

Cancer Bio Course 2025

Session 1: Introduction to cancer biology

Bridge and Engage Scholars

August 6th, 2025



Memorial Sloan Kettering
Cancer Center

Pablo Sánchez Vela, MD

Senior Research Scientist

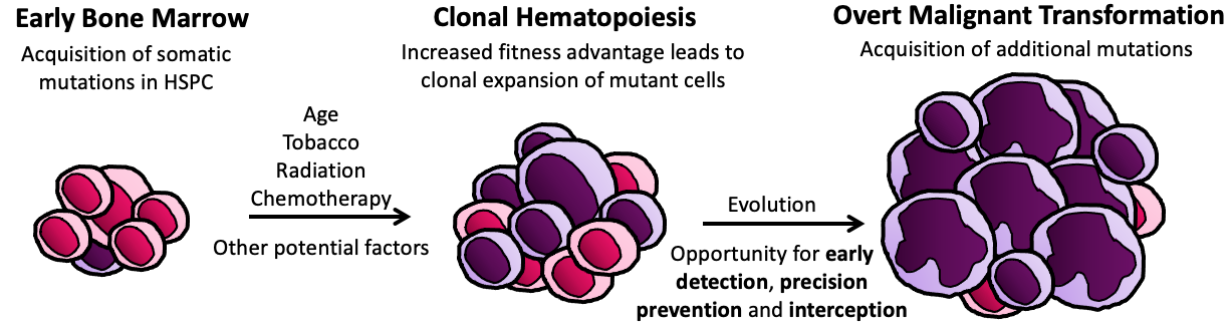
Ross Levine Lab

Molecular Cancer Medicine Service

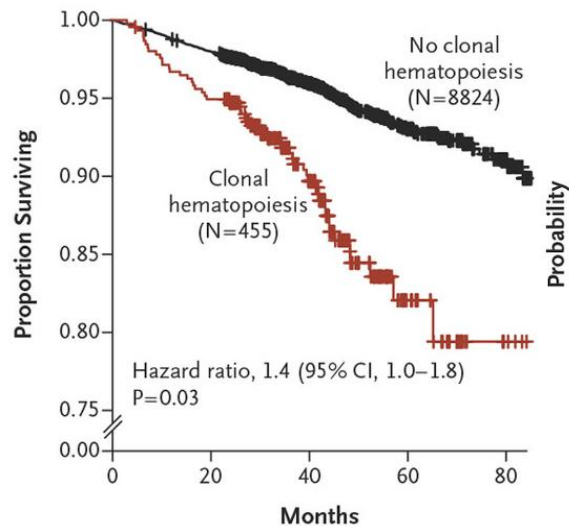
Human Oncology and Pathogenesis Program

sanchezp@mskcc.org

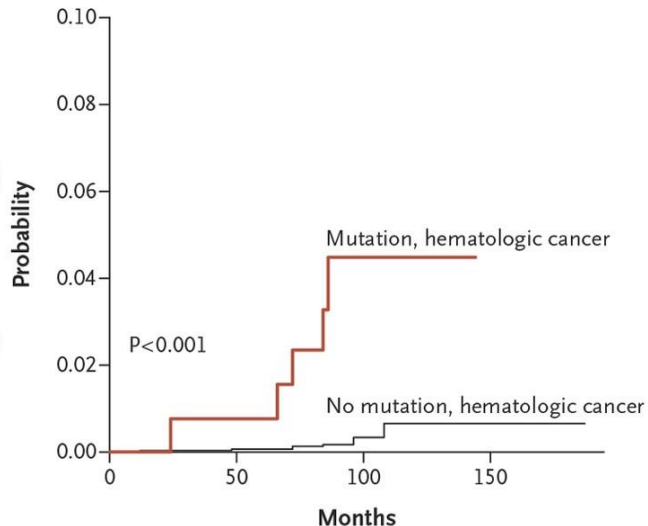
Questions I decided to tackle during my time at MSK



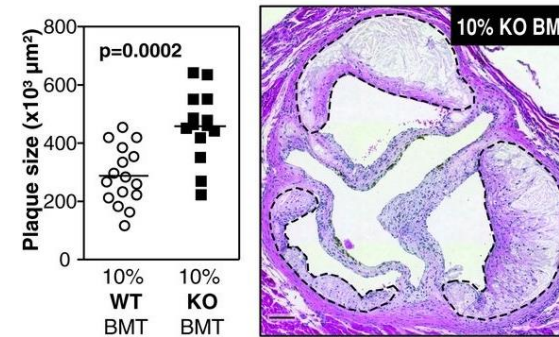
Genovese et al. NEJM 2014
Overall Mortality



