

Biomarker detection techniques

By
Dr. Gouse Mohiddin Shaik

Biomarker detection techniques

- **Introduction**
- Biomarkers present in all parts of the body
- Body fluids vs tissues
- Most important body fluids
 - Blood
 - Urine
 - CSF
 - Synovial fluid
- Tissue biomarkers generally requires biopsy

Biomarker detection techniques

- **Biomarkers in breath**
- Volatile organic compounds can be detected by gas **chromatography**
- Being used in clinical conditions like
 - Lung cancer, ischemic heart, diabetes, TB and asthma
- Uses electronic sensors for NO, O₂, NH₃ CO₂...



[Home](#) [About](#) [Technology](#) [Applications](#) [Investors](#)

Breath Analysis — The Future of Disease Detection

Breathtec Biomedical aims to advance breath analysis technology for the early screening of life-threatening diseases.

[ABOUT BREATHTEC](#)

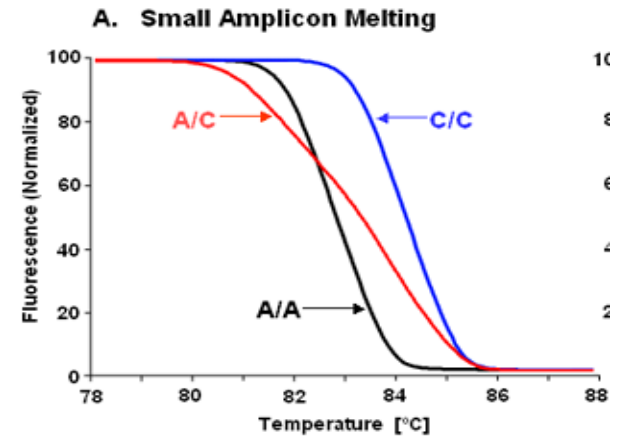
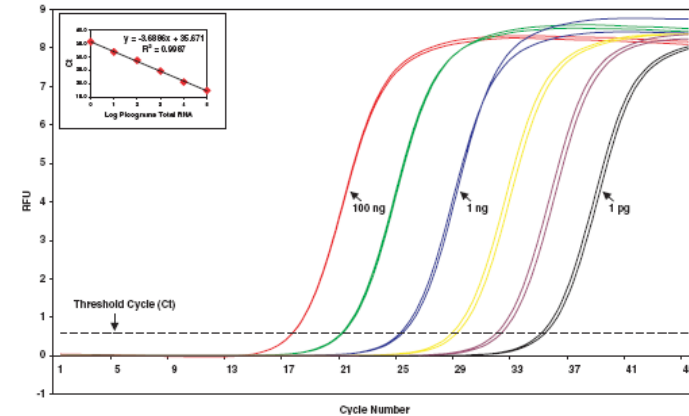
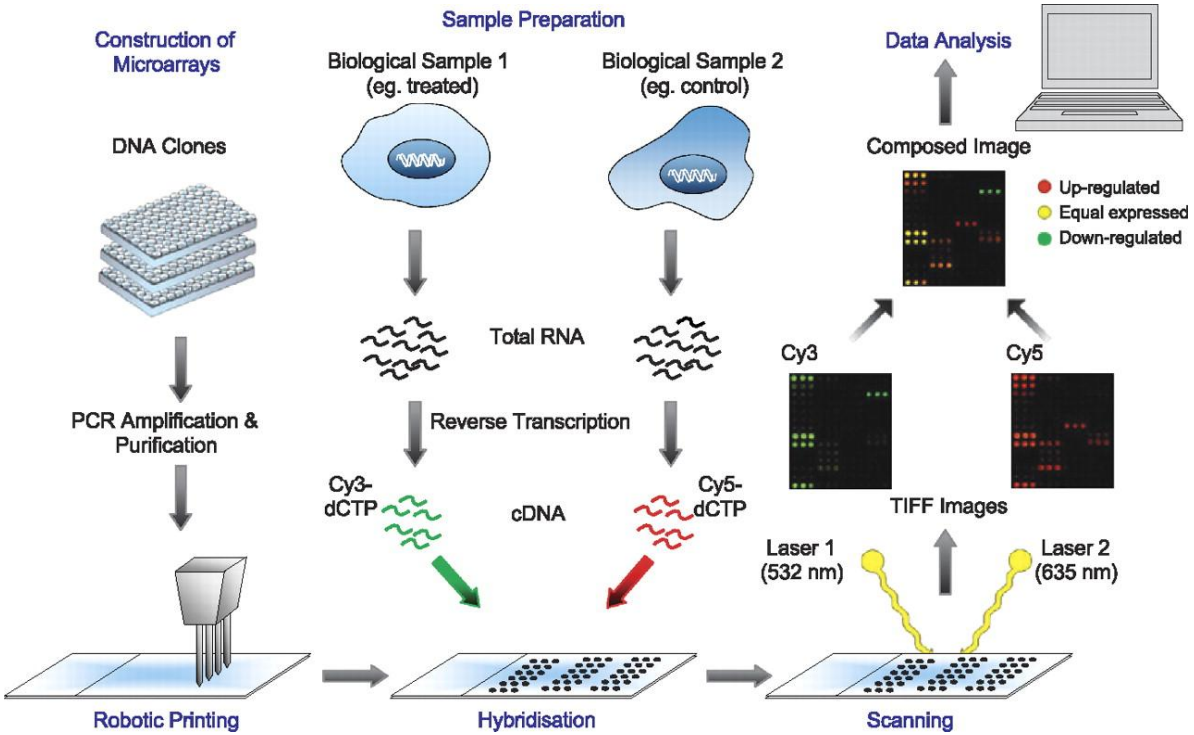
Biomarker detection techniques

