those who accumulate experiments without corresponding reasoning and among those who produce arguments unfounded in experiment. In the present state of physiology, it appeared to me that the most judicious plan was to connect

the experimental method of Haller and Spallanzani, with the grand and philosophical views of Bordeu."

Théophile de Bordeu (1722-76), an author of physiologic treatises, and a member of the Montpellier school of medicine, was France's most celebrated advocate of the doctrine of vitalism, which held that the functions of a living organism are owed to a vital principle or force distinct from physical forces and therefore not mechanistically determined. Bichat, influenced by Bordeu and his pupil Paul-Joseph Barthez, accepted the distinction and incompatibility between physical laws and animal functions, but rejected the belief that

the true nature of the vital force could be known.

Bichat believed that the object of a researcher was to observe and coordinate the facts of life, and then to connect these with a theory of structures.

Bichat's major contribution to biology and medical science was based on his systematic description of tissues as the basic structural units of all living organisms. In his first major work *Treatise on Membranes* he acknowledged his debt to Philippe Pinel who suggested in his *Nosographie philosophique* (1798) that pathology should not be founded on the site of organs but on the structure of tissues regardless of their position in the body.

Pinel was not the first to offer this concept of tissue; 2000 years earlier Aristotle had stated that "animals and plants, complex as they may appear, are yet composed of comparatively few elementary parts, frequently repeated." In the second century Galen referred to "similar parts," and in the 16th century Gabriele Fallopio (Fallopius) introduced the notion of "textures." A closer link exists between Bichat and Giovanni Battista Morgagni whose work *On the Seats and Causes of Diseases* (1761) associated pathologic changes in the organs with the symptoms of disease.

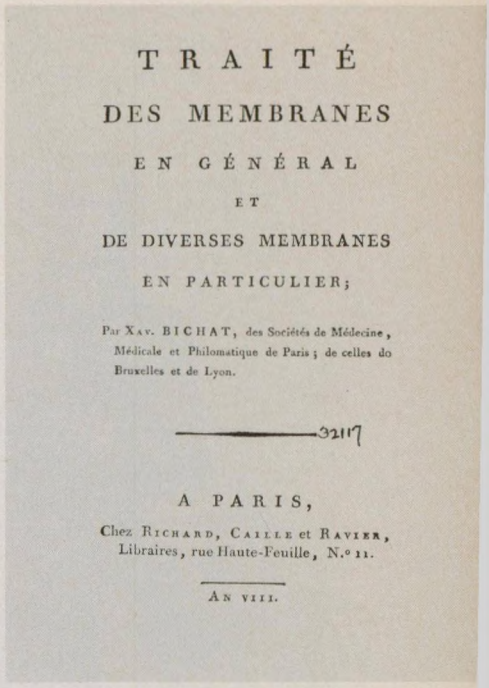
At the turn of the century Bichat wrote: "We are at a point where pathologic anatomy must take new flight. Medicine has been for a long time excluded from the exact sciences; it will have a right to be associated with them, at least as regards the diagnosis of disease, when one combines... with vigorous clinical observation the examination of the alterations suffered by our organs."

Bichat summed up his viewpoint thus: "All animals are merely an assemblage of various organs which, each one performing its function, cooperate in their own fashion to the conservation of the whole. They are so many individual machines in a general machine that constitutes the individual. These individual machines are themselves formed of several tissues of different kinds which form the elements of these organs. Chemistry has its simple elements which by various combinations form complex bodies. Similarly, anatomy has its simple tissues, which... form organs."

His dictum that life is "the sum of the forces that resist death" became famous in his time, although later its logical fallacy (a reversible equation) was demonstrated by many detractors.

In his analysis of tissues he proceeded from accurate observation to generalized statements. He distinguished 21 kinds of tissues, among them nervous, vascular, mucous, serous, connective, osseous, muscular, cartilaginous. These tissues were

Bichat's treatise on the membranes was one of his major works in anatomy.



