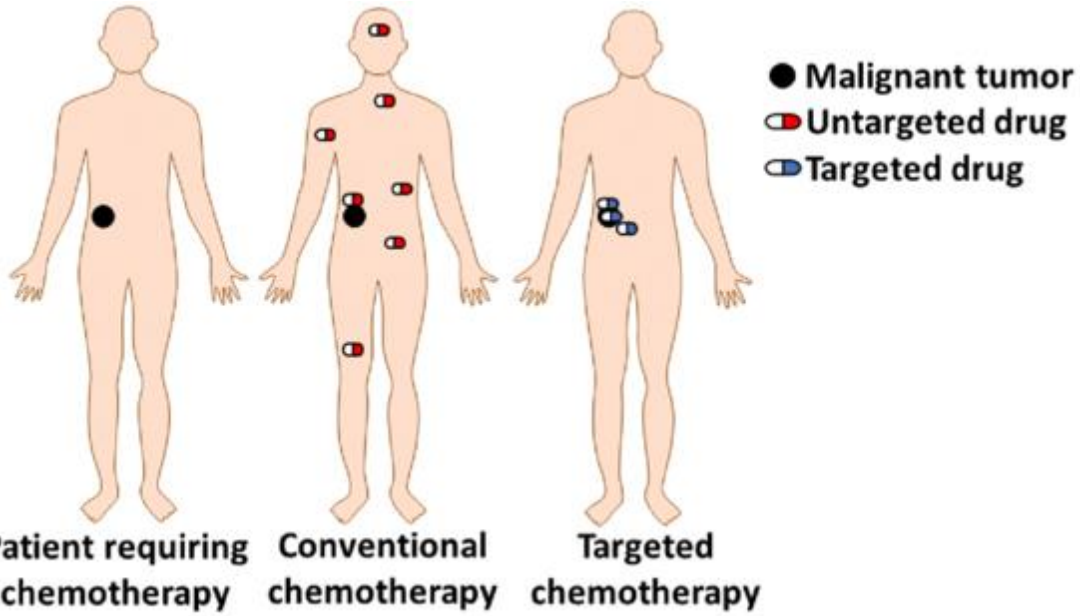
TARGETED THERAPY

Dr. Yasemin Yozgat Byrne



Cancer is as old as the history of humanity!

Oldest description of cancer was made in about 3000 BC, found in a papyrus in Egypt.

460-370 BC: Hippocrates was the first physician to use the “carcinos” or “carcinoma” terms.
28-50 BC: Celsus translated the Greek «carcinos" term into «cancer» (Latin word for crab).
130-200 AD: Galen used the word oncos (Greek for swelling) to describe tumors.

What is cancer?

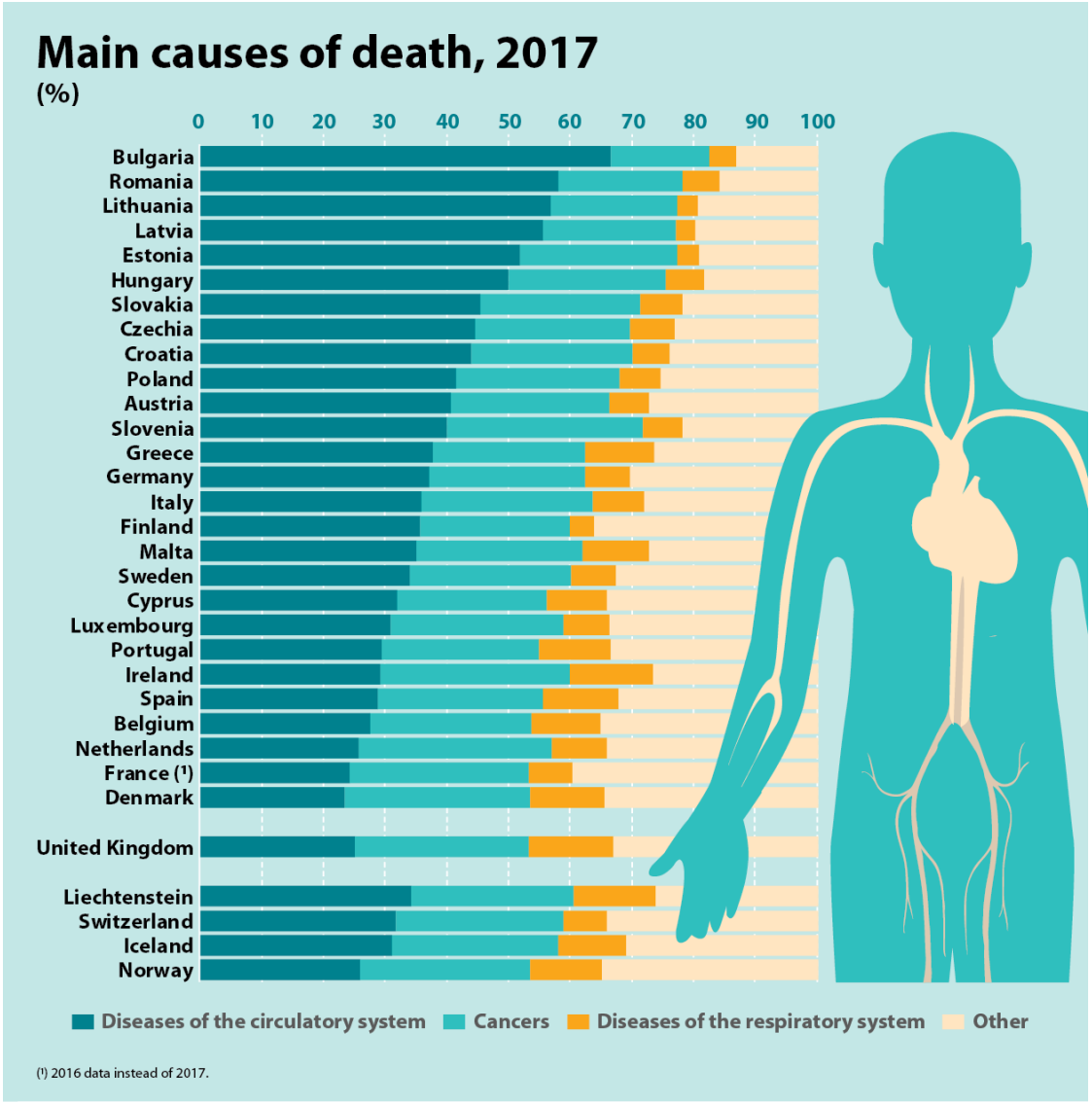
According to the American Cancer Society (ACS), cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells.
If the spread is not controlled, it can result in death.

Cancer cells are defined by two heritable properties:

(1) They reproduce without control

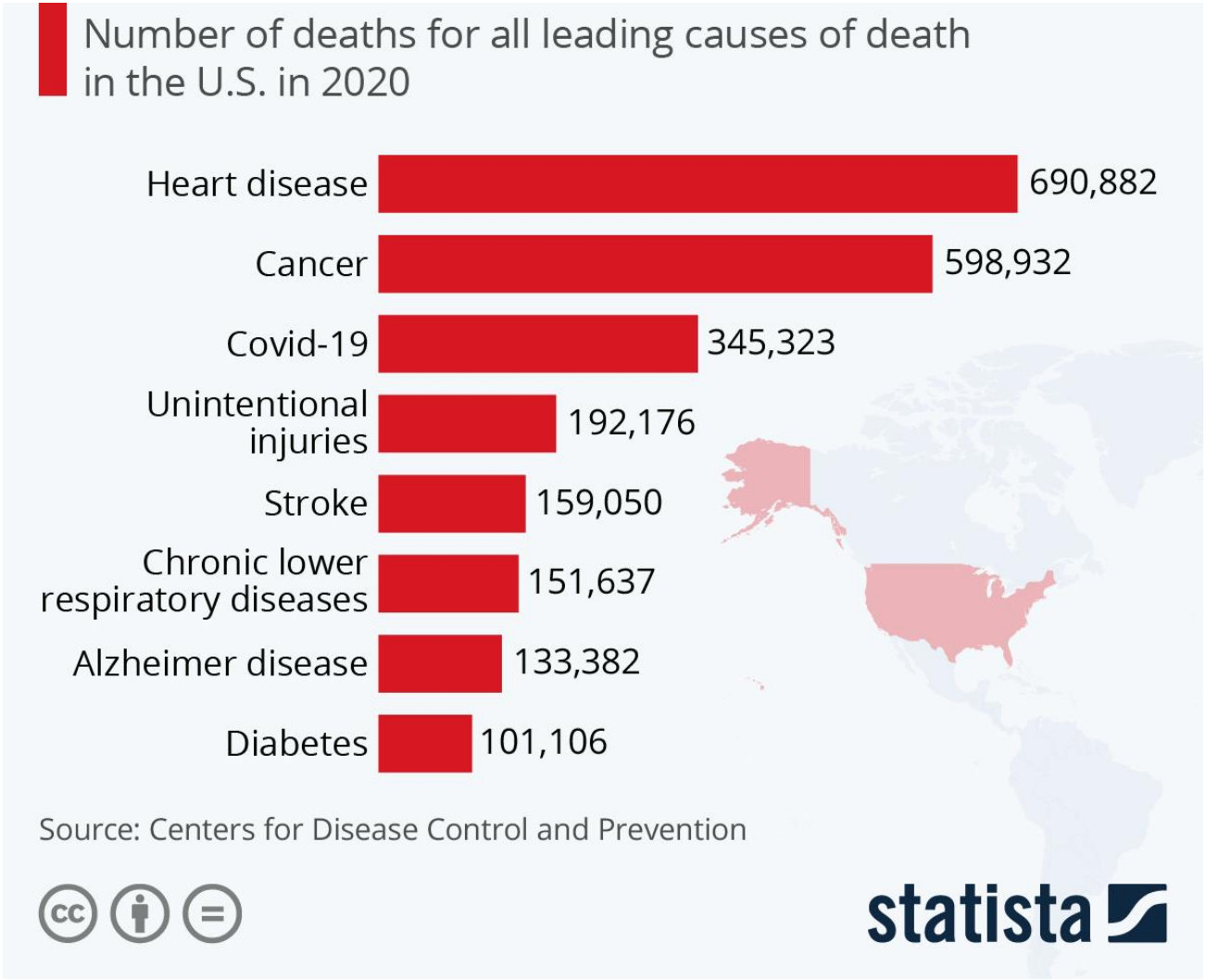
(2) They invade and colonize other tissues

Cancer is the 2nd leading cause of death in the World now but will likely become the 1st in 2060!

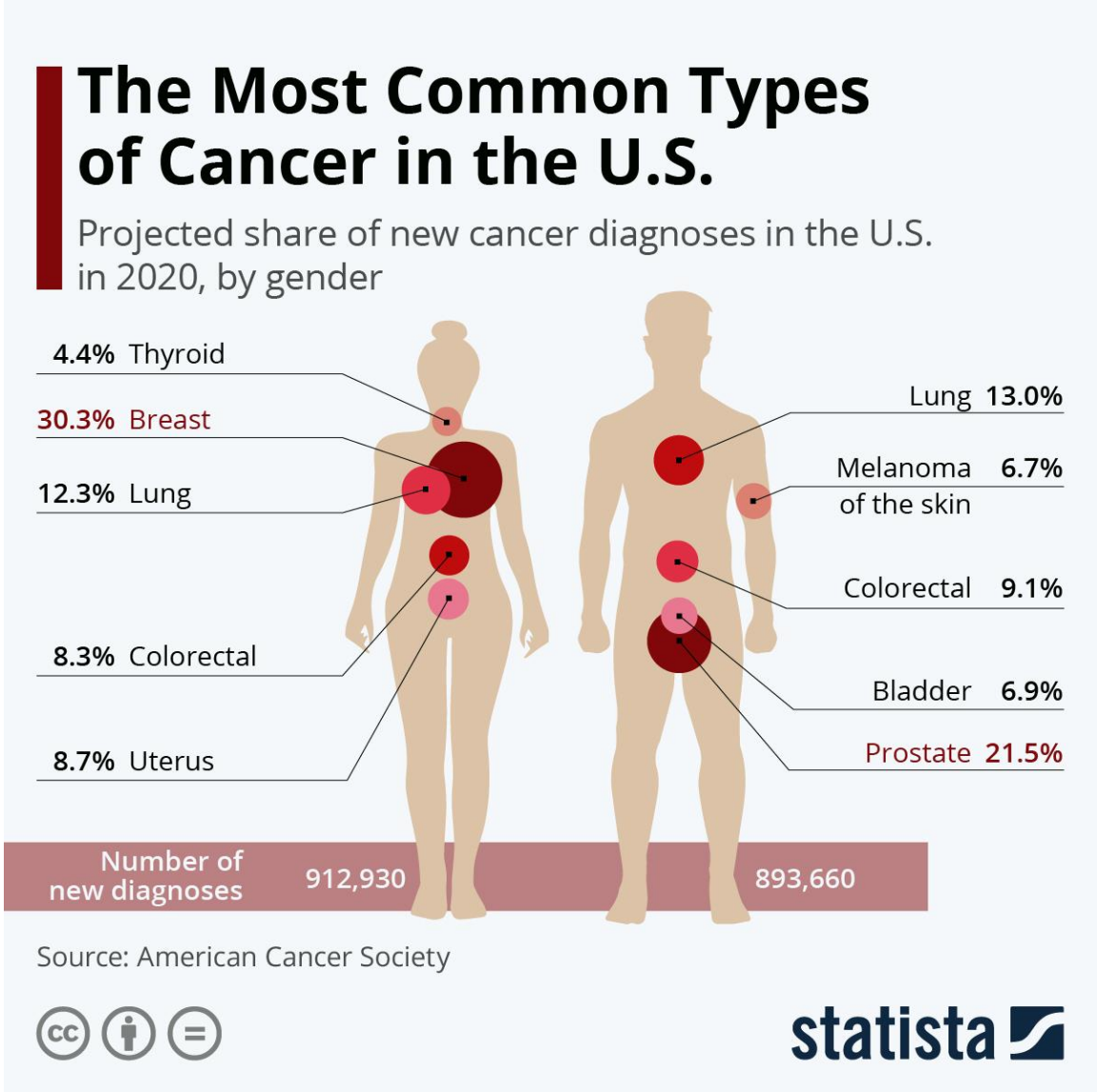


ec.europa.eu/eurostat

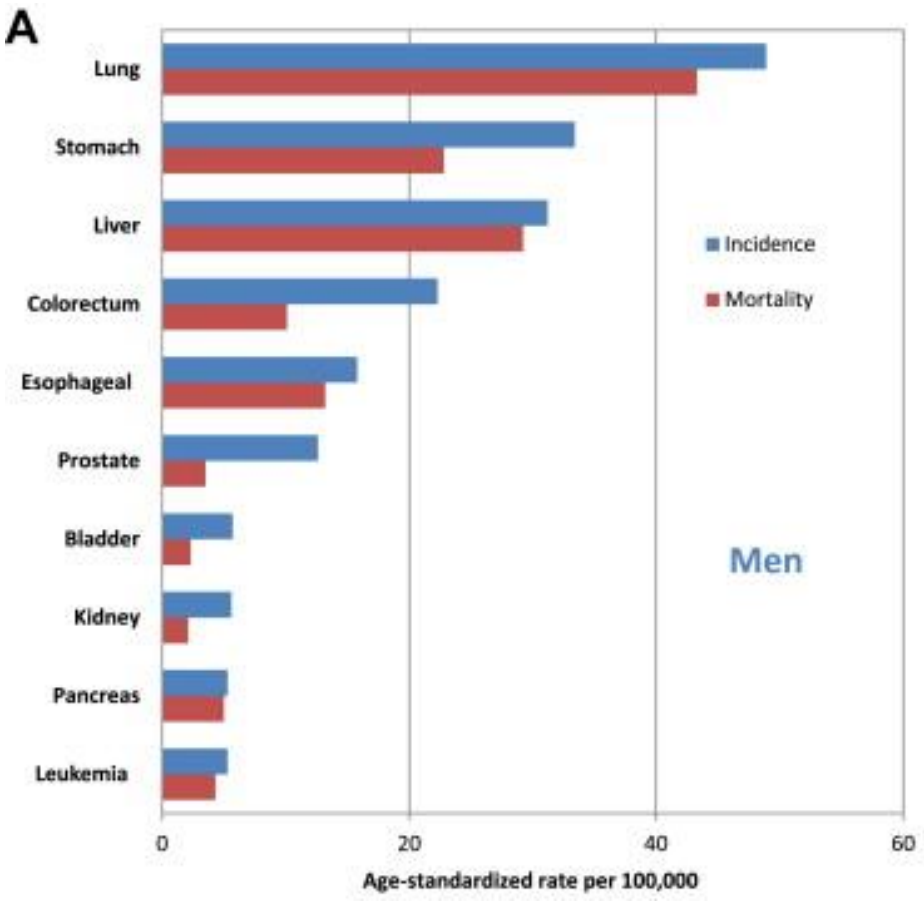
Cancer is the second leading cause of death globally, accounting for an estimated 9.6 million deaths, or one in six deaths, in 2018!

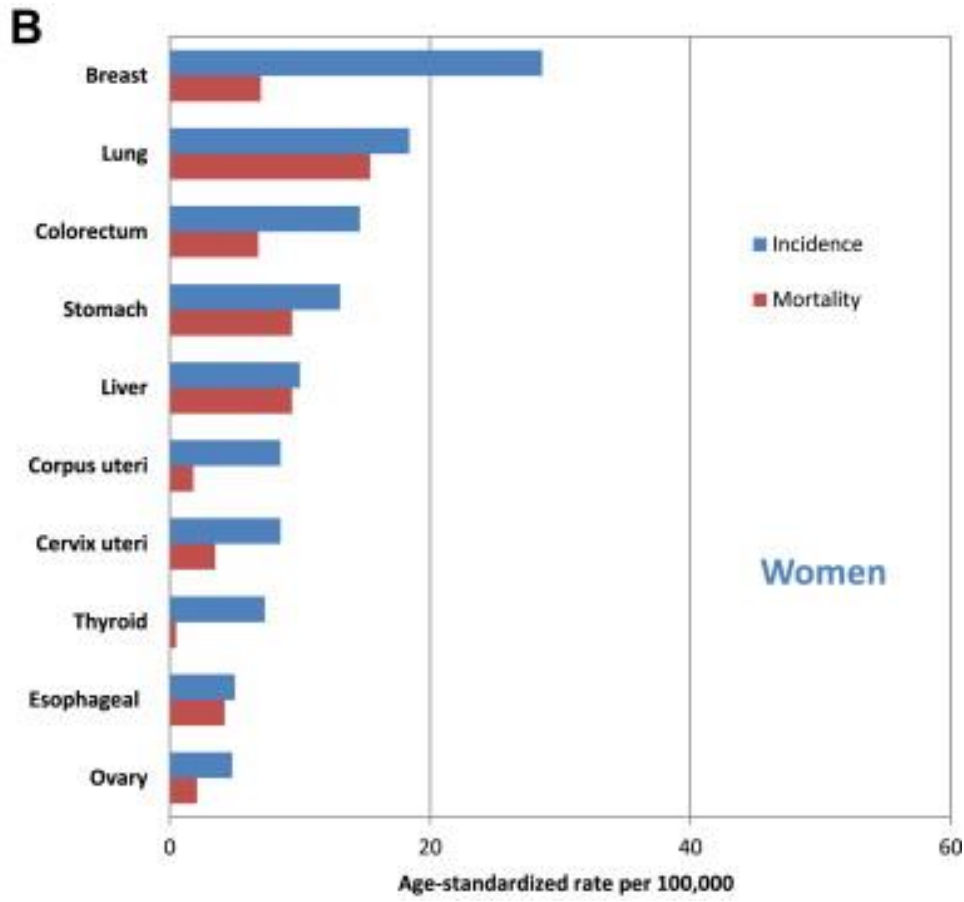


Most common types of cancers in the US in 2020



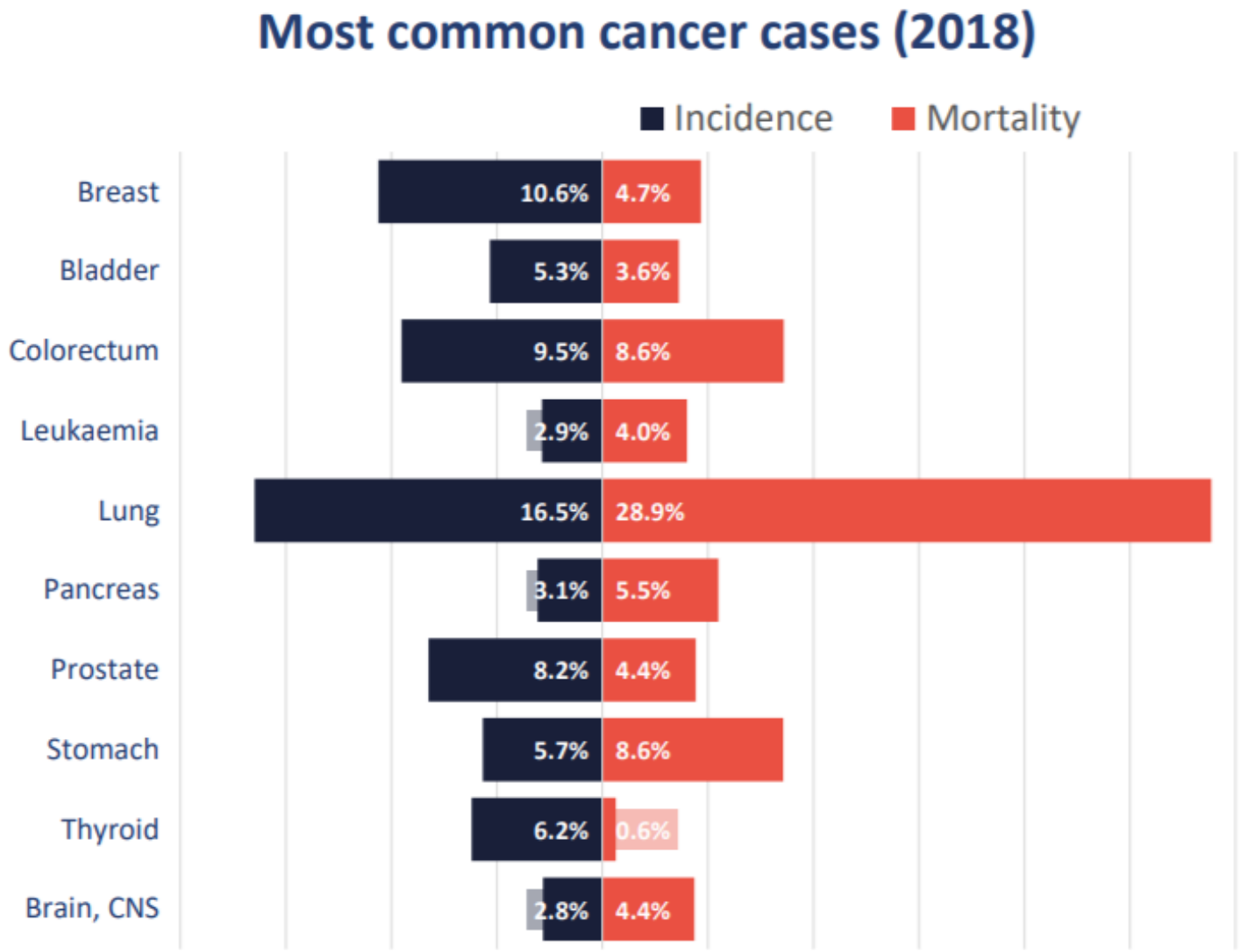
Most common types of cancers globally





Incidence: occurence of new cases
Mortality: number of deaths

Most common types of cancers in Turkey (2018)



Generally it is not possible to diagnose a tumour before it becomes a mass containing millions of cells

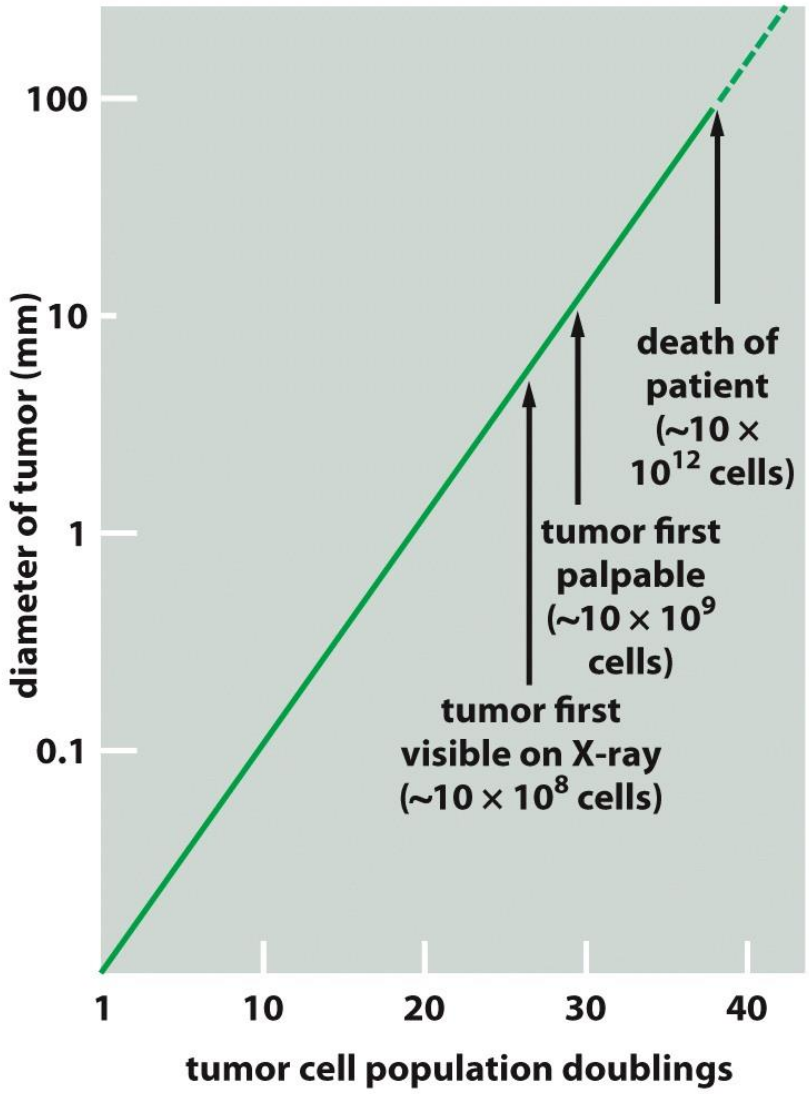
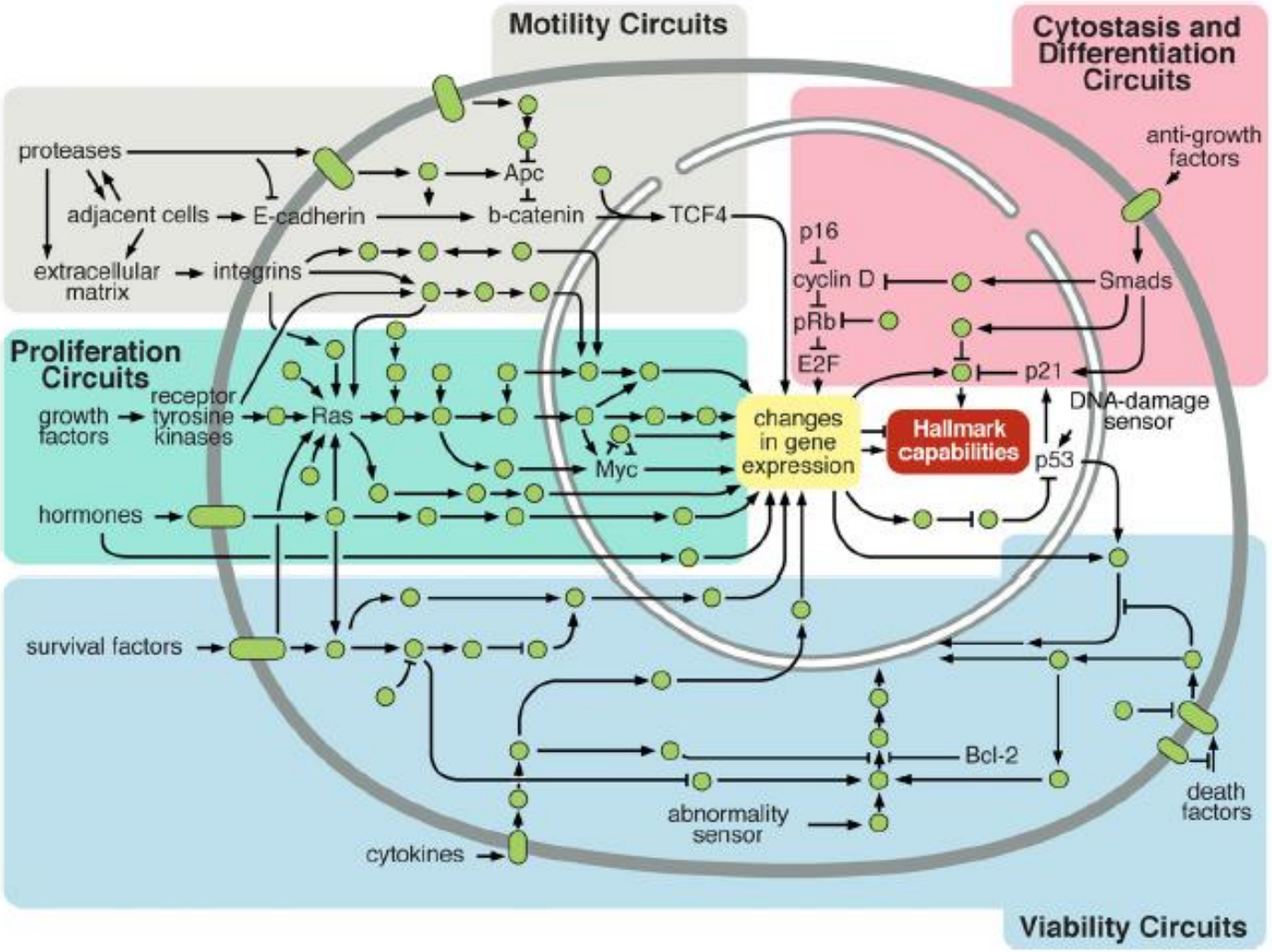


Figure 20-54 Essential Cell Biology, 4th ed. (© Garland Science 2014)

By the time a tumour is first detected, it has been typically developing for many years and already contains a billion cells or more.