- **Genomic technologies**
- Human genome project effected the way we handle diseases
- Gene mutations
- Allelic differences
- SNPs
- Genome wide methods – micro arrays
- Individual gene sequences – qRT-PCR, HRM (high resolution melting)

Genome wide methods	Individual gene sequences
Microarrays	qRT-PCR
Serial analysis of gene expression (SAGE)	Rnase protection assay
Expression profiling based on splicing	T cell receptor expression analysis

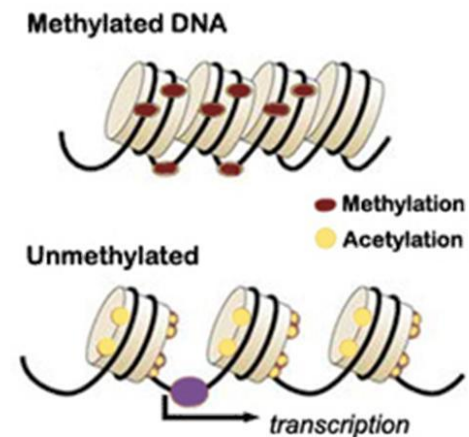
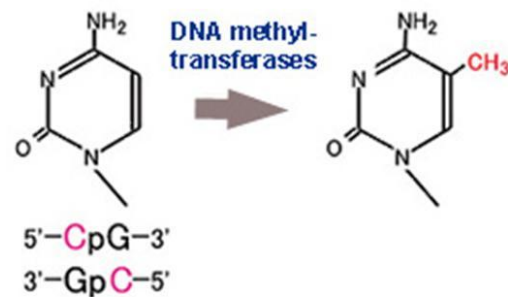
Biomarker detection techniques

- Genomic technologies



Biomarker detection techniques

- Genomic technologies
- Tissue specific arrays
- Whole blood expression profiling
- WBC expression profiling
- Epigenomic technologies
 - DNA methylation



