

# The Future of Cardiovascular Pathology

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# Disclosures

- I am an anatomical pathologist
- I am a cardiovascular pathologist
- I have no financial disclosures but am open to talk
- This talk is my opinion and may cause sleepiness and headache
- It should not be used without consulting your family doctor or health professional

Pathologist = Laboratory Scientist

# Our future

- What is happening ?
- What is happening in health care ?
- How will these changes affect our specialty of pathology ?

# Pathologist

Pathologists are physicians and scientists who take an ***active role in patient care***, utilizing available tools to integrate and interpret diagnostic information to provide an accurate diagnosis of disease

We work with other members of the health care team to assess the patient condition and prognosis in order to determine optimum therapy alternatives

# Pathologists

- Have a unique knowledge of disease processes
- Are knowledge integrators
- Can get access to and analyze many types of diagnostic data
- Are responsible for the testing that is driving therapy

# Cardiovascular pathology history

- A long and great history !
- Society for Cardiovascular Pathology 1985
- European School for Cardiovascular Pathology 1994
- Association for European Cardiovascular Pathology 2004

# Where have we been ?

## Key contributions of CVP

- Recognition of mechanisms of atherosclerosis and its complications
  - Clinical pathological studies
  - Experimental studies
  - Correlation of pathology with imaging



# Key contributions of CVP

- Cardiovascular surgical and interventional diagnostic and therapeutic procedures and devices used to manage adult and congenital heart disease
  - Congenital heart repairs and surgeries
  - Adult heart repair and surgery
  - Cardiac transplantation
  - Prostheses
  - Importance of myocardial protection

**F Schoen** Cardiovascular Pathology 2010;19:198-200

# Key contributions of CVP

- Elucidation of molecular mechanisms of disease and especially the impact of genetic abnormalities on many subsets of cardiovascular disease
  - Cardiomyopathies
  - Channelopathies
  - Vascular diseases

F Schoen Cardiovascular Pathology 2010;19:198-200

# CVP until 1970s

- Cardiac operations feasible after development of myocardial protection
- Knowledge of congenital heart anatomy
  - Cardiac registries and collections
- Conduction system studies
- Pulmonary vascular disease
- Surgical pathology of the heart and blood vessels
- Valve and vascular prostheses and their complications

# CVP in 1980s

- Interventional cardiology - angioplasty
- Endomyocardial biopsy
- Cardiac transplantation
- Cardiomyopathy classification
- ARVC - arrhythmogenic cardiomyopathy described (ARVD)
- Sudden death studies

G Thiene Kardiovaskuläre Medizin 2010;13(2):41–49

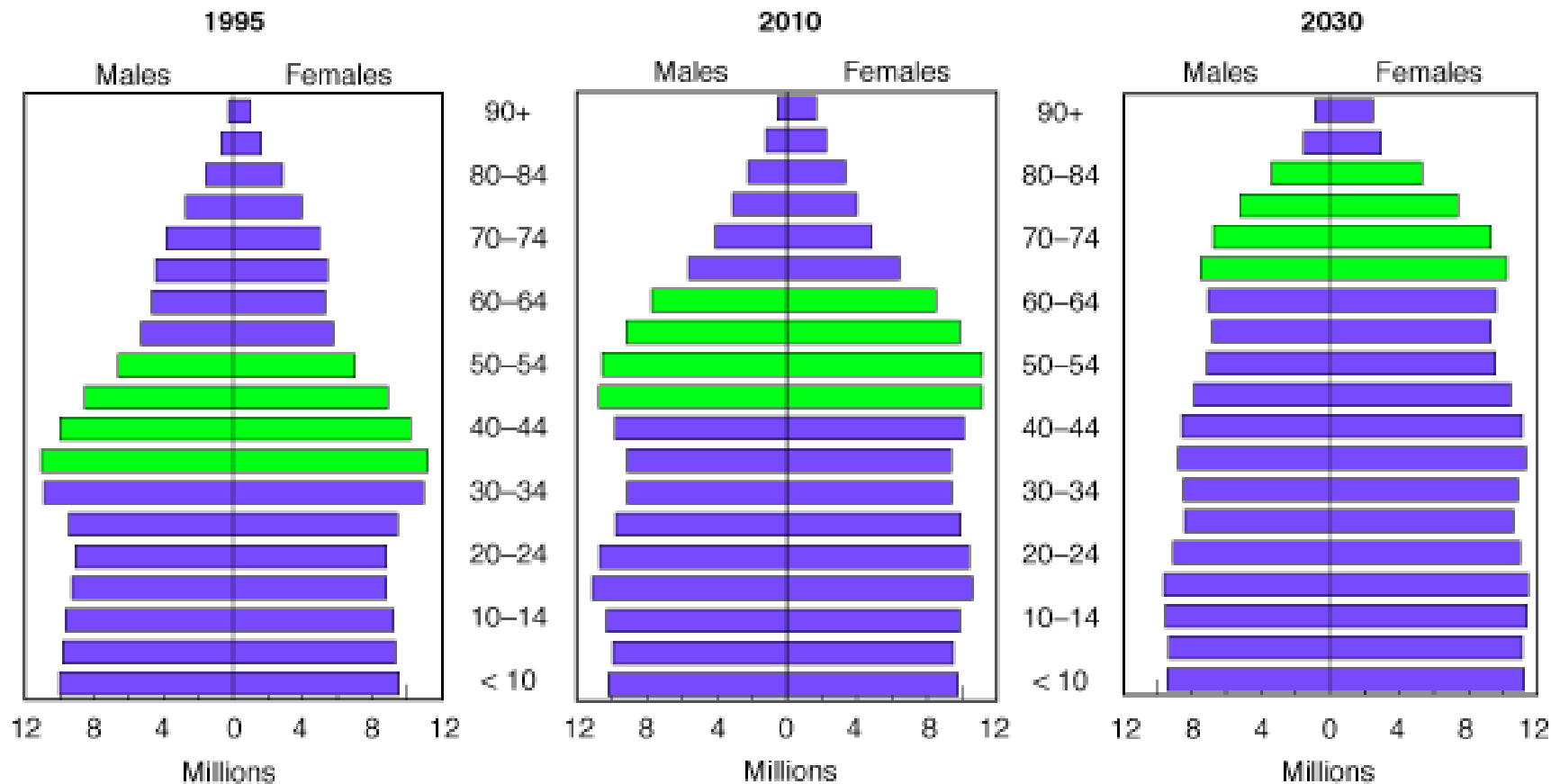
# CVP more recent

- Molecular biology
- In situ, PCR, gene sequencing
- Myocarditis
- Apoptosis and cell death
- Channelopathies
- Molecular classification of cardiomyopathy

