

the colors of
courage.

fighting cancer

improving quality of life

INMUNOLOGÍA DEL CÁNCER

ANTÍGENOS TUMORALES

Guillermo Terán
IDIC-ULA

the types of cancer

online cancer resources:





















The American Cancer Society
www.cancer.org

National Cancer Institute
cancer.seer.gov

National Center for Health Statistics
www.cdc.gov/nchs

World Health Organization
www.who.int

The 10 Most Common Cancers (in order from highest to lowest occurrence)

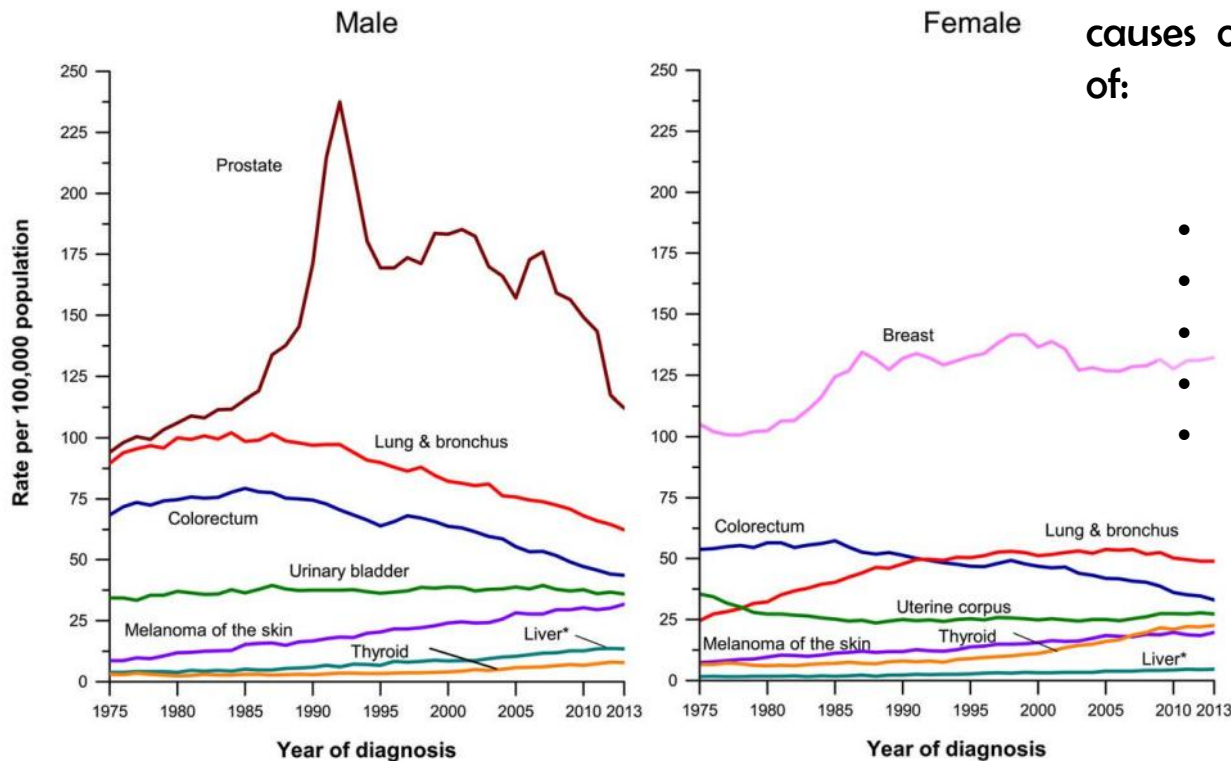
									
1	2	3	4	5	6	7	8	9	10
LUNG & BRONCHUS	COLON & RECTUM	BREAST	TESTIS	PANCREAS	HODGKIN'S DISEASE*	LEUKEMIA	LIVER	OVARY	BRAIN & NERVOUS SYSTEM
Symptoms Persistent cough, chest pain, difficulty breathing	Symptoms Bloody stool, abdominal pain, fatigue	Symptoms Lump in armpit, dark-colored discharge from nipple	Symptoms Lump in testicle, pain in lower abdomen	Symptoms Weight loss, abdominal pain, vomiting, loss of appetite	Symptoms Swollen glands in neck, armpit, or groin; fatigue, weight loss	General Symptoms Fever, swollen glands, symptoms of anemia	Symptoms Fatigue, pain in upper abdomen, jaundice	Symptoms Abdominal swelling	Symptoms Severe headaches
Diagnosis Physical exam, chest x-ray, needle biopsy	Diagnosis Digital rectal exam, fecal occult-blood test, lower GI series	Diagnosis Mammogram, physical exam, biopsy	Diagnosis Physical exam, biopsy	Diagnosis X-ray, barium swallow, cholecystogram	Diagnosis Physical exam, x-ray, lymphangiogram, biopsy	Diagnosis Physical exam, blood test, bone marrow biopsy	Diagnosis Physical exam, blood test	Diagnosis Physical exam, laparoscopy	Diagnosis Physical exam, CT Scan, blood test
Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Prolonged hospitalization, blood transfusions, chemotherapy	Treatment Surgery, transplant, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy
Risk Factors Smoking, exposure to air-borne industrial pollutants	Risk Factors High-fat diet, obesity	Risk Factors Heredity, late menopause	Risk Factors Heredity	Risk Factors Smoking, diabetes	Risk Factors Heredity <i>*caused by malignant macrophage</i>	Risk Factors Heredity	Risk Factors Alcoholism, hepatitis B or C, vinyl chloride exposure	Risk Factors Heredity	Risk Factors Heredity
									
MULTIPLE MYELOMA	CERVIX & UTERUS	THYROID	PROSTATE	KIDNEY & URINARY BLADDER	MELANOMA OF THE SKIN	NON-HODGKINS LYMPHOMA*	SMALL INTESTINE	ORAL CAVITY PHARYNX & LARYNX	ESOPHAGUS & STOMACH
Symptoms Infection, pain in bones, kidney failure	Symptoms Heavy periods, painful discharge (watery to thick)	Symptoms Swelling in front of neck	Symptoms Weak urinary stream, bloody urine	Symptoms Fever, loss of appetite, weight loss, red or cloudy urine	Symptoms A mole that spreads, changes color, bleeds, or begins to itch	Symptoms Swollen glands in neck, armpit, or groin; fatigue, weight loss	Symptoms Weight loss, fatigue, bloody stool	Symptoms Lump in mouth/throat, sore throat, difficulty swallowing/speaking	Symptoms Difficulty swallowing, rapid weight loss, persistent heartburn
Diagnosis Physical exam, blood test, x-ray	Diagnosis Physical exam, Pap smear, biopsy	Diagnosis Physical exam, biopsy	Diagnosis Physical exam, rectal exam, biopsy	Diagnosis Intravenous pyelogram, ultrasound, angiogram	Diagnosis Physical exam, biopsy	Diagnosis Blood test, x-ray, biopsy, lymphangiogram	Diagnosis Physical exam, barium swallow, x-ray, biopsy	Diagnosis Physical exam, CT Scan, biopsy	Diagnosis Physical exam, X-ray, endoscopy
Treatment Chemotherapy, radiation therapy	Treatment Hysterectomy (uterus), chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, hormone medication, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, chemotherapy, radiation therapy	Treatment Surgery, radiation therapy	Treatment Surgery, chemotherapy
Risk Factors Unknown	Risk Factors Not having given birth	Risk Factors Unknown	Risk Factors Men over 50	Risk Factors Old age	Risk Factors Light skin, excessive exposure to direct sunlight	Risk Factors Heredity <i>*caused by malignant lymphocytes</i>	Risk Factors Heredity, gastric disorders	Risk Factors Smoking/use of tobacco products, alcoholism	Risk Factors High-salt diet, gastric disorders

Design by Michael Babwahsingh | www.michaelbabwahsingh.com

Problema de salud pública

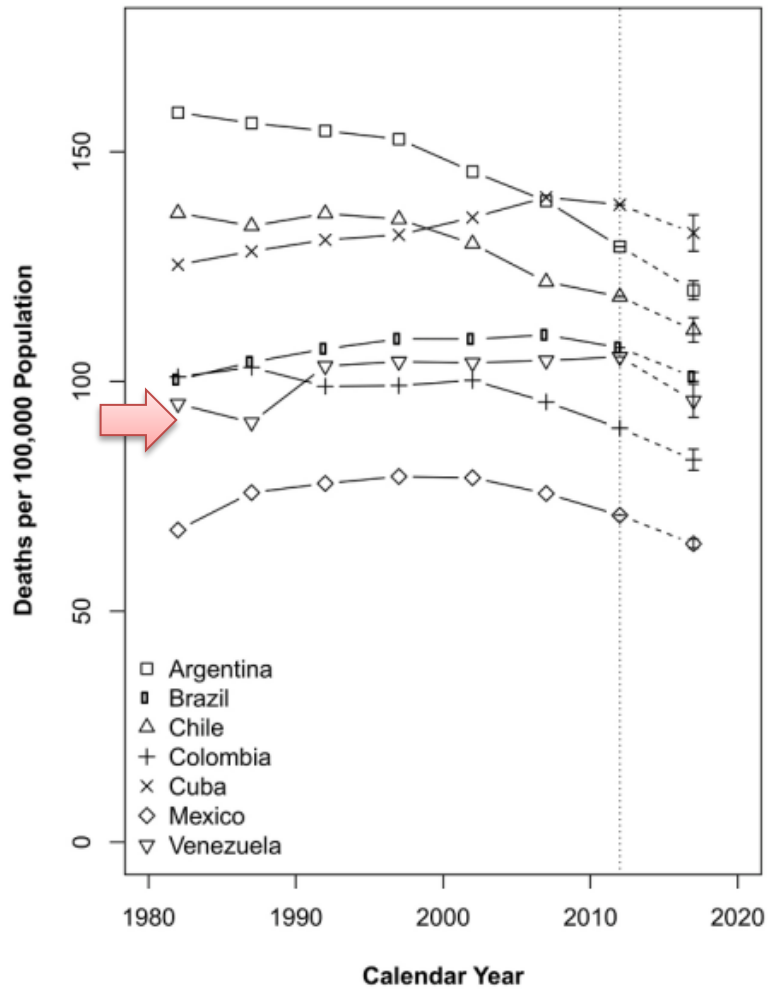
Cancer is a leading cause of death worldwide, accounting for 8.8 million deaths in 2015. The most common causes of cancer death are cancers of:

- Lung (1.69 million deaths)
- Liver (788 000 deaths)
- Colorectal (774 000 deaths)
- Stomach (754 000 deaths)
- Breast (571 000 deaths)

