Inter-disciplinary cooperation in the "networked Society" Hospital: Some historical and social aspects

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Goals of the workshop: To open and keep up a discussion about following related issues:

■ The historical background of the modern Hospital: From religious philanthropy to managed care.

■ The reflection of the civil structure, the social demands, and the individual performance, on the Hospital throughout the centuries.

■ Biomedical Technology and the 20th century Hospital.

■ Shaping the 21st Century Hospital by merging into a whole Computer Science, Biomedical Technology, and Medical Decision Making Procedures.

■ From the extreme specialization towards the academic and the professional cooperation: Inter-disciplinary research, on the job training, and day to day cooperation in the Modern Hospital.

■ The "networked Society" and the Patient - Hospital Relation.

I. Historical background

Socio-cultural conditions and medical care

■ The concepts and the methods involved in *diagnosis* and *treatment* are subject to the prevalent at the time theoretical model of disease. The concepts of *health, sickness and illness* entail a subjective aspect on the basis of which one expresses a discomfort and a disability.

■ On the other hand, they are subject to the specific *socio-cultural conditions* under which they are considered, and, on the basis of which medical care is provided.

■ *Hospitals*, as a social institution , emerged as a response to particular needs and corresponded to the specific level of the *understanding* of health and disease.

Pre-Hippocratic medicine

■ Pre-Hippocratic medicine had a religious, a magical and even a mystical character.

■ The diagnostic procedure was based on determining the extra-corporal and non-corporeal cause of the evil.
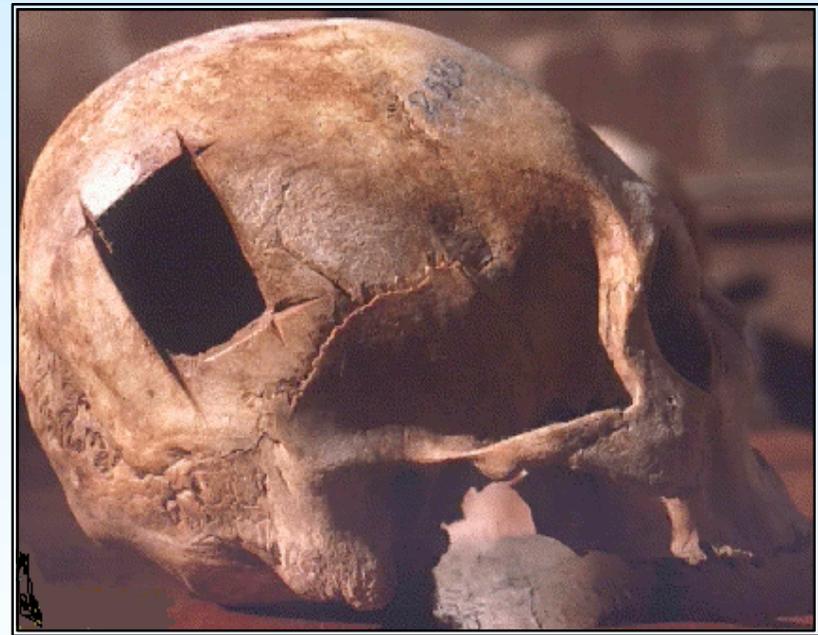
Hippocrates
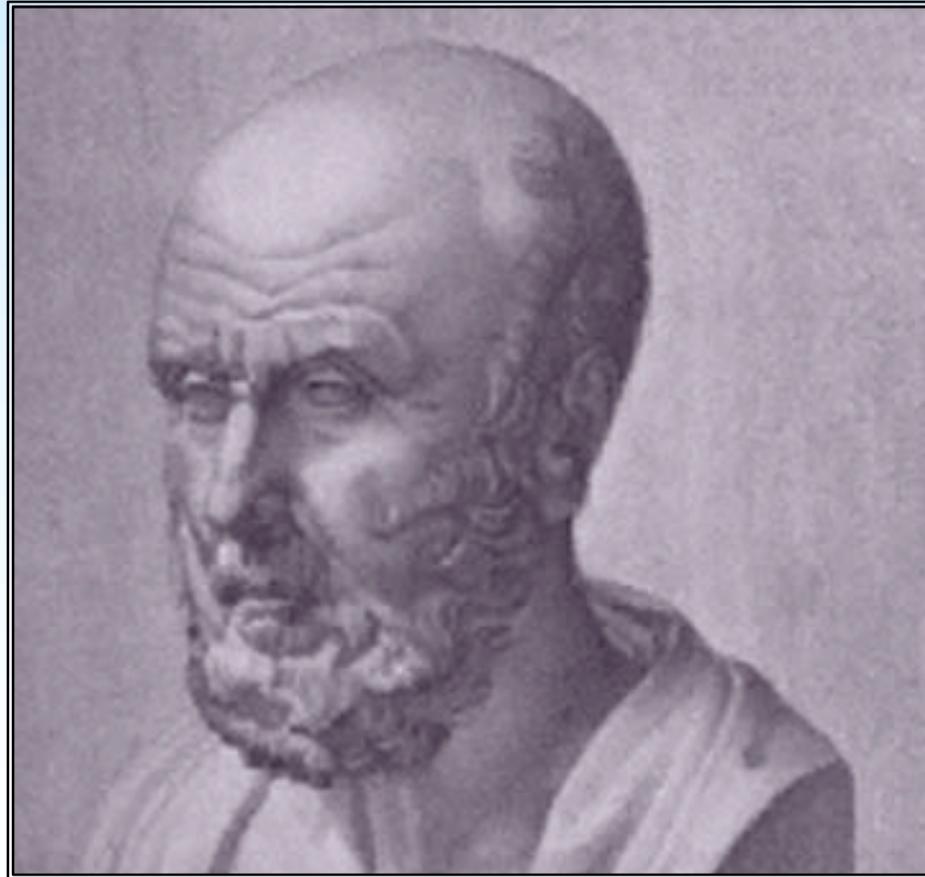
Hippocratic medicine

■ Hippocratic medicine changed the approach to illness and treatment by introducing the concept of *humours* -the four basic fluids of the body- by which diseases were explained in terms of intra-corporeal causes, i.e. the imbalance of the humours.

■ Consequently, *treatment* was the reestablishment of the proper balance.

■ Further, the theory of the humours allowed for the first time the *individuation of the diagnostic examination* and the treatment on the basis of the alteration of everyday life habits, diet, etc.