# What trends will affect our practice ?

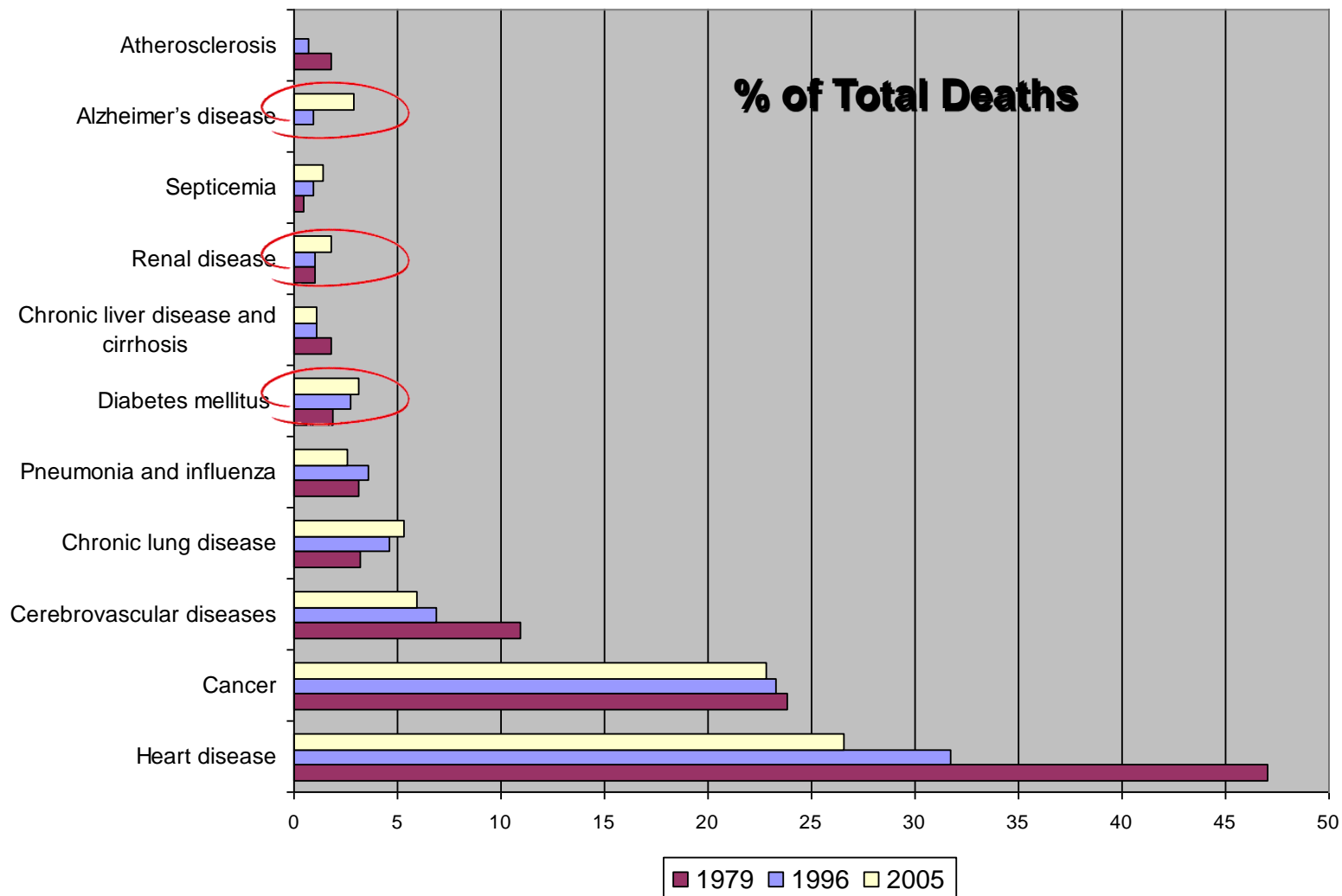
- Population demographics
- Patient expectations
- New tools - our tools and other's tools
- Integration of specialities
- Focus upon quality

# Trend = Changing demographics



Source: U.S. Census Bureau

# Disease and treatment are changing



Source: National Vital Statistics Reports, Vol 47, No 9, Nov 10, 1998; Vol 56, No 10, Apr 24, 2008



# Aging population

## More

- Diseases of degeneration
- Diabetes mellitus, type II
- Heart and renal failure
- Prolonged natural history of diseases
- Cost of health care increasing

Trend = What does the patient/**consumer** want from us ?

- High quality, up to date care
- Minimal inconvenience and easy access
- Fast & accurate information
- Reasonable cost
- Trust & confidence
- Low risk – safe care

What does the patient's physician want  
from us ?

## **Help**

- Fast and accurate results
- Understandable and useful information
- Direction on therapy

# Sometimes the health care provider isn't a physician

**American Medical News**  
American Medical News  
AMA

amednews.com  
— THE NEWSPAPER FOR AMERICA'S PHYSICIANS —

PROFESSIONAL ISSUES

**Medical testing board to introduce doctor of nursing certification**

Physicians are concerned that the move will lead to scope-of-practice expansions.