A very complex machinery exists in normal cells and cancer cells reprogram this system in order to promote overgrowth

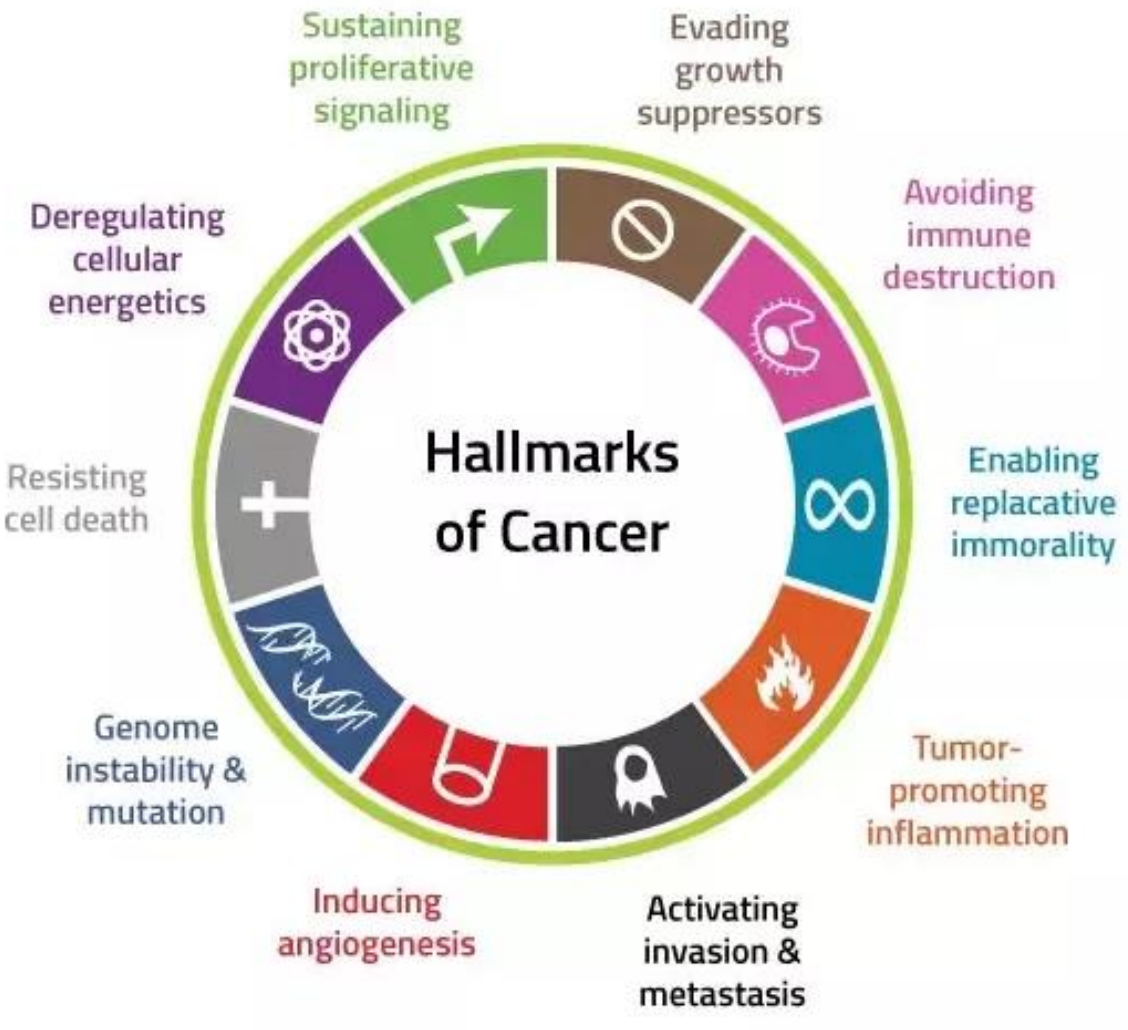


Cancers are caused by accumulation of mutations (genetic instability)

TABLE 20–1 A VARIETY OF FACTORS CAN CONTRIBUTE TO GENETIC INSTABILITY
Defects in DNA replication
Defects in DNA repair
Defects in cell-cycle checkpoint mechanisms
Mistakes in mitosis
Abnormal chromosome numbers

Table 20-1 Essential Cell Biology, 4th ed. (© Garland Science 2014)

Cancer is also a multi-layered disease with multiple complex networks of interactions located at different levels.



Hallmarks of cancer: refer mainly to the cellular and tissular processes that cause tumour growth and metastasis.

What Type of Genes are Mutated During Tumorigenesis ?

Genes that Regulate:

- Cell Growth
- Cell Death (Apoptosis)
- DNA Repair
- Angiogenesis
- Cellular Cohesion
- Drug/Xenobiotic Metabolism
- Drug Resistance

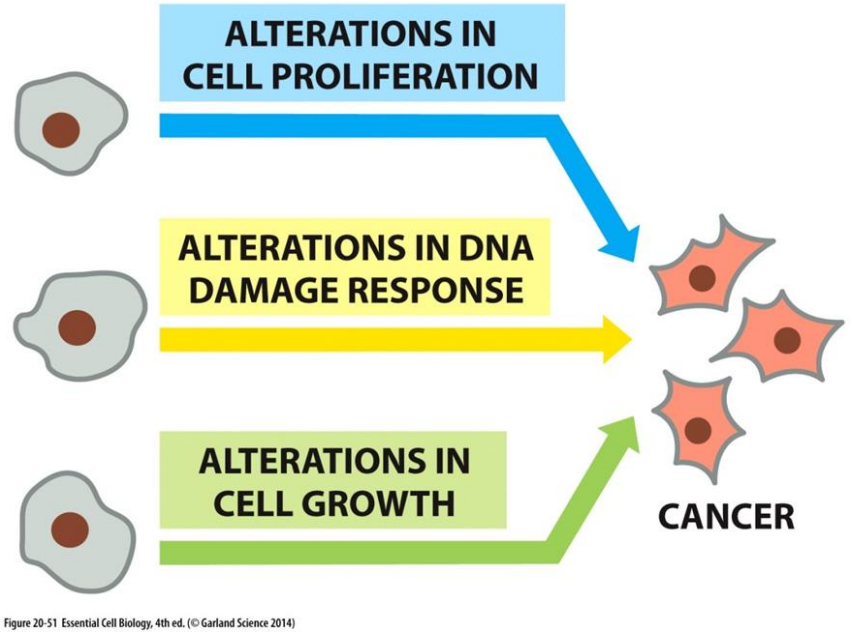


Figure 20-51 Essential Cell Biology, 4th ed. (© Garland Science 2014)

Cancer is caused by an accumulation of genetic mutations .Cancer does not arise from only one genetic alteration. It is typical to identify tumors Containing 5 or more genetic alterations.

Chromosomal duplications, deletions or translocations are common in human cancers.

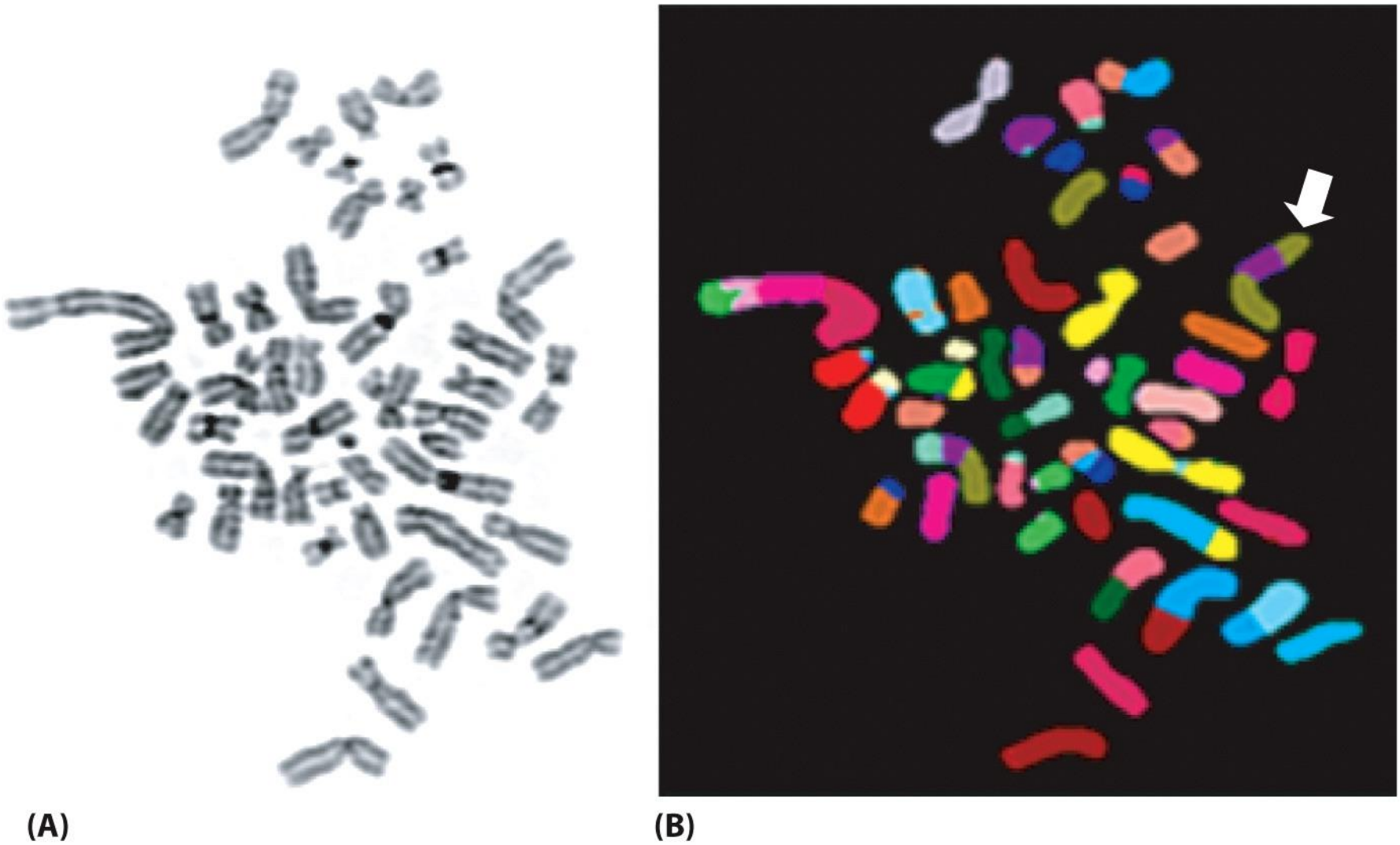


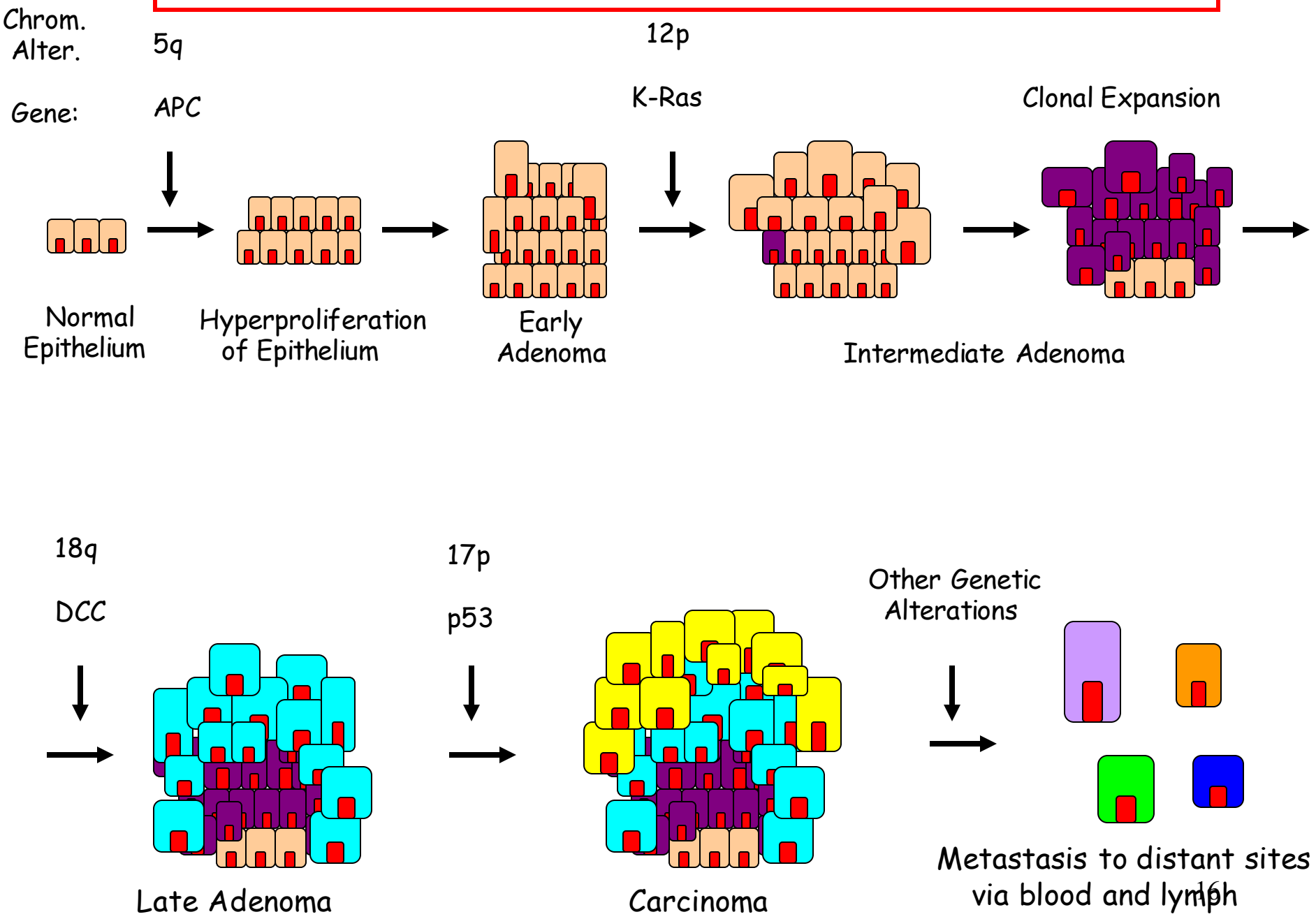
Figure 20-46 Essential Cell Biology, 4th ed. (© Garland Science 2014)

Tumor Fomation is a Multistage Process

The mutations don't happen all together....

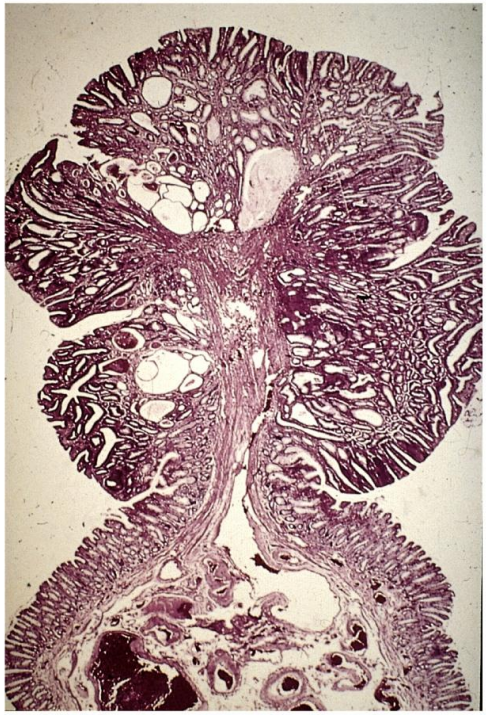
they take a long time to accumulate!!

Multistage Genetic Model for the Development of Colon Cancer



Colon cancers typically begin with the mutation and disruption of tumor suppressor gene APC (Ademotous Polyposis Coli), followed by formation of polyps.

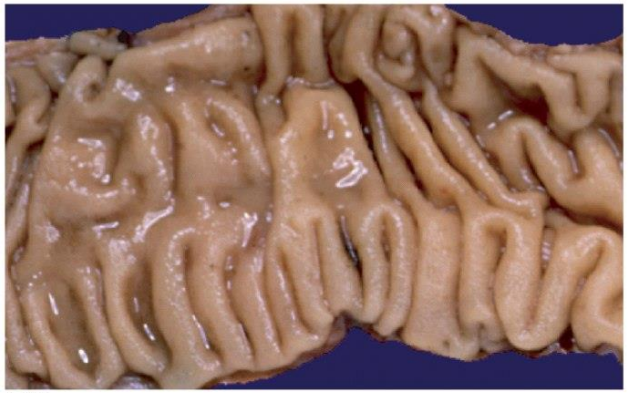
(A)



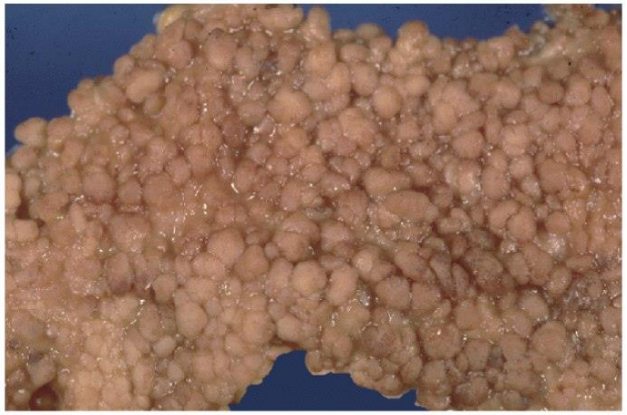
(B)

1 mm

Figure 20-52 Essential Cell Biology, 4th ed. (© Garland Science 2014)



(A)

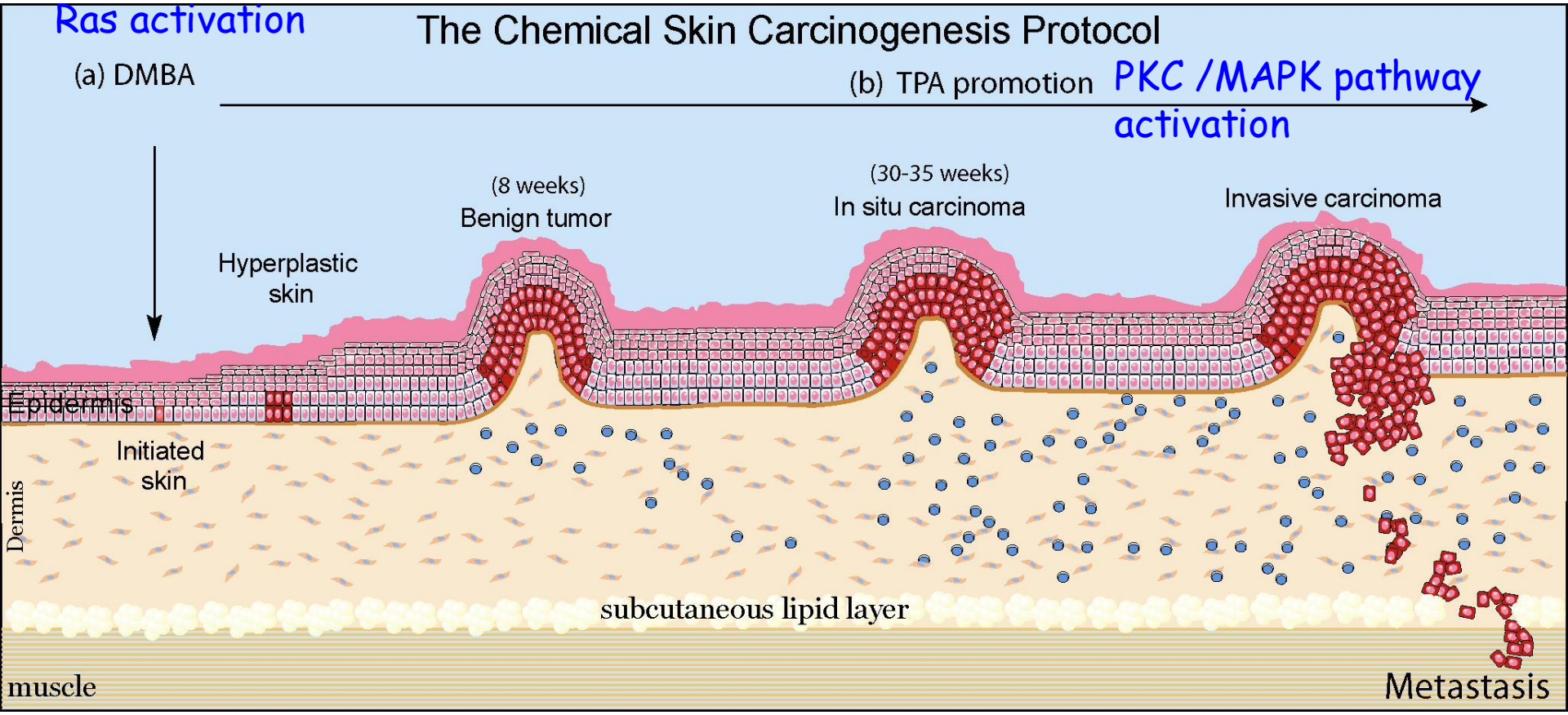


(B)

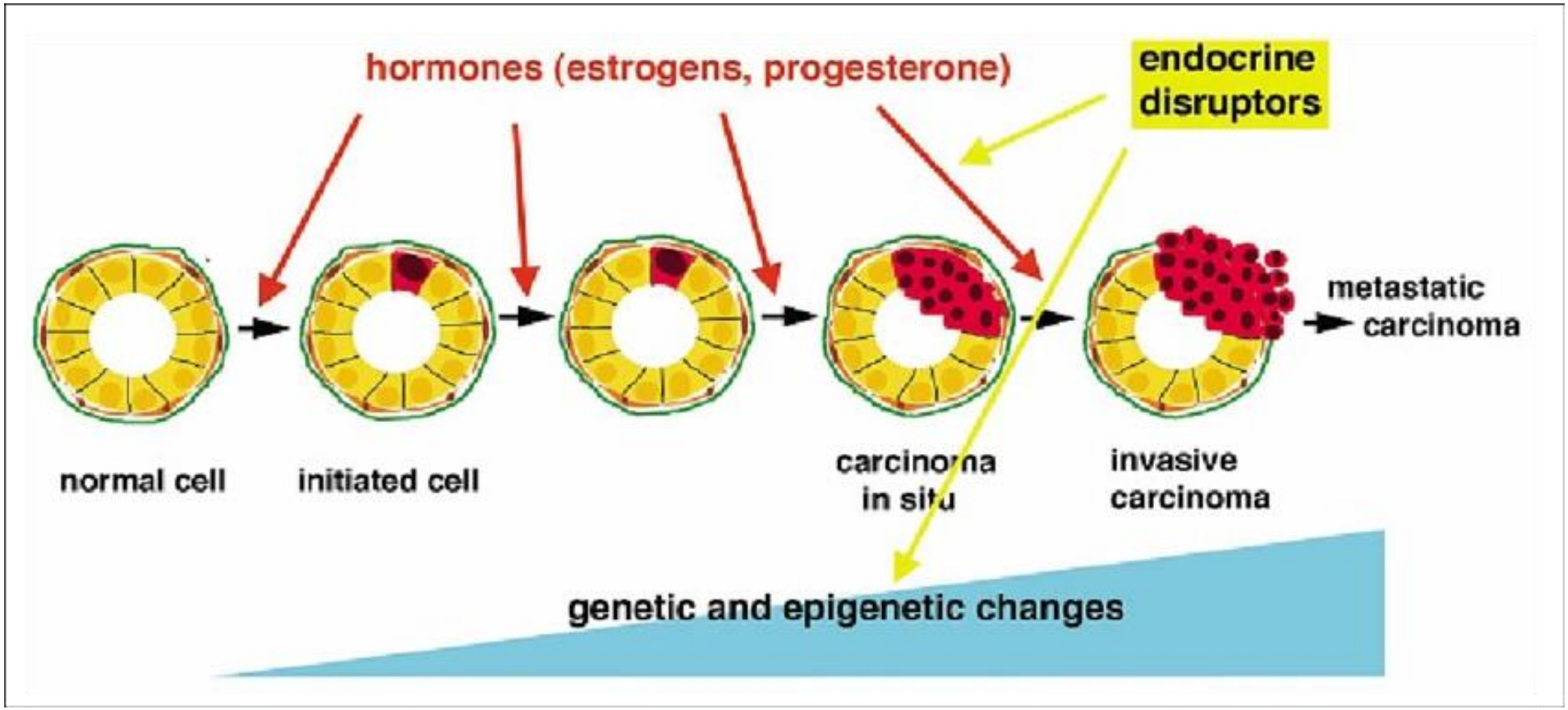
Note that excessive beef consumption was associated with colon cancers.