Asklepieia
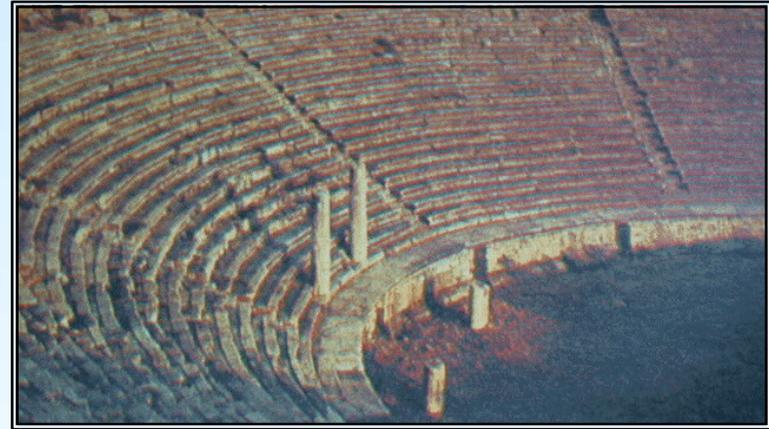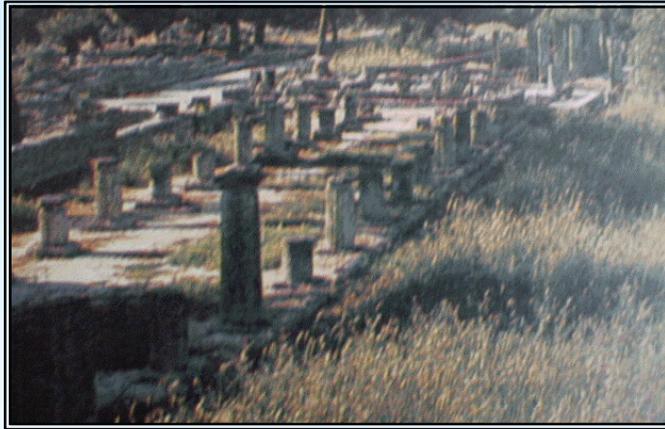
- About 2500 years ago, the temples of *Asklepius*, the god of medicine, were probably the first well organized houses of refuge for the sick and training schools for physicians.

- Hospitals also existed in *India* under Buddhist auspices as early as the *3rd century BC*.

Medical practice in ancient Greece

■ In ancient Greece, medical practice in the centers devoted to the god Asklepios, was informed by:
  ◆ *A theoretical construct encompassing a religious overview.*
  ◆ *A concept of the human body and its function.*
  ◆ *A theory of health and disease.*
  ◆ *Modes of intervention in order to deal with the problem.*

■ The synthesis of the Hippocratic to the Galenic system, introduced a symptoms-base diagnosis and a general principle of treatment, the *contraria contrariis curantur*.

■ This principle, however, led finally, to the stagnation of medicine by becoming a dogma.

Hospitals in the first centuries of the Christian era

■ The number of hospitals grew in the first centuries of the Christian era.

■ In the 4th century AD hospitals were founded in *Caesarea* and in *Rome*.

■ Elsewhere other hospitals were founded under the direction of the Roman Catholic church, such as the *Hôtel Dieu* in Paris, begun under the direction of St. Landry, the bishop of Paris from 650 to about 656 AD.

Knights of St. John Hospital in Rhodes

■ During the *Crusades*, religious orders were created that had as their chief duty the care of the sick, and these orders built a number of hospitals, particularly in the Mediterranean area.

■ The most famous was the *Knights of St. John* of Jerusalem, in Rhodes and later in Malta.

The hospitals as the result of religious philanthropy (Christian or Islamic)

Throughout the Byzantine time, the Middle Ages, the Arab and Ottoman dominance periods, the Renaissance, and even later, hospitals were almost entirely run by religious, Christian or Islamic, groups.

Πρώην
νοσοκομείο
και άσυλο
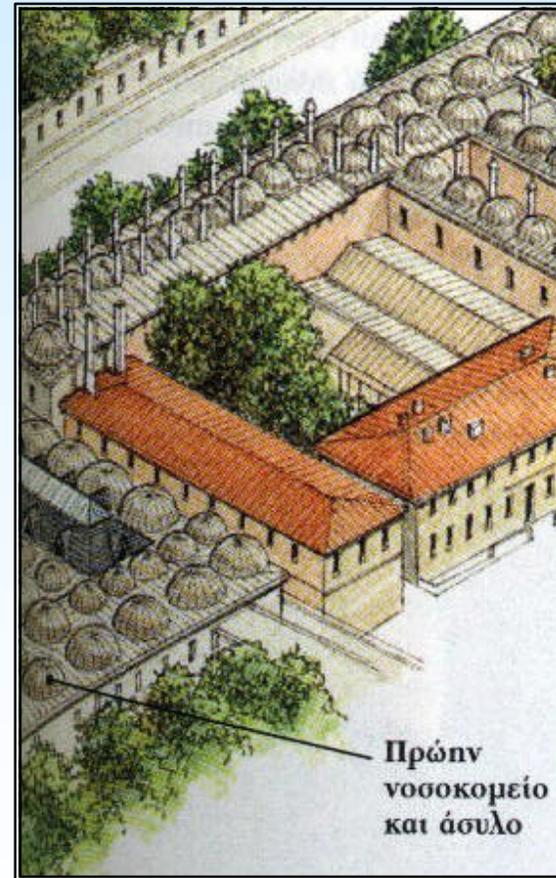
II. The gradual transformation
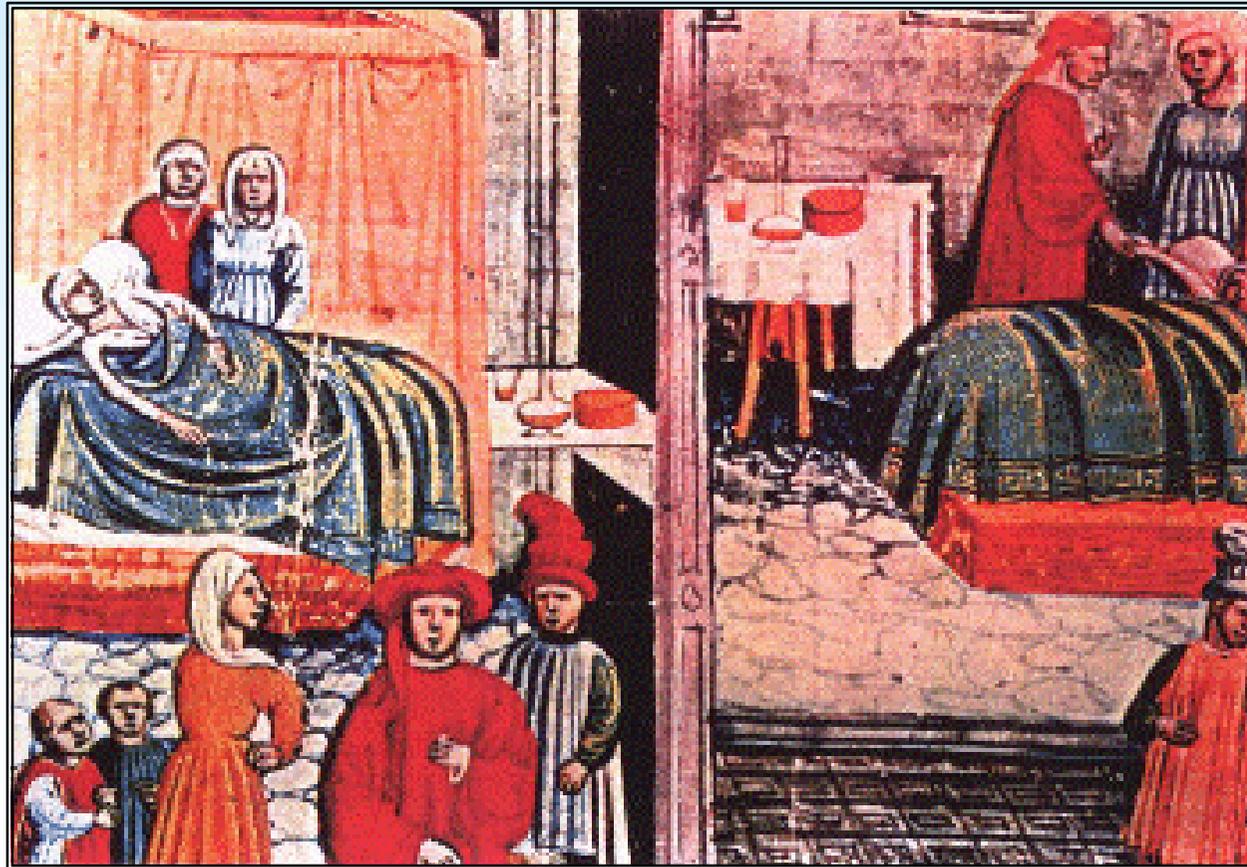
The rise of the modern hospital