By [Myrle Croasdale](#), AMNews staff. June 16, 2008.

Starting this fall, doctor of nursing practice graduates will be able to take a certification test that proponents say will set a national standard for DNP's and add to the profession's credibility.

The voluntary test, being created by the National Board of Medical Examiners, is based on the medical licensing exam. It will be offered at a time of growing momentum in the DNP movement: About 200 nursing schools are expected to offer the two-year DNP degree by 2015 --

**SECTIONS**


- Government
- Profession
- Business
- Opinion
- Health

**LISTINGS**

- Latest issue
- By date
- By region
- Map
- By health plan
- By section
- News briefs
- Columns
- Editorials
- Letters
- Write
- Topics
- Series
- Other years
- Resources
- Search

**SERVICES**

- Access info



**Making Room For 'Dr. Nurse'**

By LAURA LANDRO

AS THE SHORTAGE of primary-care physicians mounts, the nursing profession is offering a possible solution: the "doctor nurse."

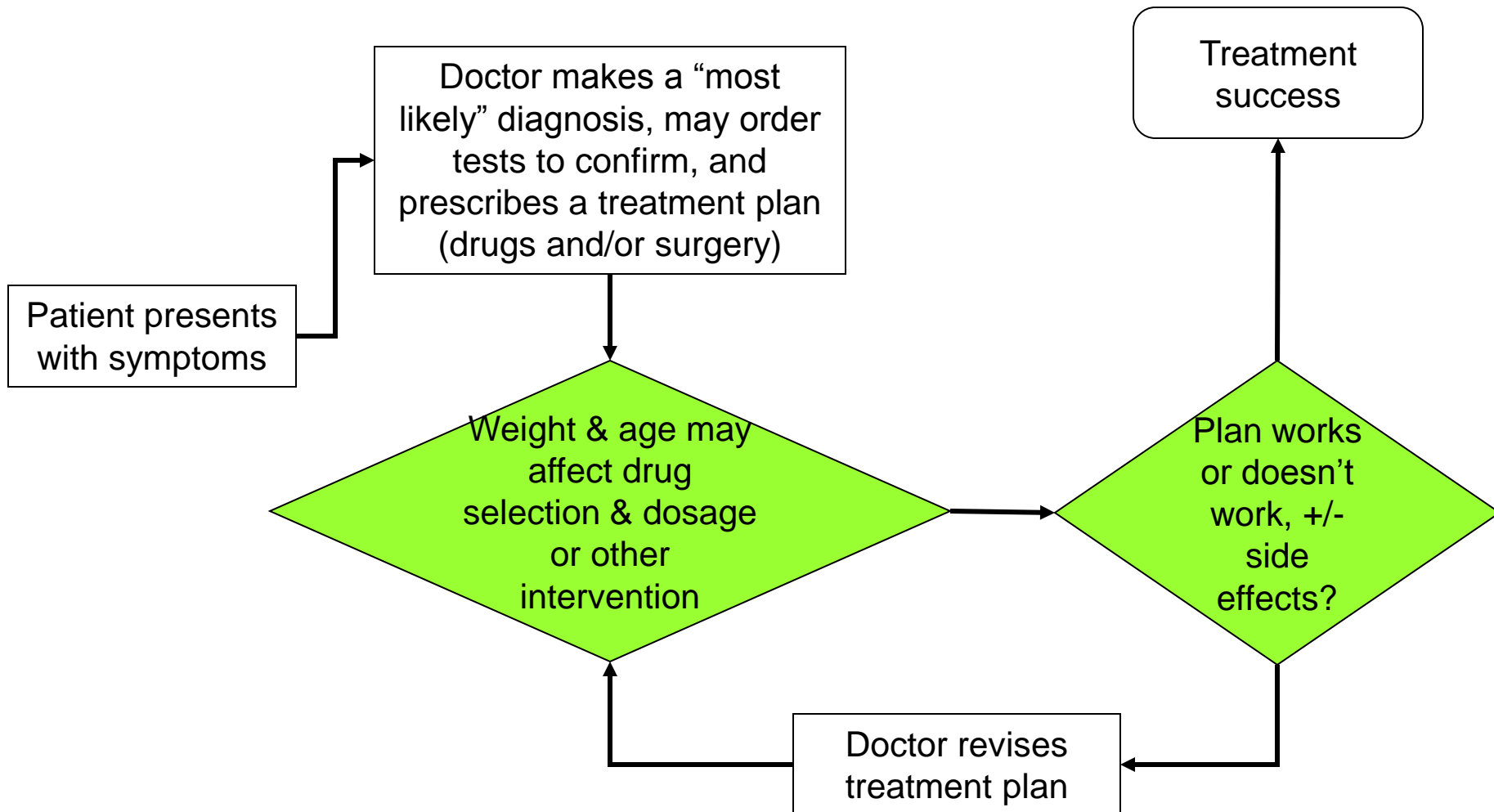
More than 200 nursing schools have established or plan to launch doctorate of nursing practice programs to equip graduates with skills the schools say are equivalent to primary-care physicians. The two-year programs, including a one-year residency, create a "hybrid practitioner" with more skills, knowledge and training than a nurse practitioner, says

Mundinger, dean of New York's Columbia University School of Nursing. She says DNP's are being trained to have more focus than doctors on coordinating care among many specialists and health-care settings.