Multistage processes of skin-cancer formation

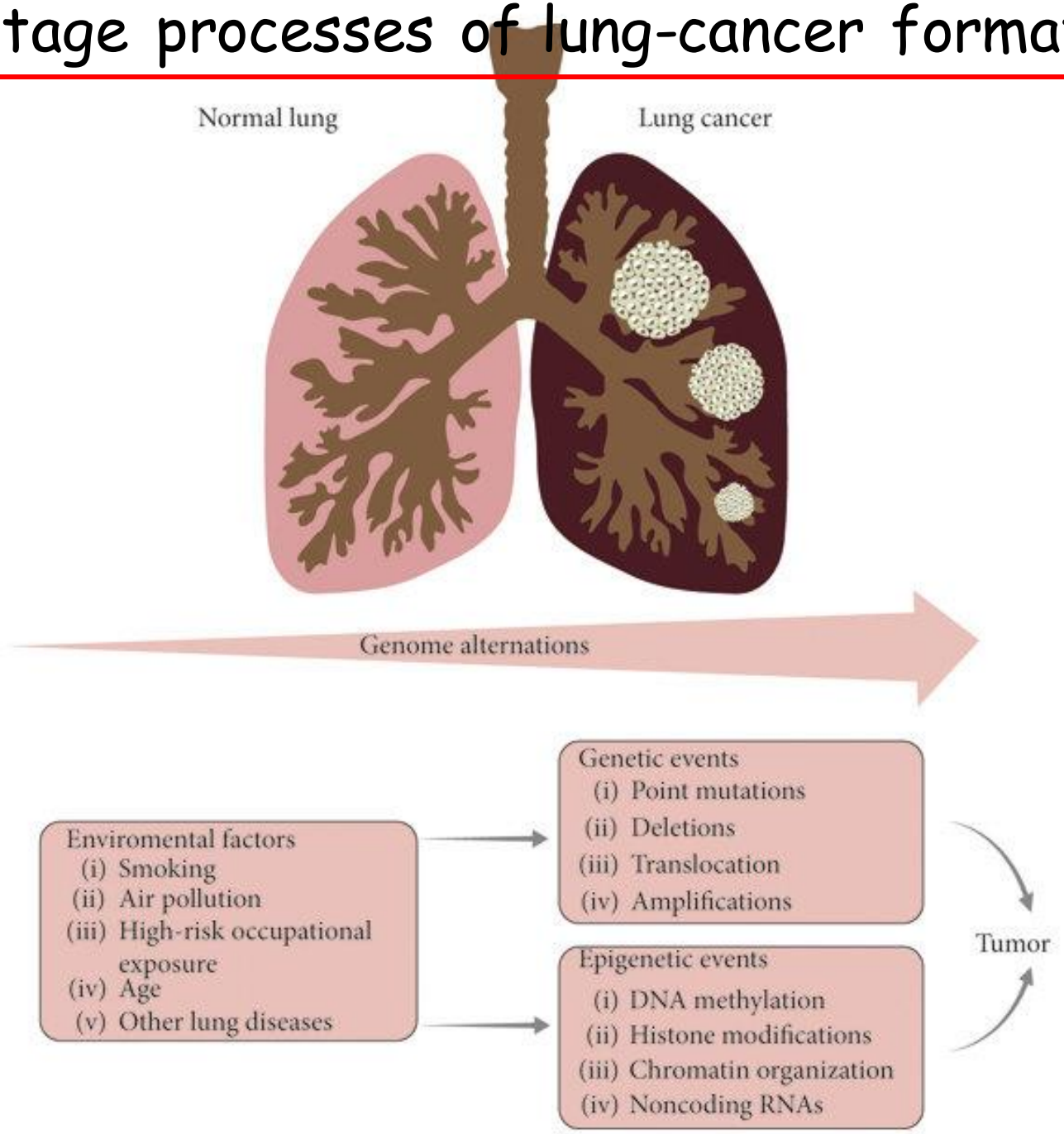
H-Ras mutation
Ras activation



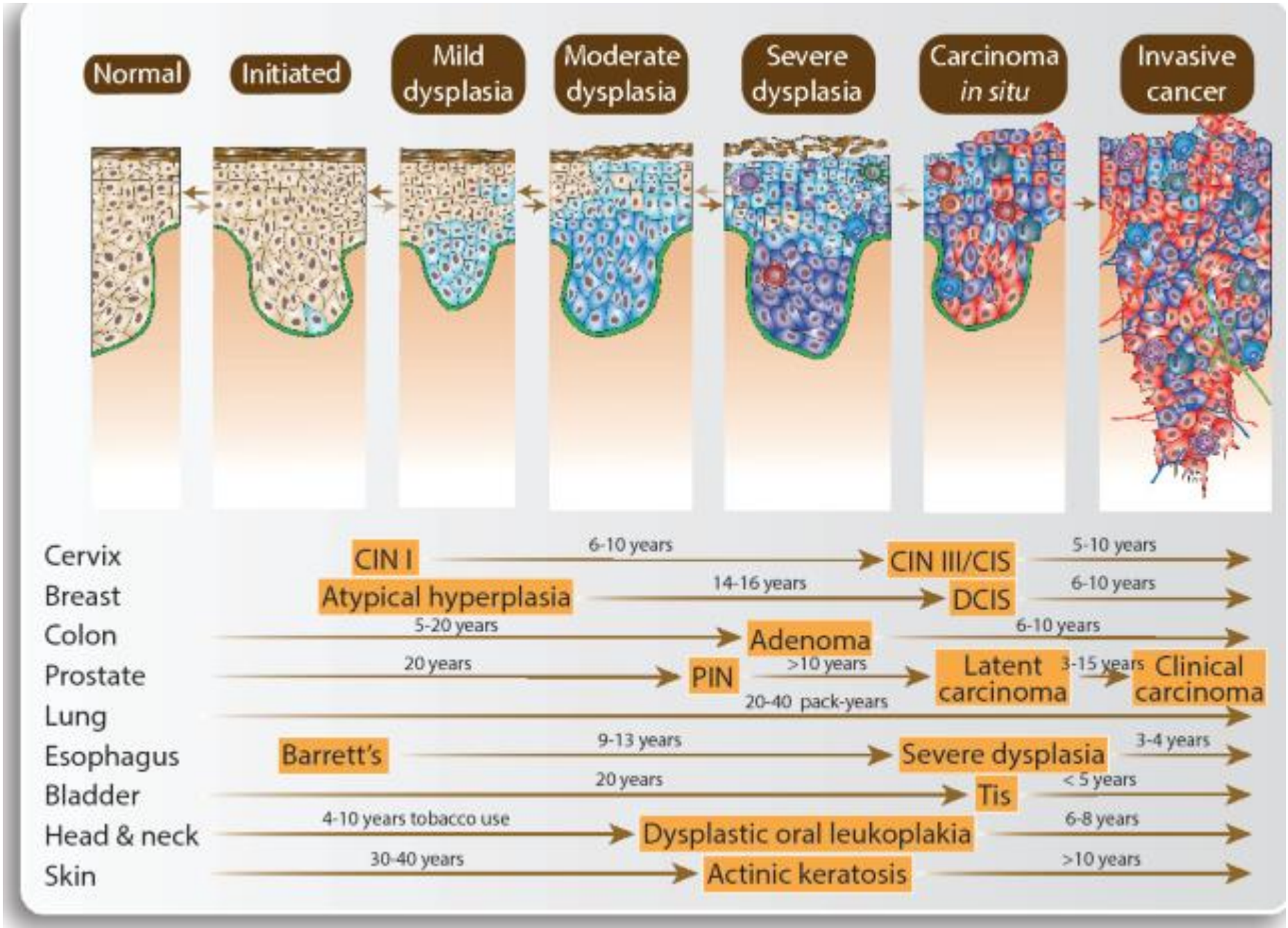
Multistage processes of breat-cancer formation



Multistage processes of lung-cancer formation

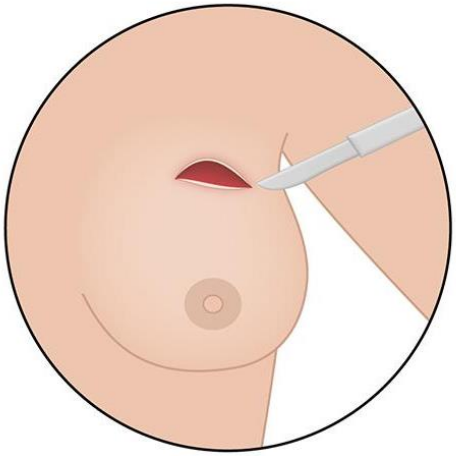


Multi-step Tumorigenesis and Genome Instability

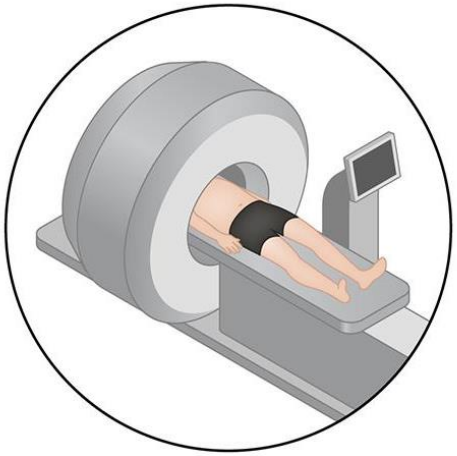


Types of Cancer Treatment

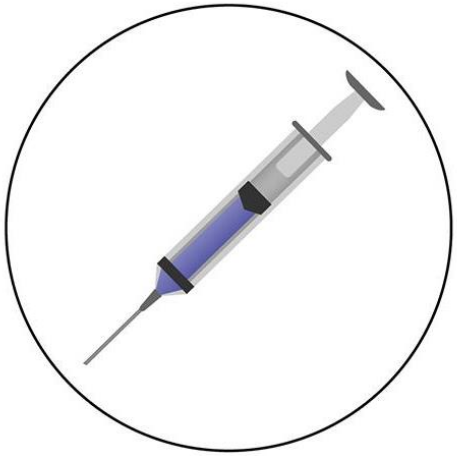
Surgery



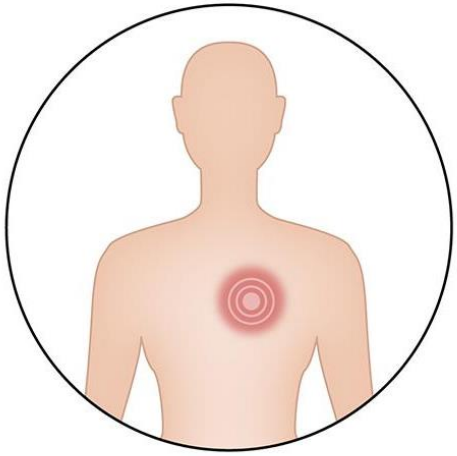
Radiotherapy



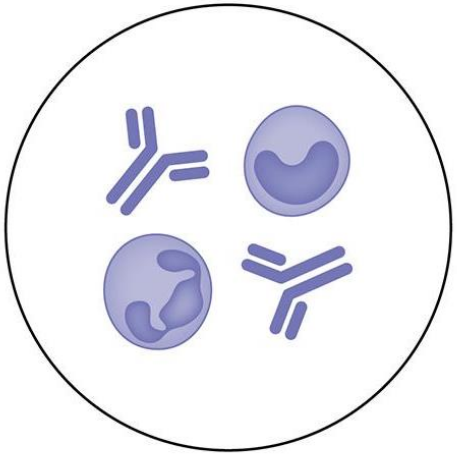
Chemotherapy



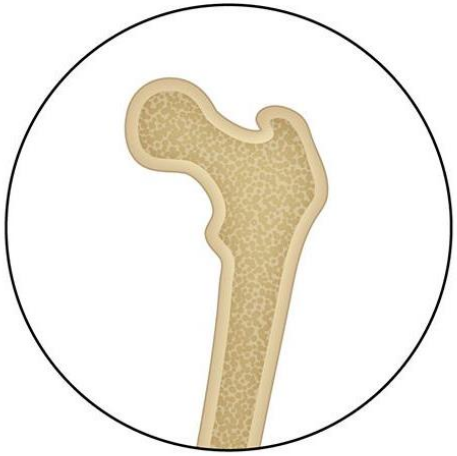
Targeted therapy



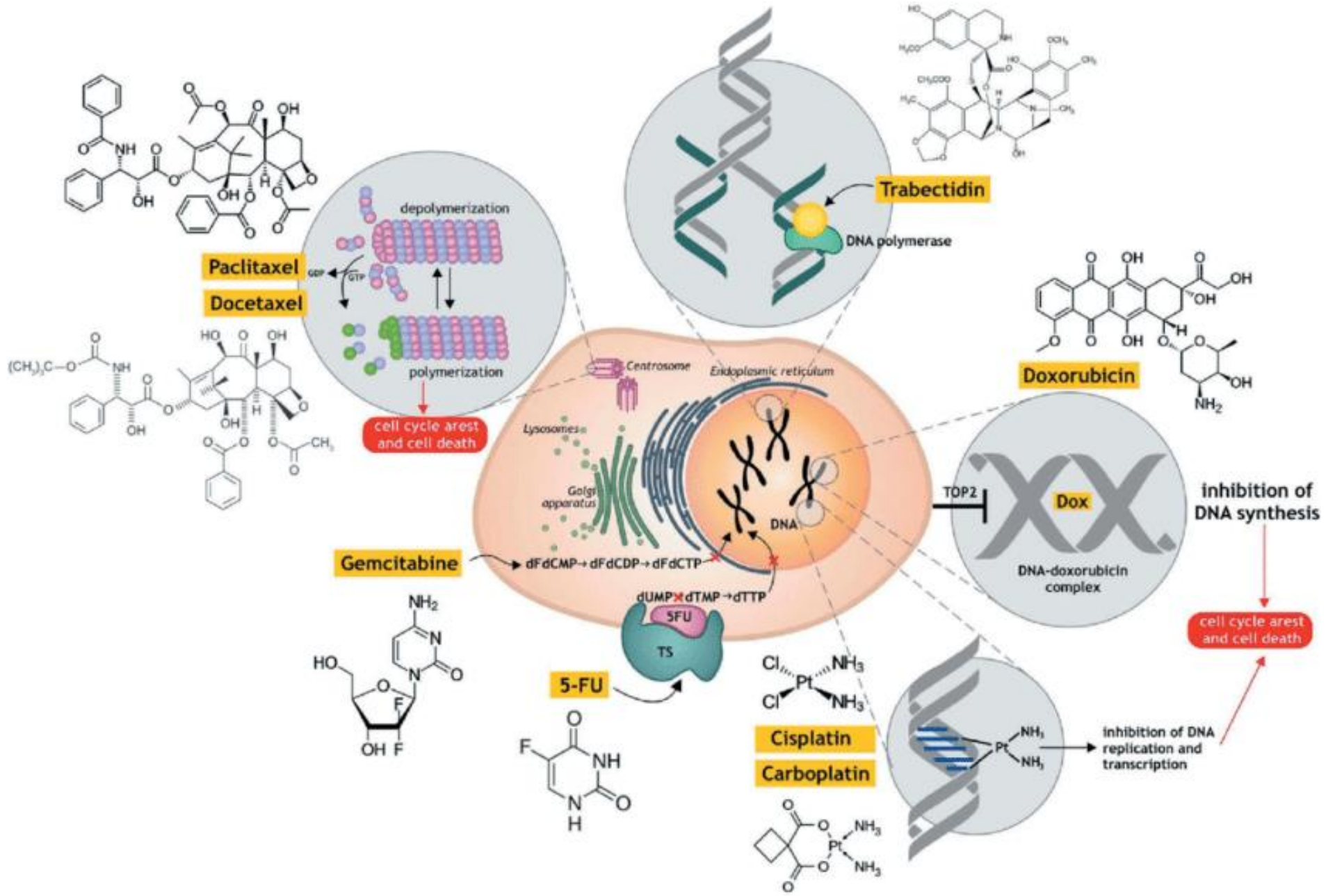
Immunotherapy



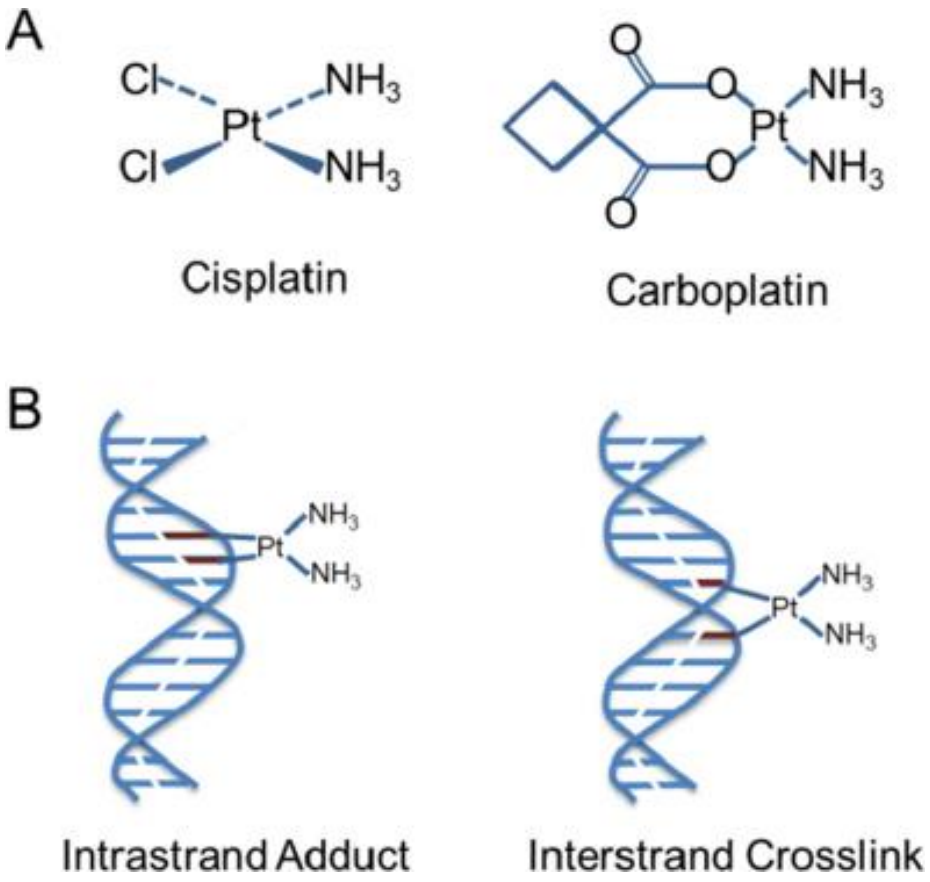
Bone marrow transplant



The mechanisms of action of the main chemotherapeutic agents

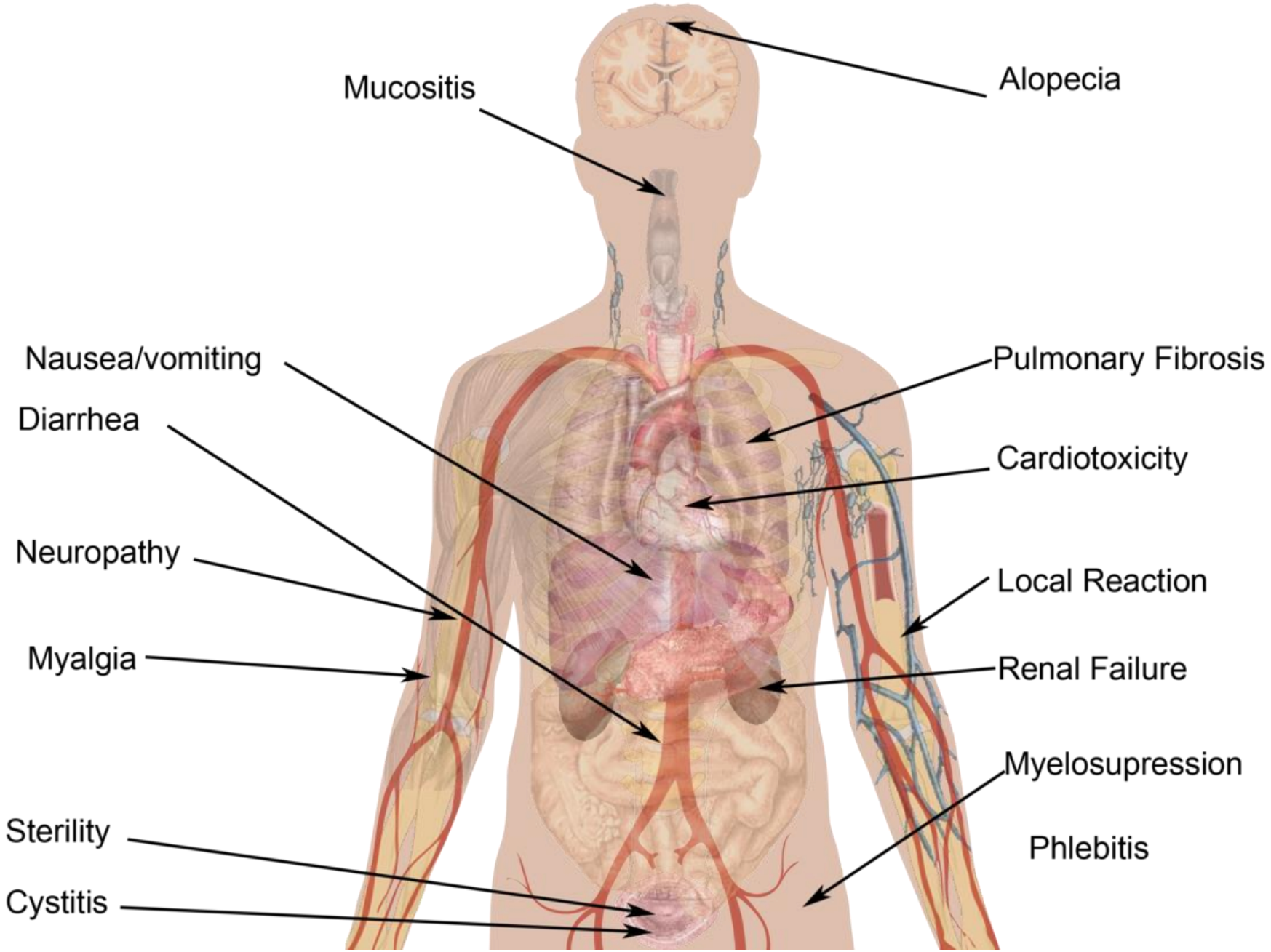


DNA damaging agents are also used in cancer because of their ability to inhibit DNA polymerase



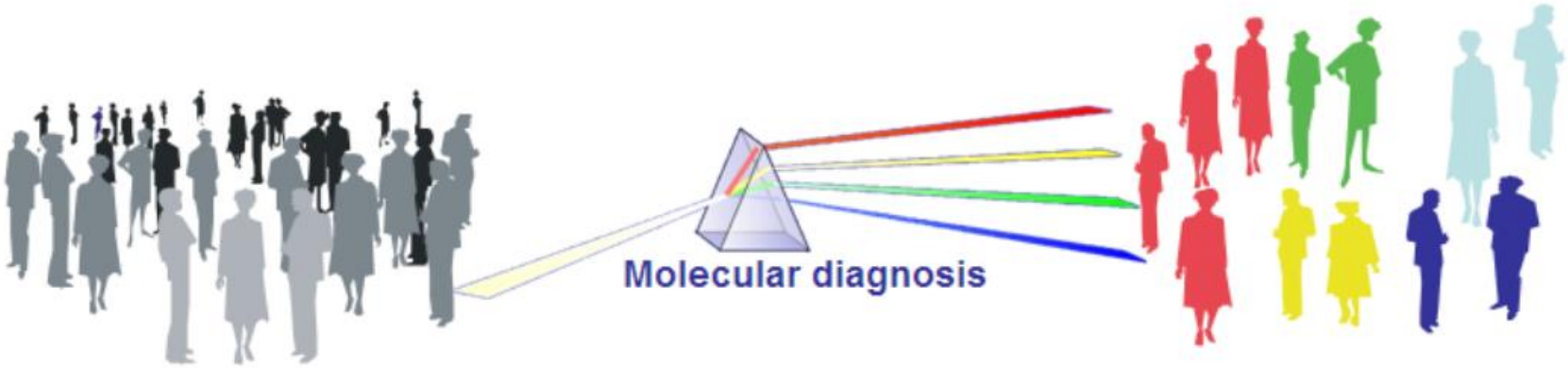
DNA damaging agents react with nucleotides and modify the structure of DNA. The modified structure then acts as a physical barrier and hinders the movement of DNA polymerase.

Side Effects of Chemotherapy



MANCHESTER 1824
The University of Manchester

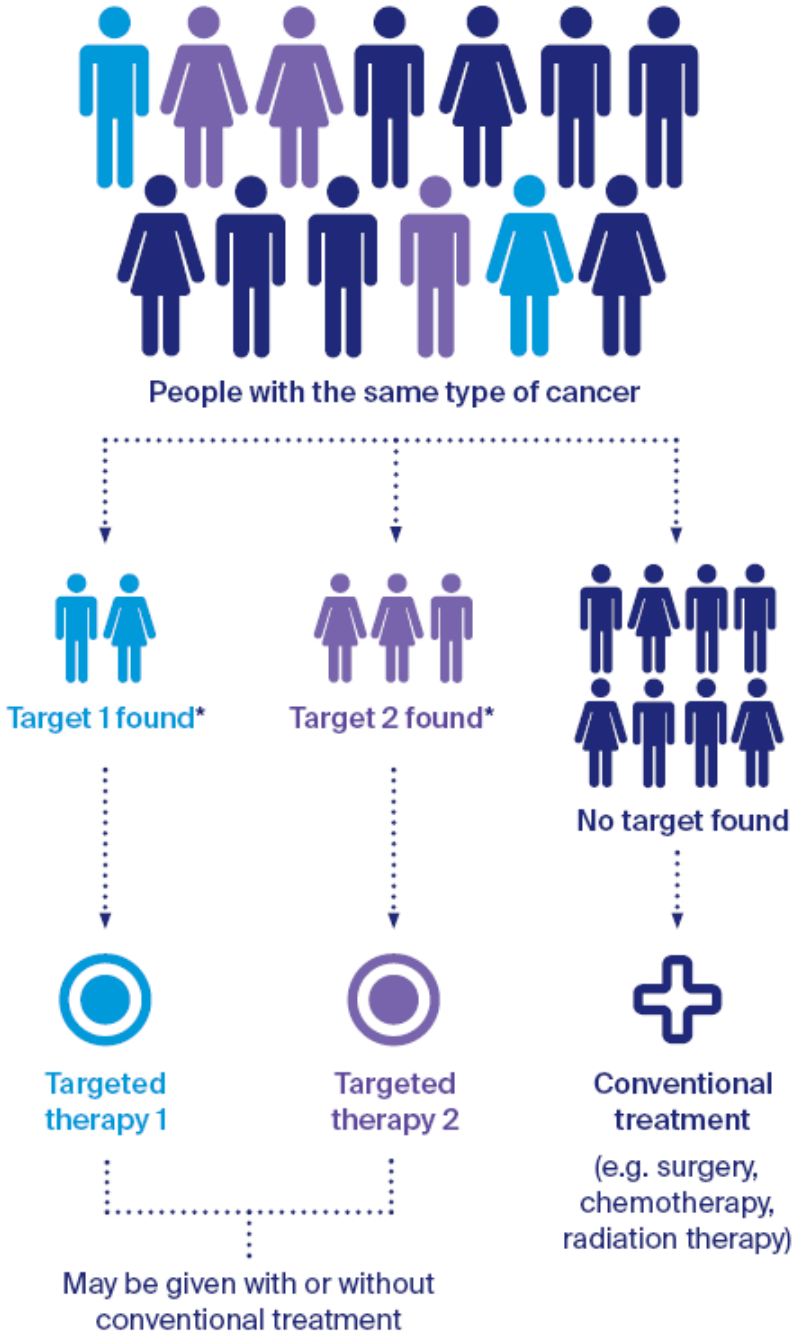
What is precision medicine?