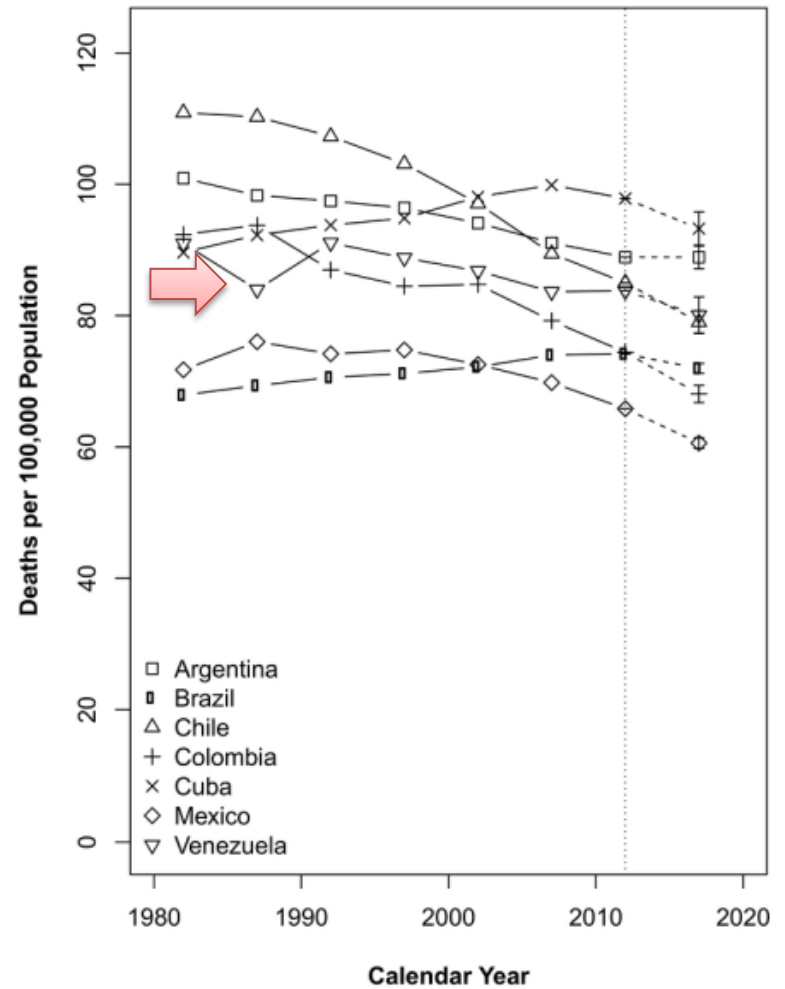


A nivel regional

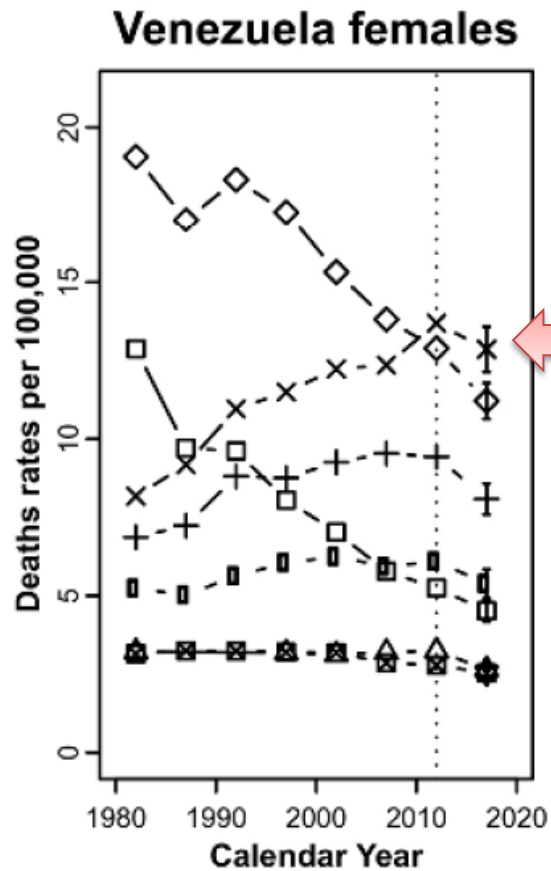
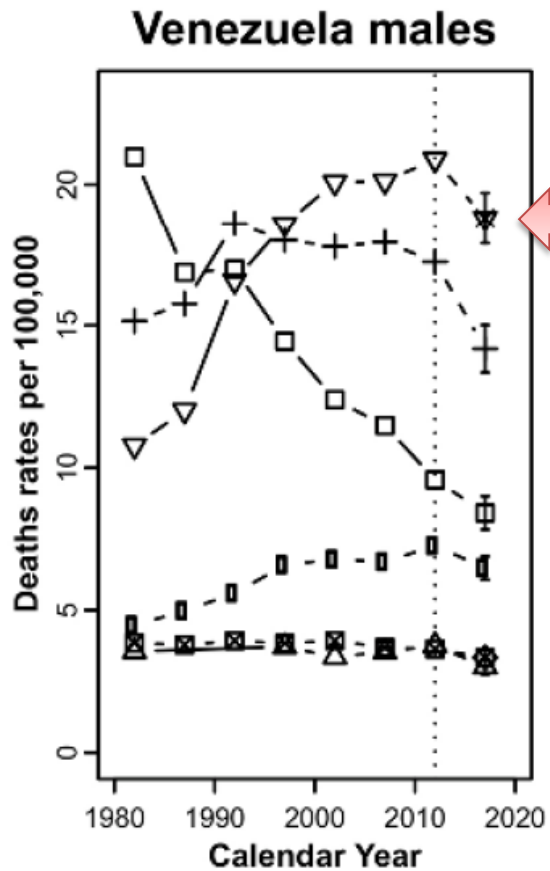
All cancers males



All cancers females



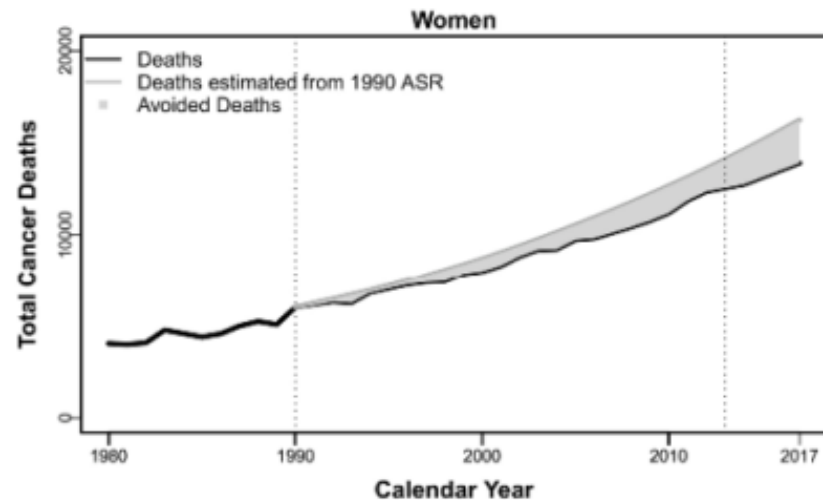
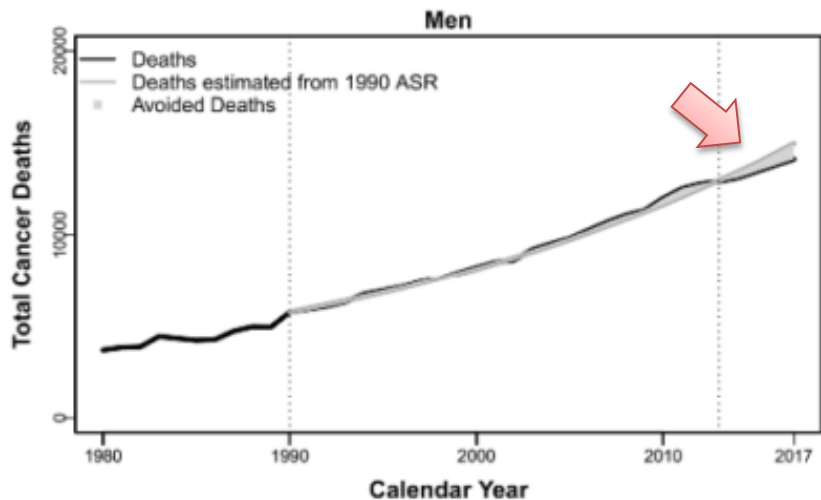
Y a nivel local



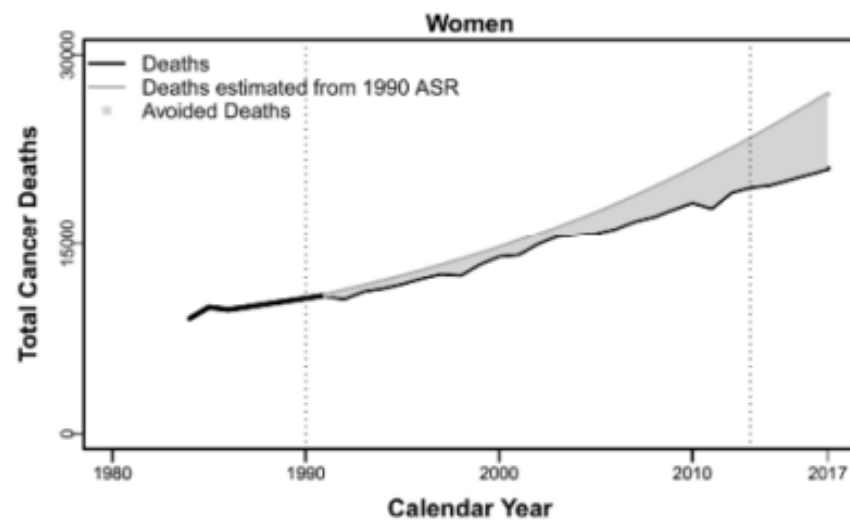
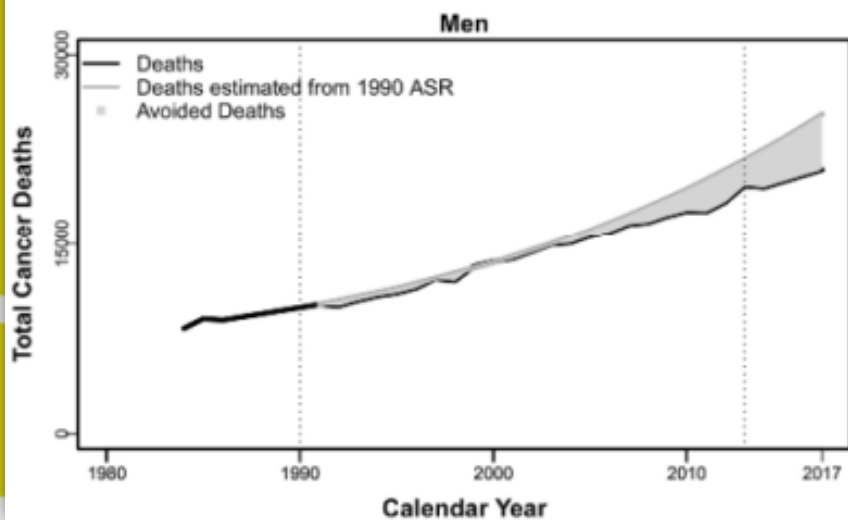
- STOMACH
- ▣ COLORECTUM
- △ PANCREAS
- + LUNG
- ▽ PROSTATE
- ▣ LEUKEMIAS
- × BREAST
- ◇ UTERUS