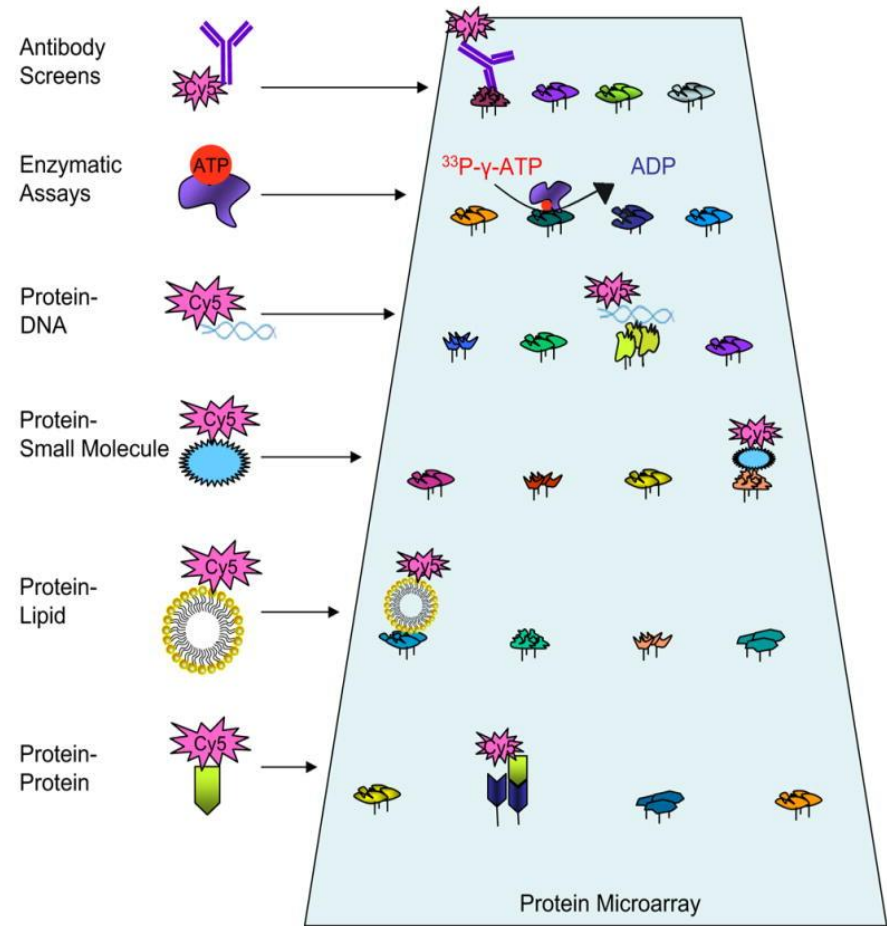
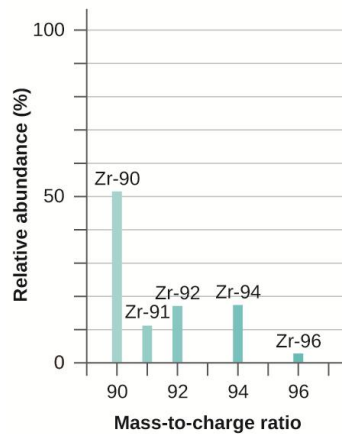
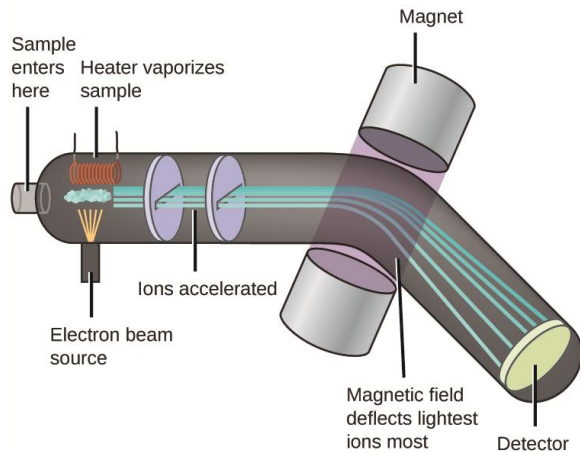
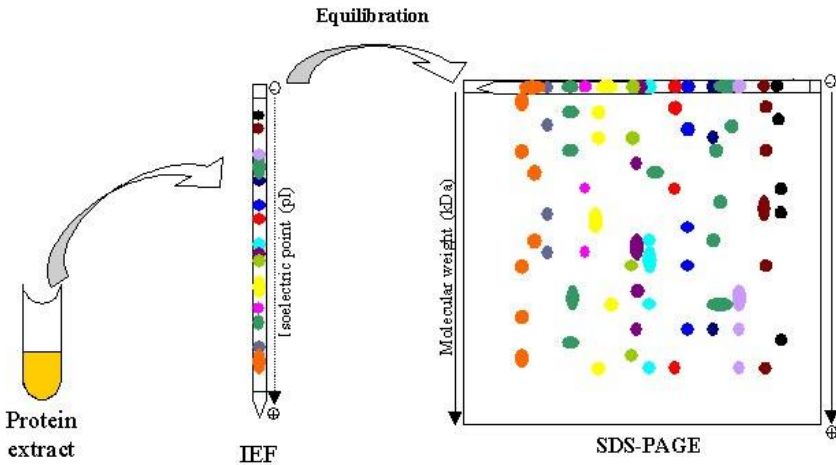
Biomarker detection techniques