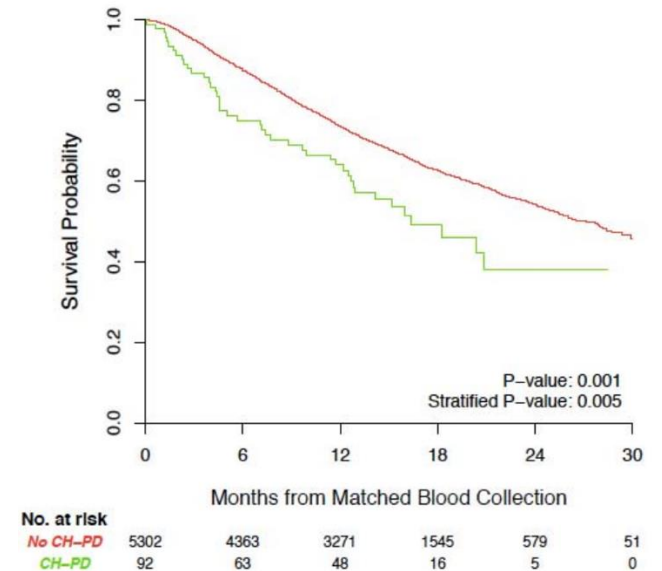
Jaiswal et al. NEJM 2014
Hematologic Malignancies



Fuster et al. Science 2017
Cardiovascular Disease



Coombs et al. CellStemCell 2017
Solid Tumors



Course structure

Scientific topics covered will include:

- Cancer as a disease
- Genetic and epigenetic mechanisms
- Computational biology and oncology
- Cancer signaling
- Cancer metabolism
- Metastasis
- Tumor modeling and heterogeneity
- Cancer types and microenvironments

This course will:

- Provide a review of advanced concepts in cancer biology
- Expose students to techniques and experimental design applied to basic-translational cancer research
- Potentiate the ability to perform critical analysis of basic-translational research
- Strengthen capacities to develop a research project

**RECORDED
LECTURES**

The diagram features a large, light blue stylized arrow pointing upwards, which serves as a background for the right side of the slide. A dark blue arrow points from the 'Scientific topics covered' box to the 'RECORDED LECTURES' text. An orange arrow points from the 'This course will' box to the 'IN-PERSON ACTIVITIES' text.

**IN-PERSON
ACTIVITIES**

Course structure

In-person activities:

- Session 1 – Introduction to course and basic techniques applied in basic cancer research

- Session 2 – Paper discussion
- Session 3 – Paper discussion
- Session 4 – Paper discussion

+ Presentations!!

- Session 5 – Guided live research activity

- **Explanation of the question under research - why on earth did they decide to do this?**
- **Discussion figure by figure – is this paper not as good as authors think?:**
 - What is the point of each figure/panel?
 - Are there any missing experimental conditions?
 - Are results interpretable?
 - Do the results support the conclusions by the authors?
 - Would you have done anything differently?
 - Are there any missing experiments?
 - What are the limitations of the work?
 - What experiments could be done as a follow-up to the paper?



Course evaluation

Class participation and attendance (33%)

- All scholars are expected **to attend all sessions**. A scholar must notify the Bridge team and instructor prior to class if they will absent. This notice should be sent by email.

Presentations (67%)

- A research question (project) will be assigned to you, in groups.
- You will have to propose a series of experiments to address that research question (i.e. a light version of the Research Strategy section of a grant) – **Max. 6 slides**
- Your work will be reviewed, and feedback will be provided. You will have the chance to made modifications according to the comments provided.
- You'll then need to implement this feedback to the final class presentation.

Lecture structure

Scientific topics covered will include:

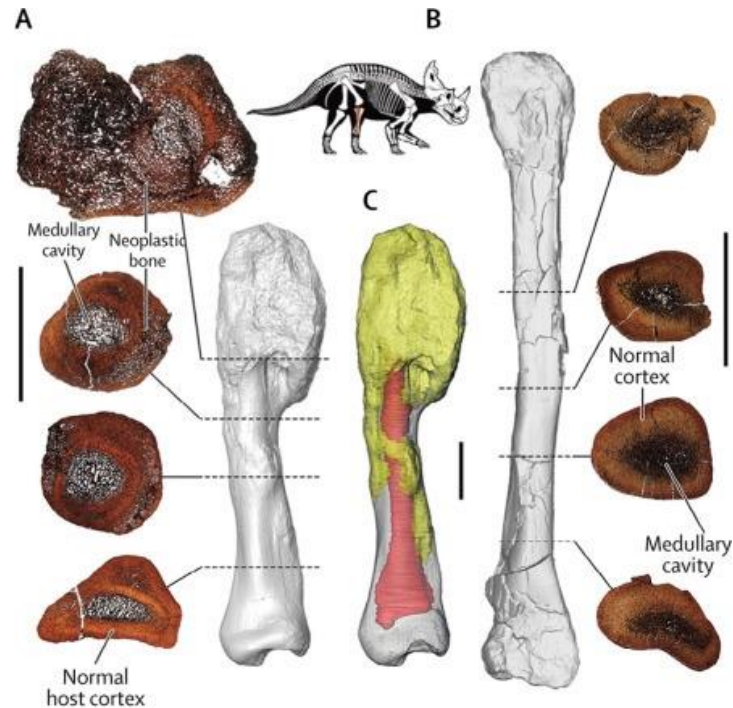
- Historical perspective of cancer treatments.
- Burden of cancer as a disease.
- Evolution of cancer classification
- Understand how tumor cells evolve and adapt.
- Understand the molecular and environmental basis of cancer