Here all patients are treated the same…

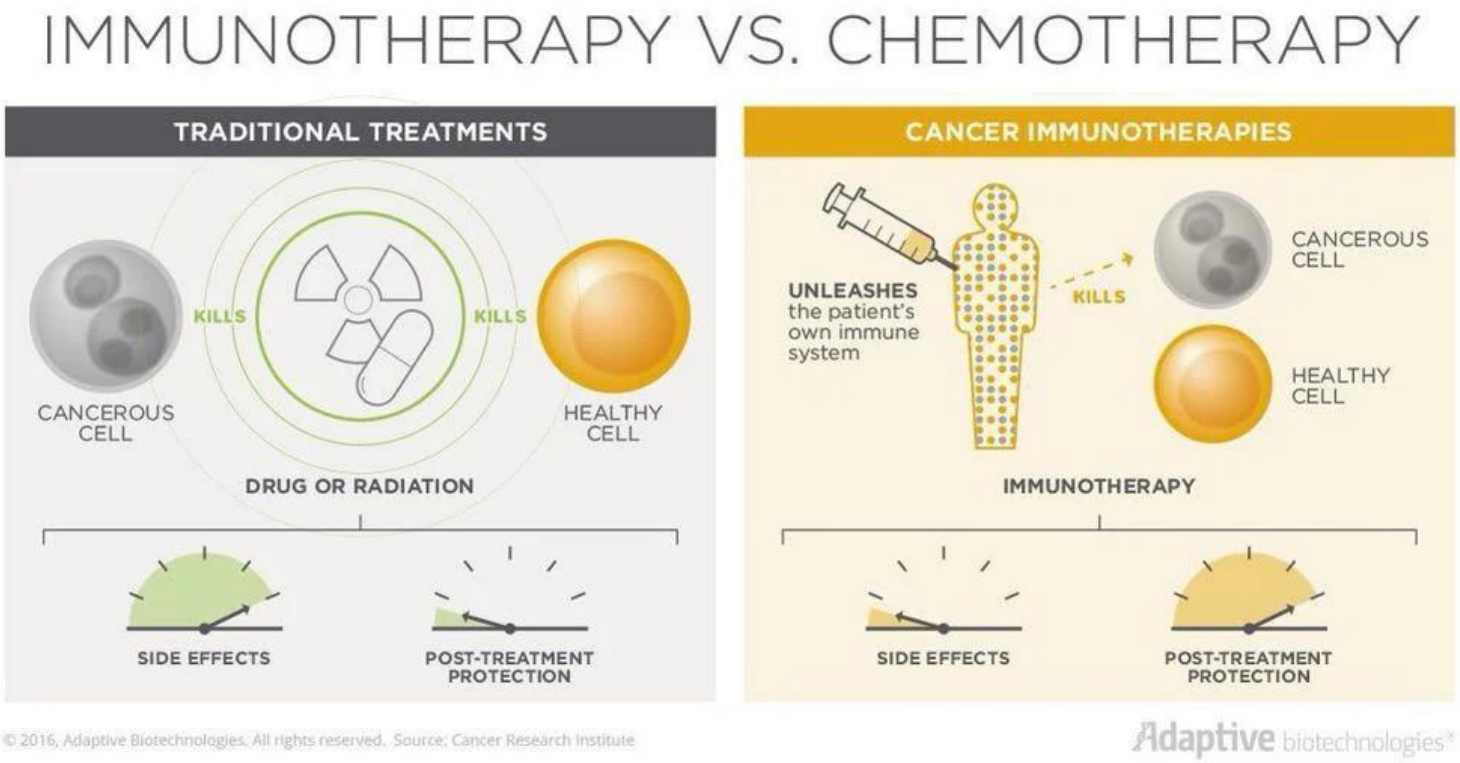
- Some respond to treatment
- Others do not

Here, patients are ***treated according to their molecular profile***, increasing the chances of benefit


People with the same type of cancer
Target 1 found*
Target 2 found*
No target found
Targeted therapy 1
Targeted therapy 2
Conventional treatment
(e.g. surgery, chemotherapy, radiation therapy)
May be given with or without conventional treatment

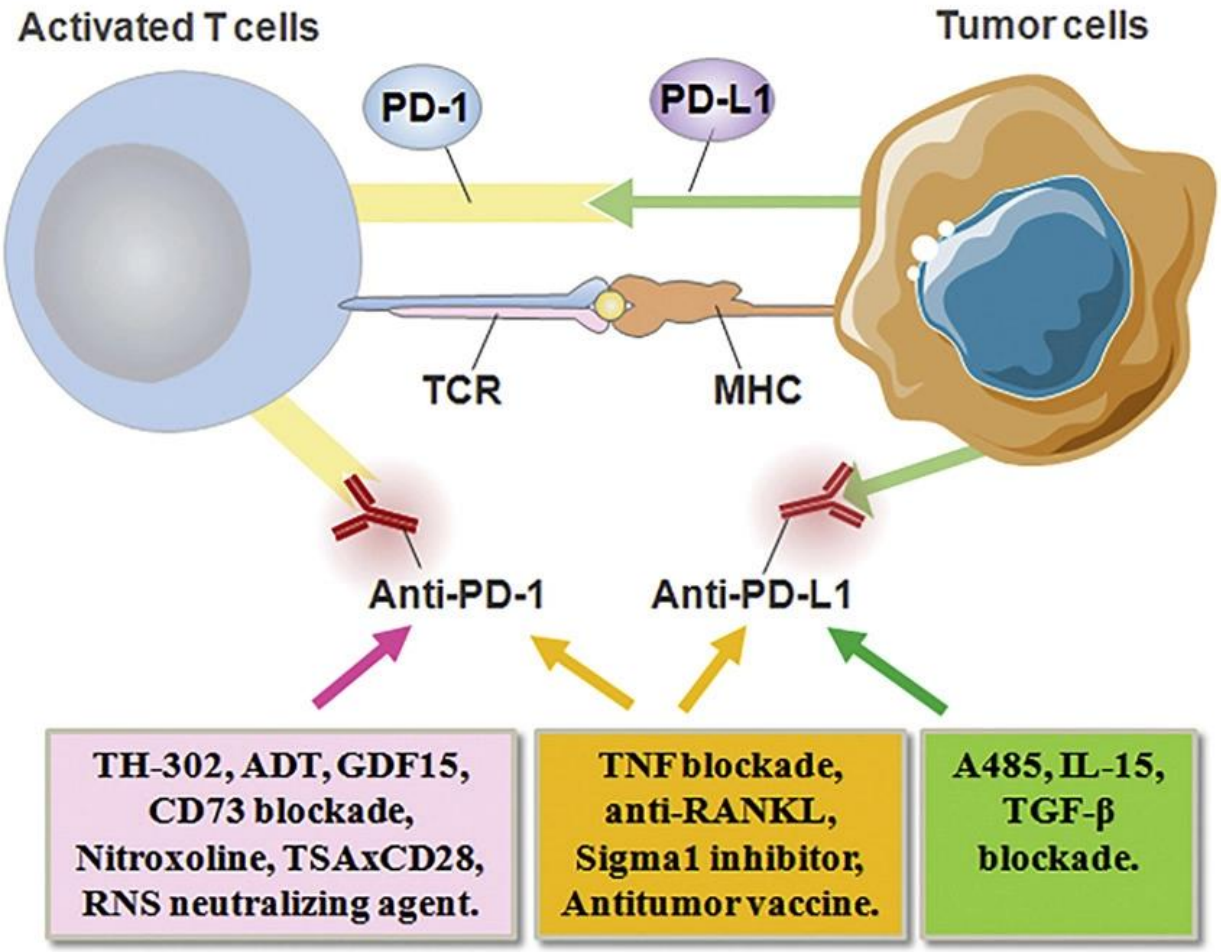
Standard chemotherapy	Targeted therapies
Generally work by damaging rapidly dividing cells	Specific disruption of pathways unique to cancer cells and absent in normal cells
Identified by trial and error	Specifically designed with a certain molecular target in mind
Generally more severe side effects	Generally milder side effects

Cancer immunotherapy is a new form of cancer treatment that uses the power of the body's own immune system to prevent, control, and eliminate cancer.

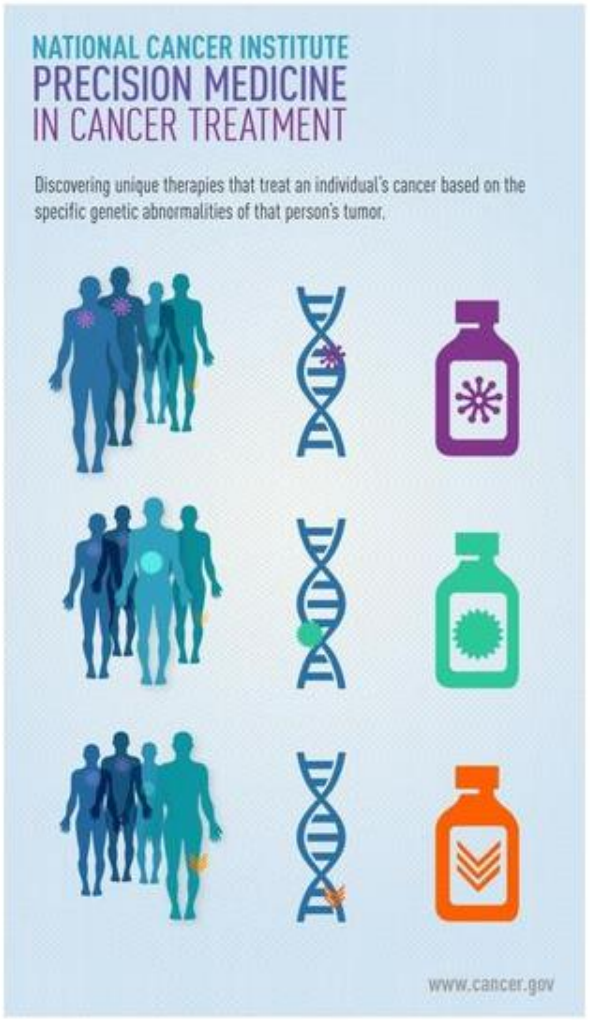


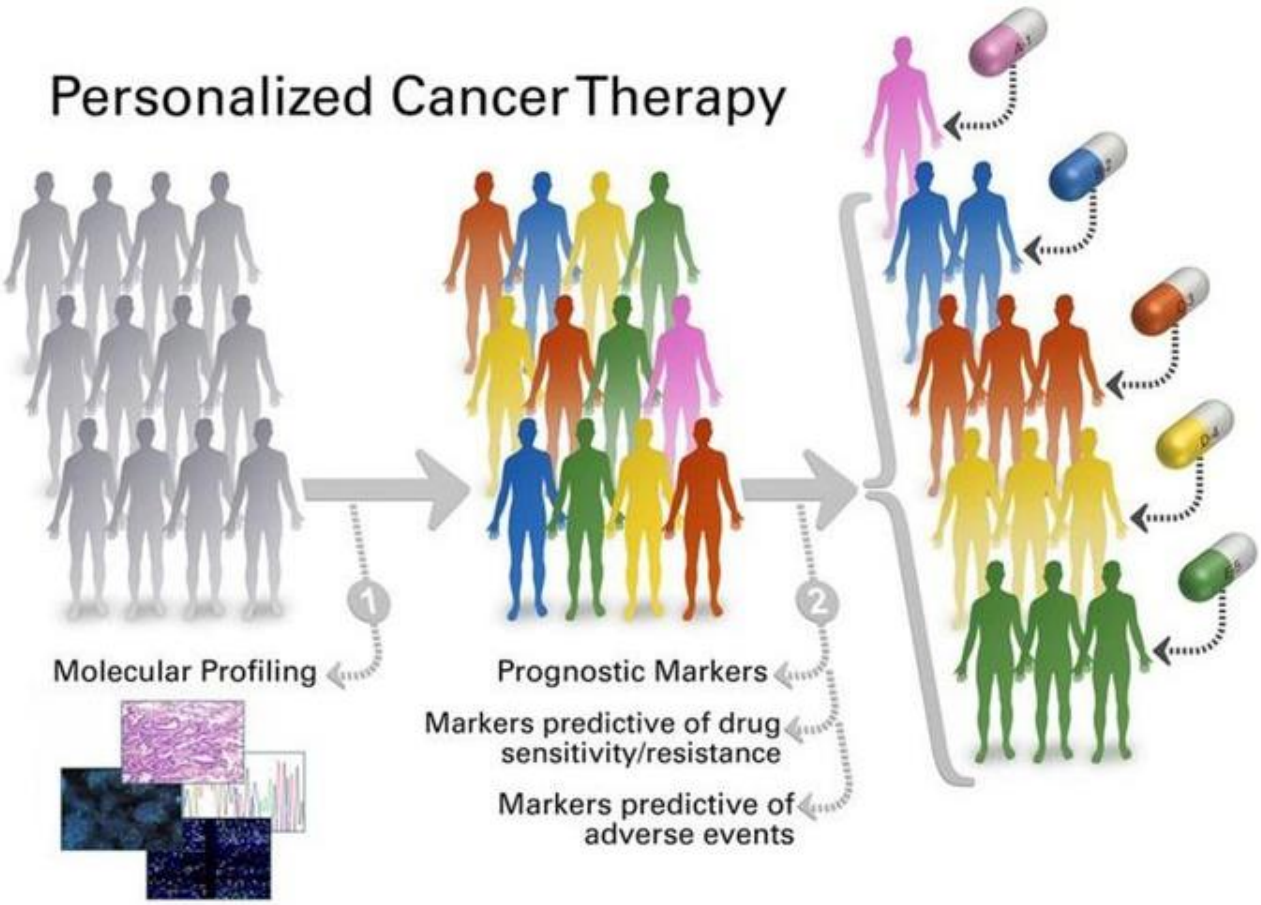
Cancer immunotherapy focuses on boosting or changing the body’s own immune system to fight cancer.

Anti-PD-1/PD-L1 immunotherapy



Molecular Profiling and Targeted Therapies





https://pct.mdanderson.org/#/

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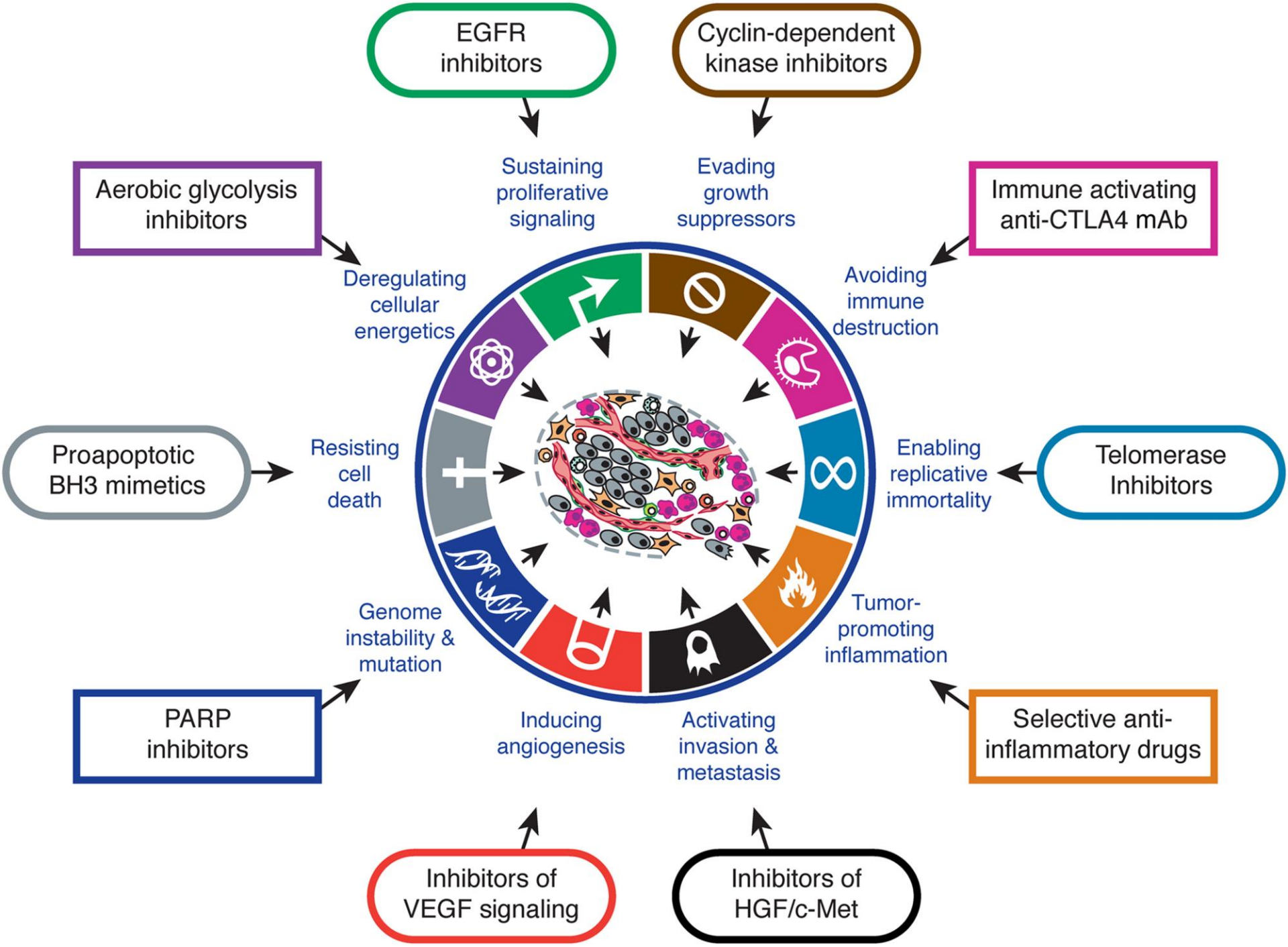
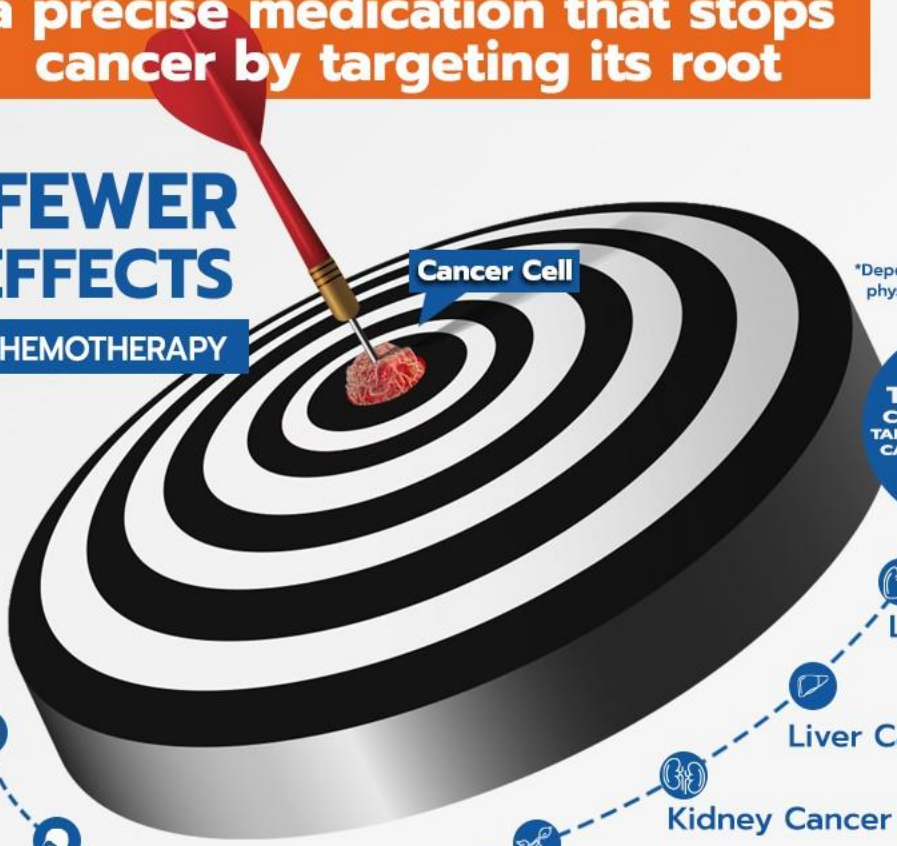

EGFR inhibitors
Cyclin-dependent kinase inhibitors
Aerobic glycolysis inhibitors
Sustaining proliferative signaling
Evading growth suppressors
Immune activating anti-CTLA4 mAb
Deregulating cellular energetics
Avoiding immune destruction
Proapoptotic BH3 mimetics
Resisting cell death
Enabling replicative immortality
Telomerase Inhibitors
Genome instability & mutation
Tumor-promoting inflammation
PARP inhibitors
Inducing angiogenesis
Activating invasion & metastasis
Selective anti-inflammatory drugs
Inhibitors of VEGF signaling
Inhibitors of HGF/c-Met

VEJTHANI
Vejthani Hospital

TARGETED THERAPY

a precise medication that stops cancer by targeting its root

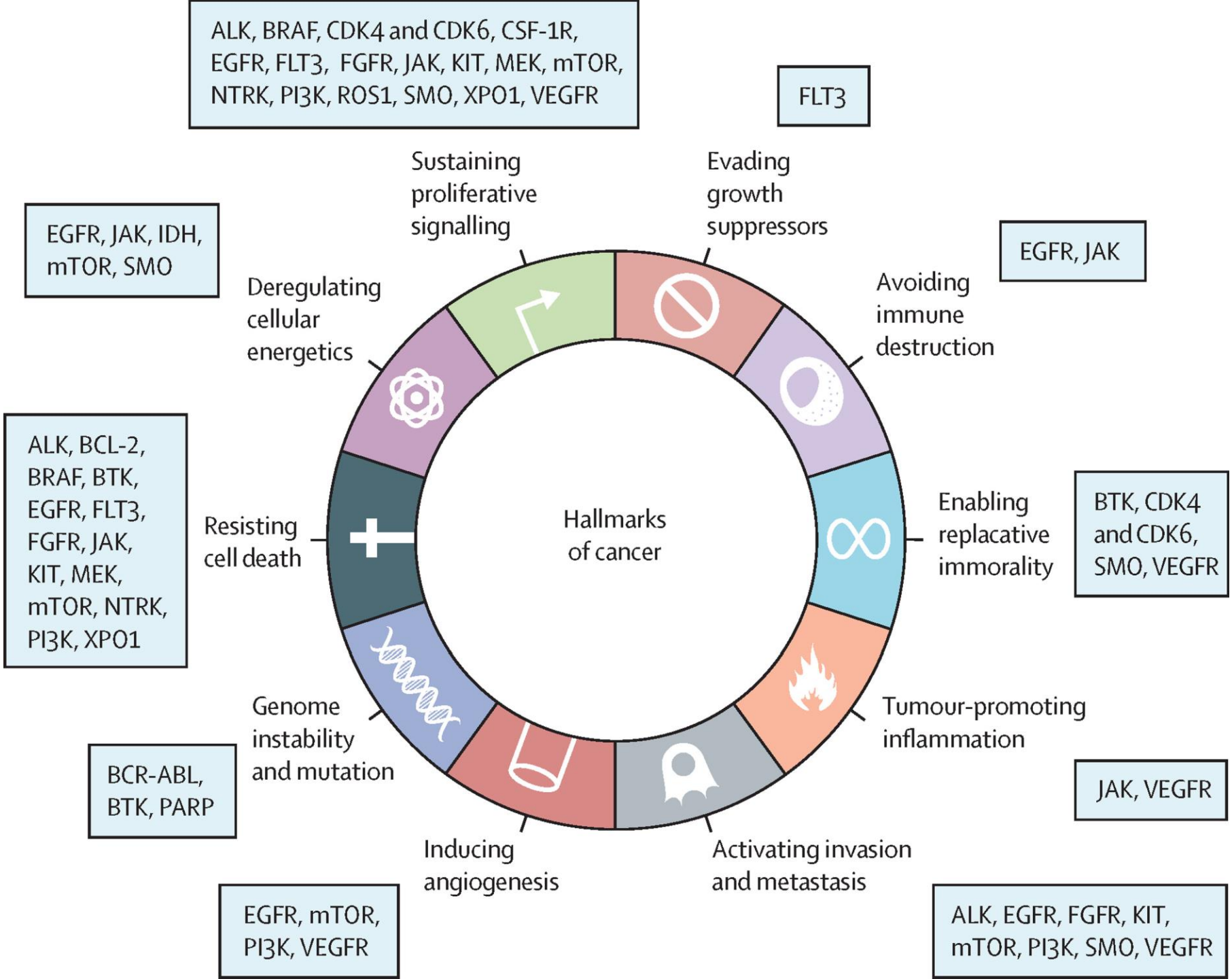
HAS FEWER SIDE EFFECTS THAN CHEMOTHERAPY

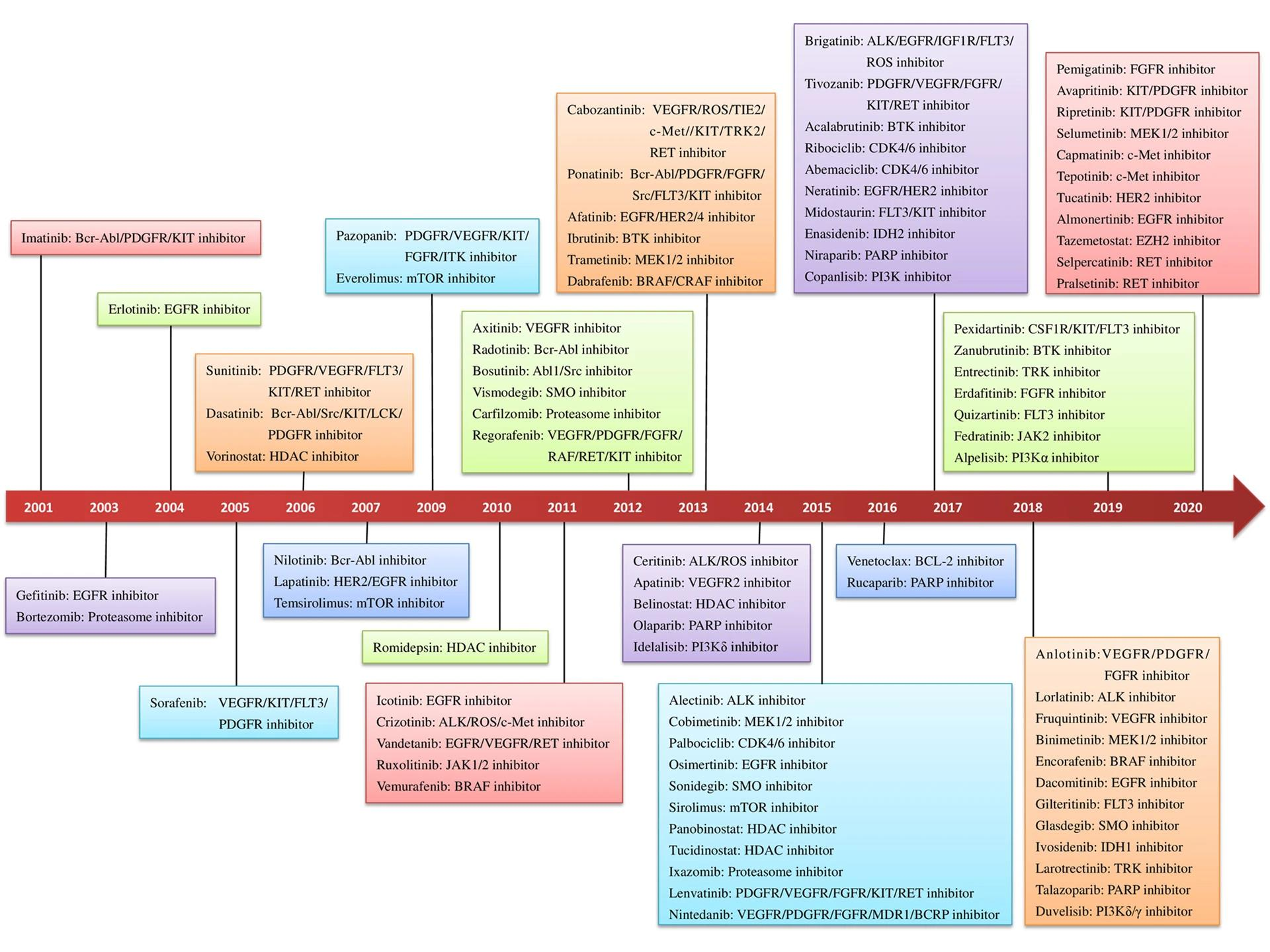


*Depends on the report of physical examinations of each individual

TYPES OF CANCER THAT TARGETED THERAPY CAN BE USED FOR TREATMENT

- Lung Cancer
- Liver Cancer
- Kidney Cancer
- Lymphoma
- Breast Cancer
- Ovarian Cancer
- Head and Neck Cancer
- Colorectal Cancer