- **Proteomic technologies**
- Proteins analysis is a classical approach to detect biomarkers
- **Proteomics** is a key technology to detect novel biomarkers
- New techniques allow simultaneous analysis of many proteins – **proteome**
- Detection of fragments of set of proteins – **fragmentome or peptidome**

2D gel electrophoresis	Mass spectrometry (MS)
Liquid chromatography	LC-MS
Protein array/ Ab array	ELISA

Biomarker detection techniques

- Proteomic technologies

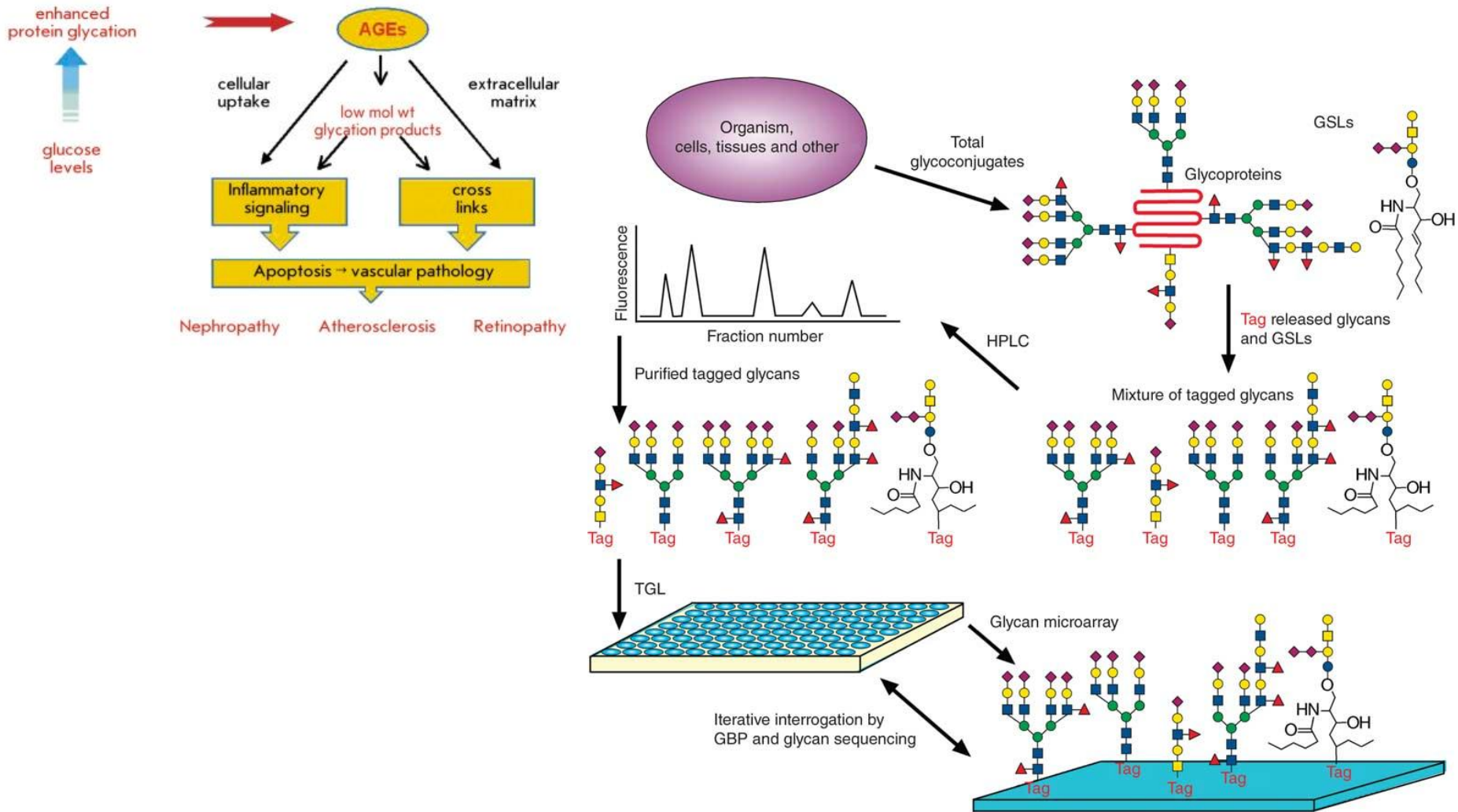


Biomarker detection techniques

- **Glycomic technologies**
- Glycans – oligosaccharides