TRAITÉ

DES MEMBRANES

EN GÉNÉRAL

ET

DE DIVERSES MEMBRANES

EN PARTICULIER;

Par Xav. BICHAT, des Sociétés de Médecine, Médicale et Philomatique de Paris; de celles de Bruxelles et de Lyon.

3211?

A PARIS,

Chez Richard, Caille et Ravier, Libraires, rue Haute-Feuille, N.° 11.

An VIII.

subjected to a variety of experiments: drying, cooking, maceration, treatment by acids, alcohol, alkalis. Bichat studied their elasticity and changes under normal and pathologic conditions. Since they entered into different combinations in producing the organs of the body, he classified them into tissue systems such as bone, cartilage and muscle. An organ was composed of several tissue systems and several organs formed a functional apparatus like the respiratory or digestive systems.

Since tissues, rather than organs, sustain vital functions, the seat of disease is not in the organs but in the affected tissue. When similar tissues become diseased in different organs the clinician notes similar symptoms; conversely when a variety of symptoms appear they are due to the diversity of tissues. Bichat regarded disease as the alteration of the vital properties of the tissues, thereby dissociating himself from the humoral or fluid theories of disease.

Influenced by Albrecht von Haller, Bichat tried to define the particular qualities of tissues, such as assigning sensibility to the nervous system, contractility and irritability to the muscles. This body of knowledge he called "general anatomy," as distinguished from his work on "descriptive anatomy," which he limited to the study of organs according to their function.

Bichat had for some time been in the devoted care of his friend Jean-Nicholas Corvisart, private physician of first consul Bonaparte. On a hot summer day in 1802 he fainted and fell on the

Contemporary engraving of Bichat at beginning of 19th century. At right is rue des Carmes where Bichat established an anatomic amphitheatre.

stairs of the Hôtel-Dieu hospital (then called Grand Hospice d'Humanité).

He returned home but the next day he had a violent headache, and that evening he applied leeches behind his ears. The next day Corvisart came to see him and emetics were administered. For several days Bichat's condition remained stationary but on July 15 one side of his face became convulsed and he passed into a delirium in which he constantly repeated the names of two famous actresses. Mme Desault was constantly at his bedside and for a time there seemed to be some hope, but Bichat fell into a coma and within 24 hours, on July 22, he died. One diagnosis was that he suffered from tuberculous meningitis.

Corvisart wrote to Bonaparte: "Bichat has just died at the age of 30. He has fallen on a field of battle which also calls for courage and which counts many a victim; he has broadened the science of medicine; no one at his age has done so many things and done them so well." By a quirk of chance François Magendie, who has one of Bichat's most ardent opponents in life, was buried in an adjacent grave in the Père-Lachaise cemetery in Paris.

INFLUENCE. Within a few years after Bichat's death his books were translated into English and published in the United States; by the middle of the century his works were well known in Germany, England, Italy. His systematic study of tissues provided the link between Morgagni's pathologic anatomy and Rudolf Virchow's later doctrine of cellular pathology.

The progressive improvement of the microscope, which Bichat disdained, permitted attention to be moved from Bichat's tissues to the cell as the basic anatomic and functional unit of life. The cellular theory was a direct and natural advance thus placing Bichat among the fathers of modern histology and histologic pathology. In a tribute to Bichat the great physiologist Claude Bernard wrote that "modern opinions concerning vital phenomena are based on histology and really have their origin in Bichat's ideas."

The father of positivism Auguste Comte wrote that the early death of Bichat was one of the most tragic events in the history of humanity. Comte believed that the intellect passed through three stages: theologic, metaphysic, scientific, and that Bichat and 12 other superior men were the most perfect symbols of the scientific era, a time characterized by the intellectual tools of observation, hypotheses, experimentation.

SUMMING UP. By Henri Mondor: "Youthfully ardent and joyously intoxicated as a creator.... Xavier Bichat sums up, in the history of medicine, an almost unique prodigy."