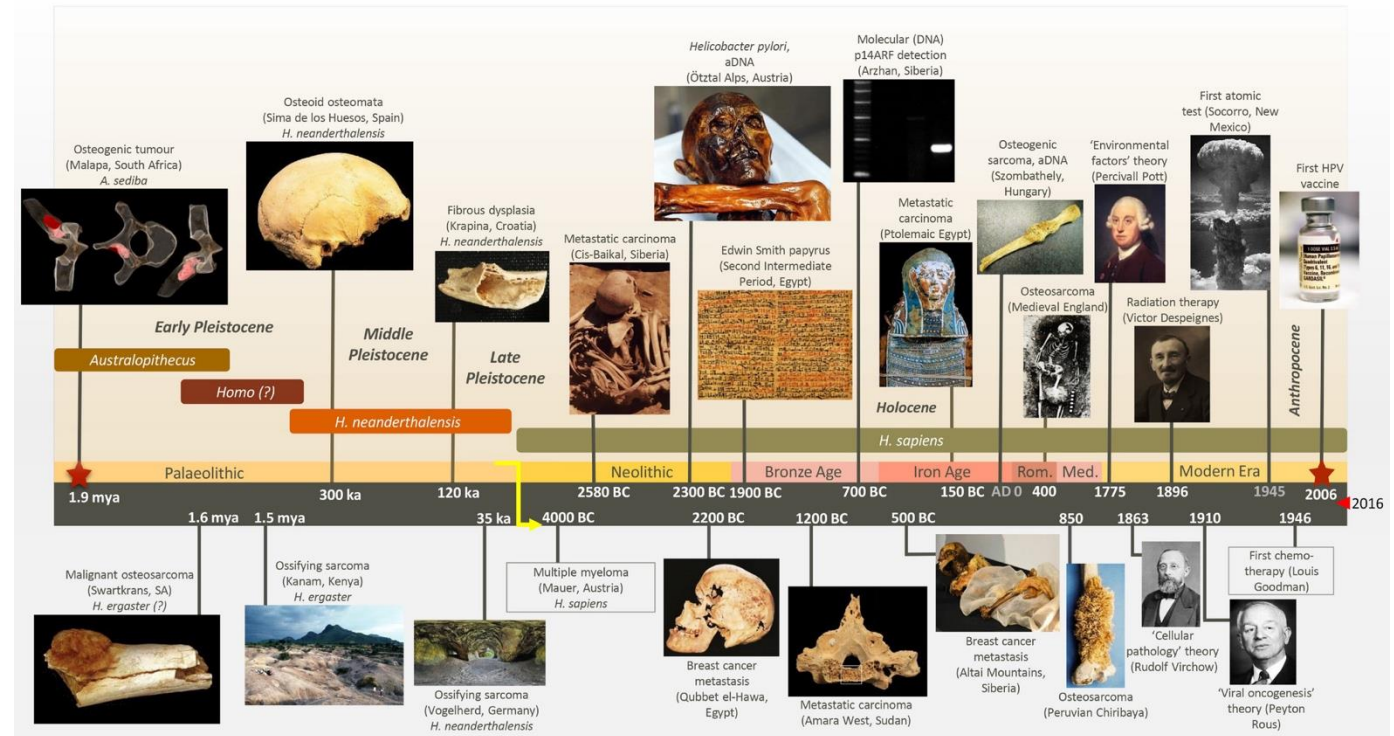
Historical perspective



First records suggestive of cancer as an ancient disease

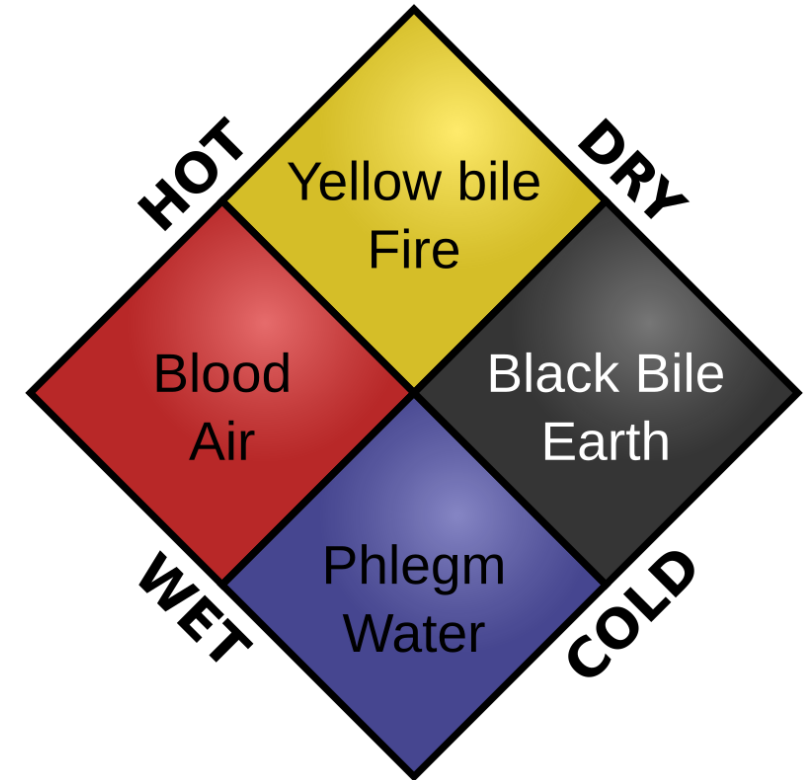
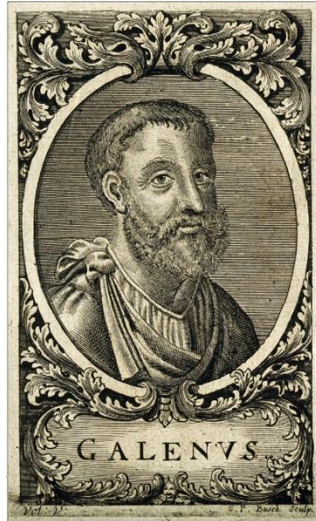
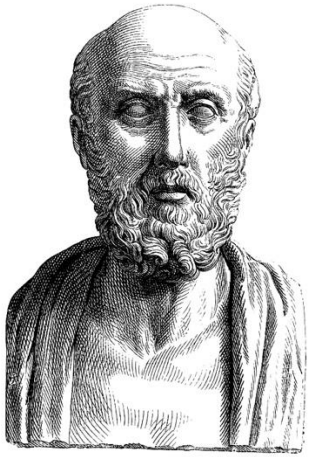


Ekhtiari, Seper et al. First case of osteosarcoma in a dinosaur: a multimodal diagnosis *The Lancet Oncology*, Volume 21, Issue 8, 1021 - 1022



Chronological incidence of prehistoric oncogenic tumours and important milestones concerning cancer aetiology and treatment (Binder et al., 2014; Bona et al., 2014; Monge et al., 2013; Odes et al., 2016; Phelan