- Glycosylation – carbohydrate covalently attached to protein or lipid – **associated with many diseases**
- This changes physical and chemical properties of the target molecule
- Need for normal functioning of many proteins
- Glycome – total glycans produced by a cell
- AGE – Advanced glycation end products
- Total glycation pattern of a protein (IgG) changes in disease conditions (cancer)
- Shotgun glycomics

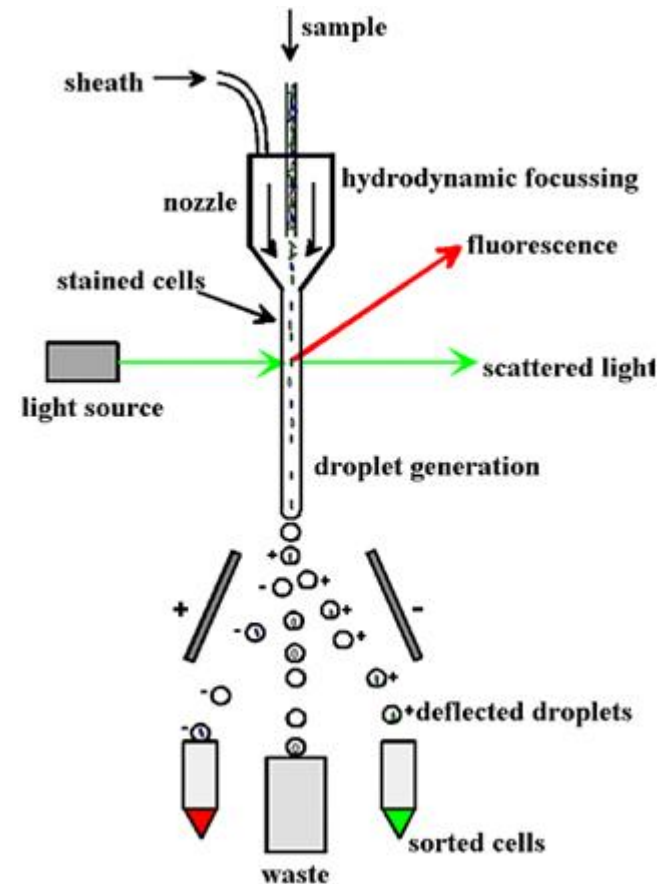
Biomarker detection techniques

- Glycomic technologies



Biomarker detection techniques

- FACS – fluorescent activated cell sorting
- Important technique for analysis of cell surface markers