To establish a national standard for doctors of nursing practice, the non-profit Council for the Advancement of Comprehensive Care plans to announce Wednesday that the National Board of Medical Examiners has agreed to develop a voluntary DNP certification exam based on the same test physicians take to qualify for a medical license. The board will begin administering the exam this

case from the next page

# Trial and error method of care is less acceptable



# Outcomes - disappointing and costly

<b>Category of Disease</b>	<b>% who respond to therapy</b>
Analgesics for pain (Cox-2 inhibitors)	80 %
Asthma	60 %
Cardiac Arrhythmias	60 %
Schizophrenia	60 %
Migraine (acute)	52 %
Migraine (prophylaxis)	50 %
Rheumatoid Arthritis	50 %
Osteoporosis	48 %
HCV	47 %
Alzheimer's Disease	30 %
Oncology	25 %

Source: Physicians' Desk Reference; Patient response rates to a major drug in selected categories of therapy

**Patient group**



**Drug toxic but  
beneficial**



**Drug toxic but  
NOT beneficial**



**Same diagnosis,  
same prescription**



**Drug NOT toxic and  
NOT beneficial**

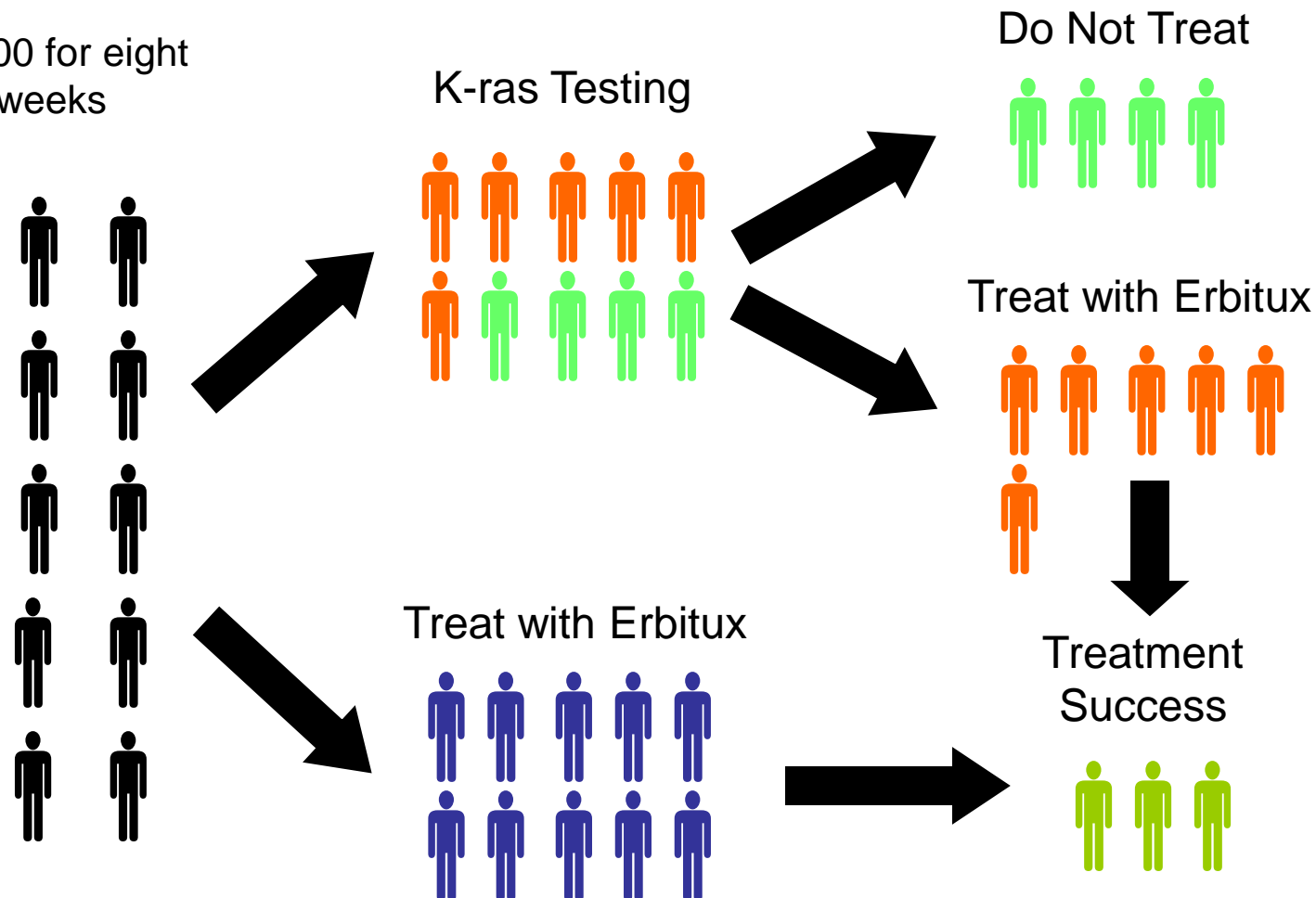


**Drug NOT toxic  
and beneficial**