et al., 2007; Randolph-Quinney et al., 2016) ('Rom.' and 'Med.' refers to Roman and Medieval Periods, respectively)

Early conceptions of health and disease: Humorism



Will one day our scientific hypothesis sound as improbable as these?

Signs of change: Defining diseases



Vienna's General Hospital, founded in 1784.
Copyright © 1998 AKG London/Erich Lessing



Van Gogh's The Ward in the Hospital at Arles (April-October 1889)

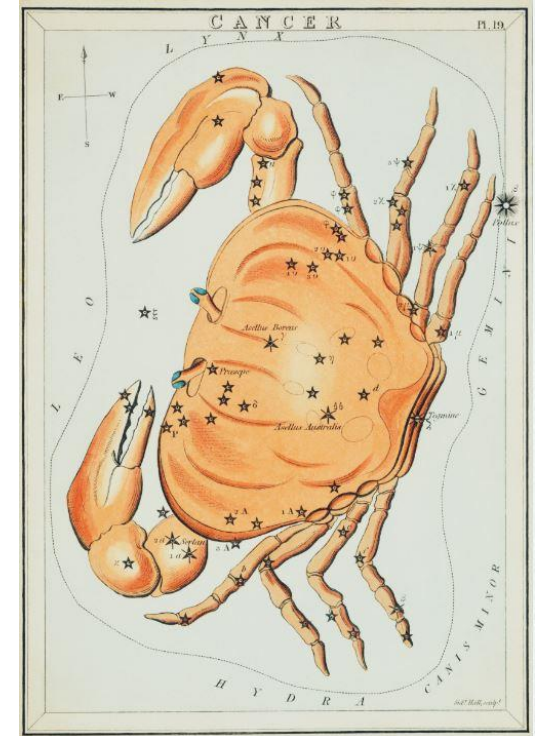
Signs of change: Defining cancer



The Anatomy Lesson of Dr. Nicolaes Tulp is a 1632 oil painting on canvas by Rembrandt