Biomarker detection techniques

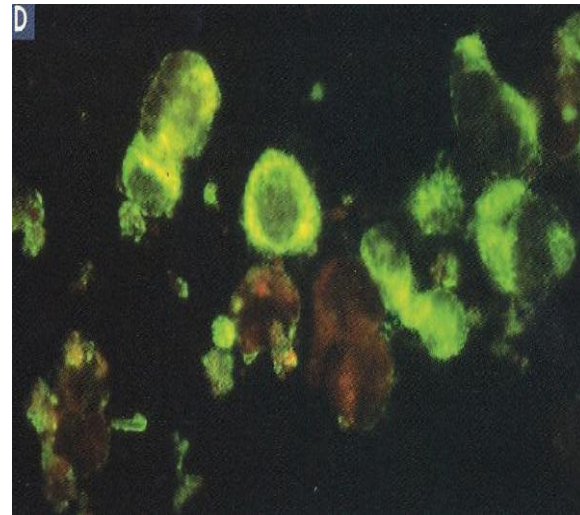
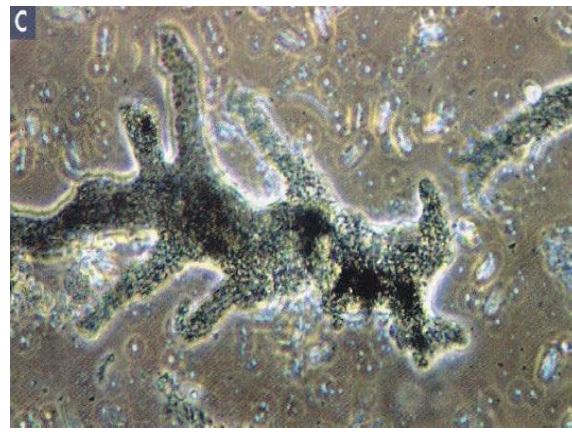
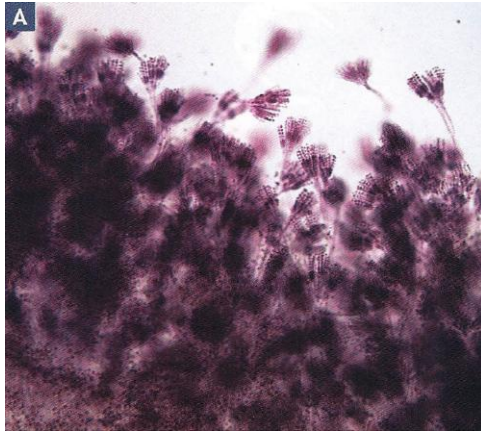
- **Imaging techniques**
- Imaging biomarkers offers advantages
- Imaging is closely associated with expressed phenotype
- Imaging offers direct association between therapy and effect
- Offers versatility of continuous monitoring of functional assessment of therapy
- Useful in translational research
 - From animal studies to human trials

Biomarker detection techniques

- **Imaging techniques**
- Microscopy plays a big role in imaging biomarkers
- Different types of microscopy in use – differ in resolution
- Light microscopy
 - Bright field (A)
 - Dark field (B)
 - Phase contrast (C)
 - Fluorescence vs confocal (D)
- Electron microscopy
 - Transmission – beam pass through the sample
 - Scanning – scans the surface of the sample

Biomarker detection techniques

- Imaging techniques



Confocal and Widefield Fluorescence Microscopy

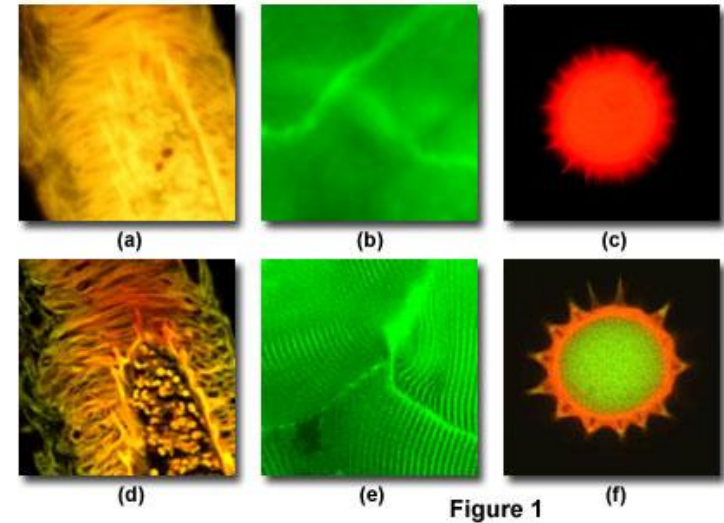
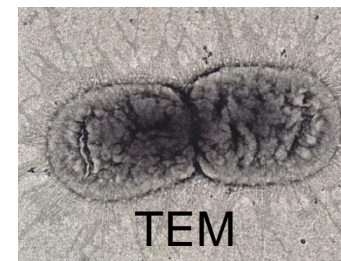


Figure 1



Biomarker detection techniques

- Imaging techniques
- X-rays
- Positron emission tomography
- MRI.....
- Many other technologies are in advance
 - Bionanotechnology
 - Bioinformatics...

Next class

- Next class.....
 - Exam