ALK, BRAF, CDK4 and CDK6, CSF-1R, EGFR, FLT3, FGFR, JAK, KIT, MEK, mTOR, NTRK, PI3K, ROS1, SMO, XPO1, VEGFR
FLT3
Sustaining proliferative signalling
Evading growth suppressors
EGFR, JAK, IDH, mTOR, SMO
EGFR, JAK
Deregulating cellular energetics
Avoiding immune destruction
ALK, BCL-2, BRAF, BTK, EGFR, FLT3, FGFR, JAK, KIT, MEK, mTOR, NTRK, PI3K, XPO1
Resisting cell death
Hallmarks of cancer
Enabling replacative immorality
BTK, CDK4 and CDK6, SMO, VEGFR
Genome instability and mutation
Tumour-promoting inflammation
BCR-ABL, BTK, PARP
JAK, VEGFR
Inducing angiogenesis
Activating invasion and metastasis
EGFR, mTOR, PI3K, VEGFR
ALK, EGFR, FGFR, KIT, mTOR, PI3K, SMO, VEGFR


Imatinib: Bcr-Abl/PDGFR/KIT inhibitor
Erlotinib: EGFR inhibitor
Sunitinib: PDGFR/VEGFR/FLT3/ KIT/RET inhibitor
Dasatinib: Bcr-Abl/Src/KIT/LCK/ PDGFR inhibitor
Vorinostat: HDAC inhibitor
Pazopanib: PDGFR/VEGFR/KIT/ FGFR/ITK inhibitor
Everolimus: mTOR inhibitor
Axitinib: VEGFR inhibitor
Radotinib: Bcr-Abl inhibitor
Bosutinib: Abl1/Src inhibitor
Vismodegib: SMO inhibitor
Carfilzomib: Proteasome inhibitor
Regorafenib: VEGFR/PDGFR/FGFR/ RAF/RET/KIT inhibitor
Cabozantinib: VEGFR/ROS/TIE2/ c-Met//KIT/TRK2/ RET inhibitor
Ponatinib: Bcr-Abl/PDGFR/FGFR/ Src/FLT3/KIT inhibitor
Afatinib: EGFR/HER2/4 inhibitor
Ibrutinib: BTK inhibitor
Trametinib: MEK1/2 inhibitor
Dabrafenib: BRAF/CRAF inhibitor
Brigatinib: ALK/EGFR/IGF1R/FLT3/ ROS inhibitor
Tivozanib: PDGFR/VEGFR/FGFR/ KIT/RET inhibitor
Acalabrutinib: BTK inhibitor
Ribociclib: CDK4/6 inhibitor
Abemaciclib: CDK4/6 inhibitor
Neratinib: EGFR/HER2 inhibitor
Midostaurin: FLT3/KIT inhibitor
Enasidenib: IDH2 inhibitor
Niraparib: PARP inhibitor
Copanlisib: PI3K inhibitor
Pemigatinib: FGFR inhibitor
Avapritinib: KIT/PDGFR inhibitor
Ripretinib: KIT/PDGFR inhibitor
Selumetinib: MEK1/2 inhibitor
Capmatinib: c-Met inhibitor
Tepotinib: c-Met inhibitor
Tucatinib: HER2 inhibitor
Almonertinib: EGFR inhibitor
Tazemetostat: EZH2 inhibitor
Selpercatinib: RET inhibitor
Pralsetinib: RET inhibitor
Pexidartinib: CSF1R/KIT/FLT3 inhibitor
Zanubrutinib: BTK inhibitor
Entrectinib: TRK inhibitor
Erdafitinib: FGFR inhibitor
Quizartinib: FLT3 inhibitor
Fedratinib: JAK2 inhibitor
Alpelisib: PI3Kα inhibitor
2001
2003
2004
2005
2006
2007
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Gefitinib: EGFR inhibitor
Bortezomib: Proteasome inhibitor
Sorafenib: VEGFR/KIT/FLT3/ PDGFR inhibitor
Nilotinib: Bcr-Abl inhibitor
Lapatinib: HER2/EGFR inhibitor
Temsirolimus: mTOR inhibitor
Romidepsin: HDAC inhibitor
Icotinib: EGFR inhibitor
Crizotinib: ALK/ROS/c-Met inhibitor
Vandetanib: EGFR/VEGFR/RET inhibitor
Ruxolitinib: JAK1/2 inhibitor
Vemurafenib: BRAF inhibitor
Ceritinib: ALK/ROS inhibitor
Apatinib: VEGFR2 inhibitor
Belinostat: HDAC inhibitor
Olaparib: PARP inhibitor
Idelalisib: PI3Kδ inhibitor
Venetoclax: BCL-2 inhibitor
Rucaparib: PARP inhibitor
Alectinib: ALK inhibitor
Cobimetinib: MEK1/2 inhibitor
Palbociclib: CDK4/6 inhibitor
Osimertinib: EGFR inhibitor
Sonidegib: SMO inhibitor
Sirolimus: mTOR inhibitor
Panobinostat: HDAC inhibitor
Tucidinostat: HDAC inhibitor
Ixazomib: Proteasome inhibitor
Lenvatinib: PDGFR/VEGFR/FGFR/KIT/RET inhibitor
Nintedanib: VEGFR/PDGFR/FGFR/MDR1/BCRP inhibitor
Anlotinib: VEGFR/PDGFR/ FGFR inhibitor
Lorlatinib: ALK inhibitor
Fruquintinib: VEGFR inhibitor
Binimetinib: MEK1/2 inhibitor
Encorafenib: BRAF inhibitor
Dacomitinib: EGFR inhibitor
Gilteritinib: FLT3 inhibitor
Glasdegib: SMO inhibitor
Ivosidenib: IDH1 inhibitor
Larotrectinib: TRK inhibitor
Talazoparib: PARP inhibitor
Duvelisib: PI3Kδ/γ inhibitor

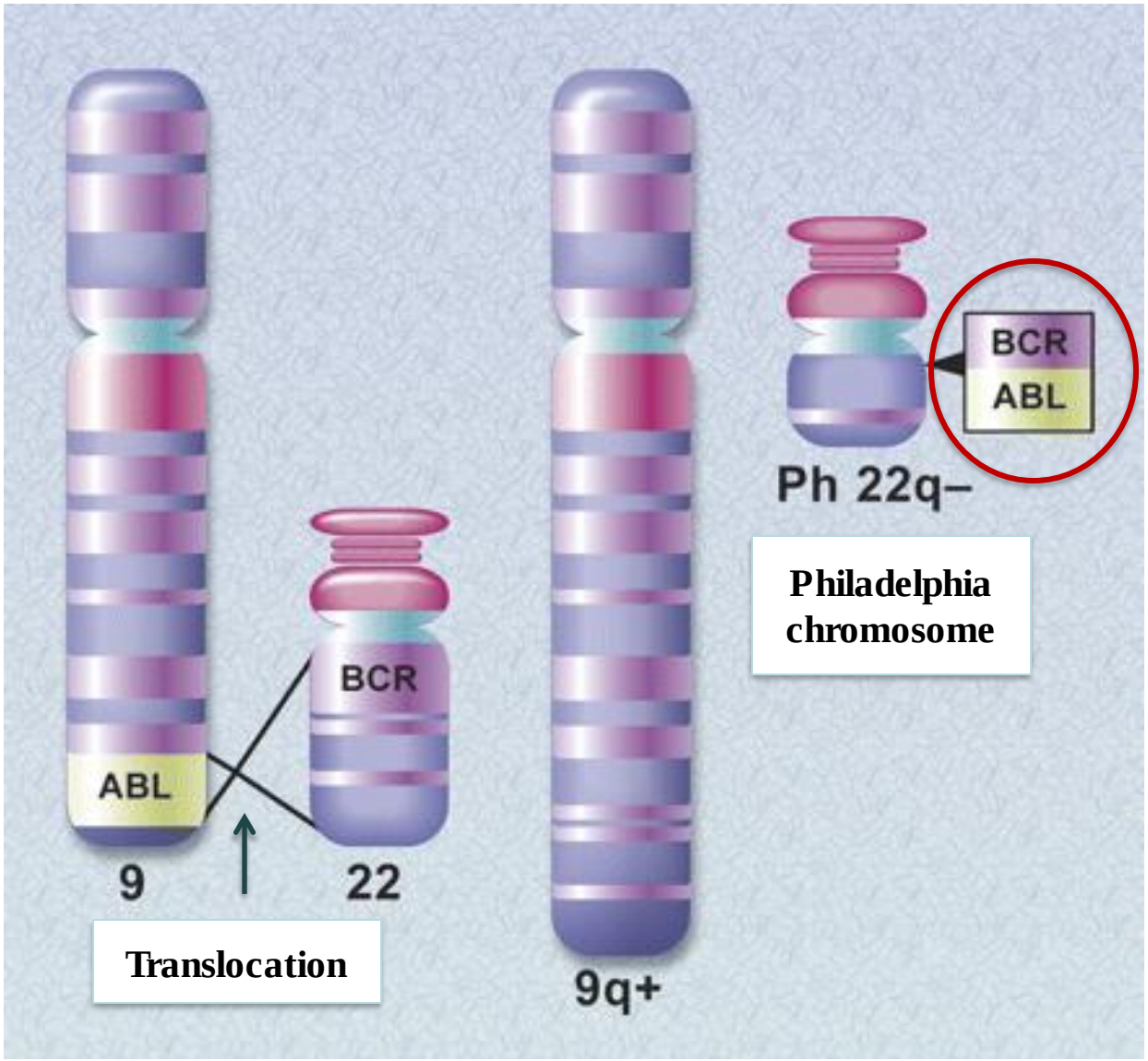
The New Era of Targeted Therapy

Nicholas Lydon, Novartis

Brian Druker, Oregon Health and science university

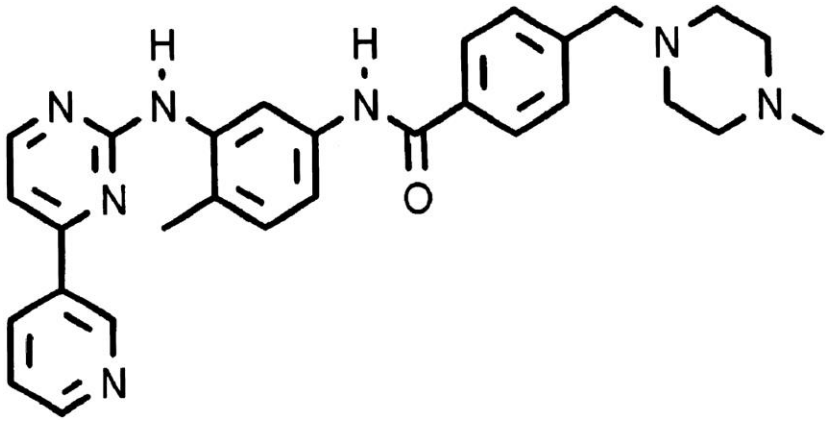
Time, May 2001

Philadelphia Chromosome



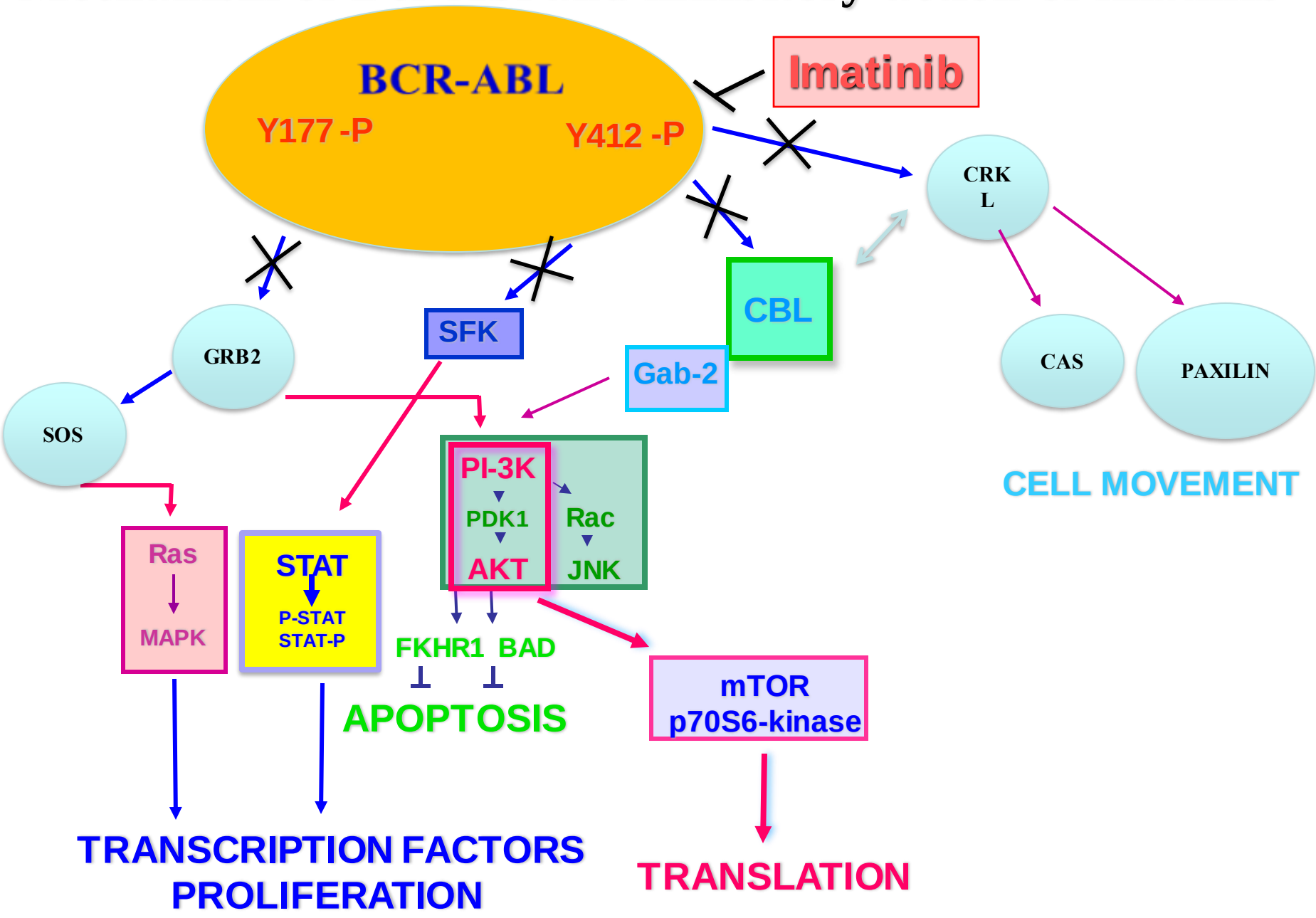
Adapted from Blood 112, 4808-4817 (2008)

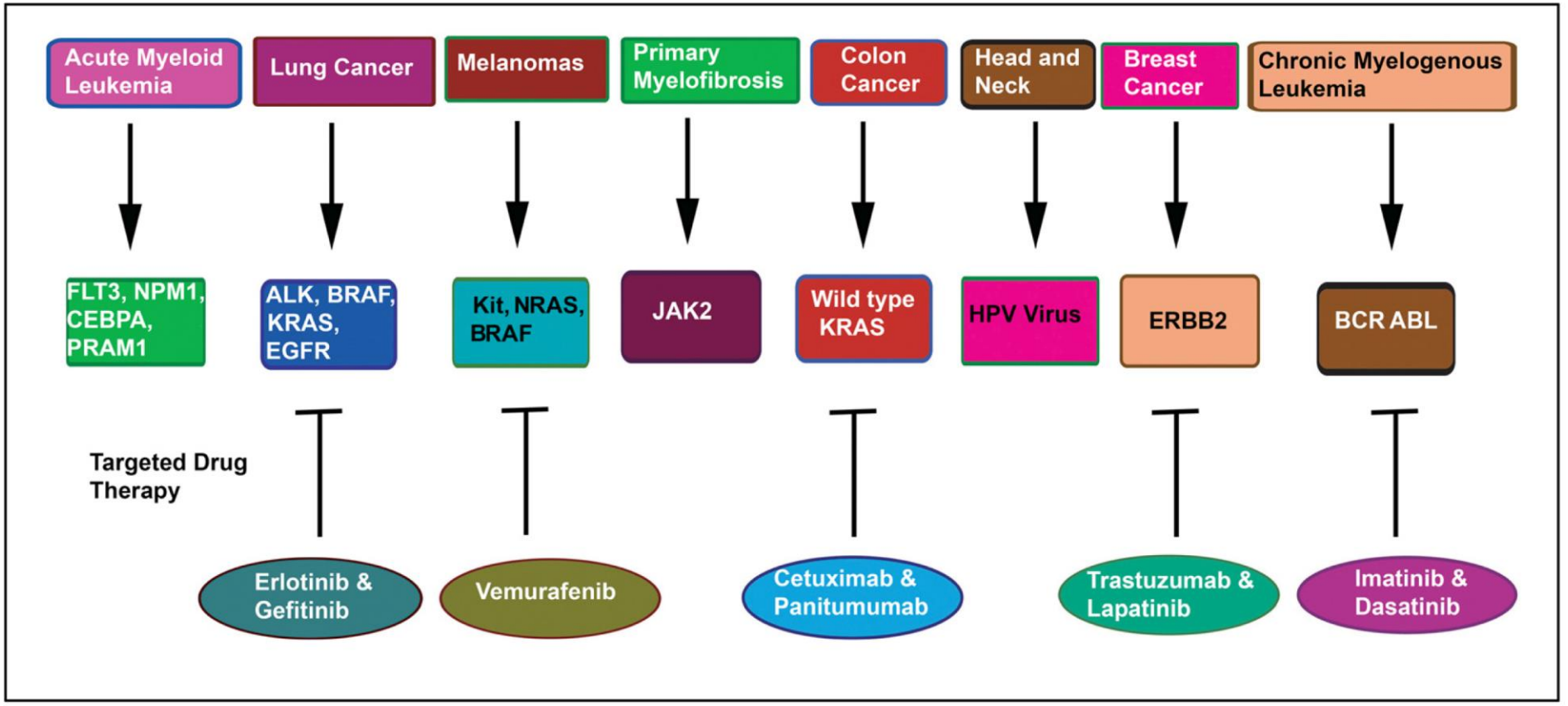
THE TYROSINE KINASE INHIBITOR
Imatinib mesylate - STI571 - GLEEVEC



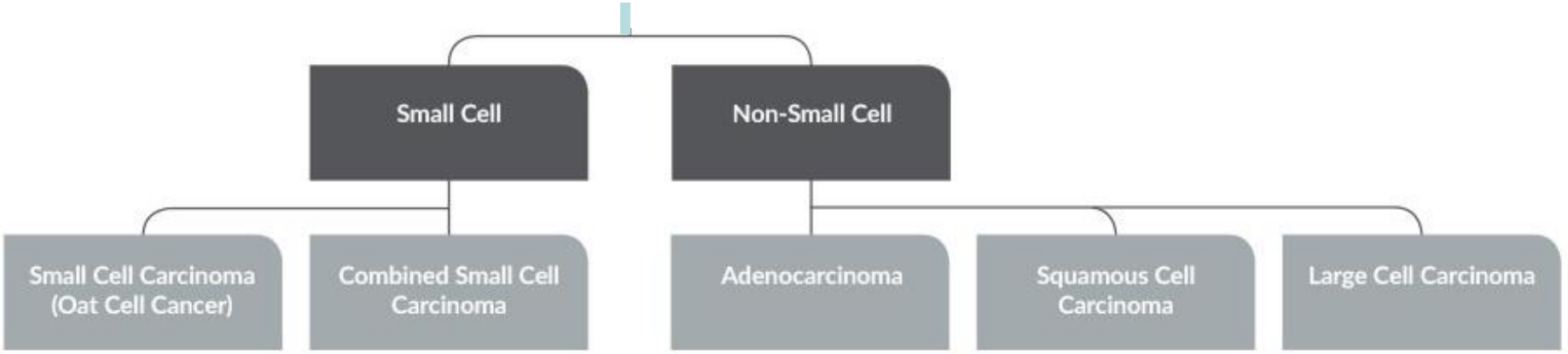
- specific inhibitor of ABL, KIT and PDGFR
- is used to treat CML (BCR-ABL) and GIST (KIT)
- inhibits inactive form of the kinases

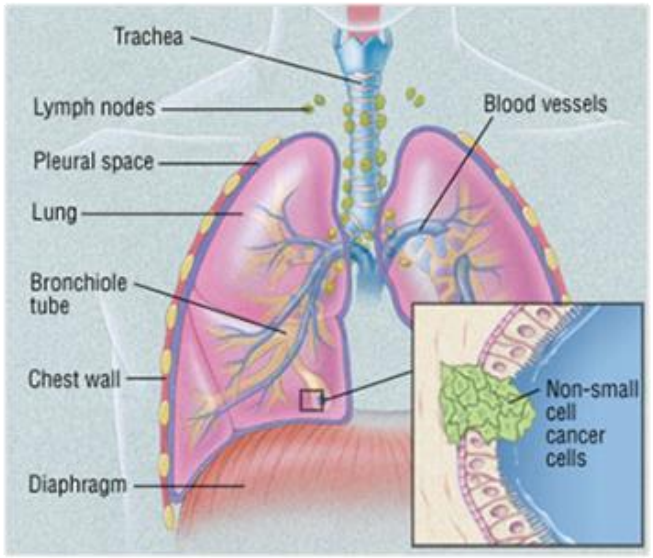
Mechanism of Bcr-Abl and inhibitory action of imatinib



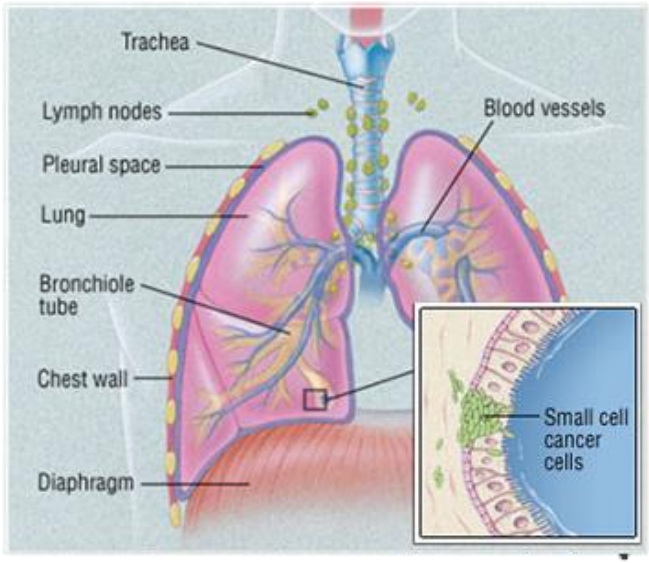

Acute Myeloid Leukemia
Lung Cancer
Melanomas
Primary Myelofibrosis
Colon Cancer
Head and Neck
Breast Cancer
Chronic Myelogenous Leukemia
FLT3, NPM1, CEBPA, PRAM1
ALK, BRAF, KRAS, EGFR
Kit, NRAS, BRAF
JAK2
Wild type KRAS
HPV Virus
ERBB2
BCR ABL
Targeted Drug Therapy
Erlotinib & Gefitinib
Vemurafenib
Cetuximab & Panitumumab
Trastuzumab & Lapatinib
Imatinib & Dasatinib