Various factors prevailed giving rise to what can be referred to as the modern hospital. These factors were:

- *First, the changing social attitudes and practices concerning the ill.*

- *Second, there were developments within the theoretical foundations of medicine such as the systematization of physiology, and technological developments such as improvements in microscopy.*

- *Finally, there was a change in the social settings within which the modern hospital was to operate.*

The first Public Hospitals

■ Hospitals ceased to be purely *philanthropic institutions* and they started to assume the character of a *social institution* where a systematic and theory-infused approach to disease prevailed.

■ Municipal hospitals operated by the *civil authorities* began to appear, particularly in England.

■ These settings required, due to the multiplicity of the components involved, a more complex *hospital based medical practice* model.

# The birth of contemporary Biomedical Technology

Two events may be considered as marking the birth of Contemporary Biomedical technology.

- ◆ *The first was the discovery of x-rays by Roentgen in 1895, an event which fulfilled the wish of all physicians since antiquity to "see" the inside of the human body. Roentgen's discovery allowed the non-invasive imaging of the human body and thus induced a revolution in medical practice.*

- ◆ *Einthoven, on the other hand, in 1901, measured for the first time the bio-electrical potentials (ECG) of the heart's action, in the body, contributing thus to the rejection of views associated with the notion of vis vitalis.*