Y a nivel local

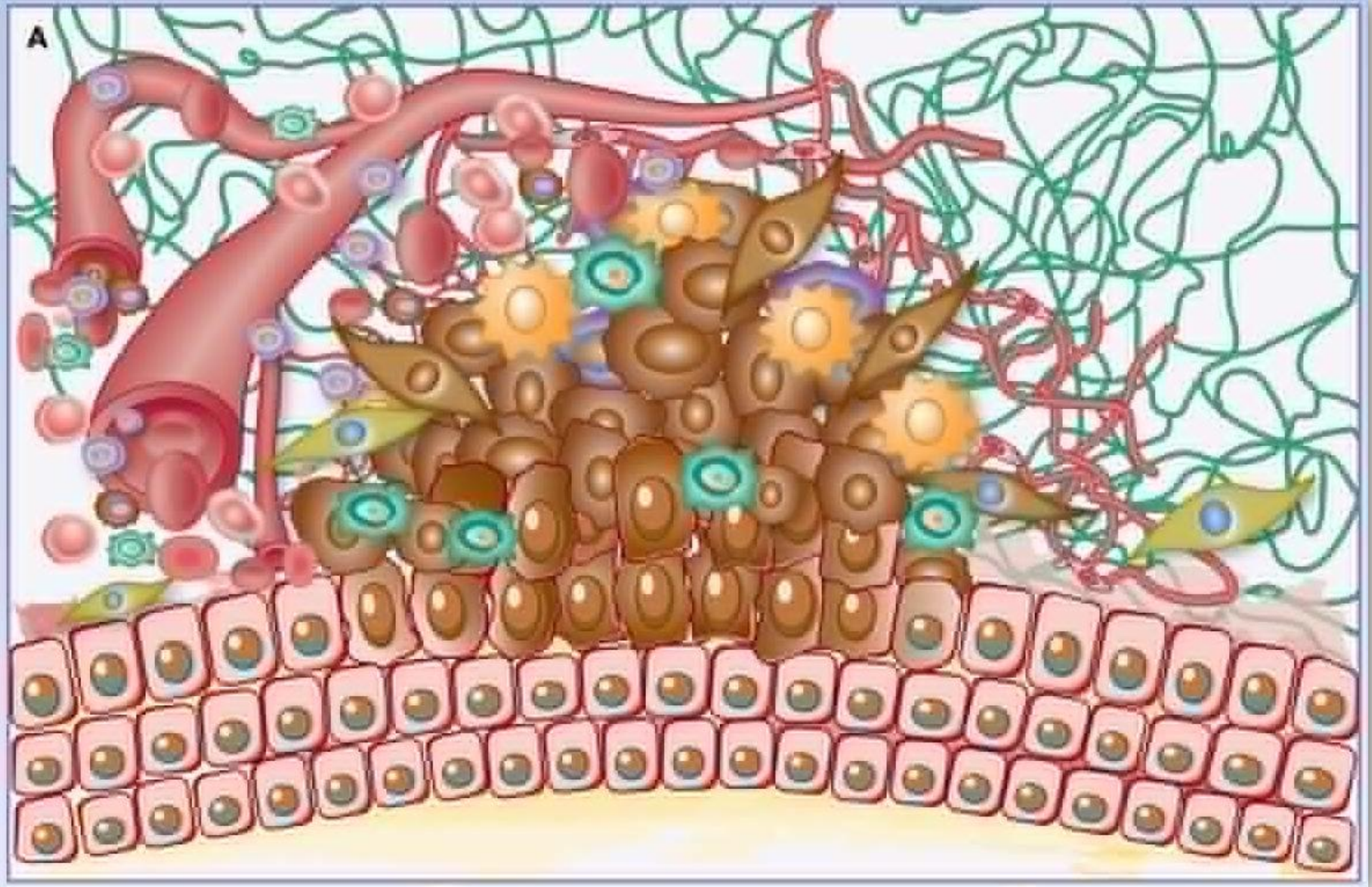
Venezuela



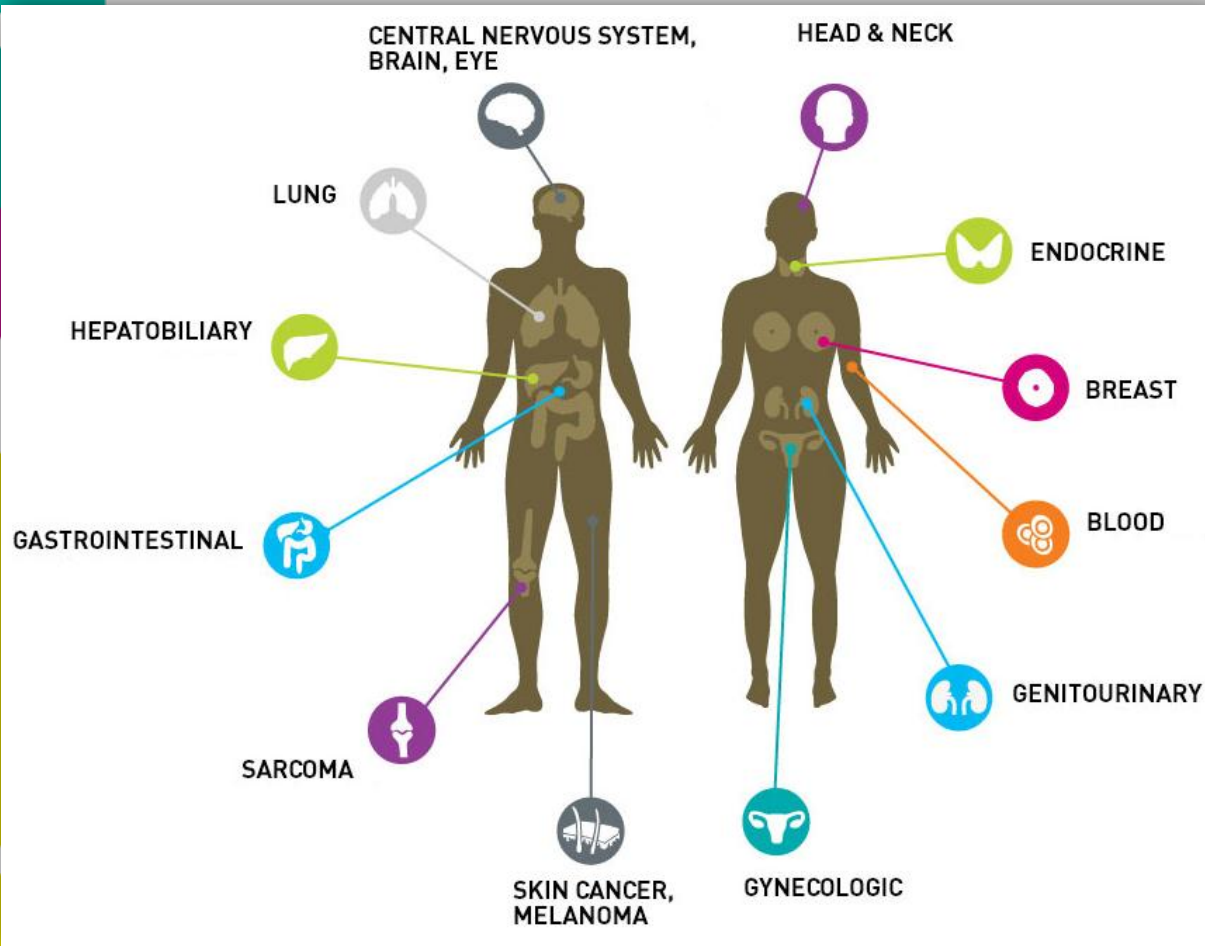
Colombia



A lo que vinimos pues!!!



El sistema inmunitario presente



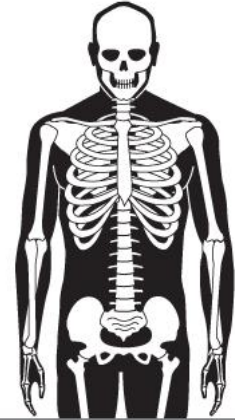
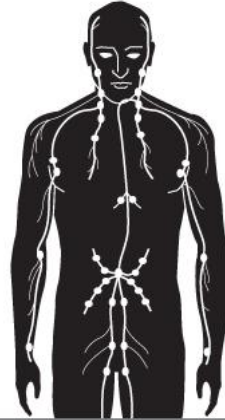
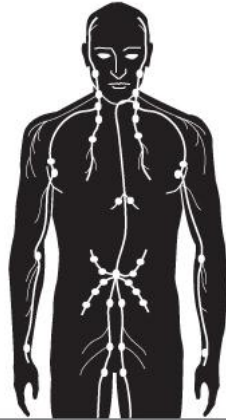
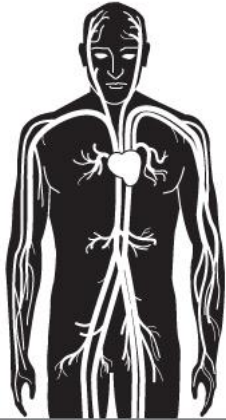
Directamente

- Leucemia
- Linfomas
- Mielomas

"Indirectamente"

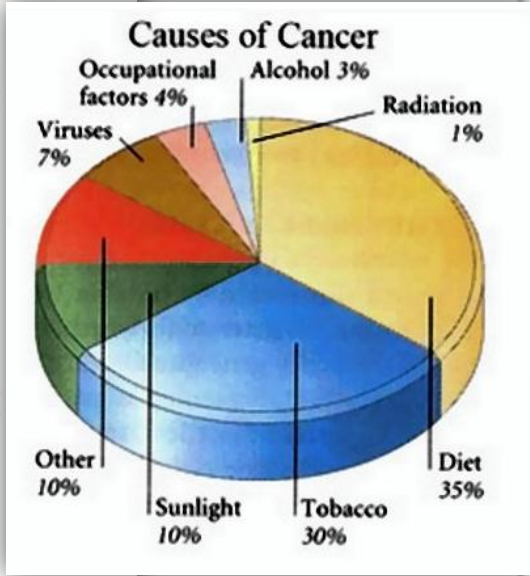
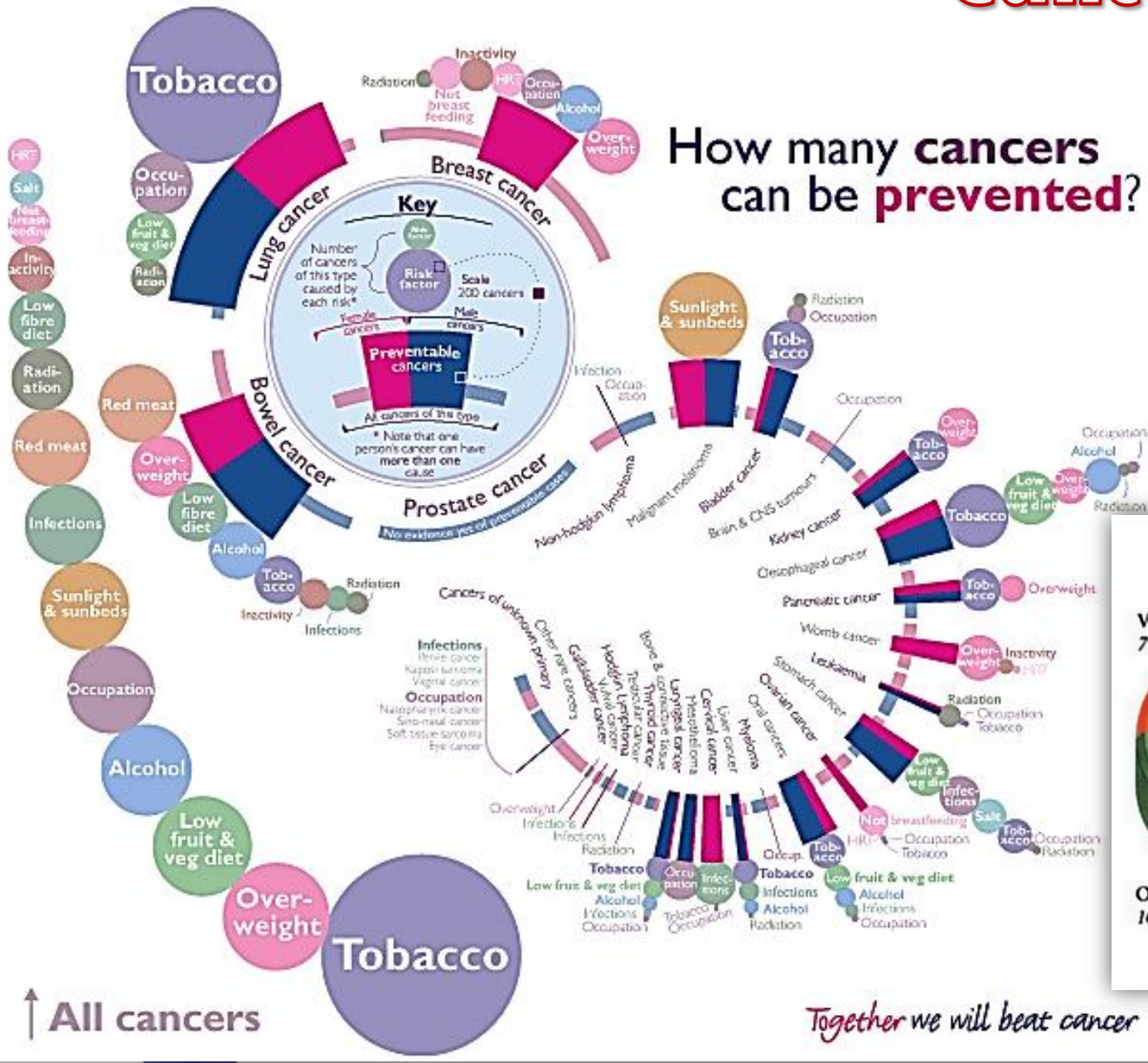
- Carcinomas
- Sarcomas