Two main types of lung cancer





Non Small Cell Lung Cancer

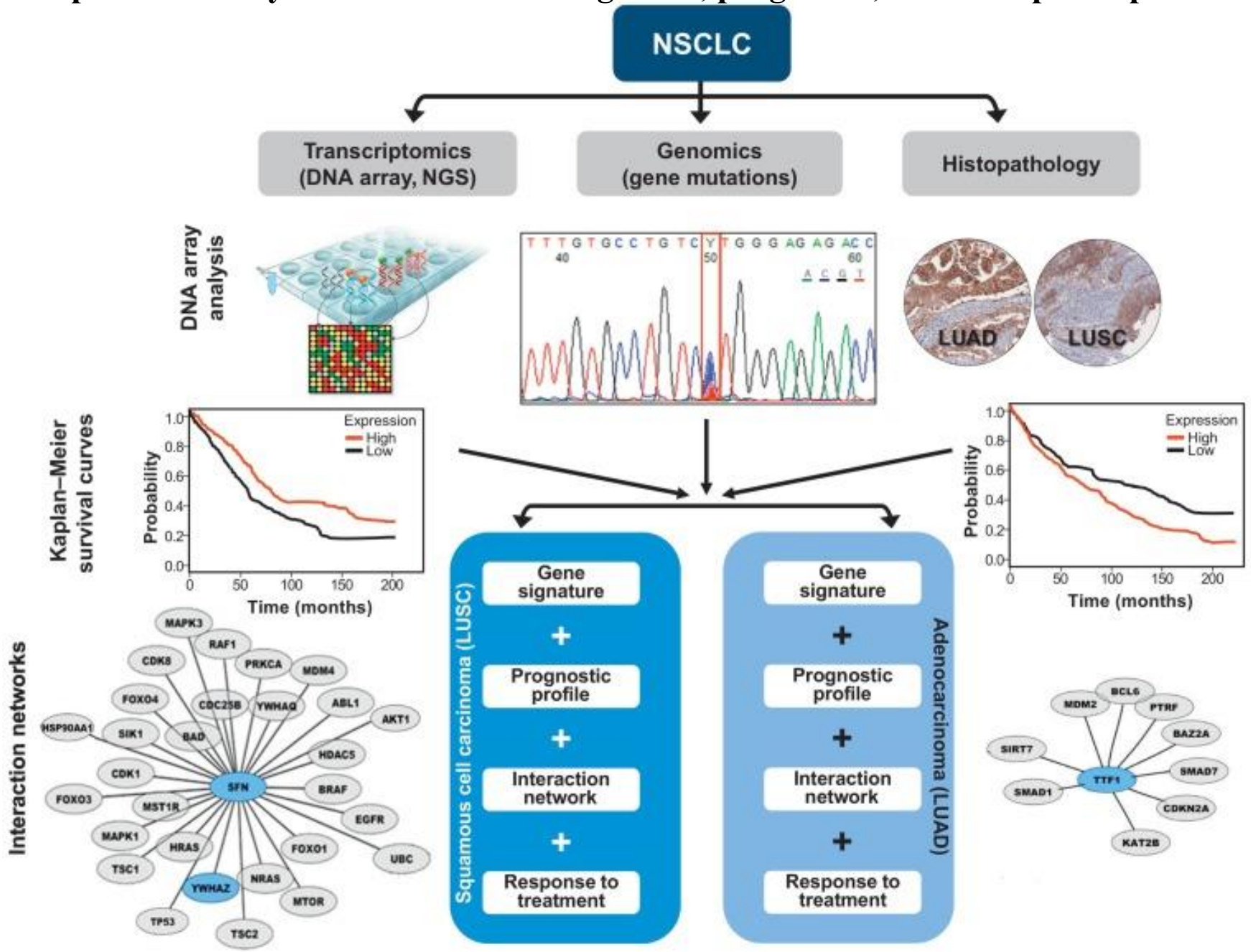


Small Cell Lung Cancer

- **Small cell lung cancer are typically smaller than the cells of non-small cell lung cancer.**

https://lcfamerica.org/lung-cancer-info/types-lung-cancer

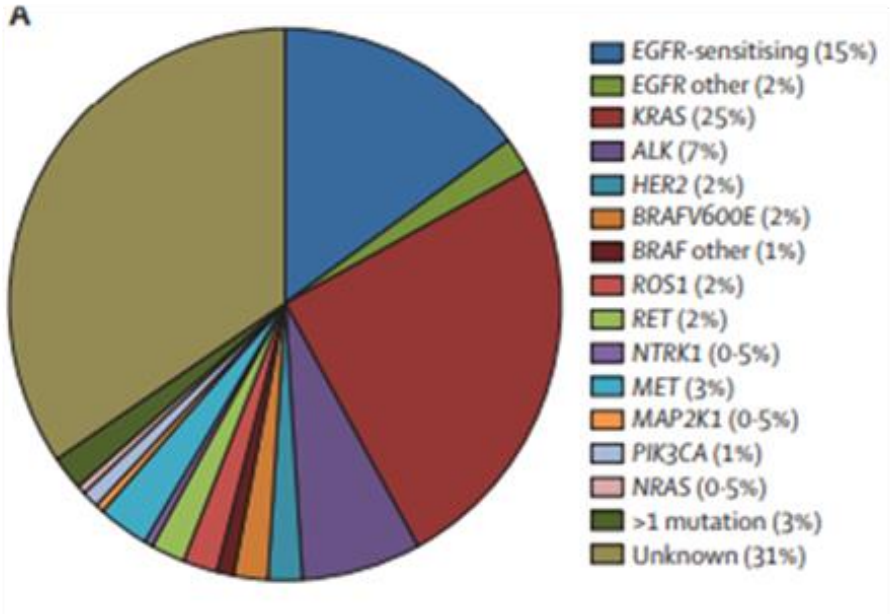
Comparative analyses of NSCLC for diagnostic, prognostic, and therapeutic procedures



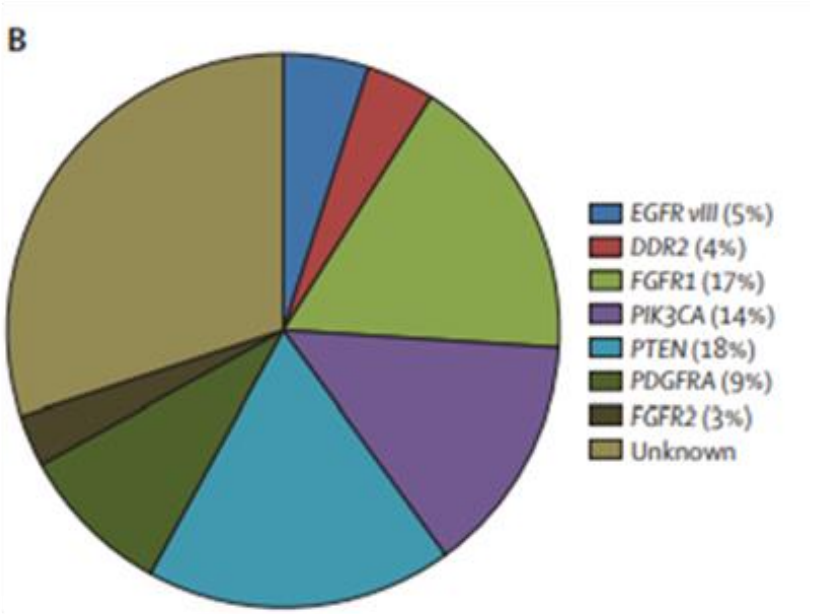
The Frequency Of Driver and Candidate Mutations in NSCLC Patients

Evolution of NSCLC Subtyping From Histologic to Molecular-Based

Frequency of driver mutations in lung ADC



Frequency of driver mutation candidates in lung SCC



Non-small cell lung carcinomas (advanced stage)

Squamous cell carcinomas

Never- or light- smokers
or
< 50 years-old

Non-squamous cell carcinomas
(AC, tumors with an AC component
or tumors where an AC cannot be reasonably excluded)

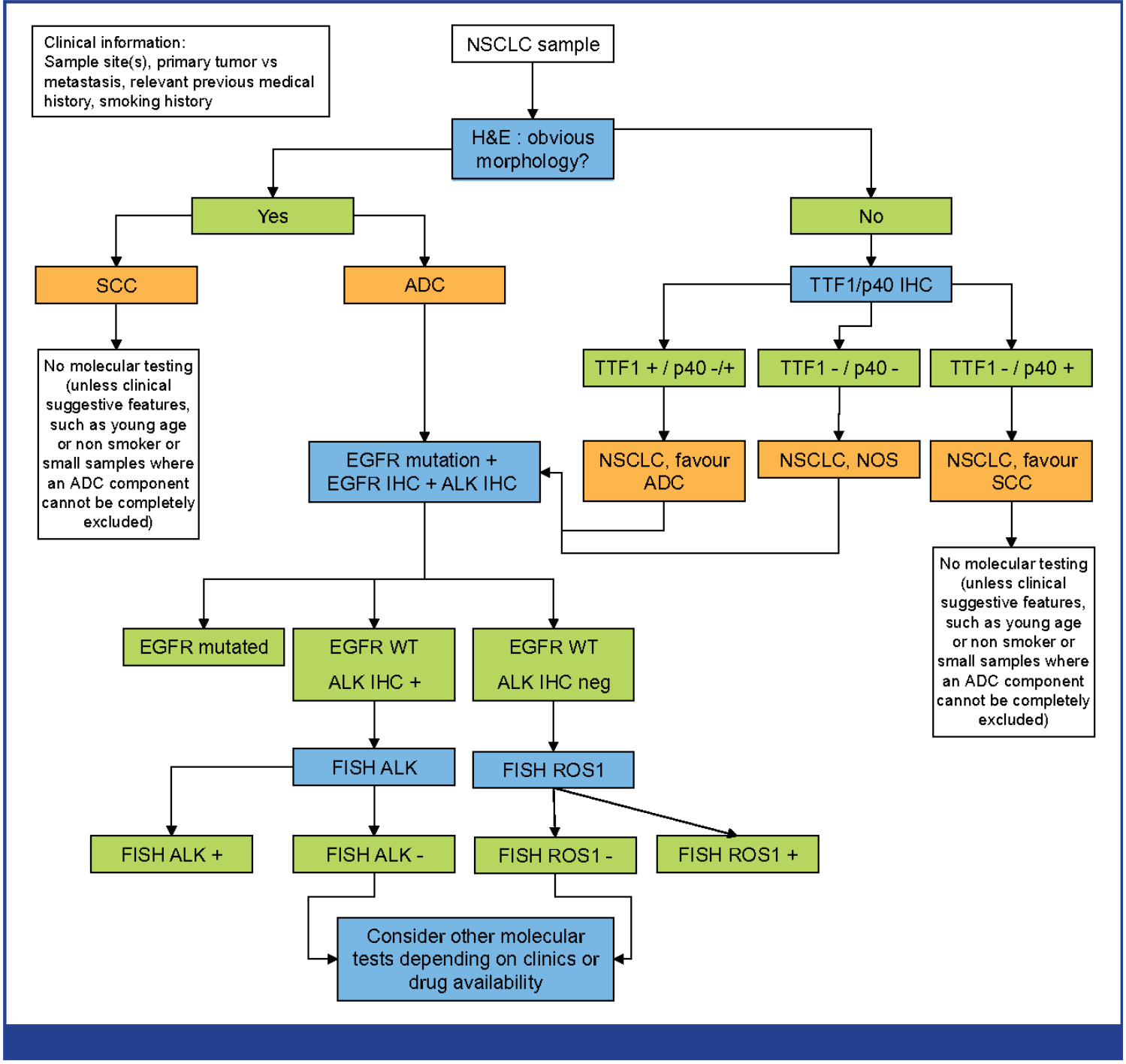
PD-L1
expression

EGFR
mutation

ALK
rearrangement

ROS1
rearrangement

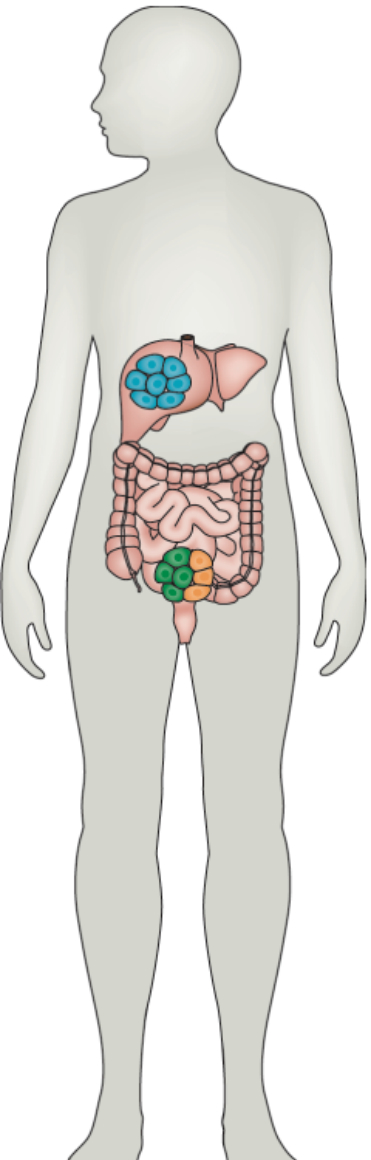
BRAF V600E
mutation


Clinical information:
Sample site(s), primary tumor vs metastasis, relevant previous medical history, smoking history
NSCLC sample
H&E : obvious morphology?
Yes
No
SCC
ADC
TTF1/p40 IHC
No molecular testing (unless clinical suggestive features, such as young age or non smoker or small samples where an ADC component cannot be completely excluded)
TTF1 + / p40 -/+
TTF1 - / p40 -
TTF1 - / p40 +
EGFR mutation + EGFR IHC + ALK IHC
NSCLC, favour ADC
NSCLC, NOS
NSCLC, favour SCC
No molecular testing (unless clinical suggestive features, such as young age or non smoker or small samples where an ADC component cannot be completely excluded)
EGFR mutated
EGFR WT ALK IHC +
EGFR WT ALK IHC neg
FISH ALK
FISH ROS1
FISH ALK +
FISH ALK -
FISH ROS1 -
FISH ROS1 +
Consider other molecular tests depending on clinics or drug availability

Targeted Therapy for Lung Cancer

Medication	Indication	Dose	Excretion	Metabolism
Afatinib	• First-line treatment of patients with metastatic NSCLC with *EGFR* exon 19 deletions or exon 21 (L858R) substitutions • Patients with metastatic squamous NSCLC who have progressed after platinum-based chemotherapy	40 mg once daily	Feces (85%); urine (4%)	Minimal enzymatic metabolism
Brigatinib	• Patients with *ALK*+ metastatic NSCLC who have progressed or are intolerant to crizotinib	90 mg once daily	Feces (65%); urine (25%)	Hepatic (CYP2C8, CYP3A4)
Erlotinib	• Patients with *EGFR*+ metastatic NSCLC with exon 19 deletions or exon 21 (L858R) substitutions receiving first-line, maintenance, or second- or greater-line therapy after progression following at least one prior regimen	150 mg once daily	Feces (83%); urine (8%)	Hepatic
Gefitinib	• Patients with first-line metastatic NSCLC who have *EGFR* exon 19 deletions or exon 21 (L858R) substitutions	250 mg once daily	Feces (86%); urine (< 4%)	Hepatic
Osimertinib	• Patients with metastatic NSCLC who have *EGFR* T790M mutations and have progressed on or after EGFR TKI therapy	80 mg once daily	Feces (68%); urine (14%)	Hepatic
Crizotinib	• Patients with metastatic *ALK*+ or *ROS1*+ NSCLC	250 mg twice daily	Feces (63%); urine (22%)	Hepatic (CYP3A4/5)
Ceritinib	• Patients with *ALK*+ metastatic NSCLC who have progressed or are intolerant to crizotinib	750 mg once daily	Feces (92%); urine (1%)	Hepatic

Biomarker-guided therapy for colorectal cancer



RAS_{WT}

Alterations in *BRAF*, *ERBB2*, *MET*, *PIK3CA*, *MAP2K1*

Improved initial response rates to anti-EGFR antibodies

Targeted combination therapies with or without anti-EGFR antibodies

MSI-H

$BRAF^{V600E}$

$ERBB2^{amp}$

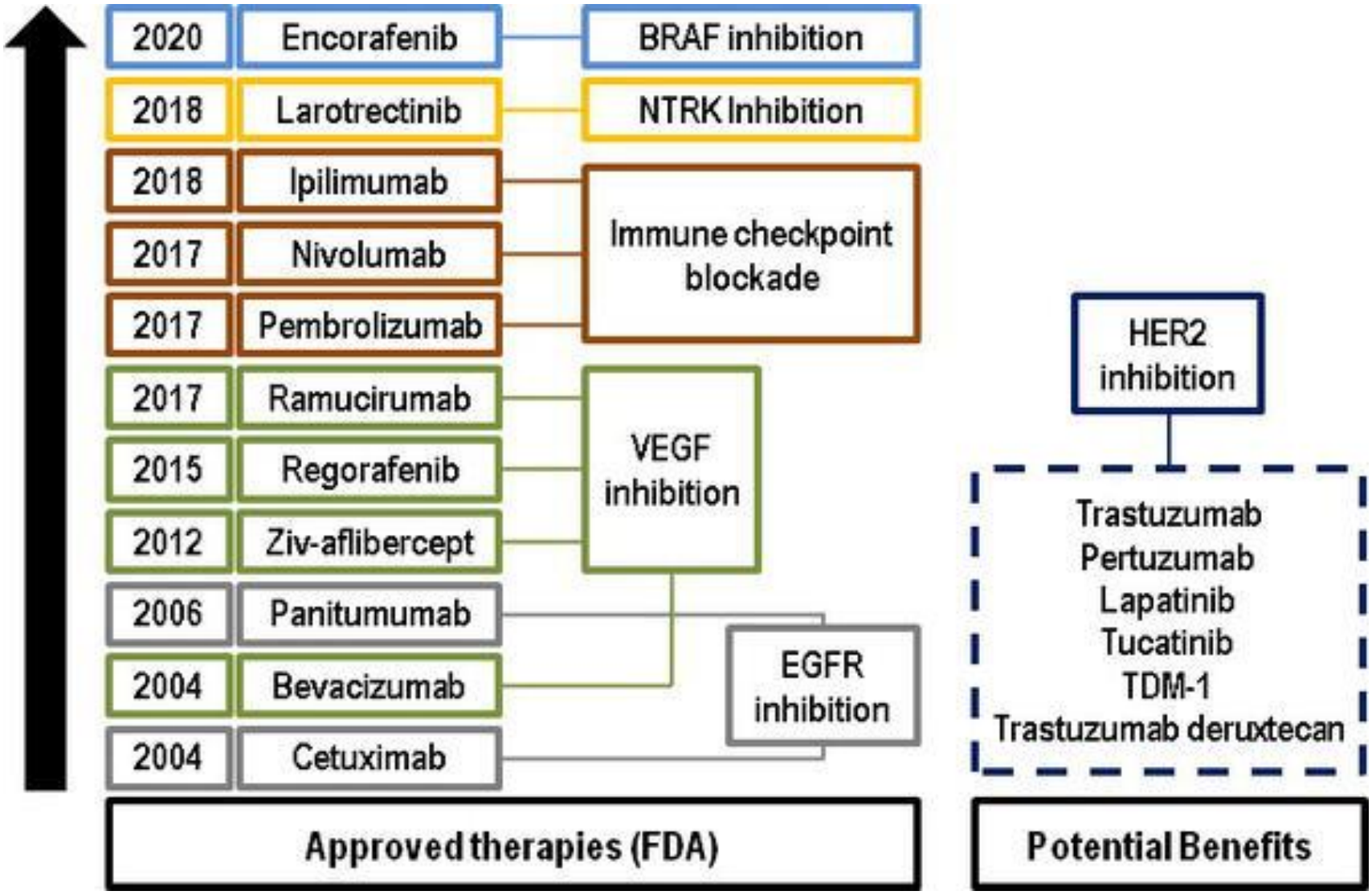
Fusion positive

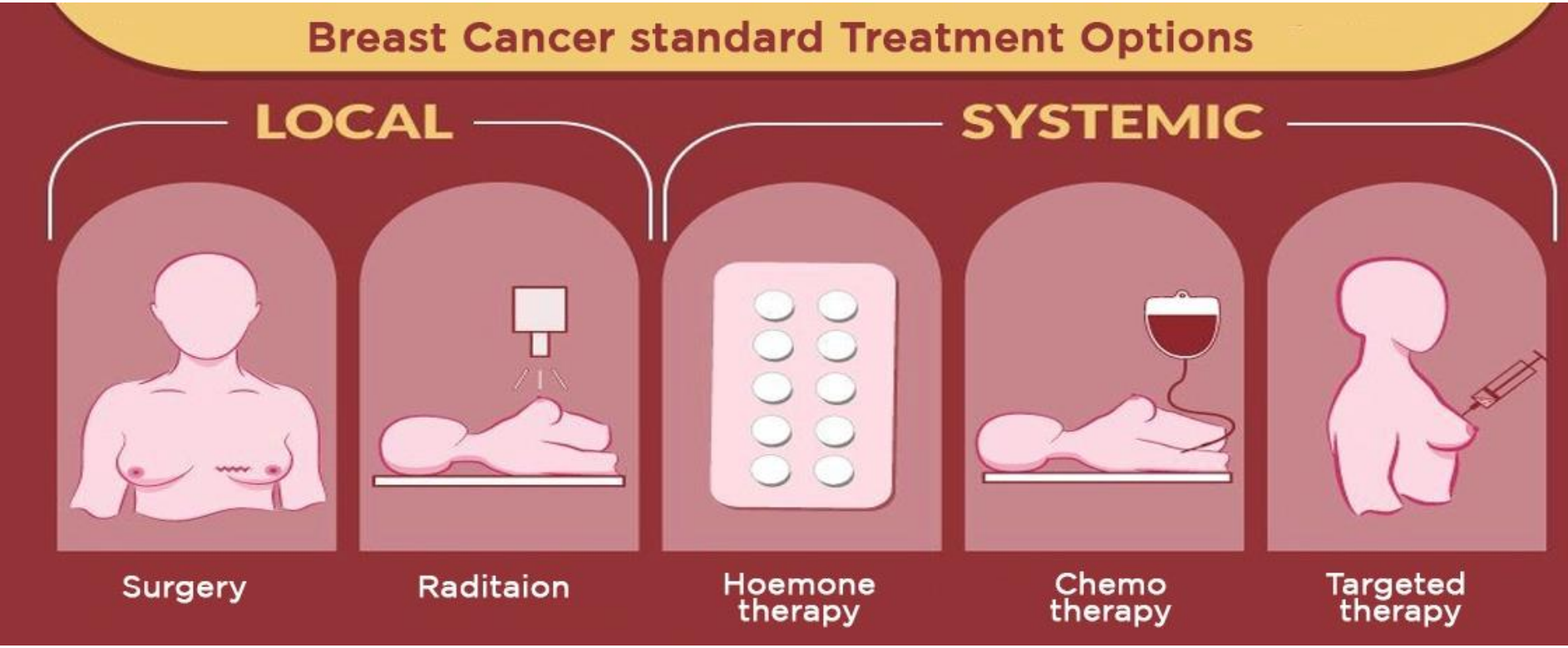
Targeted therapies available to additional patients

Co-occurrence of >1 targetable alteration

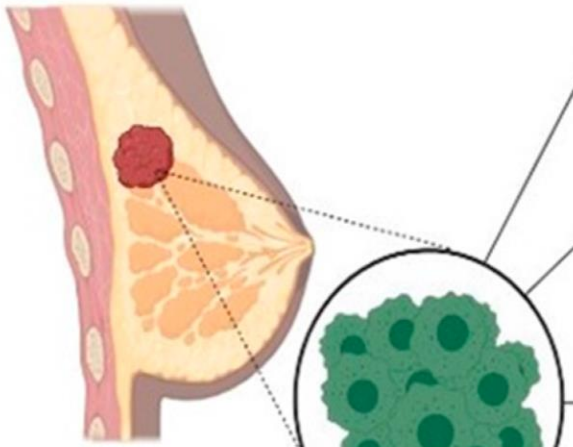
Novel options for second-line therapy

Landscape of Current Targeted Therapies for Advanced Colorectal Cancer




Breast Cancer standard Treatment Options
LOCAL
SYSTEMIC
Surgery
Raditaion
Hoemone therapy
Chemo therapy
Targeted therapy

Five Main Intrinsic or Molecular Subtypes of Breast Cancer



Receptors
HR: Hormone
ER: Estrogen
PR: Progesterone
HER2

Luminal A (~40%)
HR+ (ER+ and/or PR+), HER2-

- Most prevalent subtype
- Low levels of Ki-67 : control cancer cell growth
- Targeted therapy: Tamoxifen

Normal-like (~2-8%)
HR+ (ER+ and/or PR+), HER2-

- Low levels of Ki-67 : control cancer cell growth
- Slightly worse prognosis than Luminal A
- Targeted therapy: Tamoxifen

Luminal B (~20%)
HR+ (ER+ and/or PR+), HER2+/-

- High levels of Ki-67 : fast cancer cell growth
- Targeted therapy: Tamoxifen

HER2-enriched (~10-15%)
HR- (ER-, PR-), HER2+

- Amplification/overexpression of receptor HER2
- Faster growth than luminal subtypes
- Targeted therapy: Herceptin

Triple Negative (~15-20%)
HR- (ER-, PR-), HER2-

- Most aggressive subtype
- Occurs more often in younger women
- Highest association to BRCA1 mutations

Best Prognosis

Worst prognosis

Targeted Therapy in Breast Cancer

TABLE 1: Newer Targeted Therapies for Breast Cancer

Class	Agent(s)	Therapeutic Space
CDK inhibitor	Abemaciclib, palbociclib, ribociclib	Advanced HR-positive, HER2-negative breast cancer
PI3K inhibitor	Alpelisib	Advanced *PIK3CA*-mutated, HR-positive, HER2-negative breast cancer
PARP inhibitor	Olaparib, talazoparib	Advanced HER2-negative breast cancer with germline *BRCA* mutation
Tyrosine kinase inhibitor	Tucatinib	Advanced HER2-positive breast cancer
Immune checkpoint inhibitor	Atezolizumab	Advanced triple-negative breast cancer in combination with nab-paclitaxel for tumors that express PD-L1
Antibody-drug conjugate	Ado-trastuzumab emtansine	(1) Advanced HER2-positive breast cancer (2) HER2-positive early breast cancer for adjuvant treatment of residual invasive disease after neoadjuvant treatment
	Fam-trastuzumab deruxtecan-nxki	Advanced HER2-positive breast cancer
	Sacituzumab govitecan-hziy	Advanced triple-negative breast cancer

CDK = cyclin-dependent kinase; HR = hormone receptor; PARP = poly (ADP-ribose) polymerase; PD-L1 = programmed cell death ligand 1.

FIGURE 4. BREAST CANCER TREATMENT BY STAGE - OVERVIEW[1,2,6]

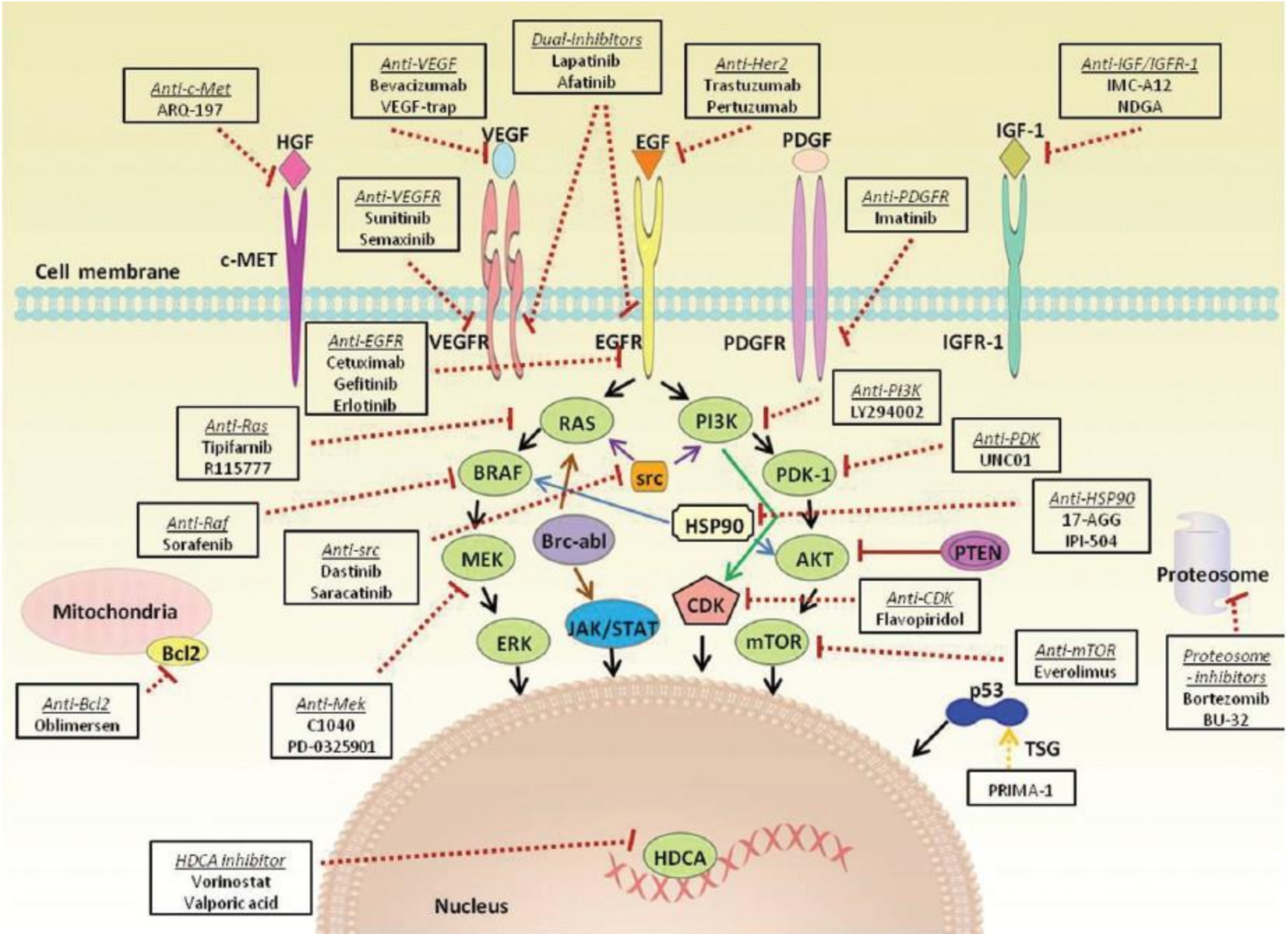
Stage 0 Noninvasive	Step 1: **Surgery** (BCS or mastectomy) +/- **SLNB** Step 2: If BCS was performed, **radiation** therapy will usually follow Step 3: Tamoxifen (any woman) or aromatase inhibitor (postmenopausal women) if HR+
Stage I & II	Step 1: **Surgery + SLNB** or **ALND** Step 2: **Radiation** therapy if BCS, tumors > 2 cm, or positive lymph nodes Step 3: **Adjuvant[a] chemotherapy** if lymph node involvement, if no lymph node involvement but risk for recurrence, or tumor > 1 cm + Hormone therapy if HR+ + Trastuzumab or pertuzumab x 12 months if HER2+
Stage III	Step 1: **Neoadjuvant[b] chemotherapy** + Trastuzumab +/- pertuzumab HER2+ Step 2: **Surgery + ALNB** Step 3: **Adjuvant radiation + chemotherapy** + Hormone therapy if HR+ + Trastuzumab or pertuzumab x 12 months if HER2+
Stage IV Metastatic	**Systemic treatment** combinations until cancer growth/intolerable adverse effects: Chemotherapy + Hormone therapy +/- CDK4/6 inhibitor, everolimus, PI3K inhibitor if HR+ + Trastuzumab +/- pertuzumab if HER2+ + Local treatment and immunotherapy in some cases **Palliative care:** improve symptoms, prolong life, and often shrink tumors

ALNB, axillary lymph node biopsy; ALND, axillary lymph node dissection; BCS, breast-conserving surgery; HR, hormone receptor; SLNB, sentinel lymph node biopsy.