Radiology Practice in the dawn of the 20ᵗʰ Century
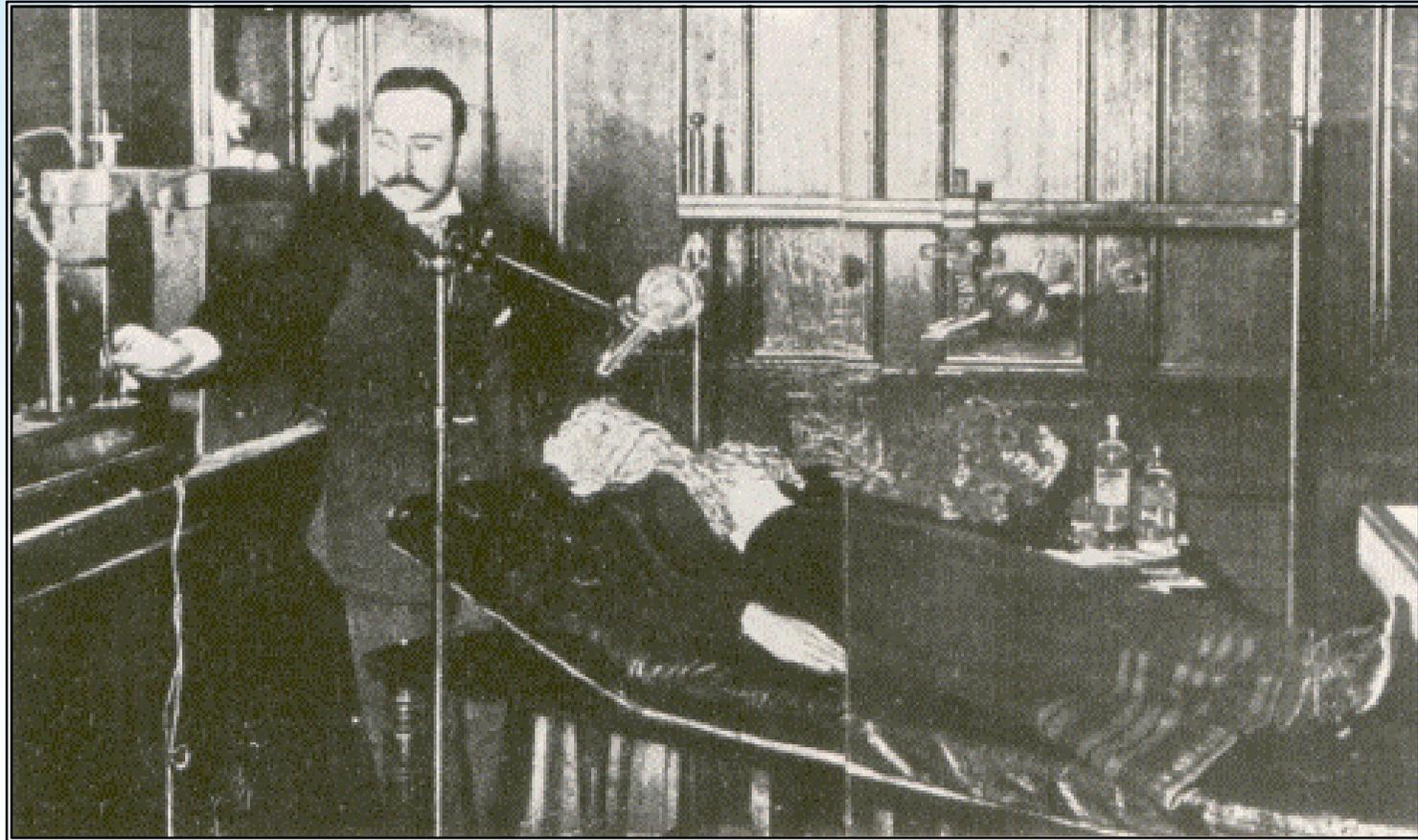
# *Einthoven in 1901 measures the bio-electrical potentials of the heart's action*
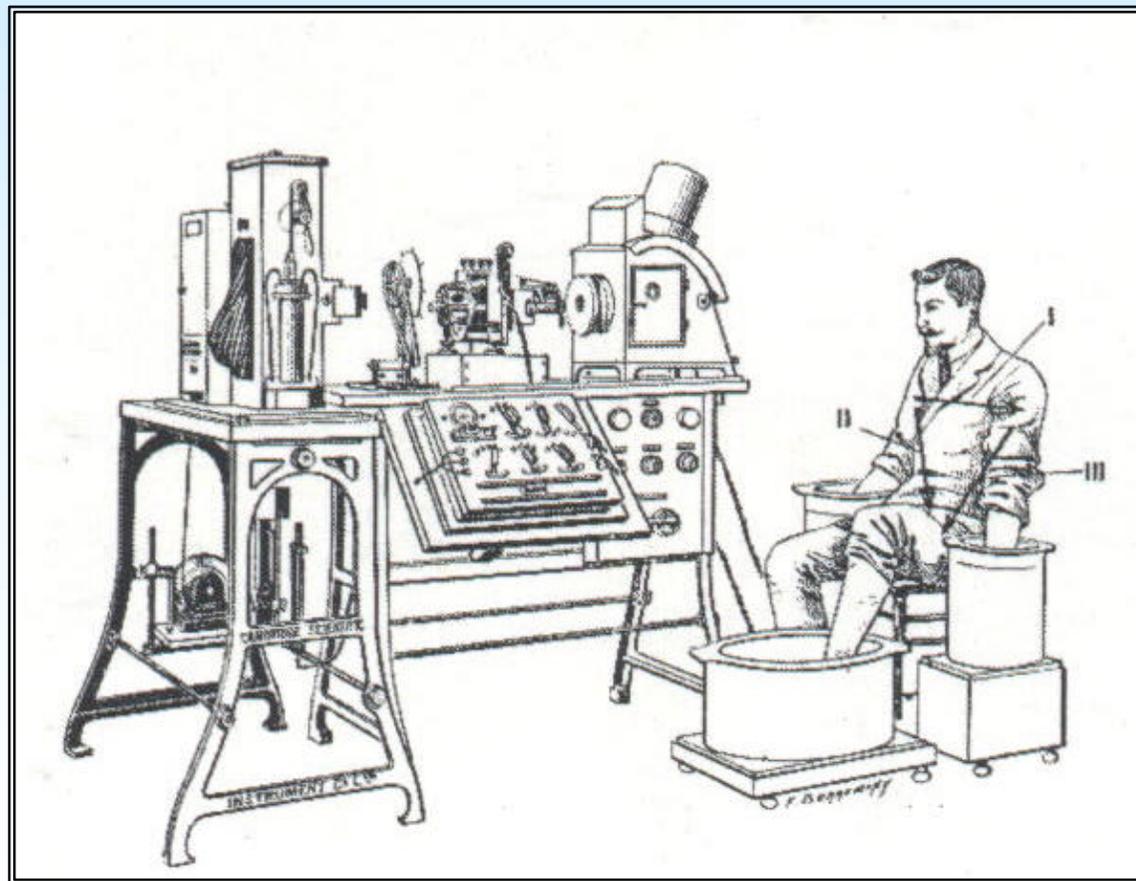
The formation of the 20th Century Hospital

■ These two events led to a close collaboration of physicists and physicians, which resulted in the development of a methodology common to both the natural science and to medicine.

■ This, in turn, led to an impressive growth of Biomedical Technology, and to the formation of the 20th Century Hospital.
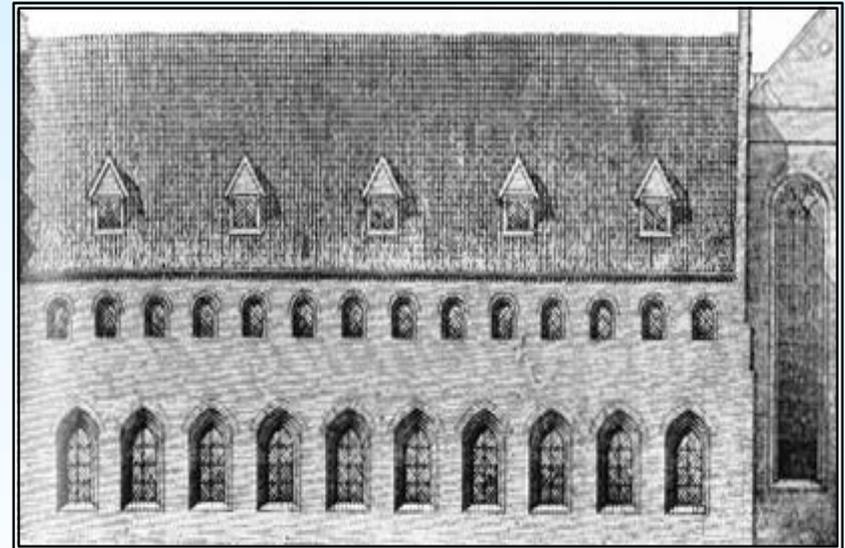
The Pennsylvania Hospital

- In North America, various small private hospitals were operated by churches and by individual physicians.