Afectación directa



LEUKEMIA	HODGKIN'S DISEASE*	NON-HODGKINS LYMPHOMA*	MULTIPLE MYELOMA
<p>General Symptoms Fever, swollen glands, symptoms of anemia</p>	<p>Symptoms Swollen glands in neck, armpit, or groin; fatigue, weight loss</p>	<p>Symptoms Swollen glands in neck, armpit, or groin; fatigue, weight loss</p>	<p>Symptoms Infection, pain in bones, kidney failure</p>
<p>Diagnosis Physical exam, blood test, bone marrow biopsy</p>	<p>Diagnosis Physical exam, x-ray, lymphangiogram, biopsy</p>	<p>Diagnosis Blood test, x-ray, biopsy, lymphangiogram</p>	<p>Diagnosis Physical exam, blood test, x-ray</p>
<p>Treatment Prolonged hospitalization, blood transfusions, chemotherapy</p>	<p>Treatment Surgery, chemotherapy, radiation therapy</p>	<p>Treatment Surgery, chemotherapy, radiation therapy</p>	<p>Treatment Chemotherapy, radiation therapy</p>
<p>Risk Factors Heredity</p>	<p>Risk Factors Heredity <i>*caused by malignant macrophage</i></p>	<p>Risk Factors Heredity <i>*caused by malignant lymphocytes</i></p>	<p>Risk Factors Unknown</p>

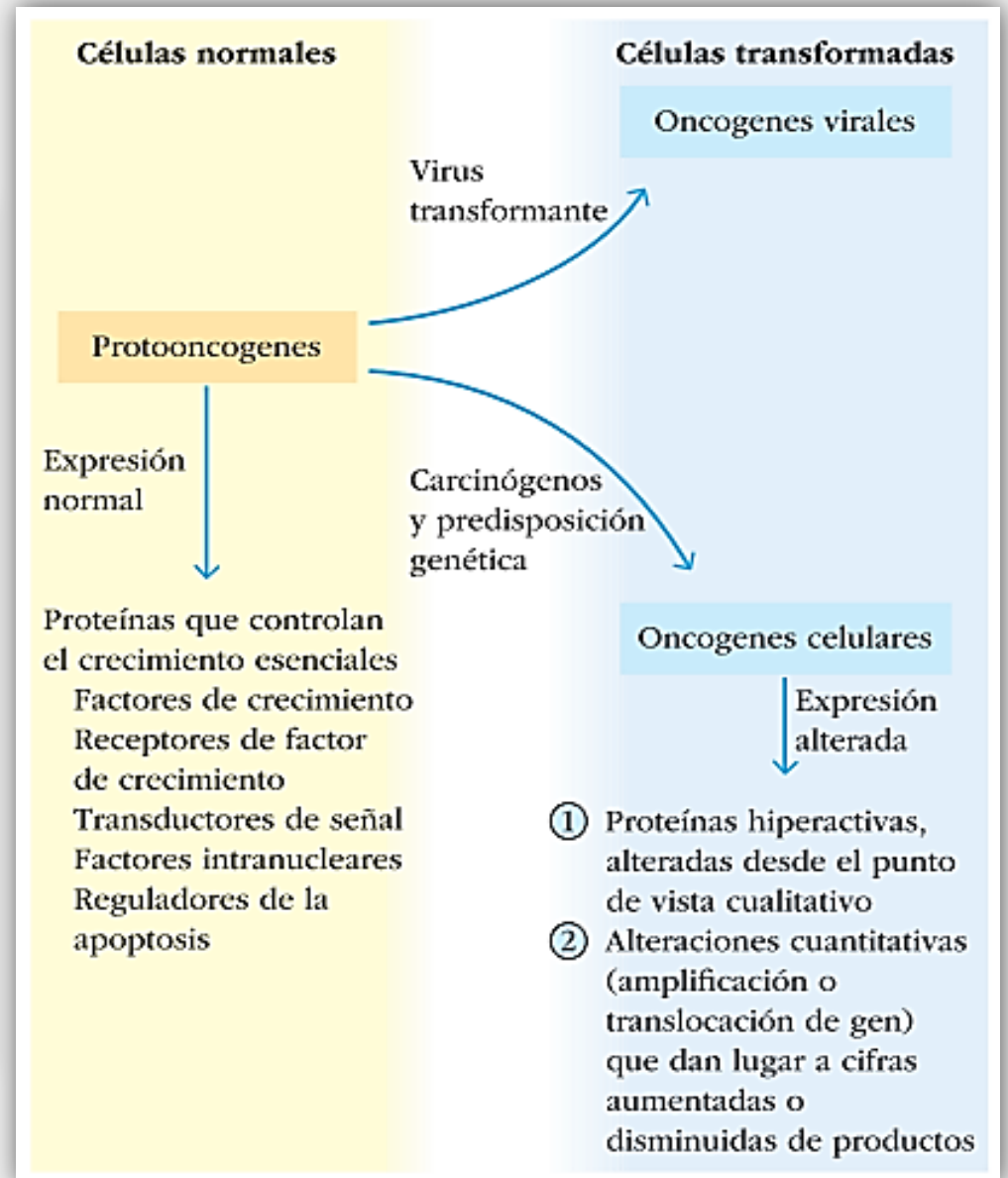
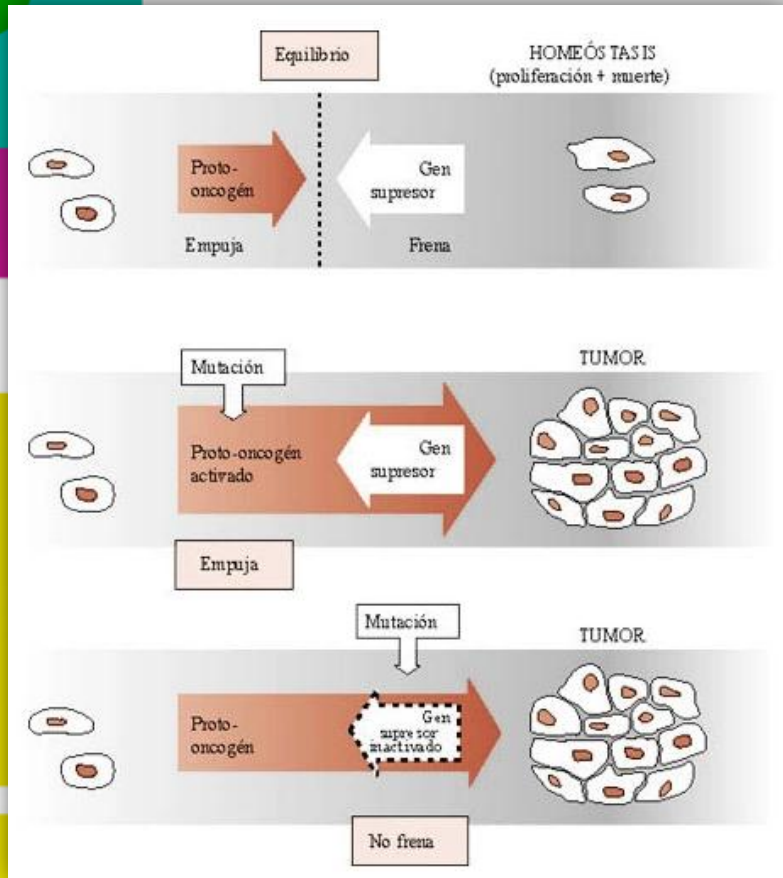
Cancerígenos



↑ All cancers

Together we will beat cancer

Oncogenes



Oncogenes

CUADRO 19-2 Clasificación funcional de genes asociados con cáncer

Tipo/nombre	Naturaleza del producto de gen
CATEGORÍA I: GENES QUE INDUCEN PROLIFERACIÓN CELULAR	
Factores de crecimiento	
<i>sis</i>	Una forma de factor de crecimiento derivado de plaquetas (PDGF)
Receptores de factor de crecimiento	
<i>fms</i>	Receptor para factor estimulante de colonias 1 (CSF-1)
<i>erbB</i>	Receptor para factor de crecimiento epidérmico (EGF)
<i>neu</i>	Proteína (HER2) relacionada con el receptor de EGF
<i>erbA</i>	Receptor para hormona tiroidea
Transductores de señal	
<i>src</i>	Tirosina cinasa
<i>abl</i>	Tirosina cinasa
Ha- <i>ras</i>	Proteína de unión a GTP con actividad de GTPasa
N- <i>ras</i>	Proteína de unión a GTP con actividad de GTPasa
K- <i>ras</i>	Proteína de unión a GTP con actividad de GTPasa
Factores de transcripción	
<i>jun</i>	Componente del factor de transcripción AP1
<i>fos</i>	Componente del factor de transcripción AP1
<i>myc</i>	Proteína de unión a DNA

Antioncogenes y apoptóticos

CUADRO 19-2 Clasificación funcional de genes asociados con cáncer

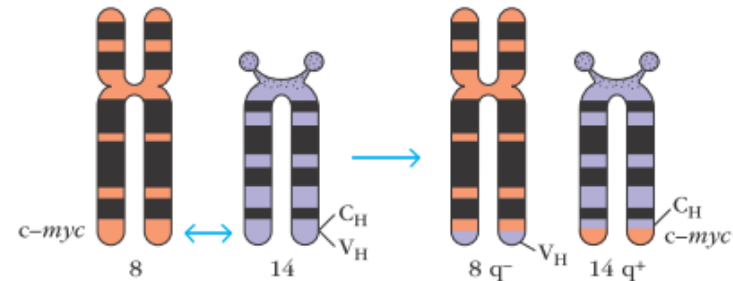
Tipo/nombre	Naturaleza del producto de gen
CATEGORÍA II: GENES SUPRESORES TUMORALES, INHIBIDORES DE LA PROLIFERACIÓN CELULAR*	
<i>Rb</i>	Supresor de retinoblastoma
<i>TP53</i>	Fosfoproteína nuclear que inhibe la formación de cáncer pulmonar de células pequeñas y cánceres de colon
<i>DCC</i>	Supresor de carcinoma de colon
<i>APC</i>	Supresor de poliposis adenomatosa
<i>NF1</i>	Supresor de neurofibromatosis
<i>WT1</i>	Supresor de tumor de Wilms
CATEGORÍA III: GENES QUE REGULAN MUERTE CELULAR PROGRAMADA	
<i>bcl-2</i>	Supresor de apoptosis
<i>Bcl-x_L</i>	Supresor de apoptosis
<i>Bax</i>	Inductor de apoptosis
<i>Bim</i>	Inductor de apoptosis
<i>Puma</i>	Inductor de apoptosis

* La actividad de los productos normales de los genes categoría II inhibe la progresión del ciclo celular. La pérdida de un gen por su desactivación por mutación en un gen supresor tumoral indicado se asocia con el desarrollo de los cánceres indicados.

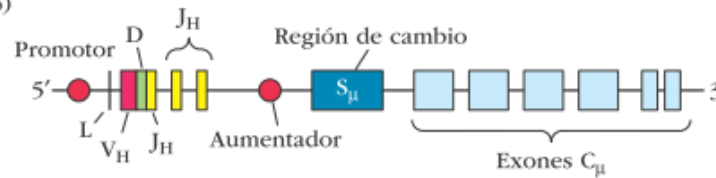
Alteraciones cromosomales



a) Linfoma de Burkitt

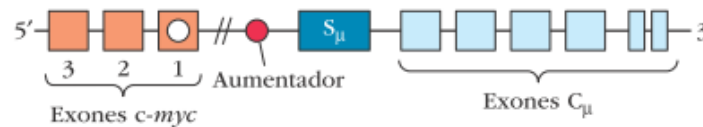


b)



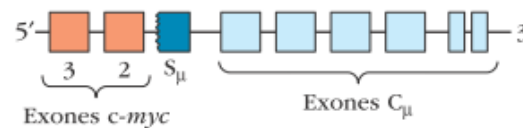
Gen que codifica para cadena pesada de IgE reordenado en el cromosoma 14

c)



Gen *c-myc* translocado en algunos linfomas de Burkitt

d)