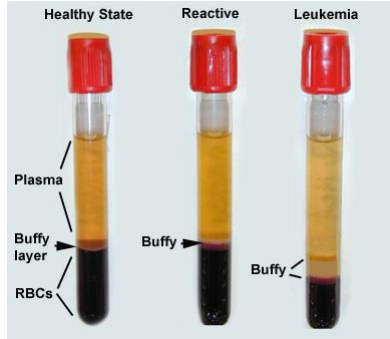


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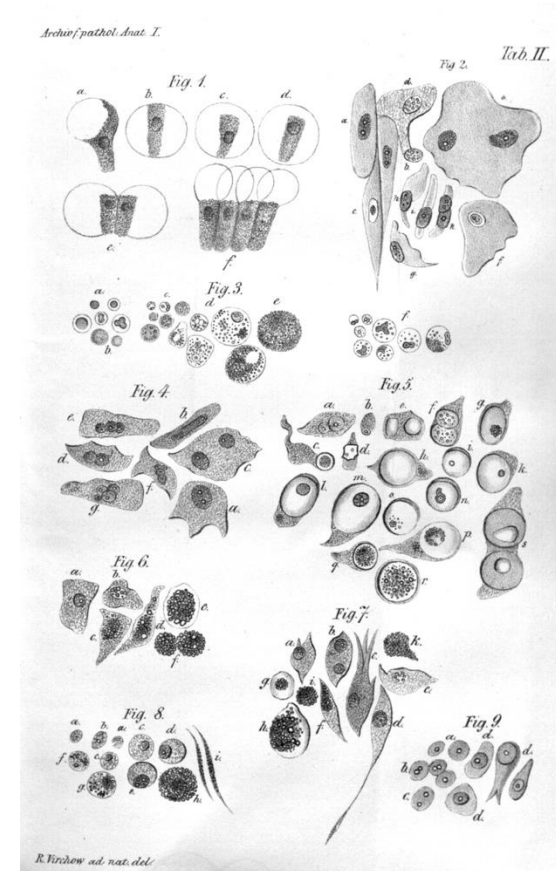
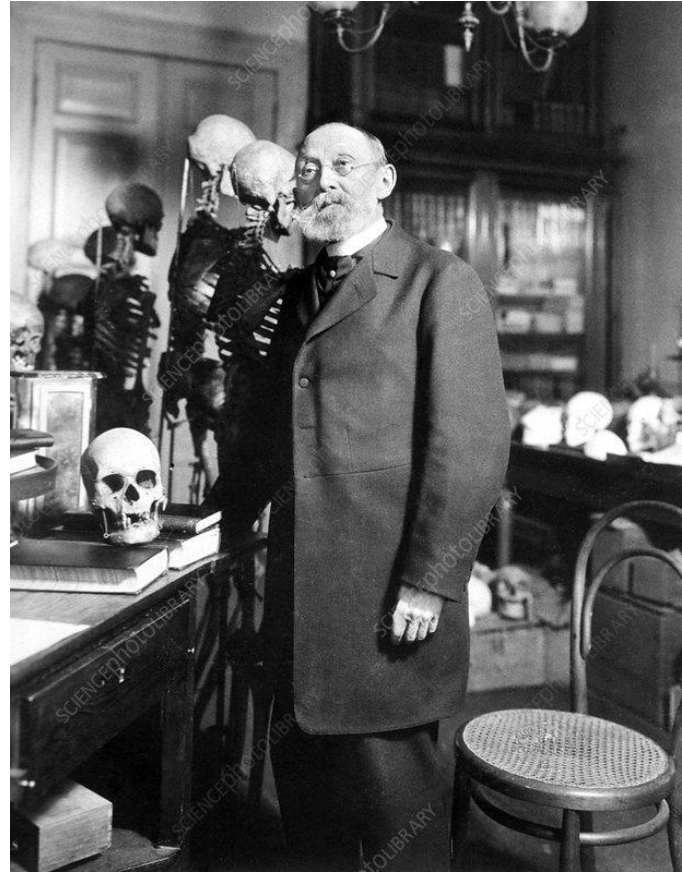
Onco- tumor or mass