- The first public hospital, the Pennsylvania Hospital, was opened 1751 in Philadelphia, through the efforts of *Benjamin Franklin* and *Thomas Bond*.
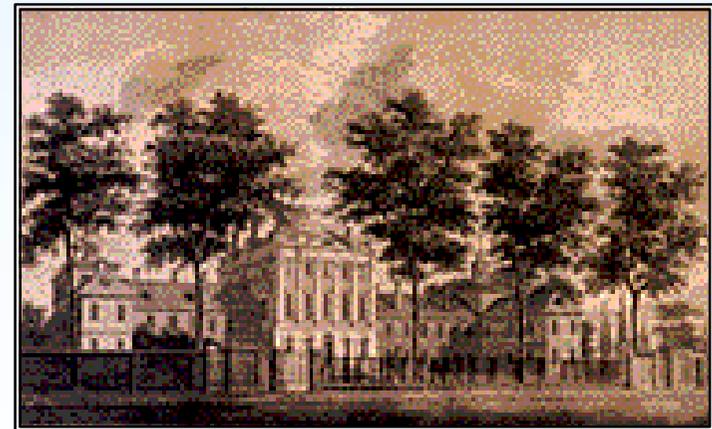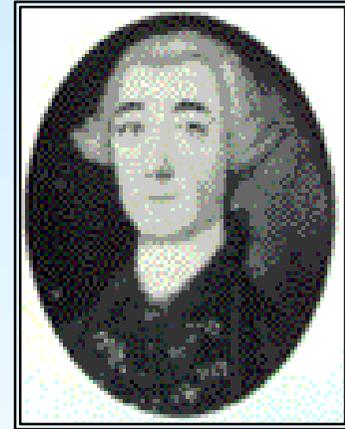
The new social and political environment in the USA

- From the middle of the 19th century on, the number of hospitals, particularly in Europe and in the USA, increased, principally because of the discovery of anesthesia, aseptic surgical techniques and, by the end of the century, the introduction of the X-rays.

- During this very important period of the American History, from the end of the Civil War until the end of Word War I, the United States obtain a leading position in the political and economical international scene.

The transformation of the Hospital - Patient Relation

■ In the major urban centers of the Northeast, the social, economic, scientific and technological conditions, are gradually permitting the *transformation of the Hospitals* and the reformation of the *Physician-Patient-Disease Relation*.

■ The demand for hospital services expanded further with the spread of prosperity, and with the introduction of various forms of *hospitalization insurance*.

Developments in Europe

■ Similar developments take place in the other side of the Atlantic and especially in *England* and in *Germany*, where the first obligatory and generalized *social insurance system* is introduced.

■ Early hospitals often grouped all patients in a *single ward*, regardless of disease.
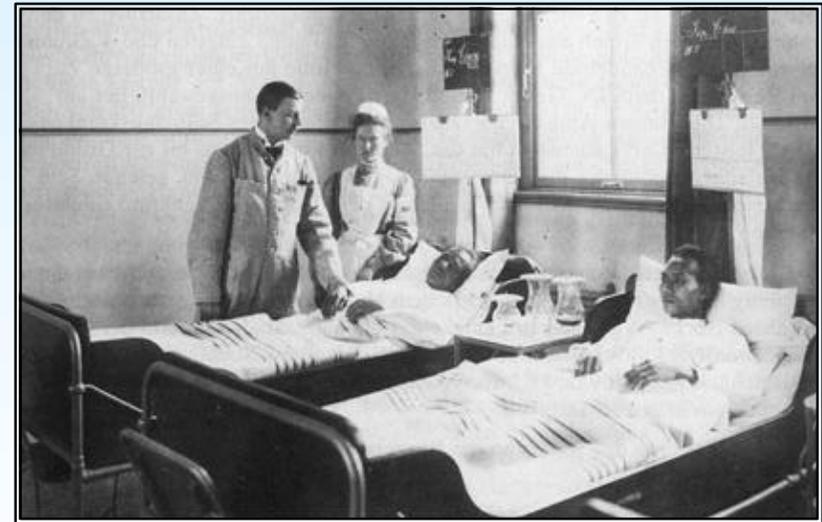
Specialty Hospitals

■ *Mental asyla, quarantine centers,* and *tuberculosis sanatoria,* were developed in the late 19th century.

■ Separate hospitals, usually associated with research and teaching activities, are established for *women* and for *children*, and for the treatment of special disorders as *ear and eye diseases*.
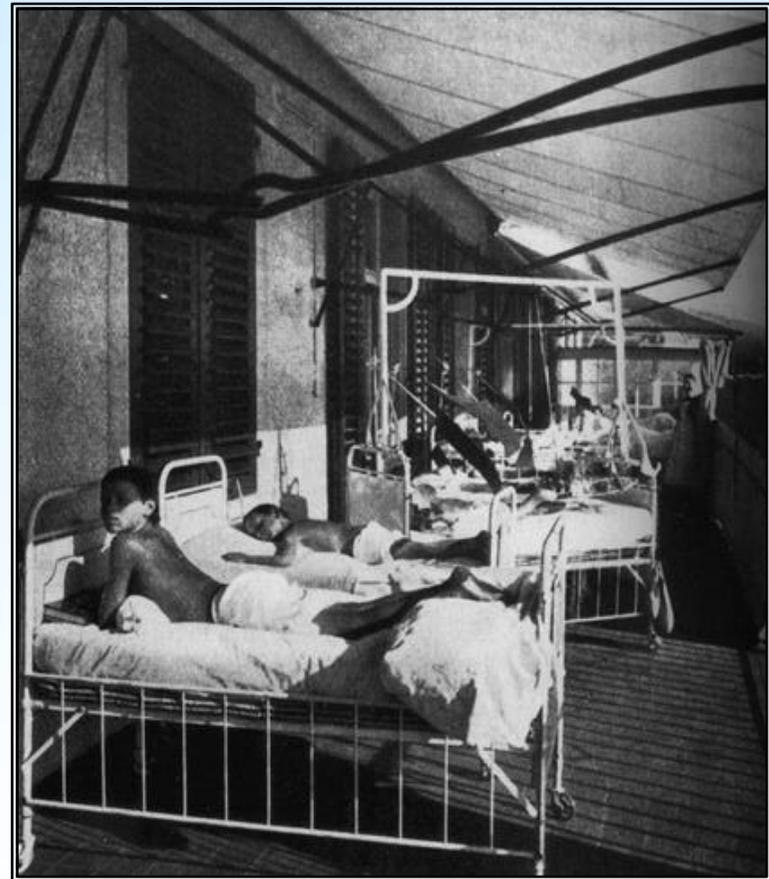
Biomedical Technology and the evolution of Hospital Infra-structure

■ The early traces of the contemporary diagnostic procedures entail the use of biomedical technology and are intimately related to its development.

■ These procedures consist of the collection of diagnostic information and the evaluation and assessment of the individual patient.