Gen *c-myc* translocado en otros linfomas de Burkitt

Cáncer e inflamación

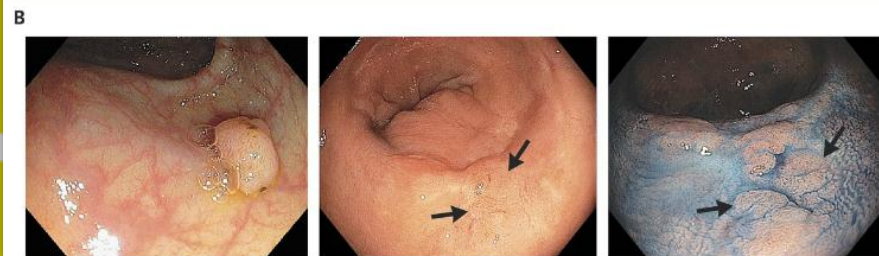
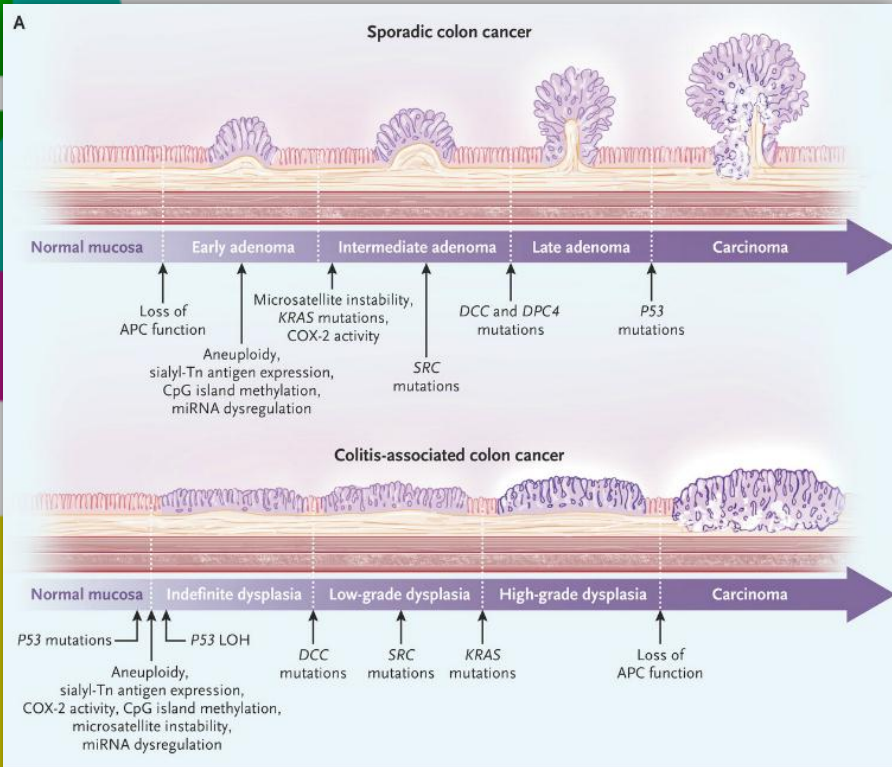
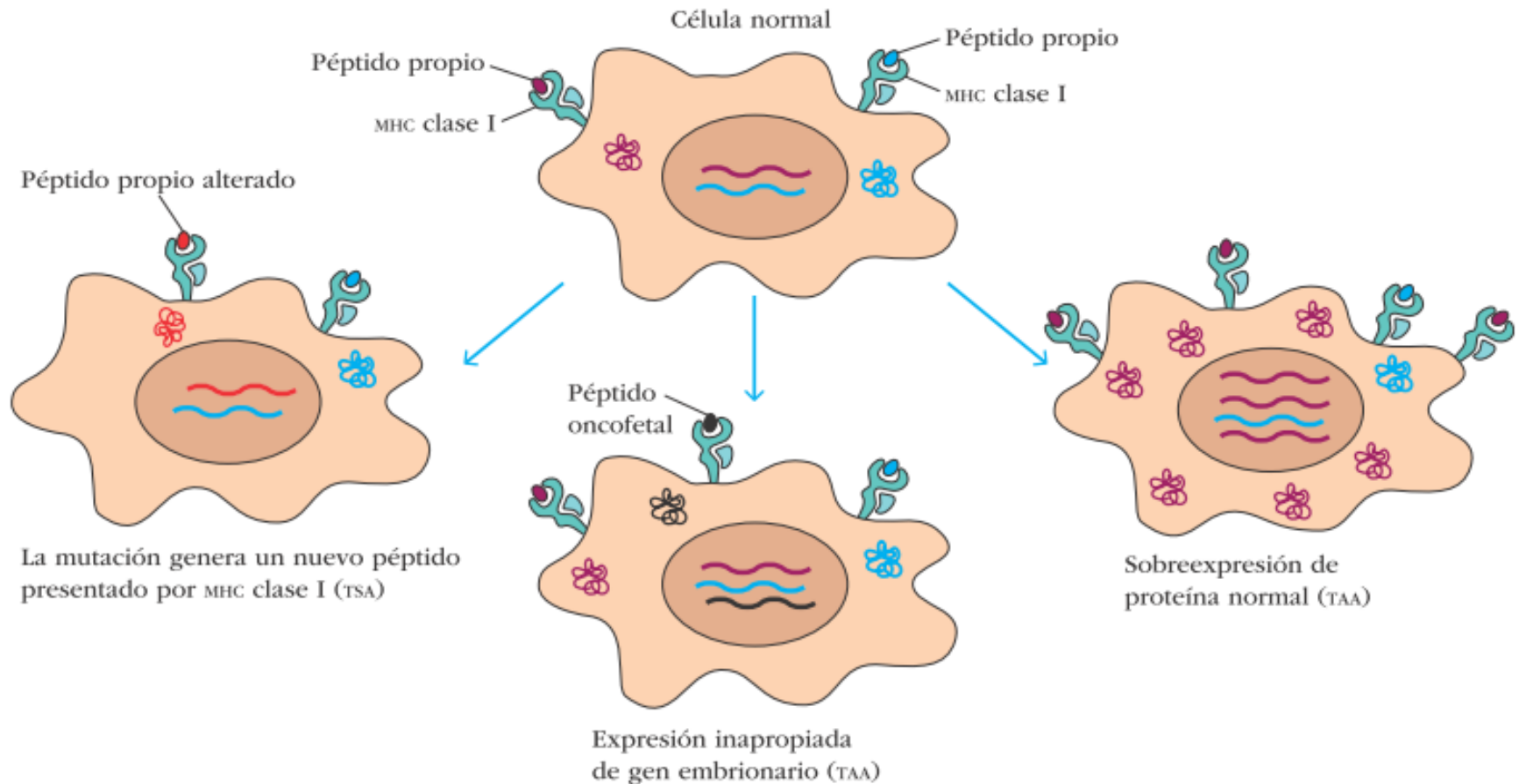


Table 1 Cancers associated with chronic inflammatory conditions

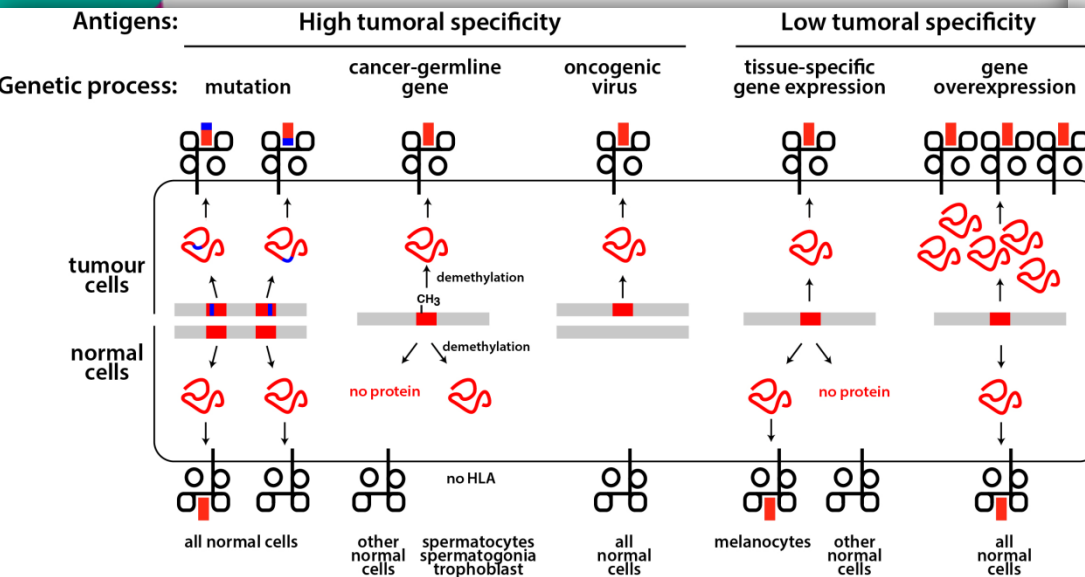
Inflammatory process	Associated neoplasia
Infectious etiology	
Human papilloma virus	Cervical cancer and head/neck cancer
Hepatitis B and C virus	Hepatocellular carcinoma
Epstein-Barr virus	Nasopharynx cancer and lymphoma
Human herpes virus type 8	Kaposi's sarcoma
<i>Helicobacter pylori</i>	Gastric cancer
<i>Schistosoma haematobium</i>	Bladder cancer
<i>Opisthorchis viverrini</i> and <i>Clonorchis sinensis</i>	Hepatocellular carcinoma
Chronic noxious stimuli	
Tobacco smoke	Lung cancer, esophageal cancer, etc.
Silica	Lung cancer
Asbestos	Mesothelioma
Alcohol intake	Esophageal cancer
Chronic pelvic inflammatory disease	Ovarian cancer
Aflatoxins	Hepatocellular carcinoma
Chronic inflammatory diseases	
Gastroesophageal reflux and Barret's esophagus	Esophageal cancer
Type A gastritis	Gastric cancer
Chronic pancreatitis	Pancreatic cancer
Inflammatory bowel disease	Colorectal cancer
Chronic osteomyelitis	Bone cancer
Hashimoto's thyroiditis	Thyroid lymphoma
Thyroiditis	Papillary thyroid cancer
NASH, Hemochromatosis	Hepatocellular carcinoma

Antígenos tumorales



Antígenos tumorales

Ejemplos de antígenos tumorales comunes



Categoría	Antígeno(s)	Tipos de cáncer asociados
Antígenos específicos para tumor (TSA)		
Viral	HPV: L1, E6, E7	Carcinoma cervical
	HBV: HBsAg	Carcinoma hepatocelular
	SV40: Tag	Mesotelioma pleural maligno (cáncer del revestimiento pulmonar)
Antígenos asociados a tumor (TAA)		
Sobreexpresión	MUC1	Mamario, ovárico
	MUC13/CA-125	Ovárico
	HER-2/neu	Mamario, melanoma, ovárico, gástrico, pancreático
	MAGE	Melanoma
	PSMA	Prostático
Etapa de diferenciación	TPD52	Prostático, mamario, ovárico
	CEA	Colon
	Gp100	Melanoma
	AFP	Carcinoma hepatocelular
	Tirosinasa	Melanoma
	PSA	Próstata
	PAP	Próstata

Evento secuencial

a)

Sitio cromosómico

5q

12p

18q

17p

Alteración

Pérdida

Activación

Pérdida

Pérdida

Gen

APC

Hipometilación de DNA

K-ras

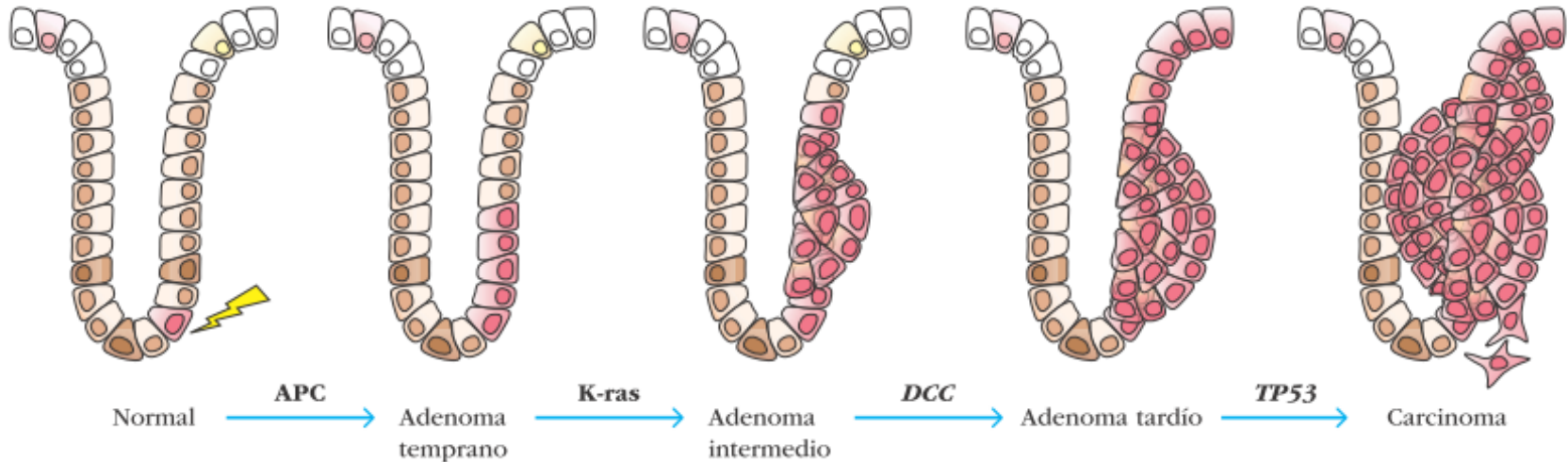
DCC

TP53

Otras alteraciones



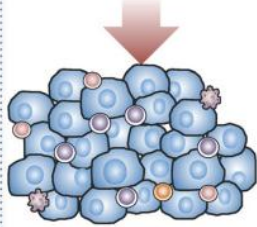
b)