Signs of change: Cellular origins of cancer



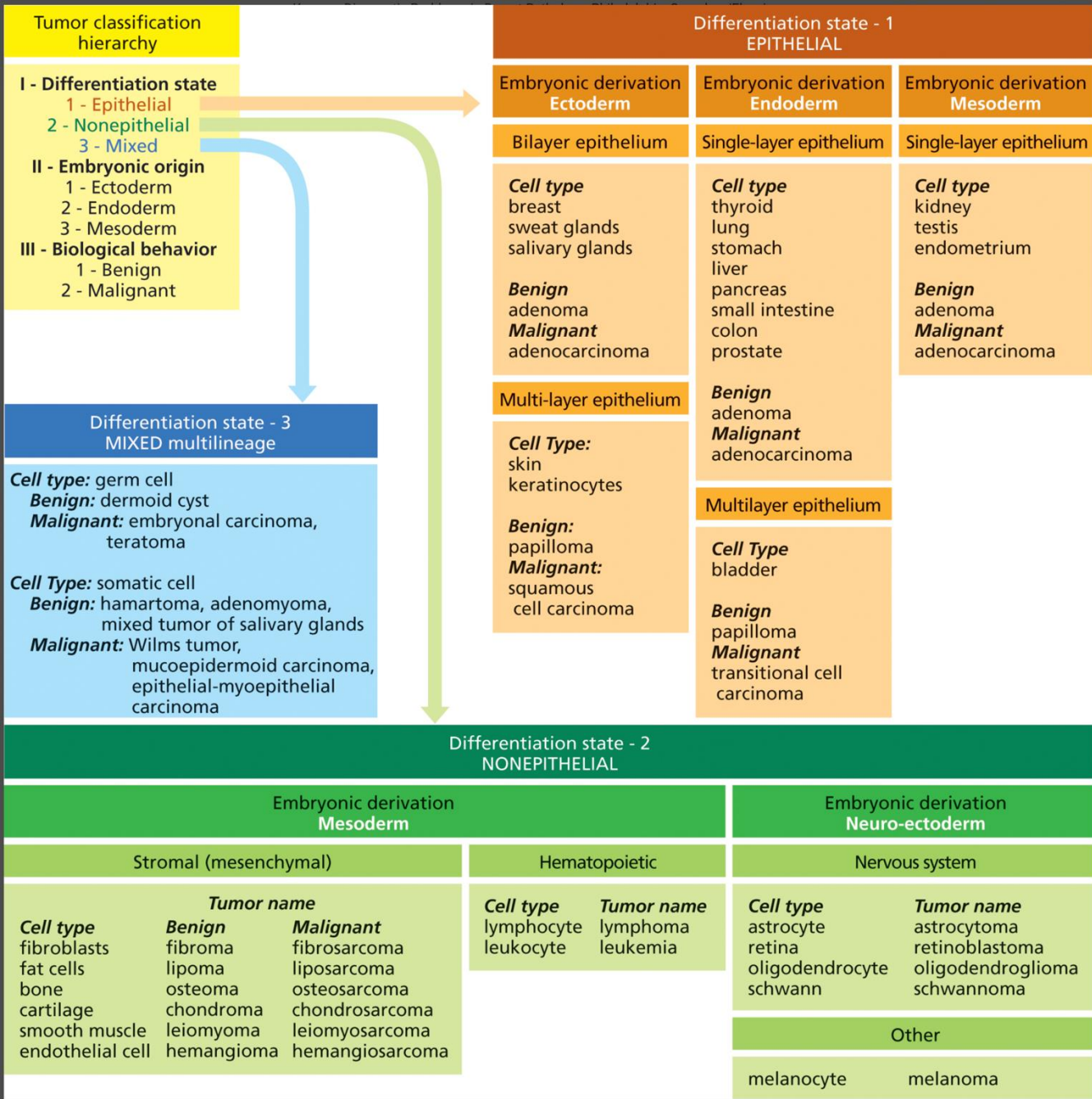
Antonie van Leeuwenhoek microscope

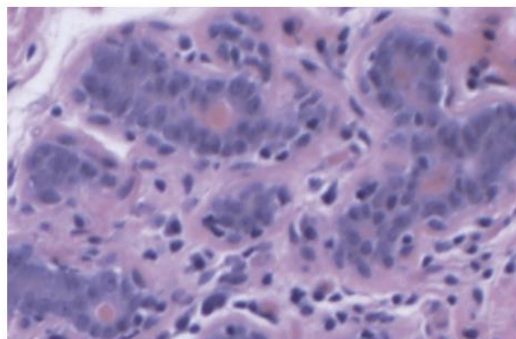
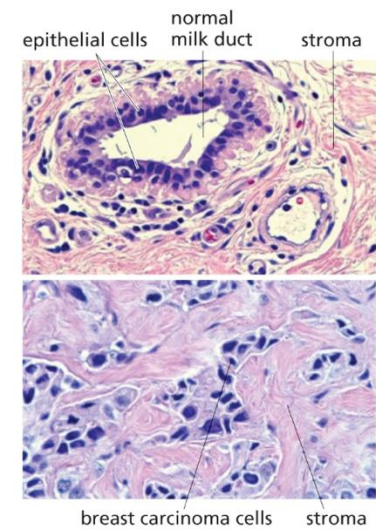
"Omnis cellula e cellula" ("all cells come from cells") Rudolf Virchow



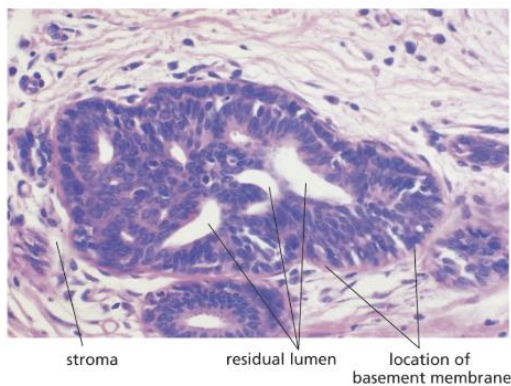
The burden of cancer



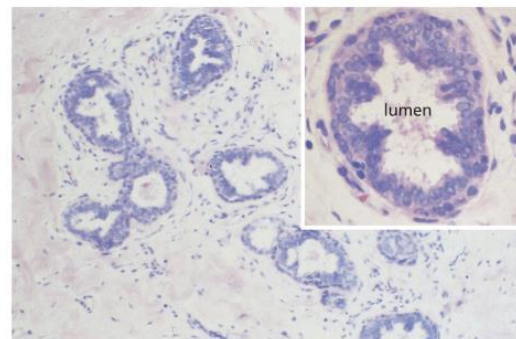




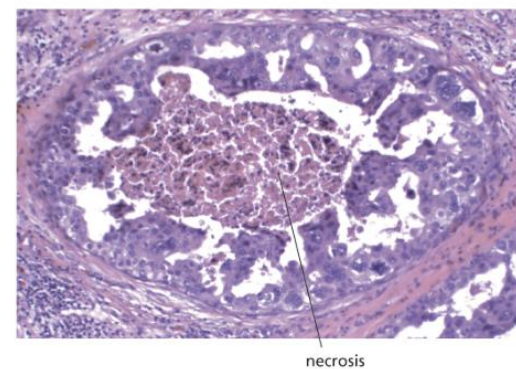
(A)