■ Most of these procedures are appearing in a primitive form during the turn of the Century preparing the contemporary revolution in Medicine.

The evaluation and assessment of the patient

The collection of diagnostic information and the evaluation and assessment of the individual patient comprises of:

- *Clinical information obtained through the case history, inspection, palpation, percussion, auscultation etc.*
- *In vivo diagnostic procedures leading to the collection of signals related to the bodily functions, such as ECG, EEG, etc.*
- *In vitro diagnostic procedures providing also data.*
- *Medical imaging procedures leading to the collection of images related to the morphology and the functions of the human body.*

The Hospital of tomorrow

■ The modern Hospital emerged gradually and successively, during a very long historical development, from a religious philanthropy Institution to the contemporary managed care Establishment.

■ The civil structure, the social demands, and the individual performance, were always and are still reflected, on the Hospital, throughout the centuries.

■ An attempt follows, to deal with the relevant processes in the specific professional and scientific context of the contemporary Hospital.

The development of the modern Hospital

III. Shaping the 21st Century Hospital

The Functional Structure and the Resources Management in the Modern Hospital

■ We experience presently the process of the integration of *Biomedical Technology, Information Technology Systems* and *Medical Decision Making Procedures* in the specific professional and scientific context of the Modern Hospital.

■ The modern hospital is not a uniform structure. It consists of various functional units which contribute to the achievement of common goals which are set for the entire structure but maintain a relative autonomy and perform unique roles.

■ Although the said integration process is an intrinsic element of each unit's function, it is far from identical in all these units.

Outpatient and Accident-Emergency Departments

■ These constitute the major interface between the society in general, and the modern Hospital.

■ These Departments act as the input gates into the Hospital structure, and they receive patients under different constraints and with different needs; hence they apply different approaches.
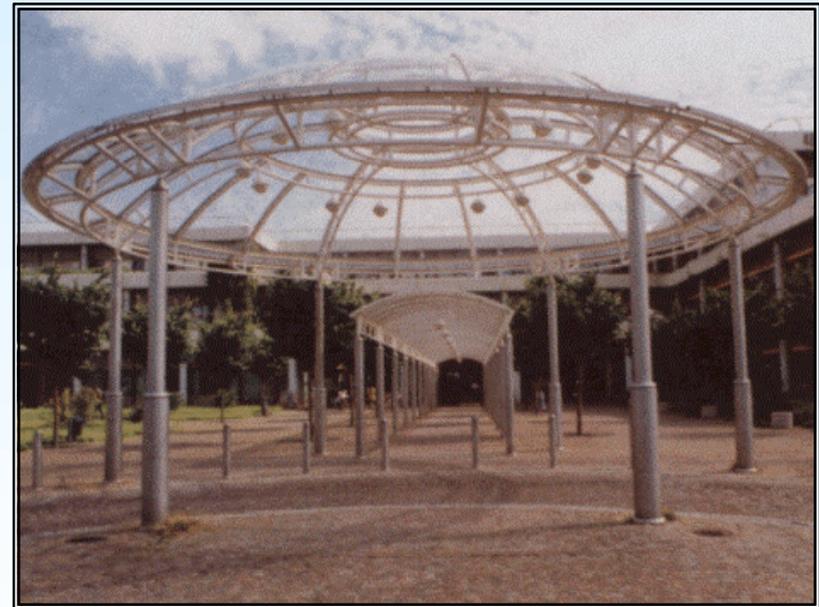
The Outpatient Department

■ The main task of the *Outpatient Department* is to perform a diagnosis in complicated cases and to provide treatment wherever this is feasible.

■ A crucial problem in this context is the mode of establishing *criteria* which are employed in the selection of the data and the reasons, which might have a bearing on both the diagnosis and the subsequent treatment.
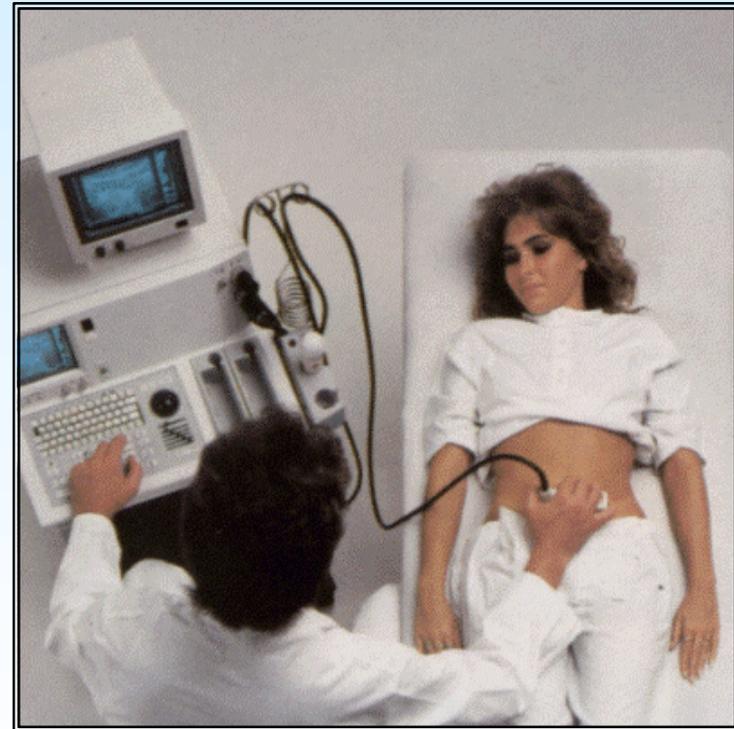
Decision making in the Accident - Emergency Department

Decision making in the *Accident and Emergency Department* requires often accelerated procedures in order to carry out the task in question, namely:

- ◆ *To prevent death.*

- ◆ *To prevent irreversible damage to the patient.*

The Emergency Patient

- The emergency patient is considered or consider himself to need immediate medical, surgical or psychiatric care.
- A high percentage of the latter category may be non-emergency cases.
- To avoid an overrun of the Emergency Department, the regular out-patient services must be well developed.

The adoption of standard *"triage"* procedures

■ The emergency department must be operational 24 hours a day and is expected to deal immediately with a wide variety of complex problems.

■ Obviously, no *"first come, first served"* rule is applicable and priority is kept according to the *"triage"* of the patients.

■ This extremely important Decision-making procedure should be adequately technically and administratively supported, and tends towards the adoption of standard procedures, both, by the personnel and by the inference-supporting equipment involved.