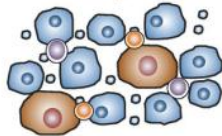
Historia natural

Cancer natural history

Chronic viral/bacterial Infection
Chemical Exposure
Chronic Inflammation



Selection of less immunogenic antigens



Selection of more aggressive tumor cells



Immune and pathological features

Low-grade neoplasia

	CD8+ T cells	+++
	PD-1+ T cells	-
	PD-L1+ tumor cells	-
	PD-L2+ tumor cells	-
	Angiogenesis	+

Intermediate-grade neoplasia

	CD8+ T cells	+
	PD-1+ T cells	-/+
	PD-L1+ tumor cells	+ / ++
	PD-L2+ tumor cells	+ / ++
	Angiogenesis	+ / ++

High-grade neoplasia

	CD8+ T cells	++
	PD-1+ T cells	+++
	PD-L1+ tumor cells	++++
	PD-L2+ tumor cells	++++
	Angiogenesis	++++

Tumor cell immunogenicity

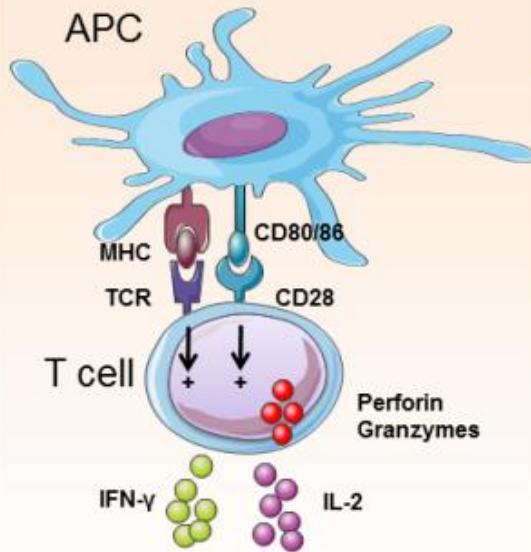
Clinical Relevance

Prognosis

Potential benefit of target and immune-based therapies

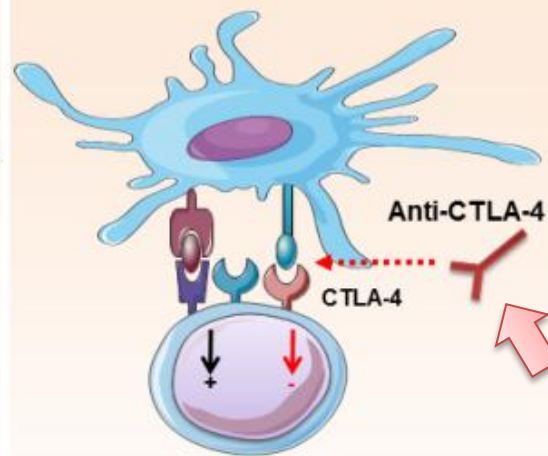
Modulación de los checkpoints

A Activation



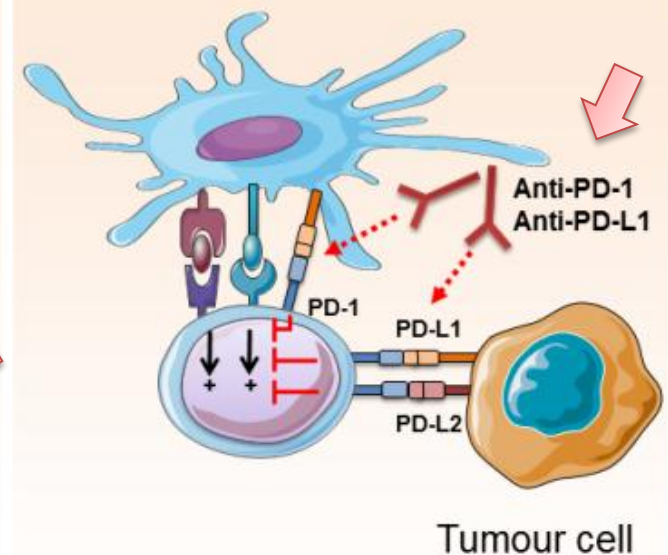
Proliferation \uparrow
Effector cytokines \uparrow
Cytotoxicity \uparrow

B Anergy



Proliferation \downarrow
Effector cytokines \downarrow
Cytotoxicity \downarrow

C Exhaustion



Proliferation \downarrow
Effector cytokines \downarrow
Cytotoxicity \downarrow

Terapia con moAb

CUADRO 19-4 Anticuerpos monoclonales aprobados por la FDA y autorizados para el tratamiento de cáncer

Nombre del mAb	Nombre comercial	Blanco	Usado para tratar	Aprobado en:
Rituximab	Rituxan	CD20	Linfoma no Hodgkin Leucemia linfocítica crónica (CLL)	1997 2010
Trastuzumab	Herceptin	HER2	Cáncer mamario Cáncer gástrico	1998 2010
Gemtuzumab ozogamicin ²	Mylotarg	CD33	Leucemia mielógena aguda (AML)	2000 ¹
Alemtuzumab	Campath	CD52	CLL	2001
Ibritumomab tiuxetan ²	Zevalin	CD20	Linfoma no Hodgkin	2002
¹³¹ I-Tositumomab ²	Bexxar	CD20	Linfoma no Hodgkin	2003
Cetuximab	Erbix	EGFR	Cáncer colorrectal Cánceres de cabeza y cuello	2004 2006
Bevacizumab	Avastin	VEGF	Cáncer colorrectal Cáncer pulmonar de células no pequeñas Cáncer mamario Glioblastoma y cáncer renal	2004 2006 2008 2009
Panitumumab	Vectibix	EGFR	Cáncer colorrectal	2006
Ofatumumab	Arzerra	CD20	CLL	2009
Denosumab	Xgeva	Ligando RANK	Cáncer diseminado a hueso	2010
Ipilimumab	Yervoy	CTLA-4	Melanoma	2011
Brentuximab vedotin ²	Adcetris	CD30	Linfoma de Hodgkin y un tipo de linfoma no Hodgkin	2011

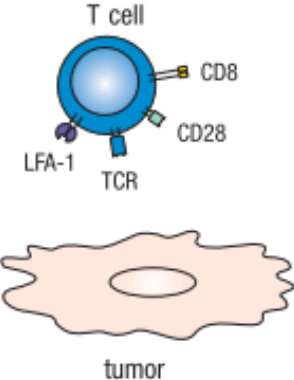
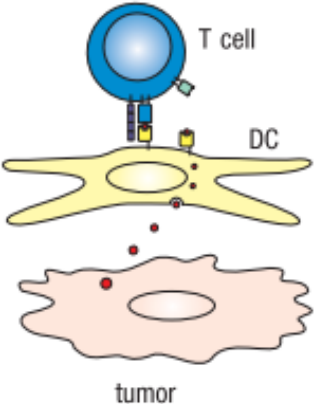
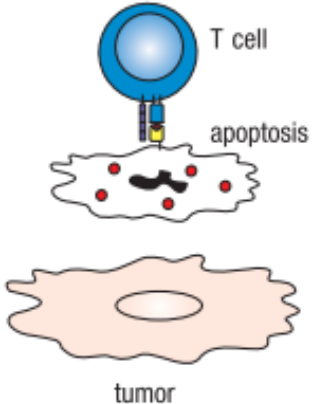
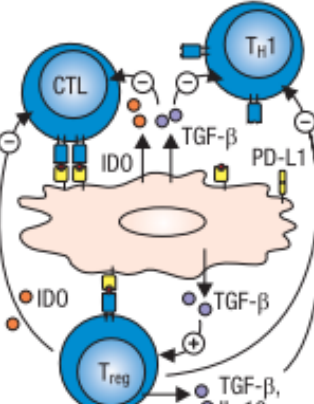
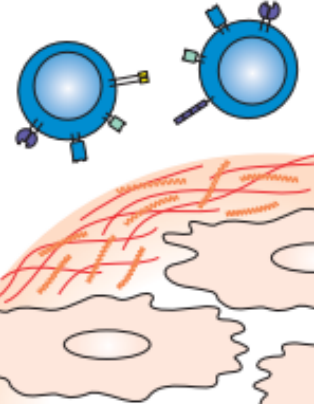
¹ La aprobación general se suspendió en 2010 y ahora sólo se usa como parte de estudios clínicos en proceso.

² Anticuerpos monoclonales conjugados.

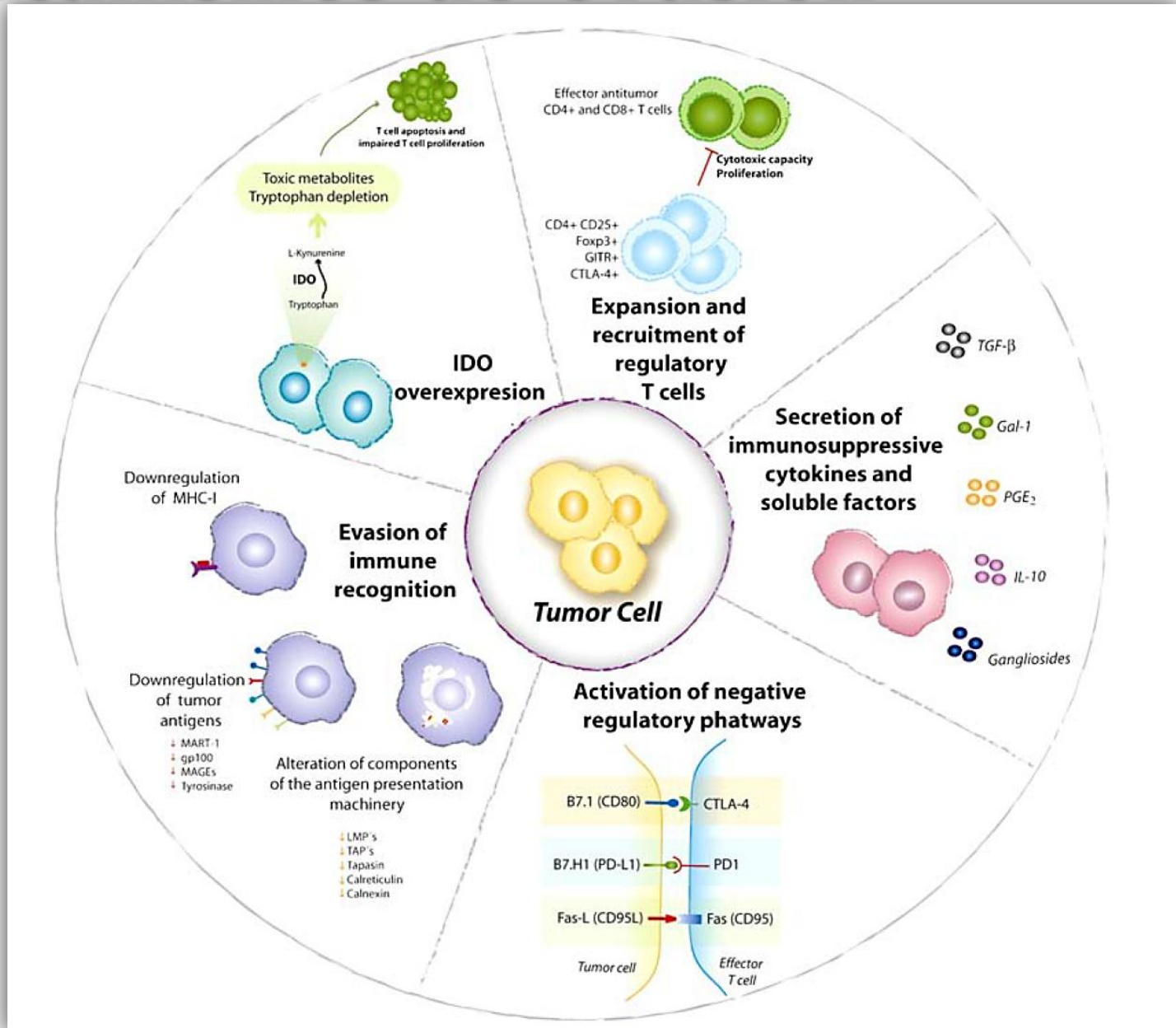
Fuente: American Cancer Society, www.cancer.org; y Tabla 2 de J.F. Aldrich et al., 2010, *Vaccines and immunotherapeutics for the treatment of malignant disease*, Clinical and Developmental Immunology, doi:10.1155/2010/697158.