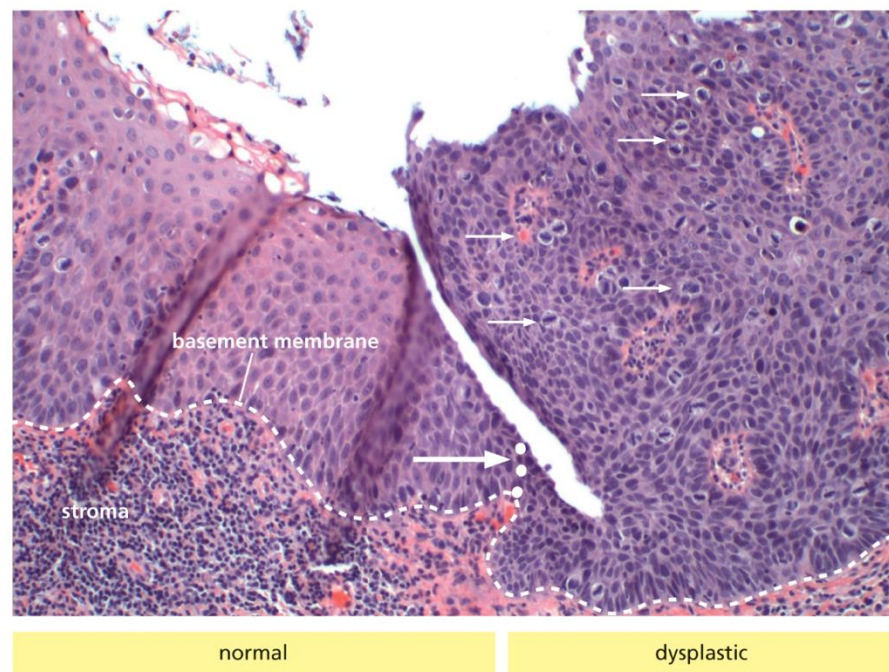
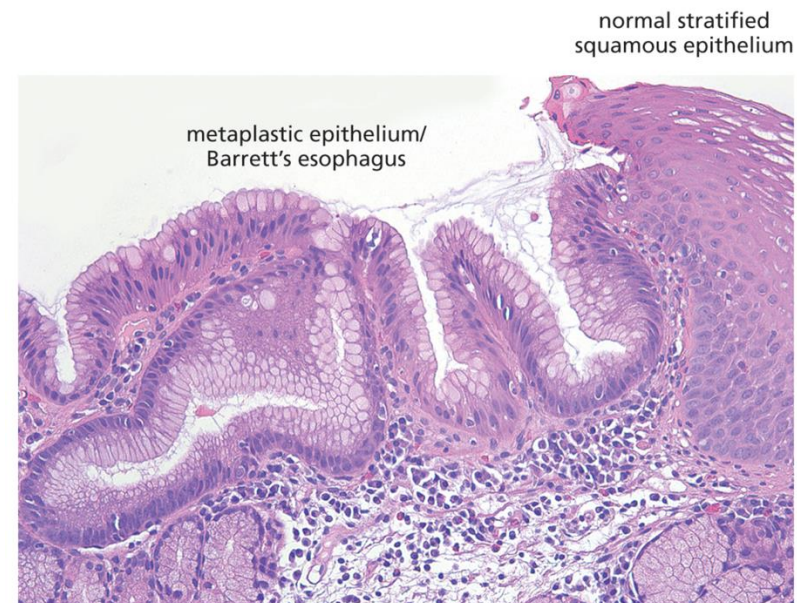
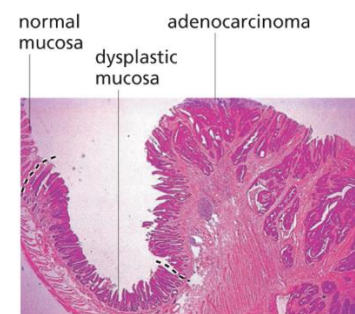
(C)



(B)



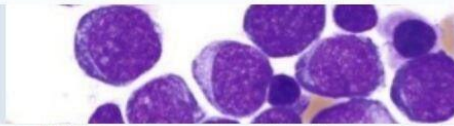
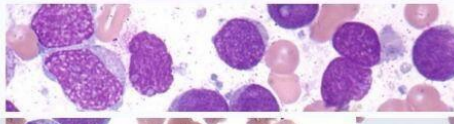