The in vitro Diagnostic Laboratories

■ The function of the *in vitro Diagnostic Laboratories* is on the one hand, to *extract data* which will be incorporated in the decision making procedures of other Departments and, on the other, to chart courses of action on the basis of the information they extract out of the specimens.

■ *Automated* examinations in body fluids, tissues, and bodily products, monitored by *Quality Assurance* procedures, provide prosperous ground for medical reasoning.

■ Innovative techniques, based on *Molecular Biology and Genetics*, combined to modern *Information Technology*, characterize the 21st Century Laboratory profile.

Medical Imaging

■ The main type of decision making in *Medical Imaging* concerns the *discrimination of forms* and the *ascription of specific characteristics* on to them.

■ The degree of personal involvement of an expert in the final evaluation, is still very strong, because of the great variation of the forms of biological structures.

■ The integrating common element in all imaging techniques, is the increasing use of diverse *Digital Image Processing* algorithms, which allows for the extraction of essentially more information, supporting medical decision making, and enabling gradually, the pursued *generalized non-invasive tissue characterization*.

The Operating Room

■ Decisions in the *Operating Room* result in from the evaluation of the clinical features of the patient, from the contacting of bio-signals and from the medical images evaluation before and during the operation.

■ Crucial decisions are made, such as those concerning:

   ◆ *Pre-operative care.*

   ◆ *Intra-operative judgement and management.*

   ◆ *Post-operative care.*

Advances in the Operating Room

■ Surgical advances have been largely dependent on the basic scientific R & D, on the experimental surgery, and on the para-surgical innovation.

■ However, running the surgical suite, even supported by modern medical and information technologies, is still an elaborate procedure.
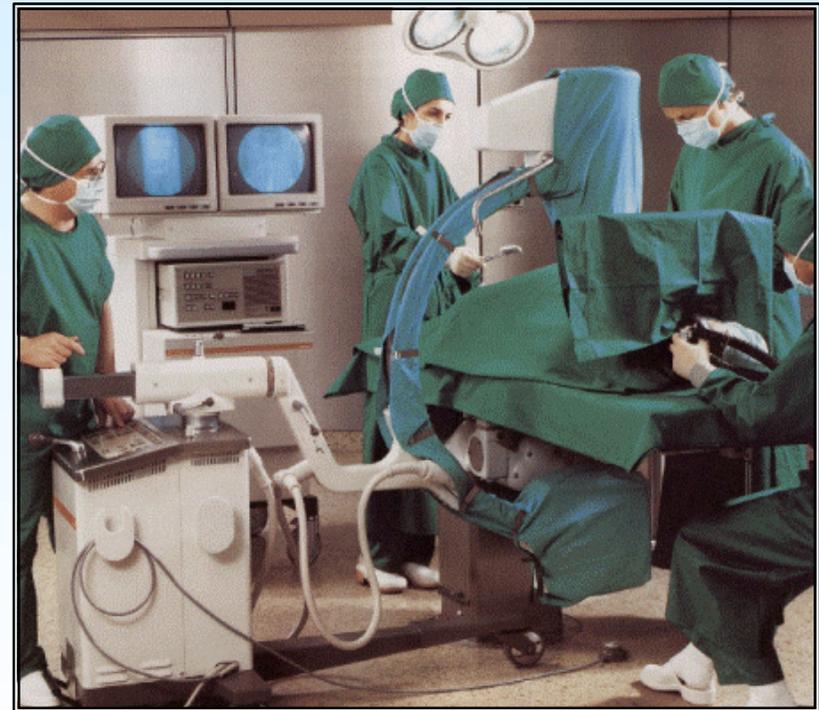
Intensive Care Unit

■ A manifold of decisions are made at the *Intensive Care Unit*. Among those are:

◆ *First, the selection of the patients to be admitted.*

◆ *Second, the development of treatment strategies.*

◆ *Third, the evaluation of the data deriving from both the clinical examinations and the bedside monitoring equipment.*

■ Decisions concerning the handling of critical situations.

■ It should be noted that this manifold of decisions is imbued with ethical dilemmas at every stage of the patient's treatment.

The Inpatient Wards

■ The quality of care available in the *Inpatient Wards* is related first and foremost to the *quality of the nursing care*, and to the *clinical acumen of the medical staff*.

■ However, without the necessary equipment and the appropriate environmental design, the safety and the efficiency of the patient care, will be lessened.

■ *Computerized Data Management* is becoming common, and *Decision Supporting Systems* have also made their appearance in the Wards, assisting the monitoring, the evaluation, and the treatment of the patient.

Decision Supporting Systems in Medicine

■ Contemporary Decision Supporting Systems in Medicine provide for adequate approximations of the function that:

◆ *Describes the state of the patient.*

◆ *Enables the physician to detect and evaluate the abnormality region in each value domain.*

■ This is generally valid only if:

◆ *The subject-matter of a problem group in a clinical specialty is thoroughly defined.*

◆ *The knowledge and experience concerning it is founded on the basic medical sciences.*

Acquisition, processing, and dissipation, of Medical Knowledge

■ Thus, Decision Supporting Systems in Medicine depend definitely on the *proximity of the description* of the empirical disease, to the *well defined and theoretically supported* basic medical scientific knowledge.

■ However, the sophisticated available computer technology constitutes the most powerful contemporary instrument, for *the acquisition, the processing, and the dissipation* of medical knowledge.

Medical Records

■ Another important example is this of the Medical Records, which are used in a variety of ways and they serve a multiplicity of purposes.

■ Beyond the explicit involvement of records in the therapeutic process, there are several other discernible uses, such as:

  ◆ *In research.*

  ◆ *In teaching.*

  ◆ *In the allocation of resources.*

  ◆ *In the construction of the patient's personal history.*

Electronic patient records

■ However, current health information systems are built for the convenience of health care providers and consequently yield *fragmented patient records* in which medically relevant lifelong information is sometimes incomplete, incorrect, or inaccessible.

■ A substantial current task of medical informatics, is the development of a personal system that will help *track, manage, and interpret the subject's distributed health history*, and offer advice to both patient and provider.

■ The system must maintain *comprehensive, cumulative, correct, and coherent medical records*, accessible in a timely manner as the subject moves through life, work assignments, and health care providers.

Interdisciplinary Activities in the modern Hospital

■ The Hospital environment exhibits a variety of actions:

  ◆ *Administrative.*

  ◆ *Medical.*

  ◆ *Technical.*

  ◆ *Financial etc.*

■ There is a variety of *reasons* employed in the various inferences which lead to corresponding actions.

■ There are some very crucial decisions, *of non-medical nature*, made in Hospitals, which have a direct bearing on the operation of the whole structure.