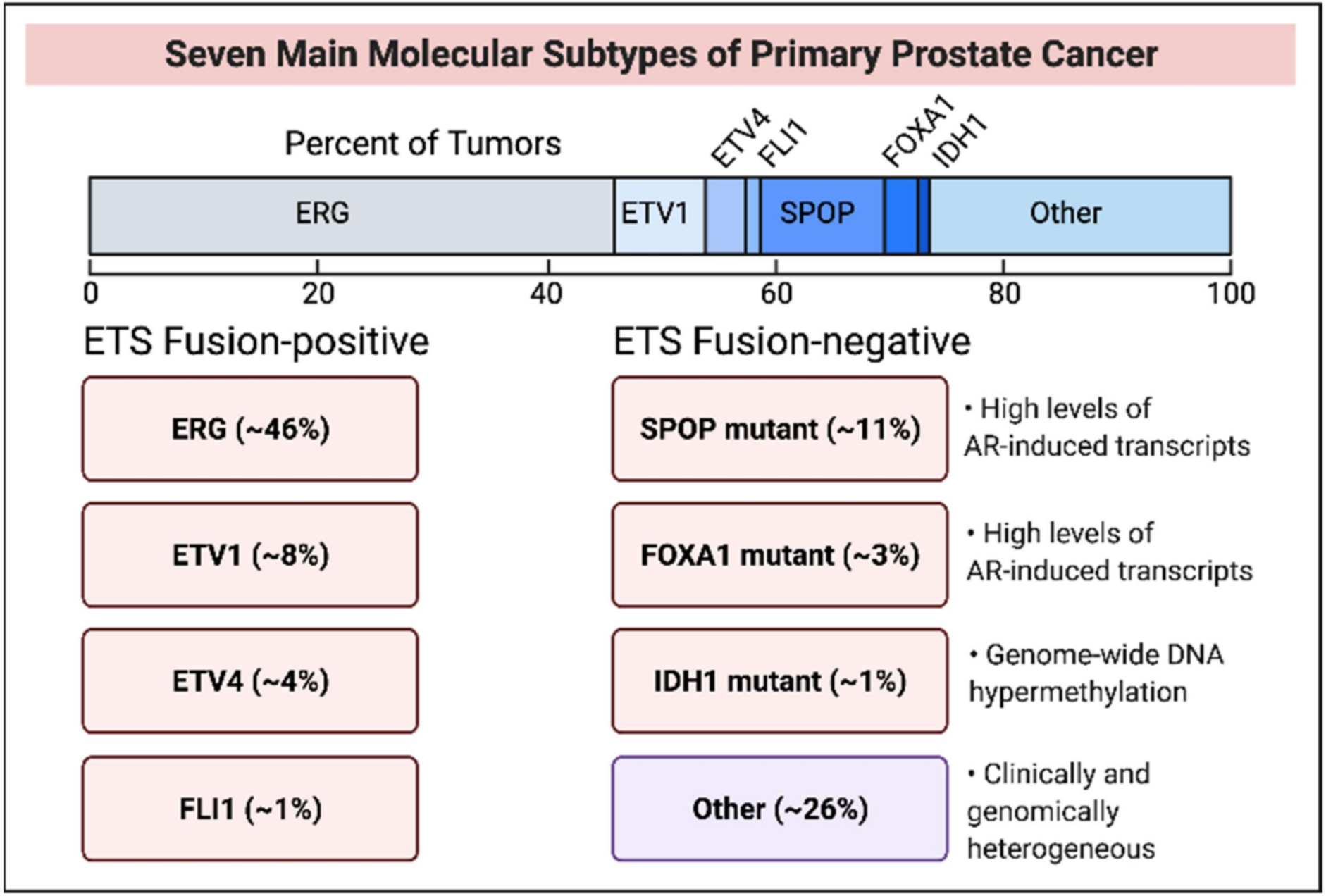
[a]Adjuvant refers to after surgery.

[b]Neoadjuvant refers to before surgery.

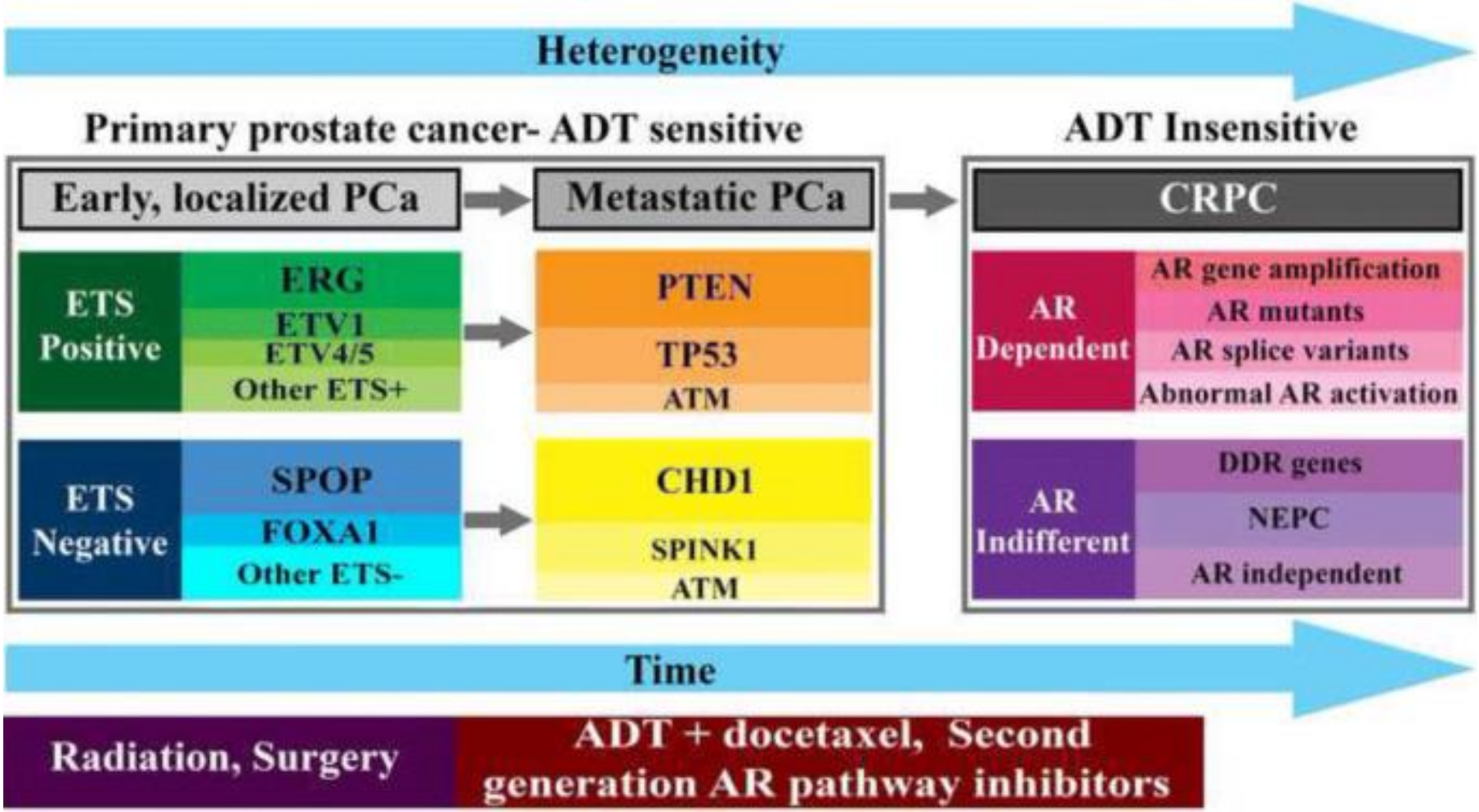
Promising molecular targeted therapies in breast cancer



Current Molecular Profile of Prostate Tumors



Current Molecular Profile of Prostate Tumors

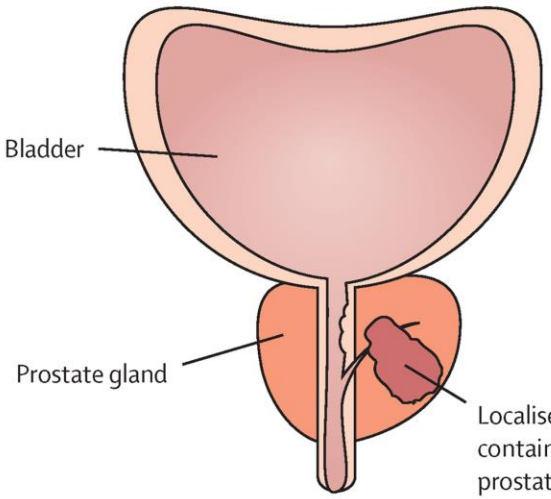


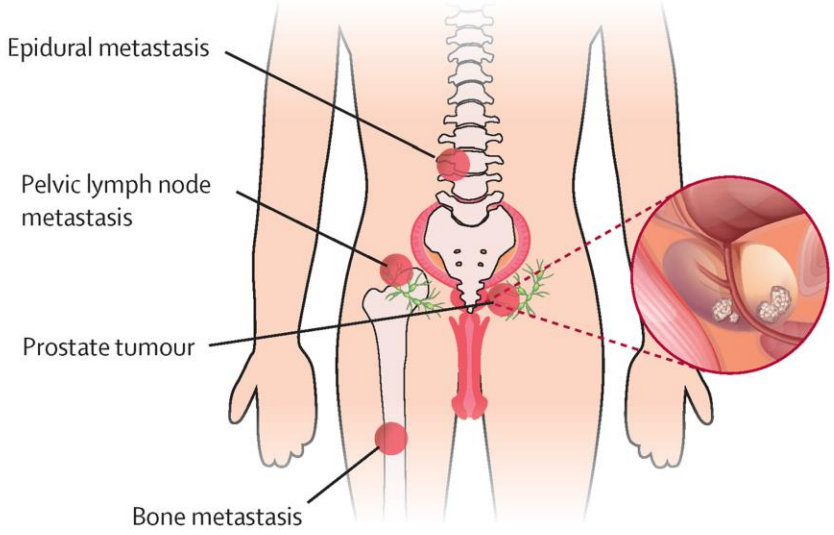
Genetic prognostic or predictive assays

RNA signatures
DECIPHER
Prolaris
OncotypeDx prostate
Markers of hypoxia

DNA repair
Mutations
Functional assays

ctDNA or CTCs
AR-V7
Epigenetic changes





Curable disease

Currently incurable disease

Castration-sensitive prostate cancer — mCSPC — Castration-resistant prostate cancer — mCRPC — CRPC-NE

Indolent low risk

Intermediate or high risk

Intermediate or high risk plus occult metastases

Micro metastatic

Macro metastatic

Somatic genetic changes

SPOP
Mutation

FOXA1*
Mutation

PTEN
Mutation
10q deletion

TP53
Mutation
17p deletion

AR
Amplification
Mutation
Overexpression
Increased signalling

RB1
Mutation
13p deletions

Gene fusions
(eg, *TMPRSS2-ERG*)

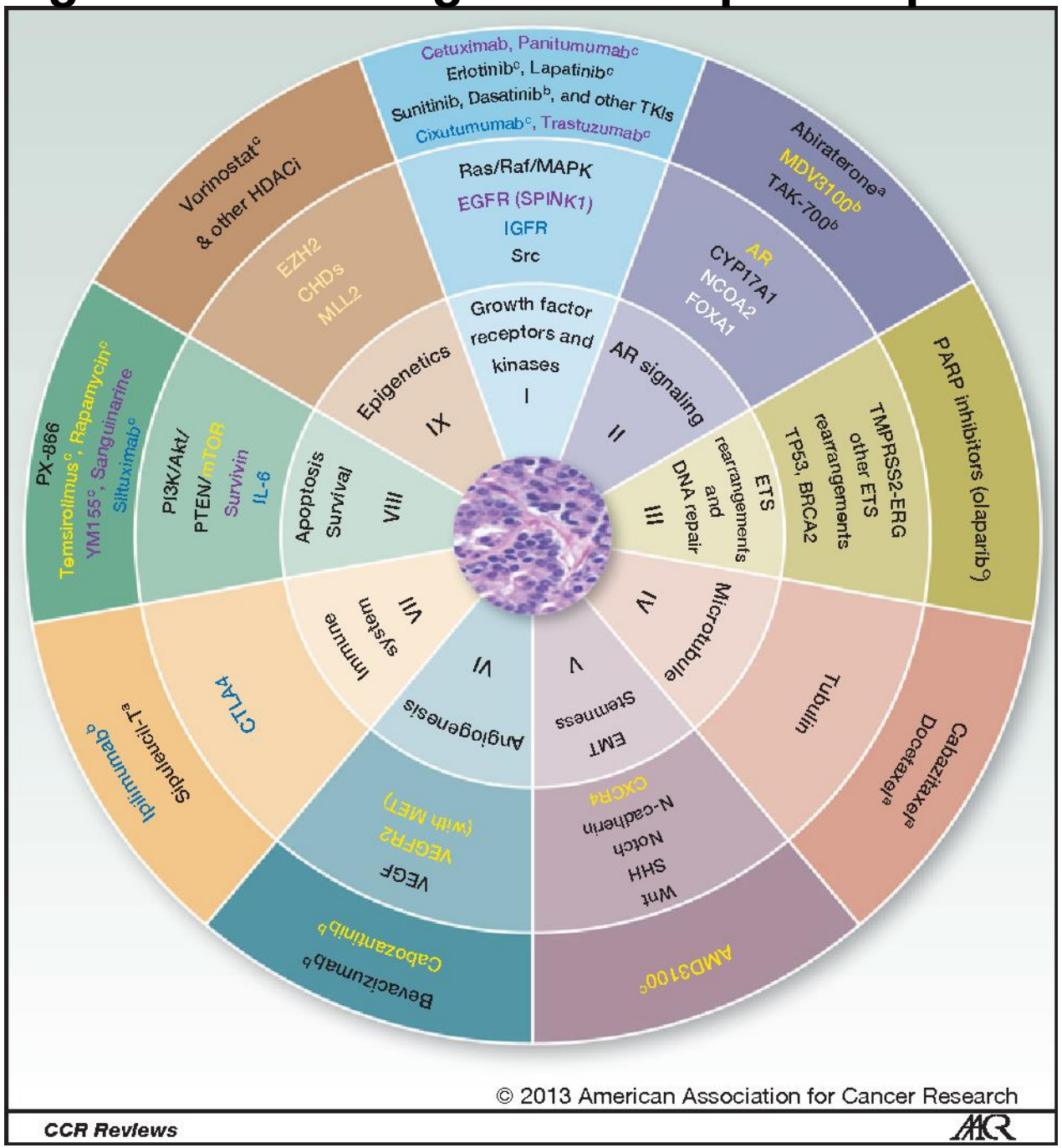
MYC
Overexpression
8q gain or amplification

BRCA2
Mutation
13q deletion

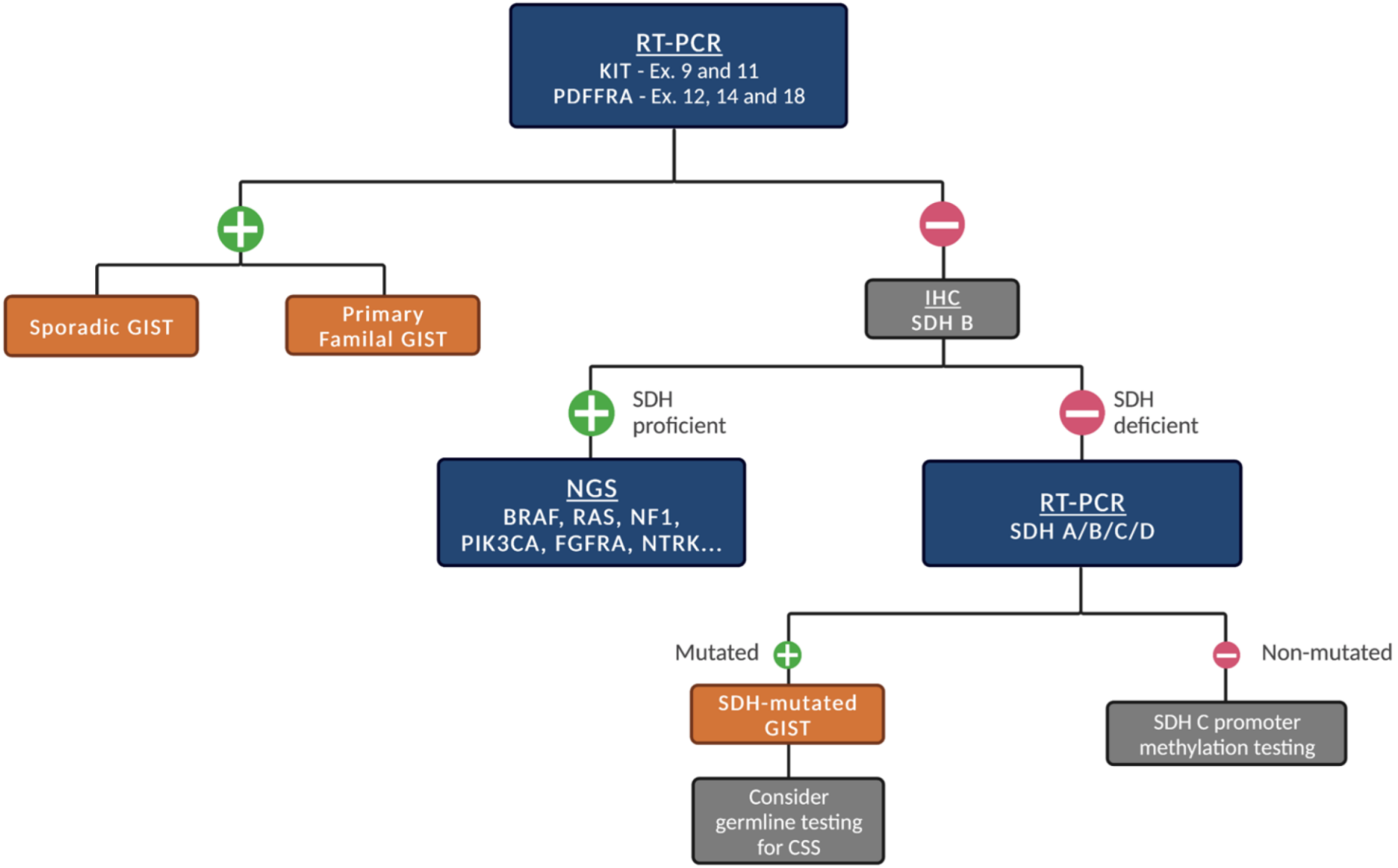
Prostate cancer treatment

Stage	Management or treatment options
Localised	Active surveillance, surgery or radiation therapy are usually offered. Watchful waiting may be an option.
Locally advanced	Active surveillance is not recommended and you will be offered surgery and/or radiation therapy. Androgen deprivation therapy (ADT) may also be suggested.
Advanced/ metastatic (at diagnosis)	Usually offered androgen deprivation therapy (ADT), sometimes chemotherapy or radiation therapy. Watchful waiting may be an option. Newer treatments may be available as part of a clinical trial.

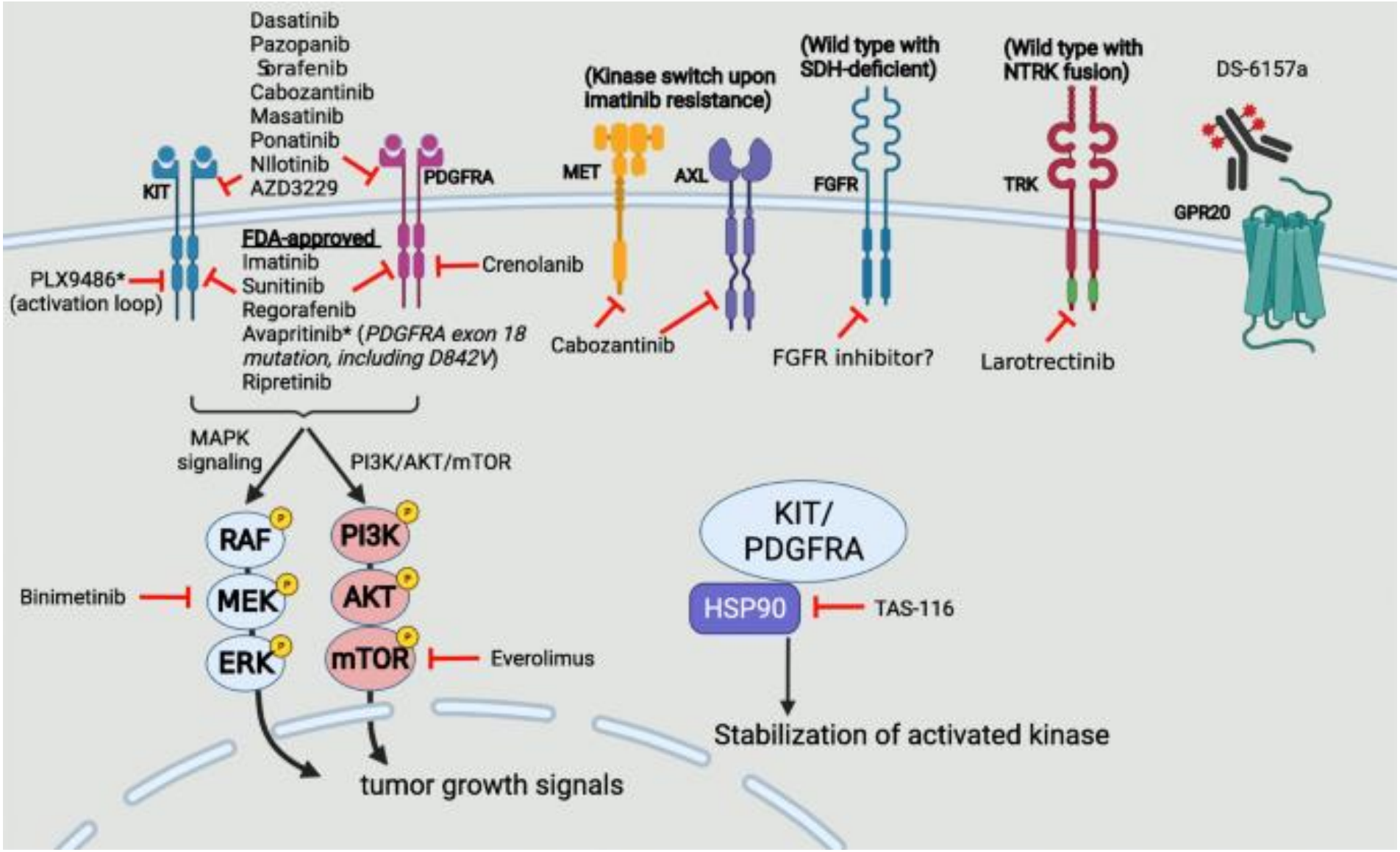
Promising molecular targeted therapies in prostate cancer



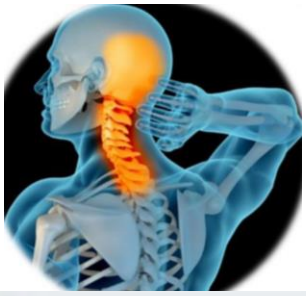
Current Molecular Profile of Gastrointestinal Stromal Tumors