# In era of personalized medicine, pathologists have a direct impact on patient care...

Cetuximab EGFR Ab

€4,300 for eight weeks





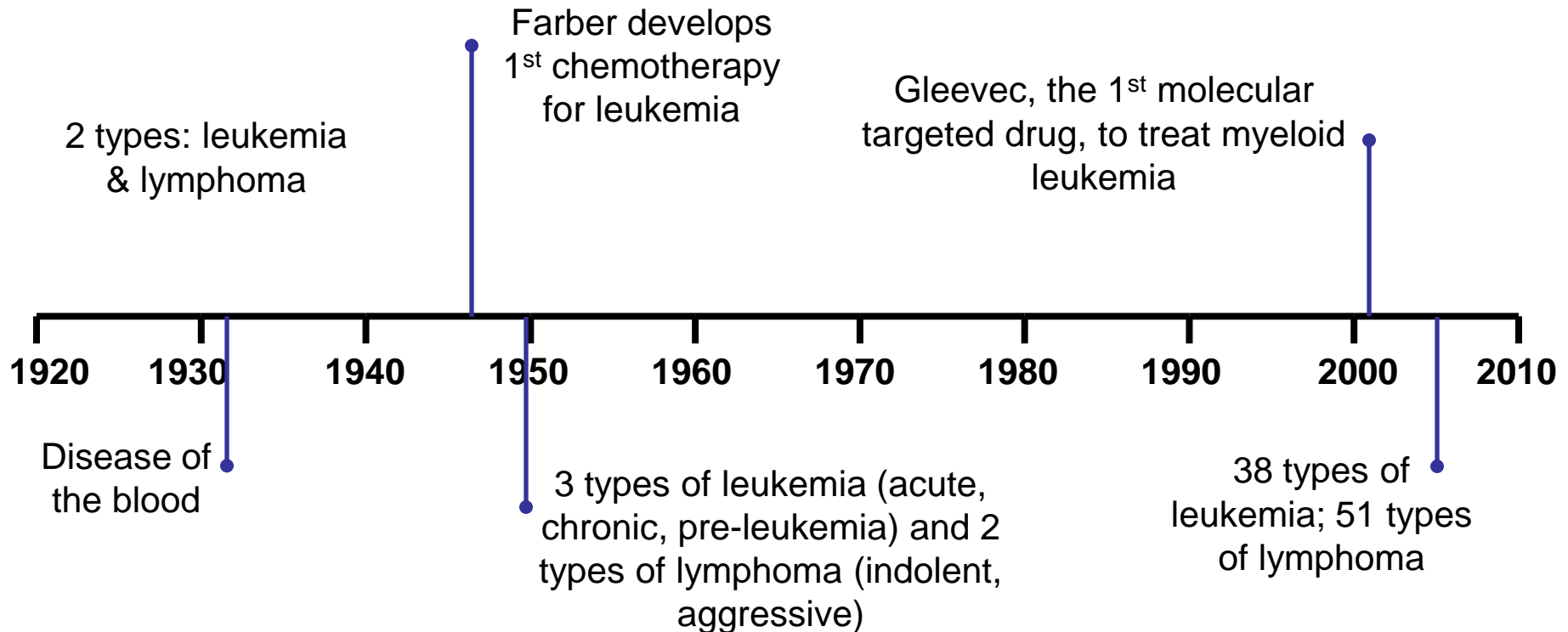
# Trend = Shift to personalized medicine

- Provision of care for diseases which can be precisely diagnosed
- Treatment with predictably effective rules based therapies
- ***Precise diagnosis must precede predictably effective therapy***

# Personalized medicine not new; consider infectious disease therapy

- Microscope and various stains
- Identification of microbes that caused disease
- Tailored antibiotic therapy based on the species of organism
- Molecular subtyping and resistance profile of the involved strain

# Cancer is experiencing a similar shift



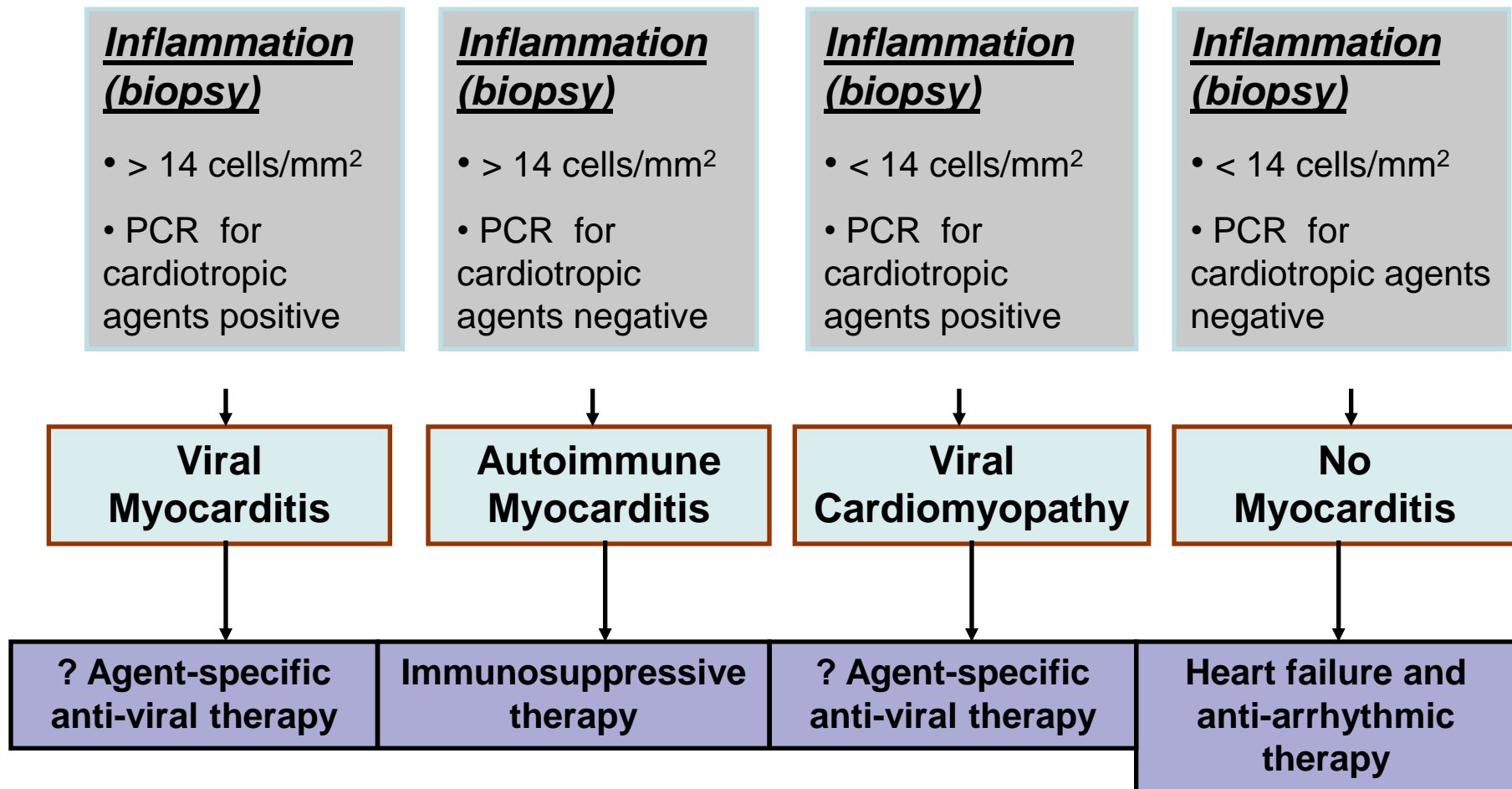
# Personalized medicine

- Diagnosis to **predict risk** of disease
- Monitoring healthy people to detect early signs of disease
- Determining whether a treatment is working
- Producing safer drugs by predicting potential for adverse effects earlier
- Targeting groups of people most likely to benefit from a drug, while keeping its use from those who may be harmed by it