The overall Hospital policy

Such decisions pertain to the overall policy of the Hospital and in particular to matters of:

- ◆ *Allocation of human and material resources.*

- ◆ *The efficiency of its operation.*

- ◆ *The degree of automation of various procedures.*

- ◆ *The level of decentralization of the various Departments necessitated by the rising costs.*

- ◆ *Last but not least, the social role of the Hospital, that is the position of the Hospital in the health system adopted by a given society.*

On the job training in the Modern Hospital

■ The optimization of the *decision making processes* in the hospital requires a continuous training.

■ Further, on the job training in the Modern Hospital, contributes to the promotion of *interdisciplinary research*, and, it addresses in an effective manner the problem on *intra-hospital communication* between the various specialties.

■ The new electronic media may offer a cost-effective way, to enhance education and training alternatives.

IV. The "networked Society" and the Patient - Hospital Relation

The new(?) patient image

■ Medical data, disseminated in the Web or available in other digital forms, on the one hand, constitute *cost-effective and practical means*, augmenting equality in medical training, on the other, they result in a new type of *fragmentation and compartmentalization* of the patient's body and personality, thus endangering the *interpersonal relation* between him and the physician.

■ Further, the use of the Web, combined to other traditional ways of distribution of medical data, such as published epidemiological studies and case-studies presentation in conferences and textbooks, intensifies the risk of eliminating the *individual characteristics* of the specific *patient*, in favor of the *impersonal condition*.

The new professional activity environment

■ Obviously, this new "networked" environment has an influence on the health-care professional codes of conduct.

■ These codes appeared together with the emergence of socially recognized groups of specialists in various fields of practice, and they set the framework, within which the professional-client interaction is carried out.

■ The 21st Century Hospital will provide a radically different professional activity environment and a quite different professional-client interaction modus.

The "over-informed" patient and the critically judged physician

■ Although modern medicine is still based on people memorizing scientific knowledge, the elimination of limitations to access medical knowledge is already an irreversible procedure.

■ Virtually, everyone has access to medical information, independent of the validity and the value of such information.

■ This fact creates a new type of a self-confident "over-informed" patient and a critically judged physician.

The new patient-physician relation
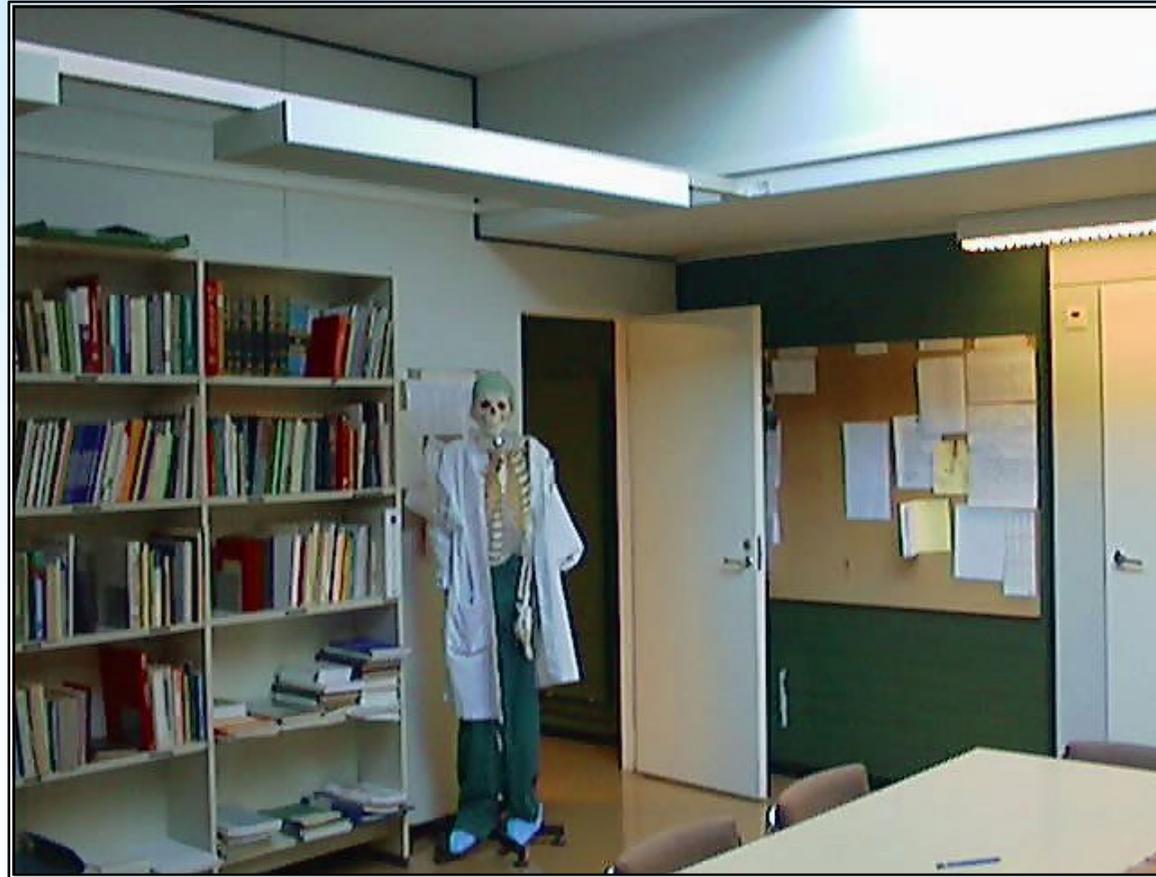
The new Hospital Framework

■ The new patient-physician relation will be developed within a new Hospital Framework, characterized by:

　◆ *First, extended Outpatient Departments.*

　◆ *Second, short stationary treatment in Day-Clinics and Special Care Units.*

　◆ *And third, a high percentage of Intensive Care Beds.*

■ Finally, the emerging General Hospital will increasingly encourage telemedicine supported *home-care*.

Complementary Institutions

The 21st Century Hospital's Mission will be completed by a network of various associated *"satellite"* Institutions, providing several interrelated types of:

◆ *Preventive medicine.*

◆ *Care for aged citizens.*

◆ *Rehabilitation services for impaired persons.*

◆ *Mental health-care programs.*

From the "Digital Disease" onto the Hippocratic Nosos

What remains to be seen, is whether this arising *"medical landscape"* of tomorrow, will help the Physician to escape from the *"Digital Disease"* on to the Hippocratic Nosos, that is, to reinstate the individual patient in the *compartmentalized Medicine* of today.