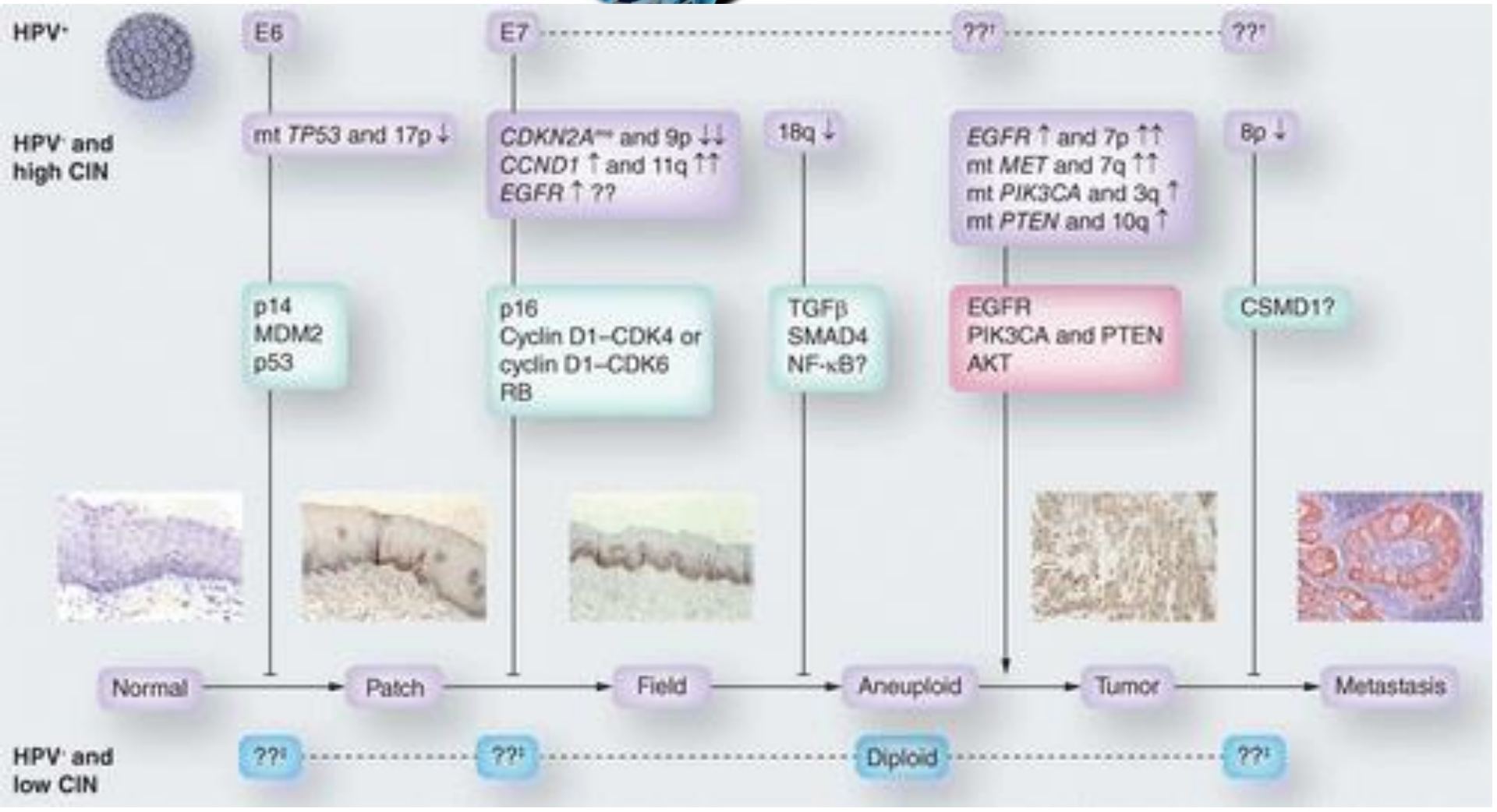


Systemic Therapy for Gastrointestinal Stromal Tumor

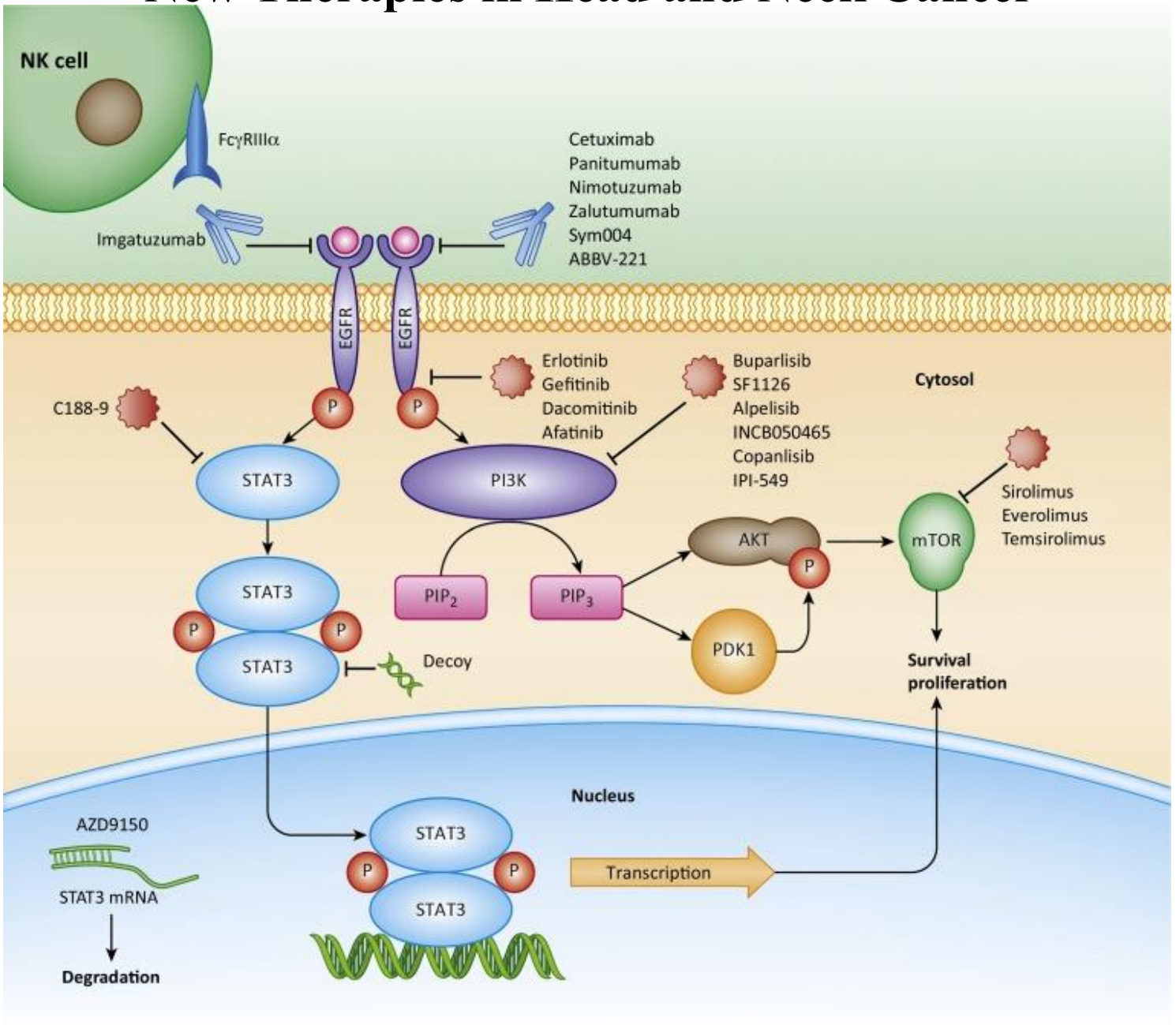


Molecular diagnostics of head and neck cancer

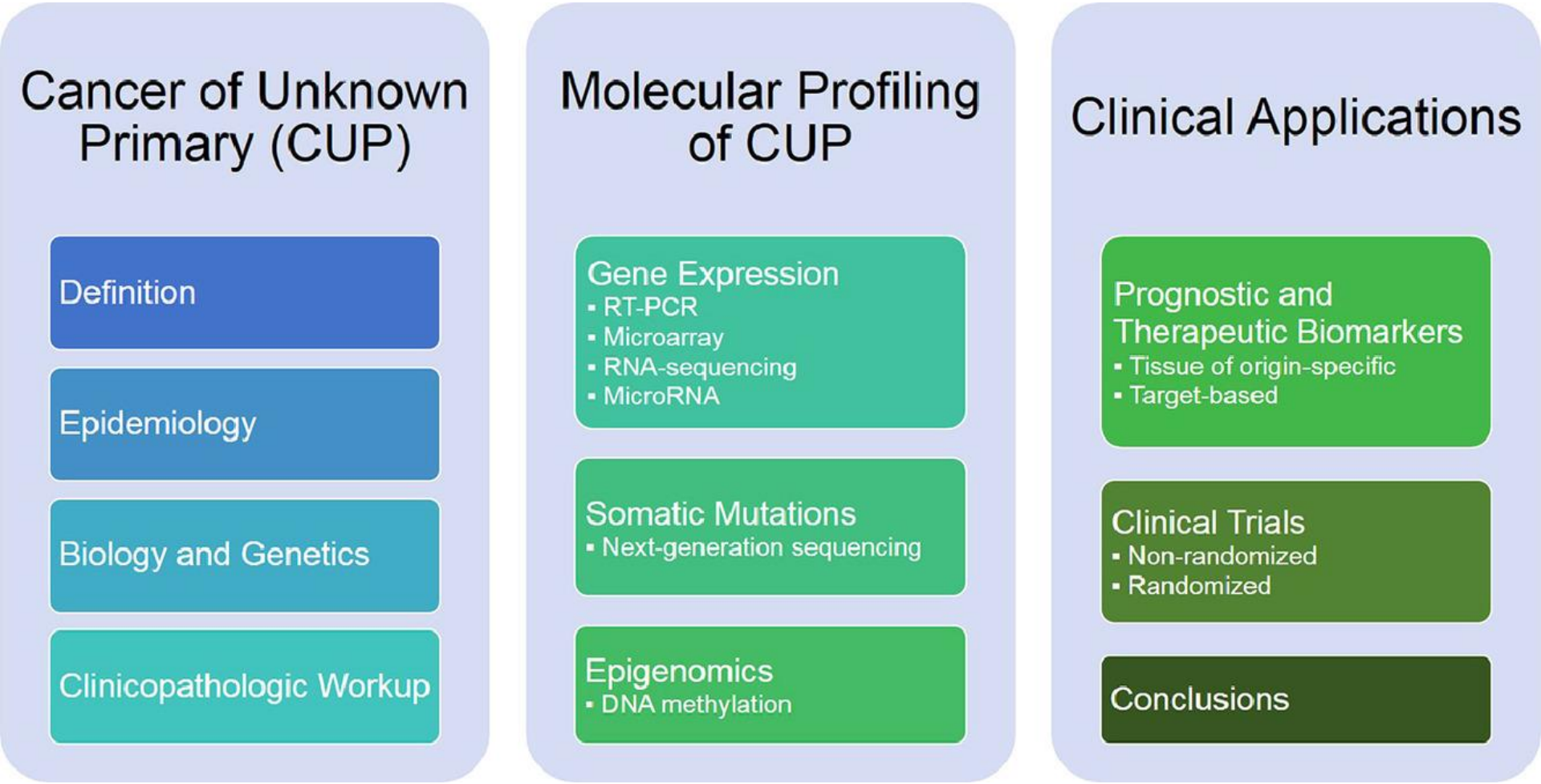




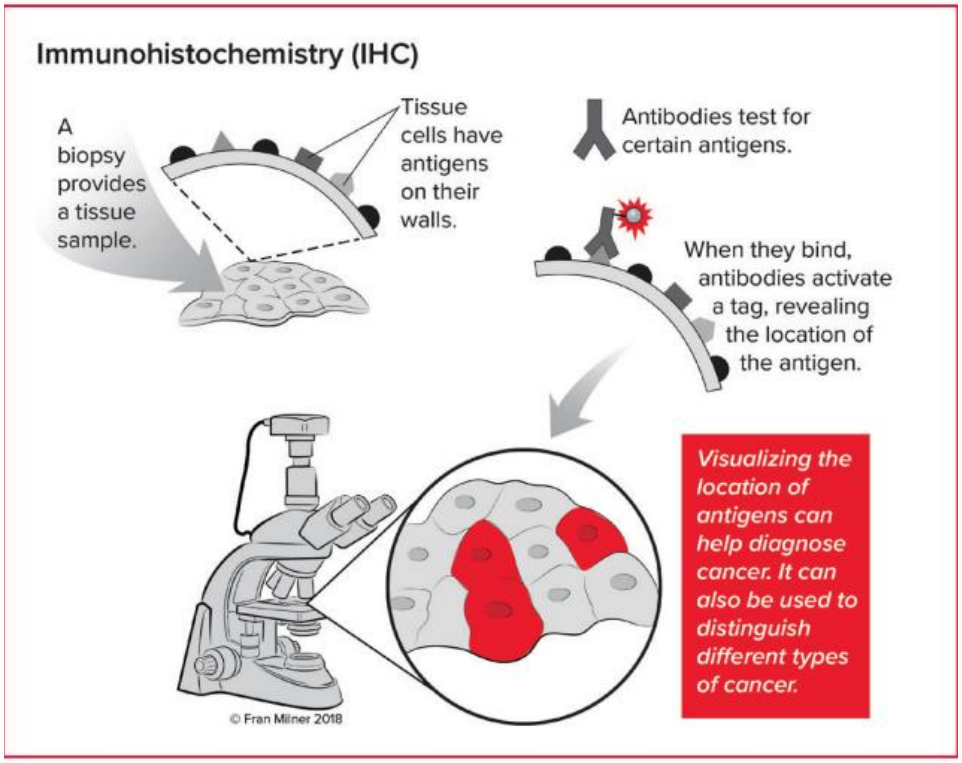
New Therapies in Head and Neck Cancer

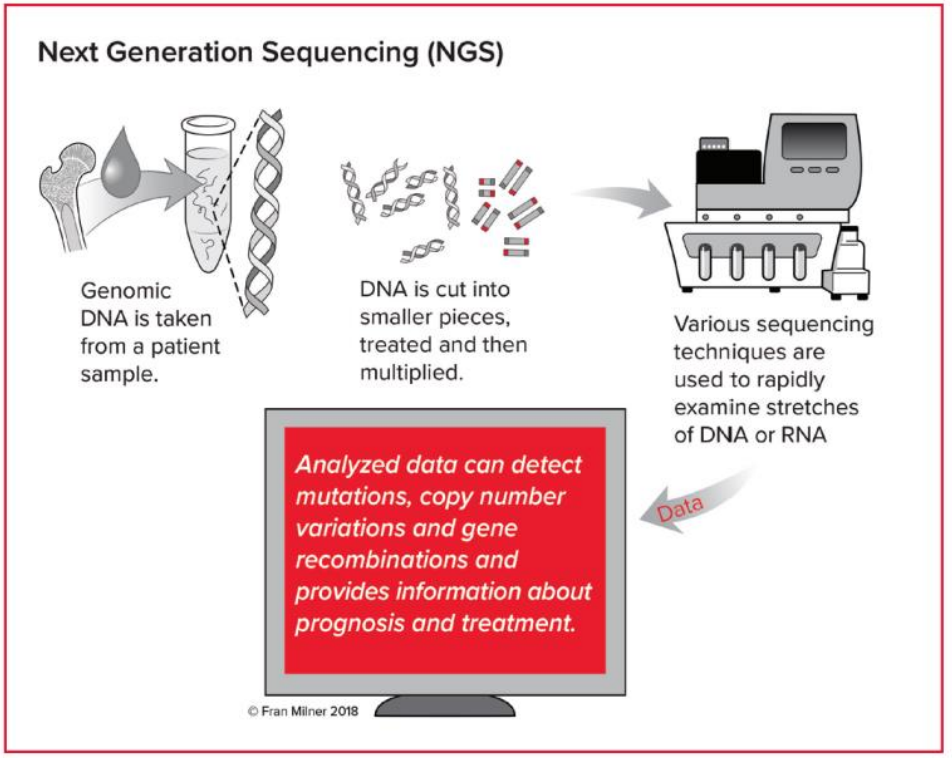


How Molecular Profiling Works



How Molecular Profiling Works

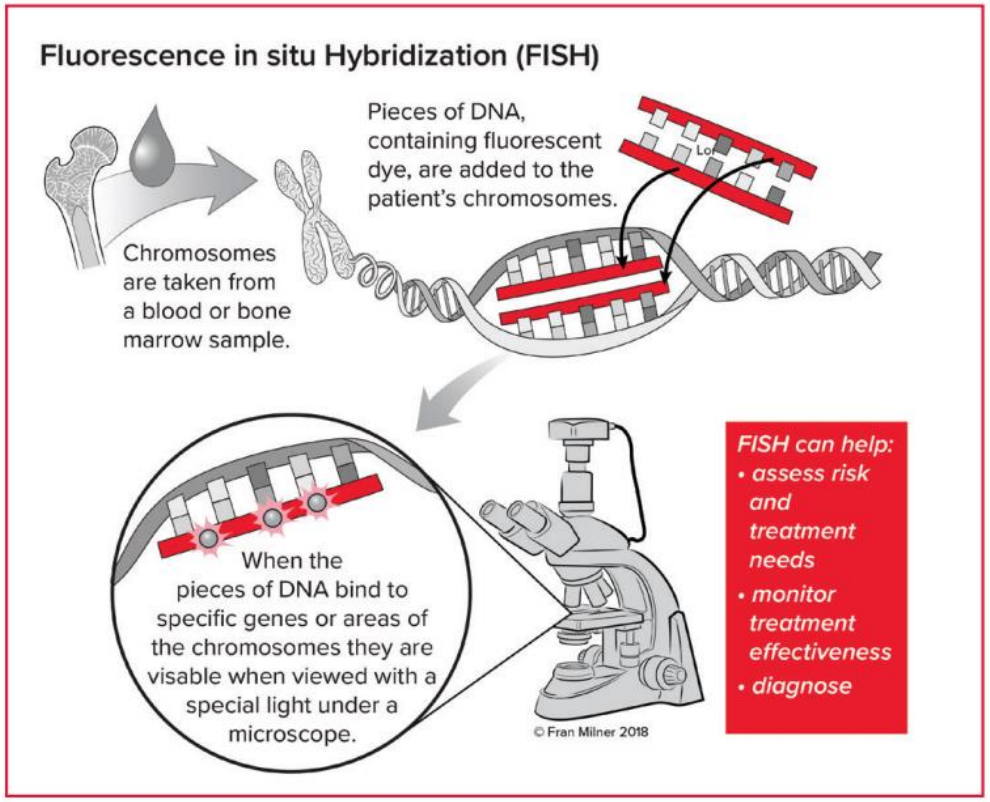


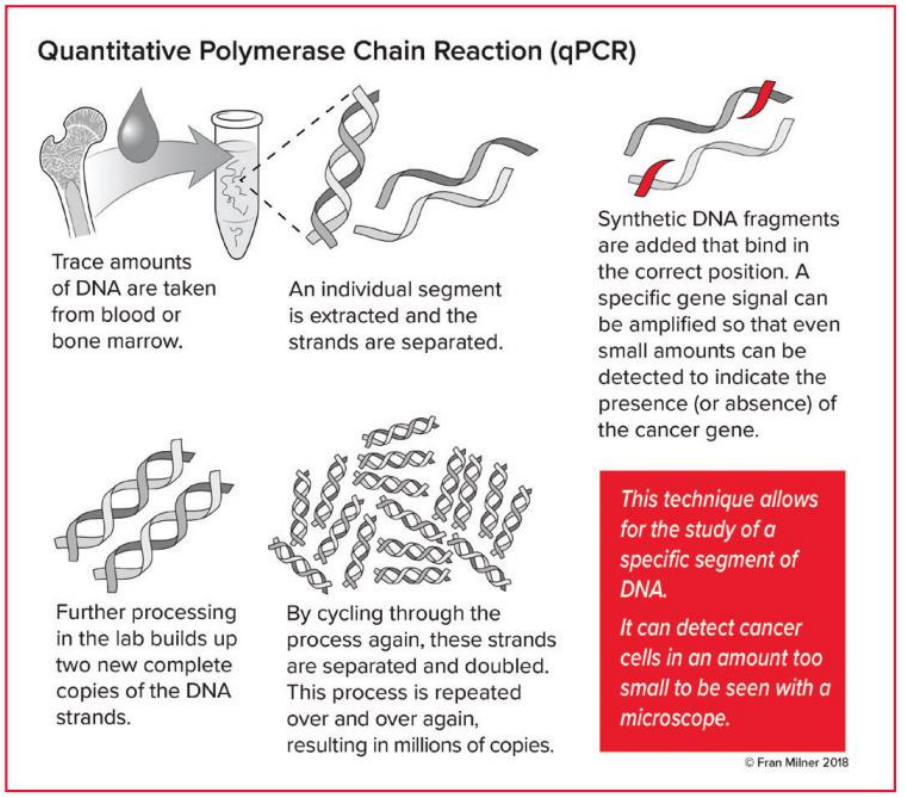


This lab test uses antibodies to detect certain antigens (markers) in a tissue sample acquired from a biopsy. Immunohistochemistry provides information that helps doctors to diagnose diseases such as cancer

DNA mutations, copy number variations and gene fusions across the genome and provide information about prognosis and treatment.

How Molecular Profiling Works

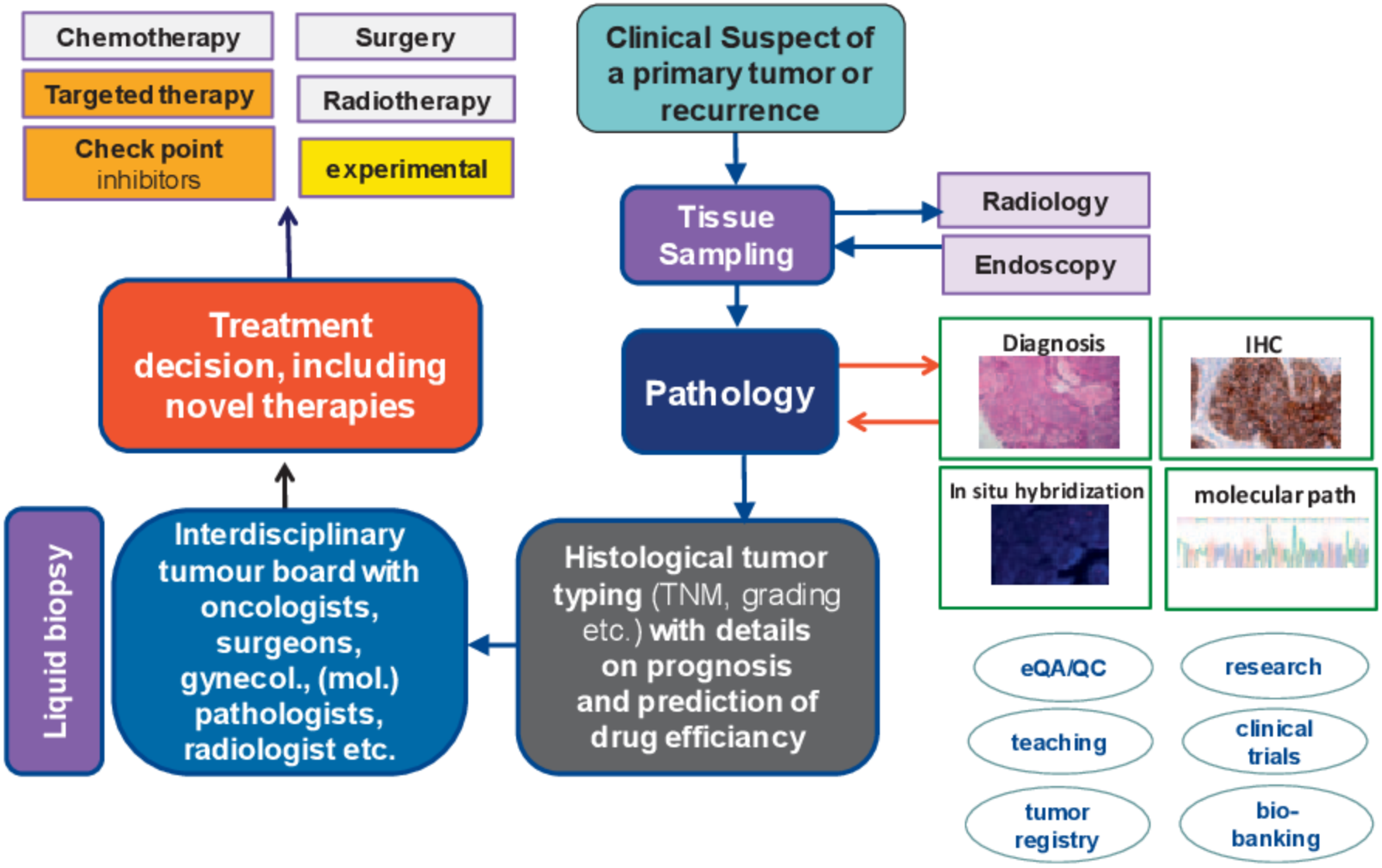




This laboratory technique is used to evaluate genes and/or DNA sequences on chromosomes. FISH can be helpful in diagnosing, assessing risk and treatment needs, as well as for monitoring treatment effectiveness.

This is a technique that expands trace amounts of DNA so that a specific segment of DNA can be studied. This technique has become useful in detecting a very low concentration of blood cancer cells, too few to be seen using a microscope.

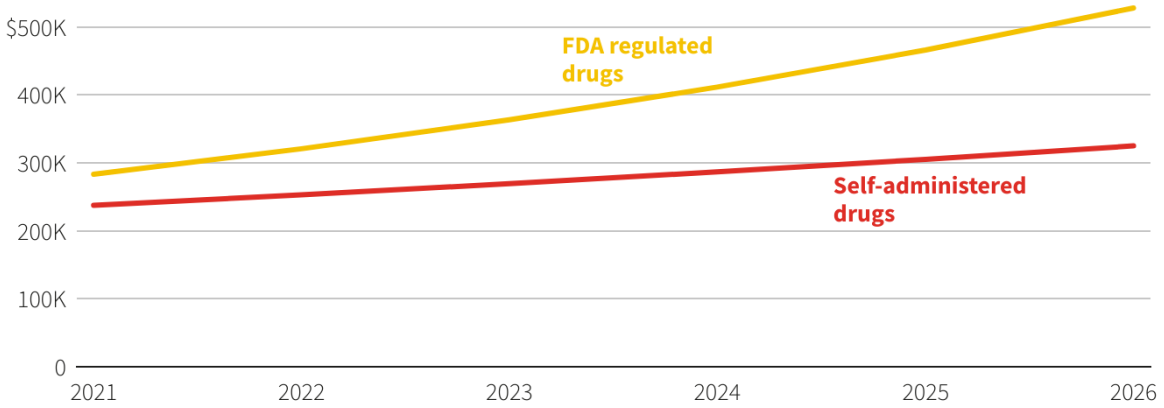
Multidisciplinary Cooperation Enables Precision Oncology



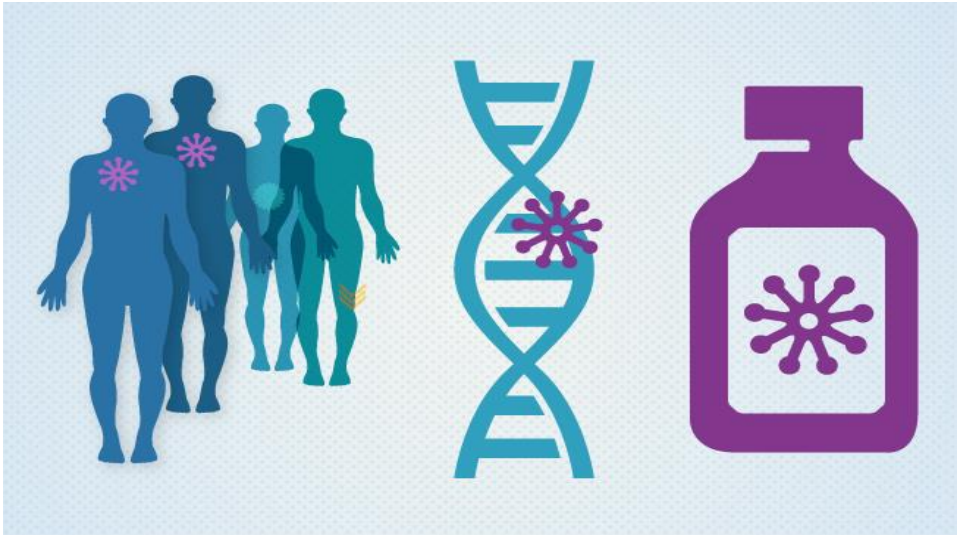
Targeted therapy's major benefit is that it can kill cancer cells without damaging healthy cells

U.S. cancer drugs set to get costlier

Despite the Inflation Reduction Act, launch prices of drugs treating various cancers are poised to rise in the coming years.



Note: 2021 is actual year-end data. FDA regulated drugs do not include CAR-T therapies.
Source: Office of U.S. Representative Katie Porter | Reuters, Nov. 2, 2022 | By Prinz Magtulis




THANK YOU
↓
TERIMA KASIH