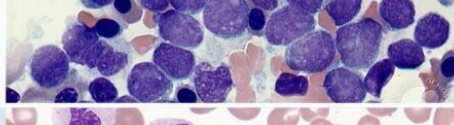
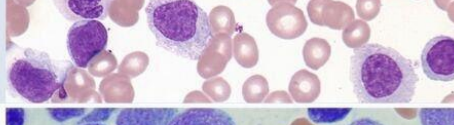
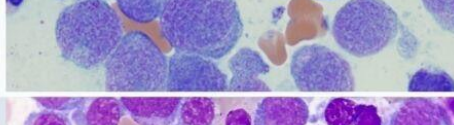
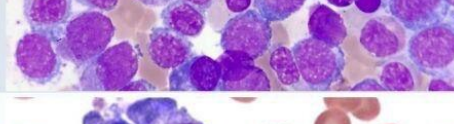

(D)



Historical classification of blood cancer

MORPHOLOGY-based: How things look?

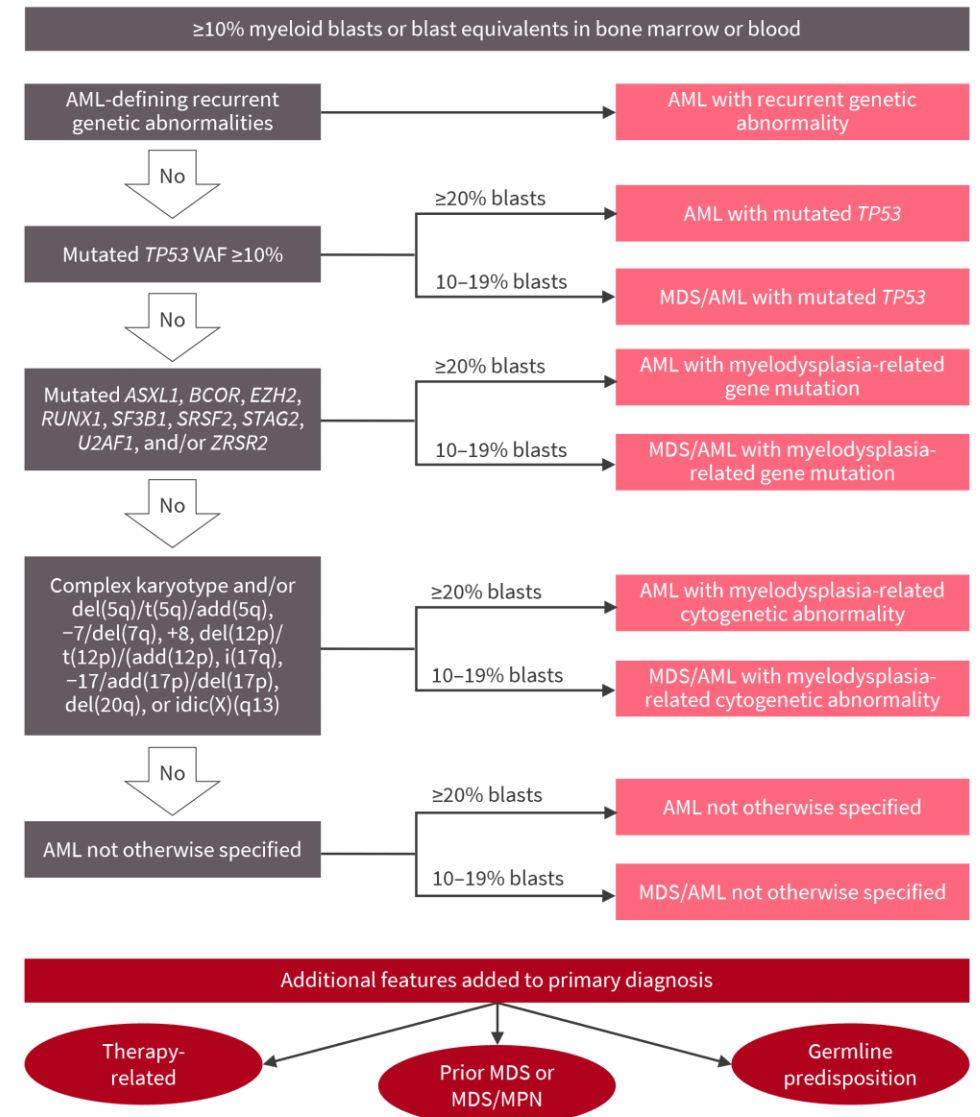
FAB CLASSIFICATION SYSTEM OF ACUTE MYELOID LEUKAEMIA

M0	AML with minimal differentiation	
M1	AML without maturation	
M2	AML with maturation	
M3	Acute promyelocytic leukaemia	
M4	Acute myelomonocytic leukaemia	
M5	Acute monoblastic and monocytic leukaemia	
M6	Pure erythroid leukaemia	
M7	Acute megakaryoblastic leukemia	

WWW.BLOOD-ACADEMY.COM

Current classification of blood cancer

MOLECULAR-based: What genetic abnormalities do you carry?





Thanks for your attention!

Any questions?



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