Mecanismos de evasión

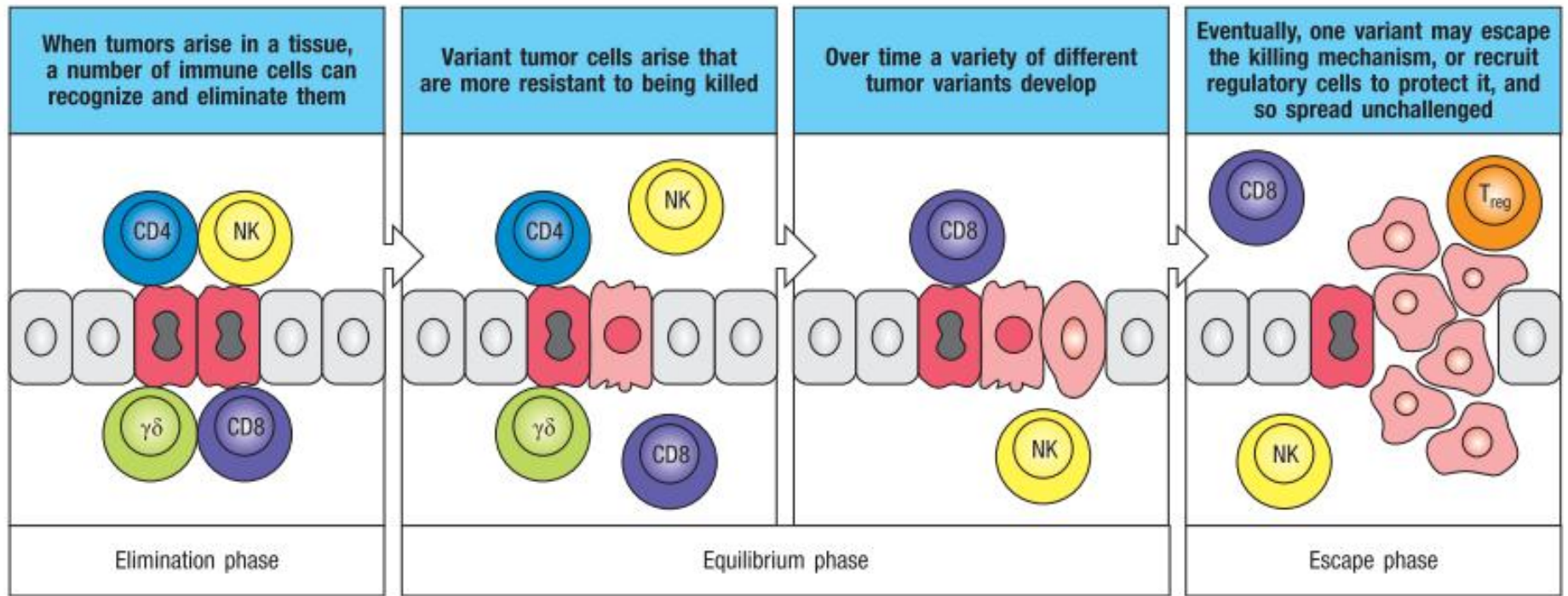
Mechanisms by which tumors avoid immune recognition

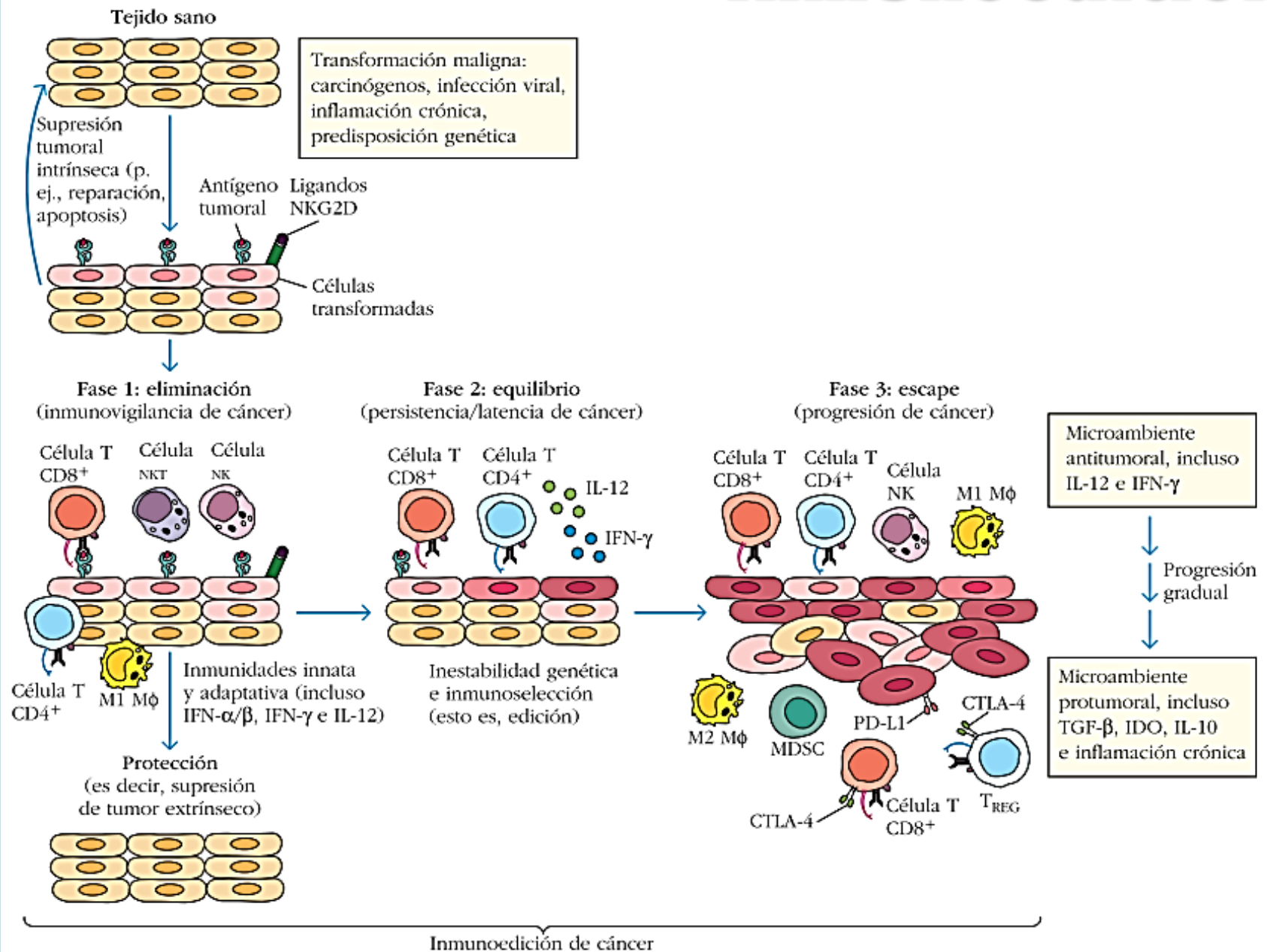
Low immunogenicity	Tumor treated as self antigen	Antigenic modulation	Tumor-induced immune suppression	Tumor-induced privileged site
<p>No peptide:MHC ligand No adhesion molecules No co-stimulatory molecules</p>	<p>Tumor antigens taken up and presented by APCs in absence of co-stimulation tolerize T cells</p>	<p>T cells may eliminate tumors expressing immunogenic antigens, but not tumors that have lost such antigens</p>	<p>Factors (e.g., TGF-β, IL-10, IDO) secreted by tumor cells inhibit T cells directly. Expression of PD-L1 by tumors</p>	<p>Factors secreted by tumor cells create a physical barrier to the immune system</p>
 <p>T cell CD8 CD28 LFA-1 TCR tumor</p>	 <p>T cell DC tumor</p>	 <p>T cell apoptosis tumor</p>	 <p>CTL T_H1 T_{reg} IDO TGF-β PD-L1 tumor</p>	 <p>tumor</p>

Mecanismos de evasión

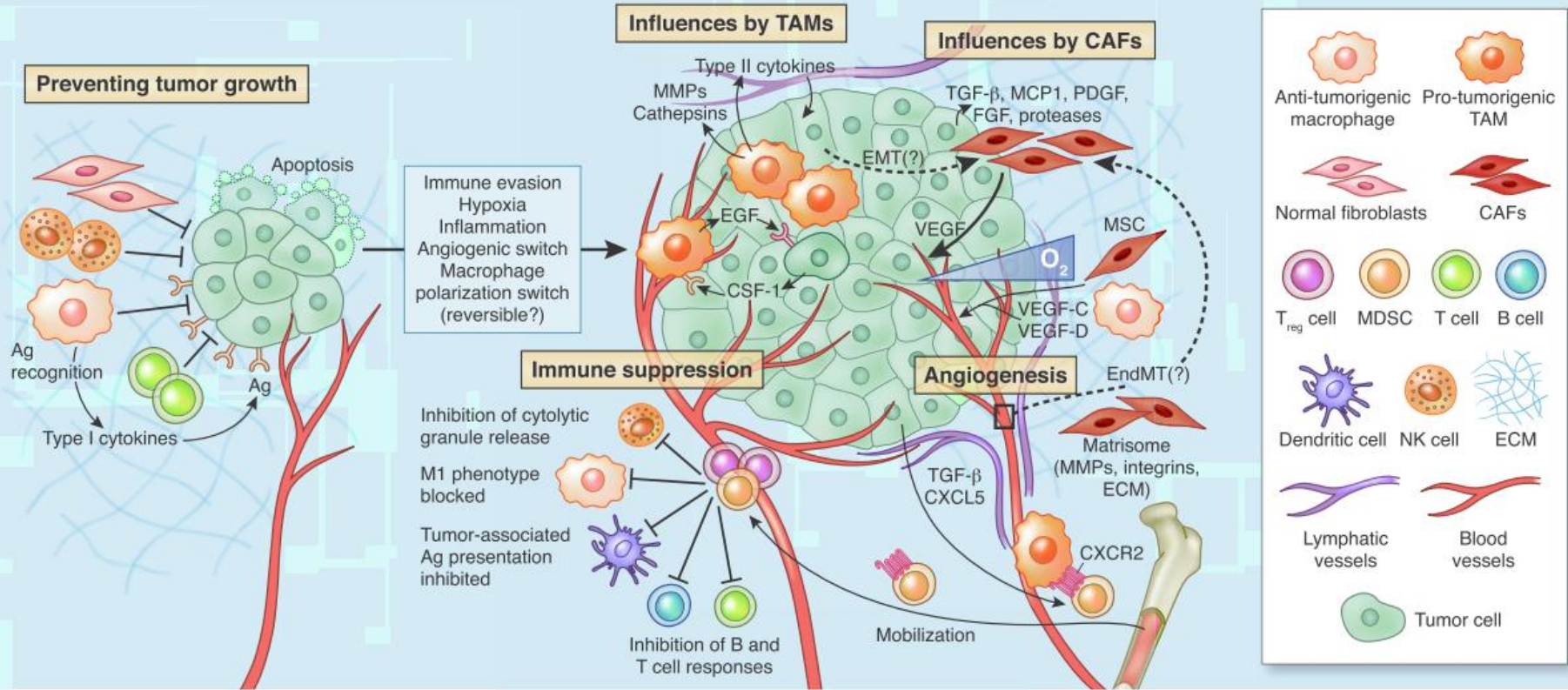


Inmunoedición (versión fácil)