# Personalized CVP path

- Myocarditis - viral Tx or immunosuppression or immunoenhancement
- Cardiomyopathy – molecular diagnosis ? Tx
- Arrhythmia – channelopathies
- Drug treatment of many CVP diseases
  - Thrombolytics/ anti-platelet
  - Myocardial remodelling / cell death
  - Systemic arterial hypertension
  - Arrhythmias

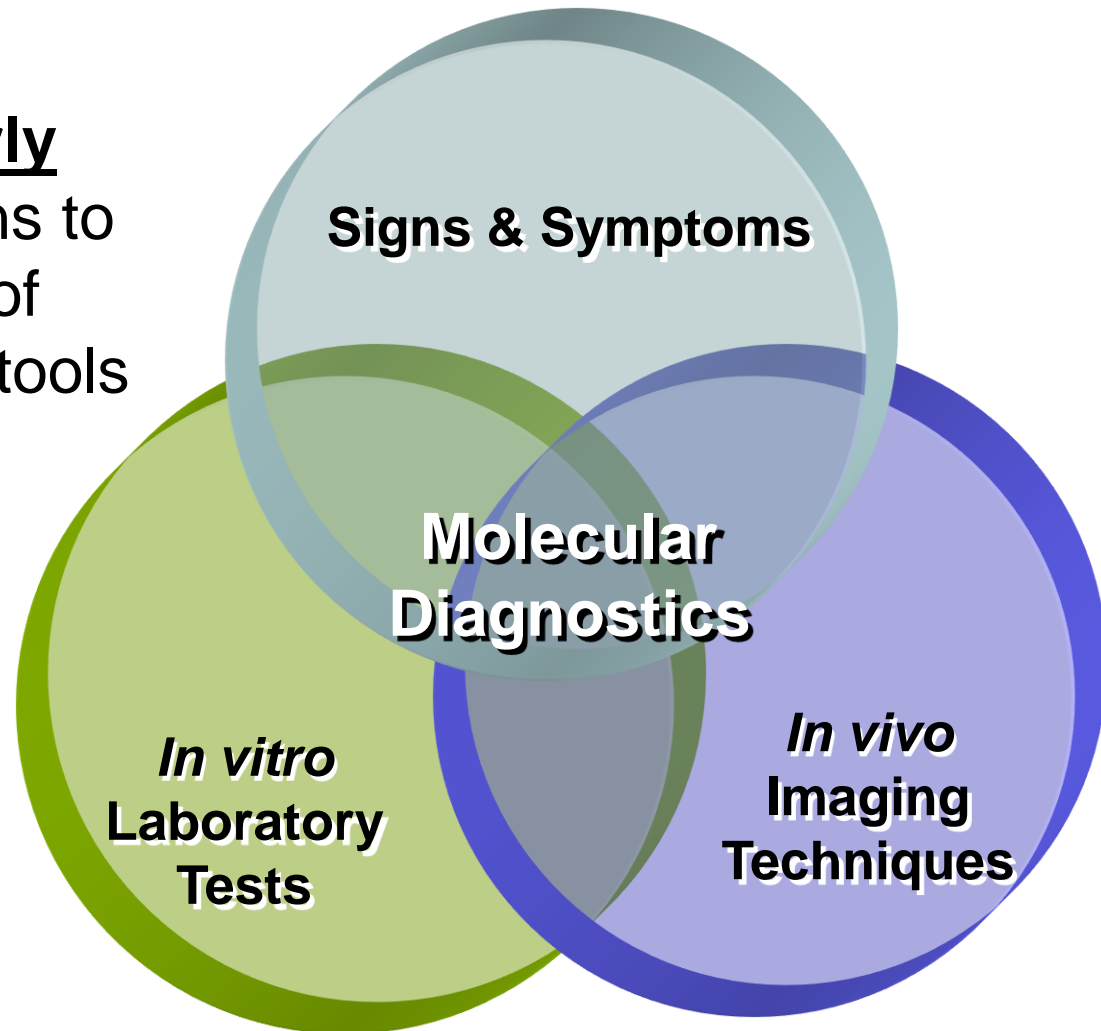
# EMB for myocarditis



# **Molecular diagnostics** is at the core of personalized medicine

## **Disease diagnosis early**

Before the patient begins to manifest any evidence of illness using traditional tools



Trend = New technologies & tools

- Molecular Diagnostics
- Pharmacogenomics / Proteomics
- Digital Diagnostics
- Bedside diagnostics
- Nanosensors



# Our tools



**1595:** 1<sup>st</sup>  
Compound  
Microscope



**Mid-1700s:** Cuff-style  
microscope; 1<sup>st</sup> to  
provide ease of use  
and accurate focusing  
mechanisms



**1680s:** English  
Tripod  
Microscope

**1899:** Ernst Leitz  
Compound Binocular  
Microscope



**Present:** Accessories for DIC,  
fluorescence, polarized light,  
phase contrast, and  
photomicrography

# New tools



**Automation and  
robotics**



**Molecular diagnosis  
and Targeting**



**Bioinformatics**



**Nanotechnology**

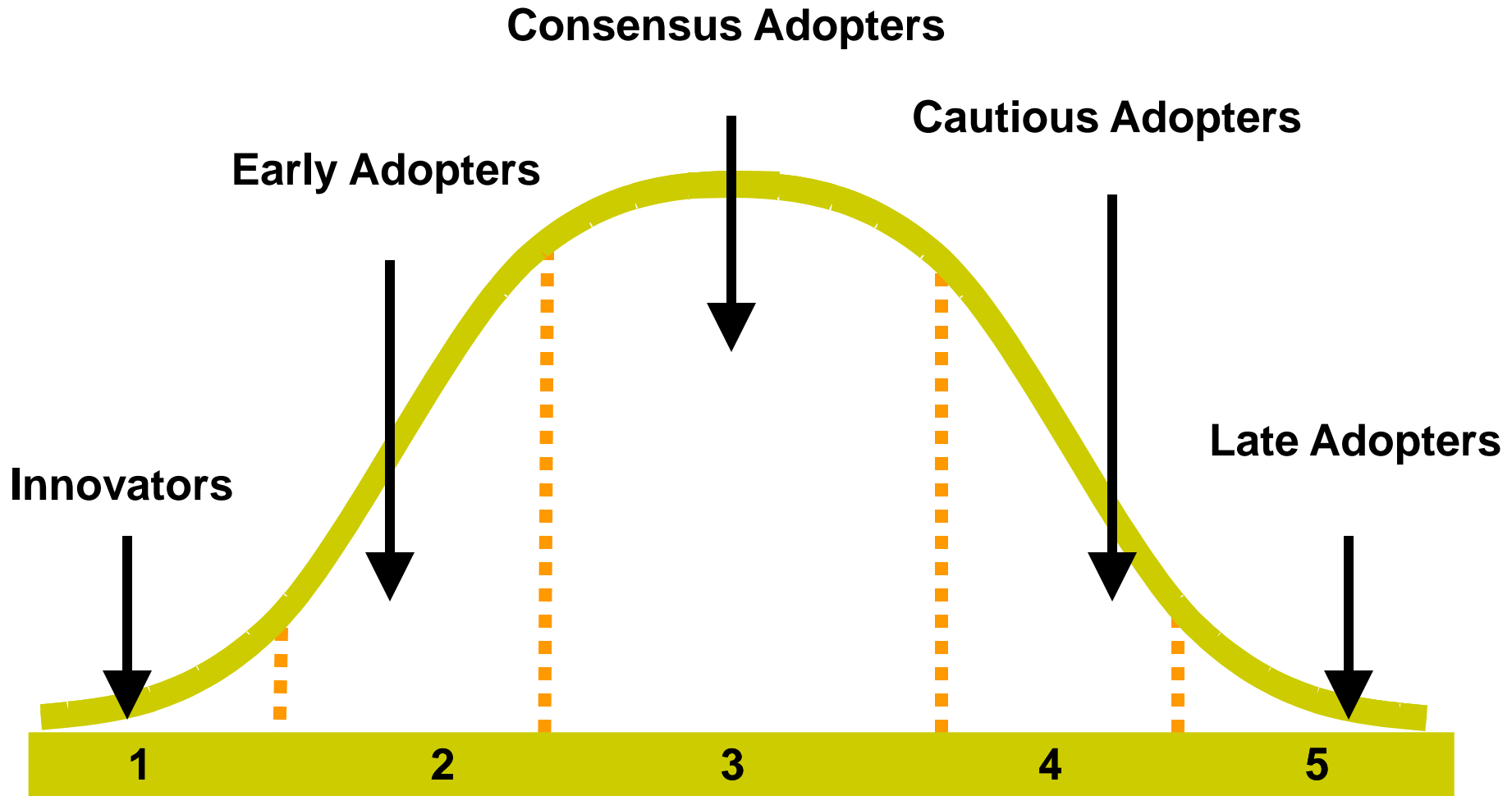


**Biomarkers**



**Personalized  
Medicine**

# Are we/ you keeping up ?



# Microscopy & imaging

- Virtual slide and computer
- Replace or complement the microscope
- Good image clarity
- Can be quantitative, rather than qualitative
- Easier to store
- More durable than glass

# Digital pathology

## An opportunity

- rapid and long distance consultations
- knowledge sharing
- virtual discussion
- distance education

# Trend = Specialty lines defined by our diagnostic tools are fading

- Distinctions within pathology are already rapidly diminishing - “molecular pathology”

AP, heme, micro, virology, biochem, genetics

- Traditional lines within and between specialties will continue to gray - hybrids

Radiology, surgery, pathology

- All specialties will look at new modalities to improve and refine their diagnoses

# Autopsy !

- CT used to “enhance” or ***replace*** autopsy
- Future - Pathologist and radiologist collaborate/ Pathologist alone
- May create renewed interest
  - Comprehensive documentation
  - Increased understandability
  - Non-infectious, non-invasive procedure
  - Efficient, targeted minimally invasive autopsy
  - Less intrusive for families with religious concerns





# Trend = Information overload !

amednews.com  
— THE NEWSPAPER FOR AMERICA'S PHYSICIANS —

PROFESSIONAL ISSUES

**Older doctors are not keeping up to date clinically, study says**

Research shows older doctors are not keeping up to date clinically, study says  
By Myrle Croas

**Dark Daily**  
Clinical Laboratory and Pathology News/Trends

Hosted by:  
R. Michel  
and Sylvia Christensen

**UK Junior Doctors Ordering Lab Tests They Can't Interpret**  
Dark Daily August 13, 2008

*...time devoted to pathology and clinical lab testing in medical school is often not adequate to teach new physicians to be...competent and confident in ordering the right tests...and respond to the lab test results with the correct, recommended actions*



**Doctors and patients overloaded**



# Pathologist = Diagnostic Intelligence expert

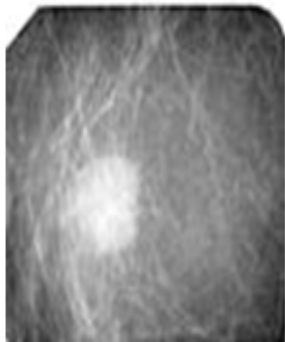
- We blend knowledge of pathology, disease related molecular processes, and lab diagnostics
- We can be **the integrators of information** related to the molecular, biochemical, and cellular processes underlying the patient's disease, complications and symptoms

# Trend = Quality and safety

- Is our speciality full of divergent methods and opinions ?
- Do we have standards for our speciality ?
- How do we monitor quality ?
- Are we reproducible ?
- Are we safe ?

# Breast Cancer Test Errors Cause Faulty Treatment

January 4, 2008, 8:09 am  
Posted by Jacob Goldstein



The era of personalized medicine won't work unless we can also find our way into the era of reliable diagnostic testing. And in the case of breast cancer — one of the diseases with good personalized drugs for certain types of tumors — the diagnostic tests aren't working very well, the WSJ reports.

As a result, many women who would benefit from drugs such as Genentech's Herceptin or GlaxoSmithKline's Tykerb are going without because faulty tests say their tumors wouldn't respond to the drugs. At the same time, errant tests also cause other women are to take drugs that aren't right for their type of tumor.

"If we tried to market pregnancy tests with this rate of inaccuracy, they would be taken off the market," says Allen Gown, chief pathologist of PhenoPath Laboratories in Seattle, told the WSJ. "It means there are a lot of women being treated inappropriately."

A study published last year and led by Genentech researchers reviewed how well labs performed Her-2 tests, which are used to determine whether a woman should take Herceptin. It found that 14% to 16% of those judged positive for Her-2 were actually negative. Of those judged negative, 18% to 23% were in fact positive.

That sort of high error rate could lead to tighter oversight of labs. The Centers for Medicare and Medicaid Services, the federal agency that regulates the testing sites, is examining tougher quality-control requirements. At the moment, labs have to pass outside proficiency checks on 83 types of tests — a list that was devised 15 years ago and doesn't include the breast-cancer tests

# The Gazette

How good are our medical laboratories?

Monday, March 24, 2008

What a dreadful tale of incompetence and dismal medical practices is emerging from the Newfoundland inquiry on botched breast-cancer tests.

Perhaps  
Testi  
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GlobeLife

## Health

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Quality of cancer testing a 'nightmare'

CARLY WEEKS AND JESSICA LEEDER  
Globe and Mail Update

March

CBCNEWS.ca

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Miramichi hospital had 'enough significant problems' to warrant changes, inquiry told

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## Miramichi News

Local news for Miramichi, NB continually updated from thousands of sources on the web.

N.B. officials pulling files as pathologist's work goes under the microscope

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Patients at risk even after lab woes addressed: pathologists

- Health  
the wo

Tuesday, February 12, 2008

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Eastern Health was warned in 2005 that the way lab tests were being handled was threatening the safety of breast cancer patients, documents registered with a pending inquiry show.

Dr. Rai

Eastern Health was told in 2005 that its proposed solutions to flawed breast cancer testing were inadequate.

Justice Margaret Cameron is expected later this month to begin a commission of inquiry on flawed hormone receptor tests, including hundreds which may have

“[We're] coming to grips with the fact this isn't a dream. It's more like a nightmare and it looks like it's going to get worse. Suddenly it clicked. This is likely going to get a lot worse before it gets better.”

Andrew Padmos  
CEO, Royal College of Physicians  
and Surgeons of Canada  
March 2008

# “It’s time to try and fix the problem”

Jagdish Butany, MD

President, Canadian Association of Pathologists

Potential solutions the Canadian medical associations have identified

- Creation of **large laboratories** where all medical tests in a region would be **analyzed by specialists** rather than general pathologists
- Mandatory requirement for a 2nd pathologist to sign off on tests showing malignancies
- **Creation of standardized terminology, interpretation measures and handling procedures** to ensure all lab staff across country use the same thresholds to make a diagnosis
- Requirements for all foreign pathologists to receive the same **accreditation** in Canada

March 16, 2008

# We have a bright future in medicine

- Clinical Consultant
- Researcher/Innovator
- Test Provider
- Interpreter
- Clinical Data Integrator
- Lab Director
- Business Developer
- Practice Leader

Pathologist



# The new lab

- Information extracted from minute tissue and fluid samples using complex, automated and miniaturized devices will continue to increase
- Computer based algorithms help integrate information
- Enhanced imaging capabilities will allow groups of pathologists to share information on tissue based diagnostics

# We must interact with patients and with other clinicians

- Expand beyond the tissue on the slide – use all diagnostic tools available
- Broaden our sphere of influence
- Market our services
- Expand your value by influencing prognosis and treatment

**...be a part of the treatment team**



# This is our future

- Personalized medicine
- Virtual pathology
- Information management
- Increased professional overlap and collaboration
- Focus upon quality

# ...a new mindset

- Provide more than just the diagnosis
- New technology & technology integration
- New practice techniques
- Continuous passion for learning
- New management & soft skills
- Collaborate with others
- Assuming a central important role in the treatment team

# Presidential address

## Pathological Society of London 1889

Pathology is of great antiquity, but is far from being exhausted. The science of the 19<sup>th</sup> century has touched it with new vitality, and, with the help of the microscope and chemistry, it is now developing and bearing fruit in a manner which has no parallel in any former part of its long history

- WH Dickinson Pres. address Pathological Soc London 1899 BMJ Feb 2 1889

# It's déjà vu - all over again Y Berra

Pathology is of great antiquity, but is far from being exhausted. The science of the 21st century has touched it with new vitality, and, with the help of the microscope, imaging and molecular medicine, it is now developing and bearing fruit in a manner which has no parallel in any former part of its long history

Two things are bad for the heart:  
Running up stairs, and  
Running down people.

Bernard Baruch