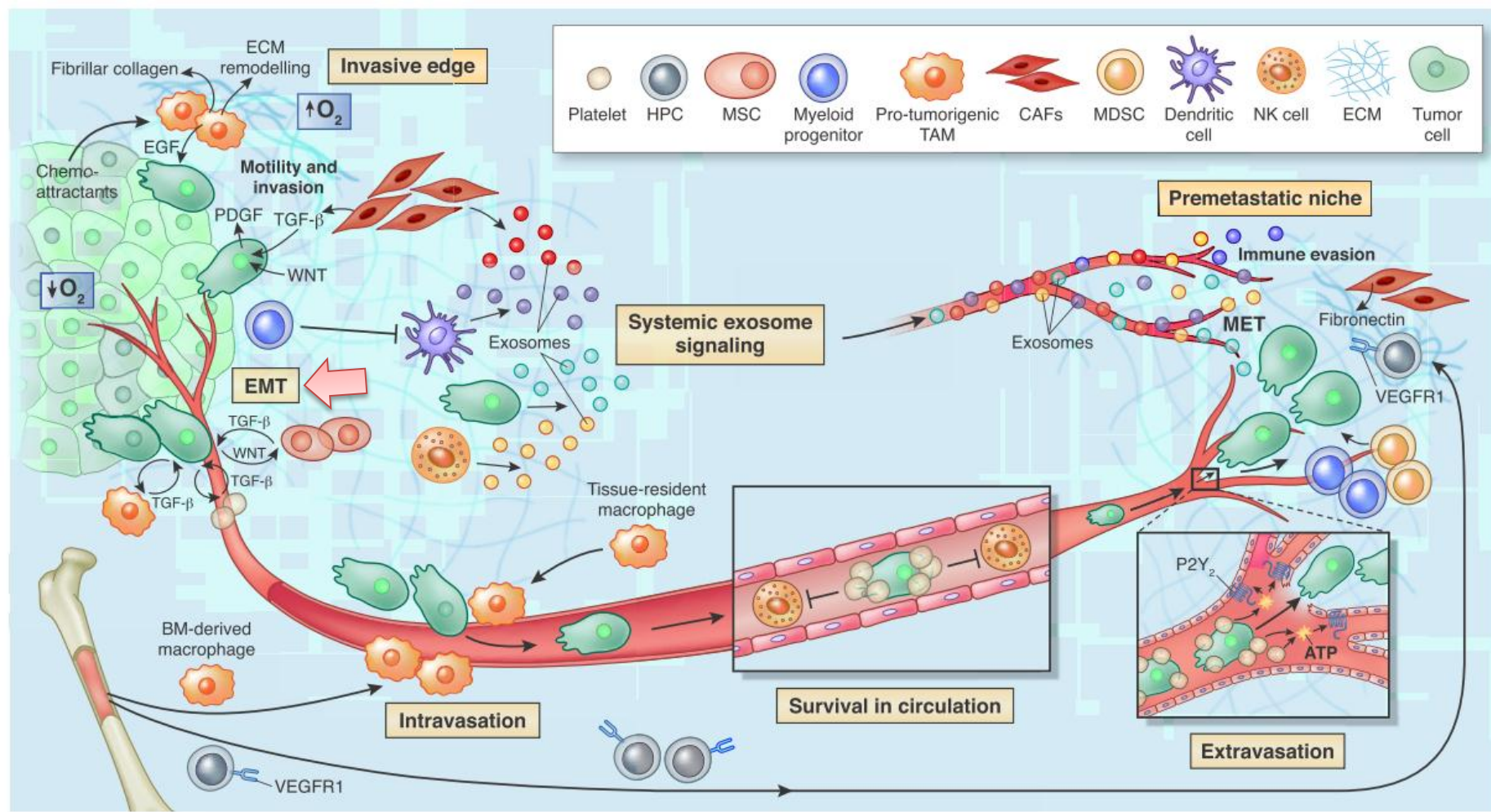


Establecimiento



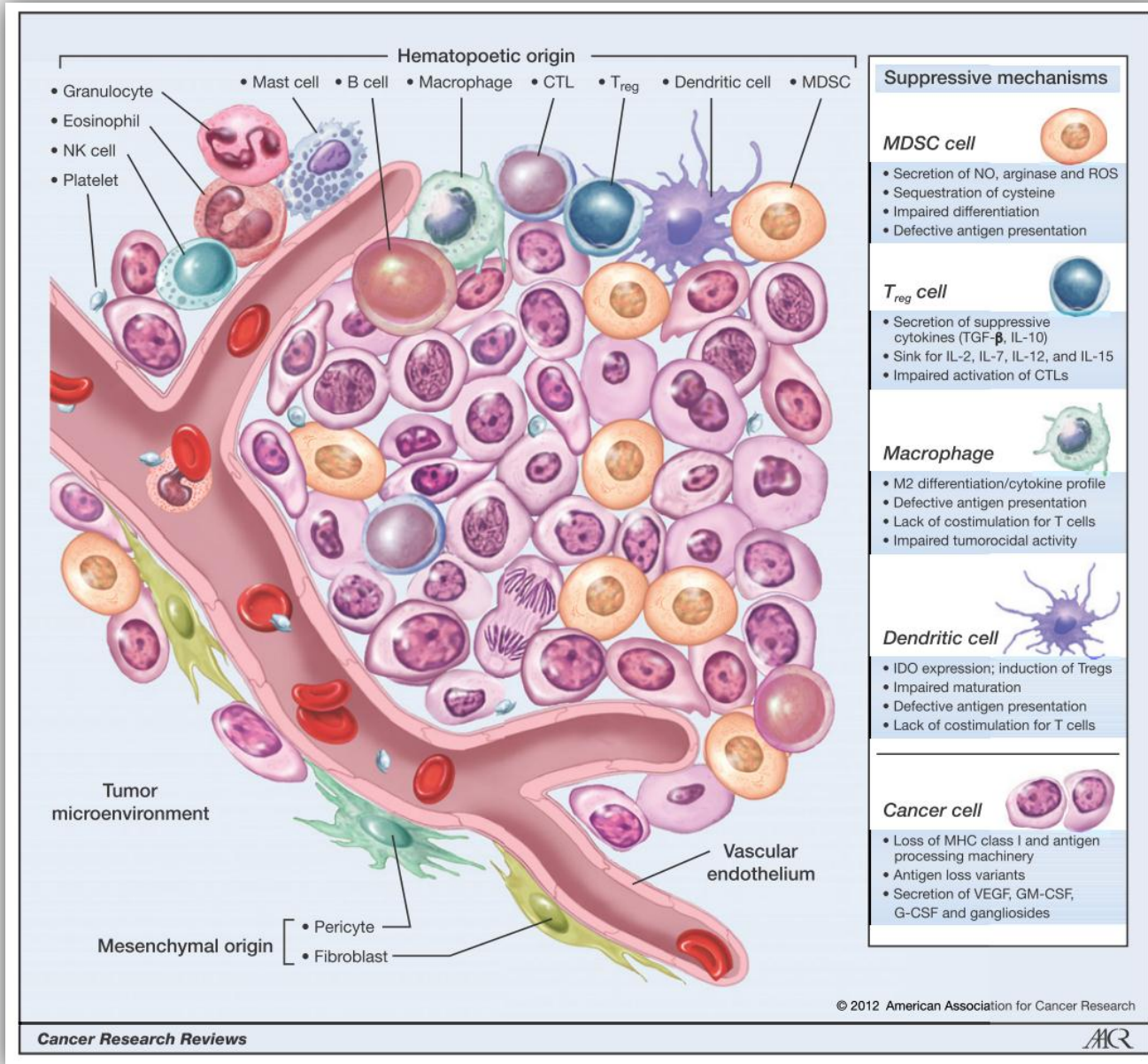
Debbie Marzels

Diseminación

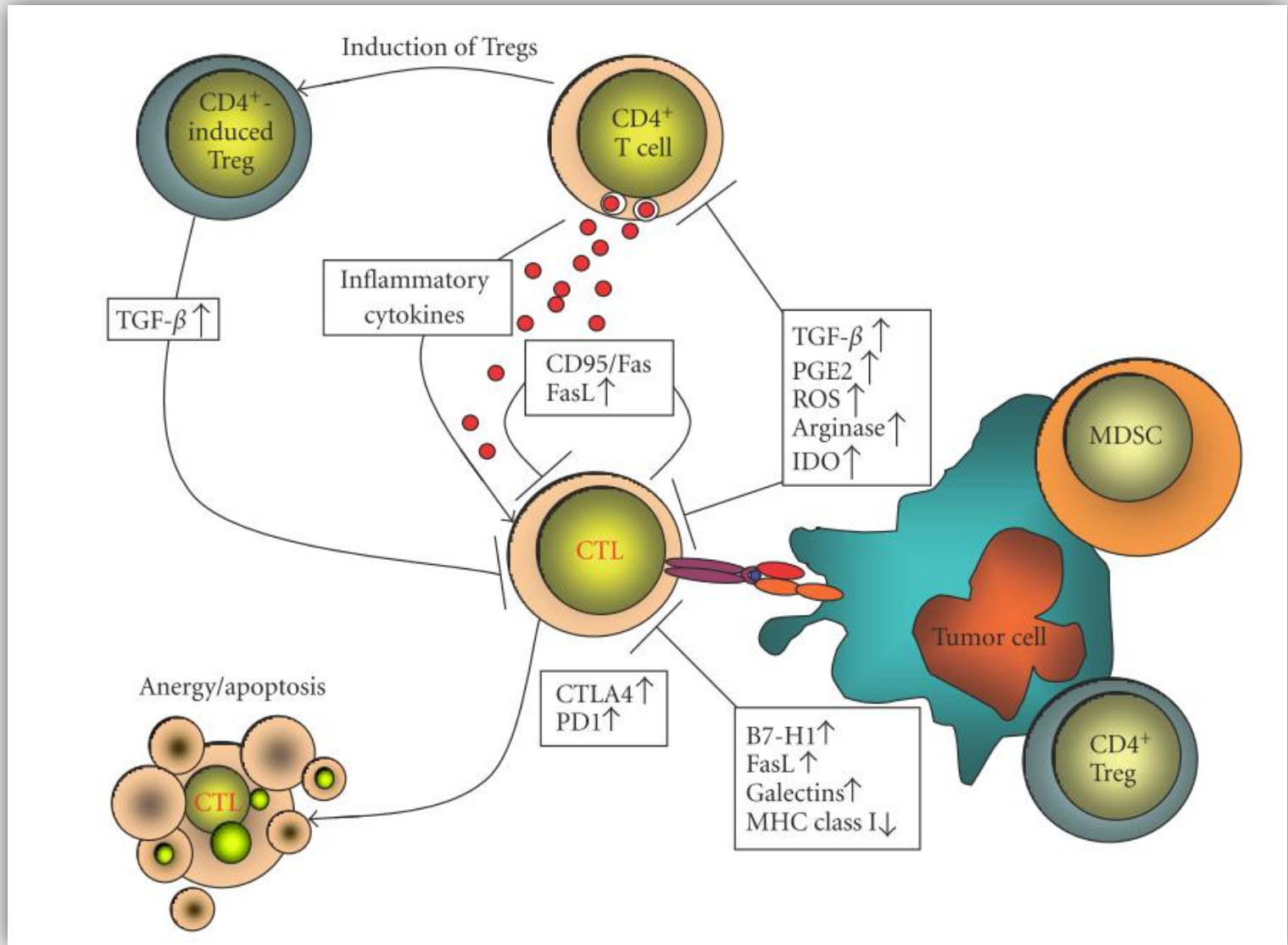


Debbie Maizels

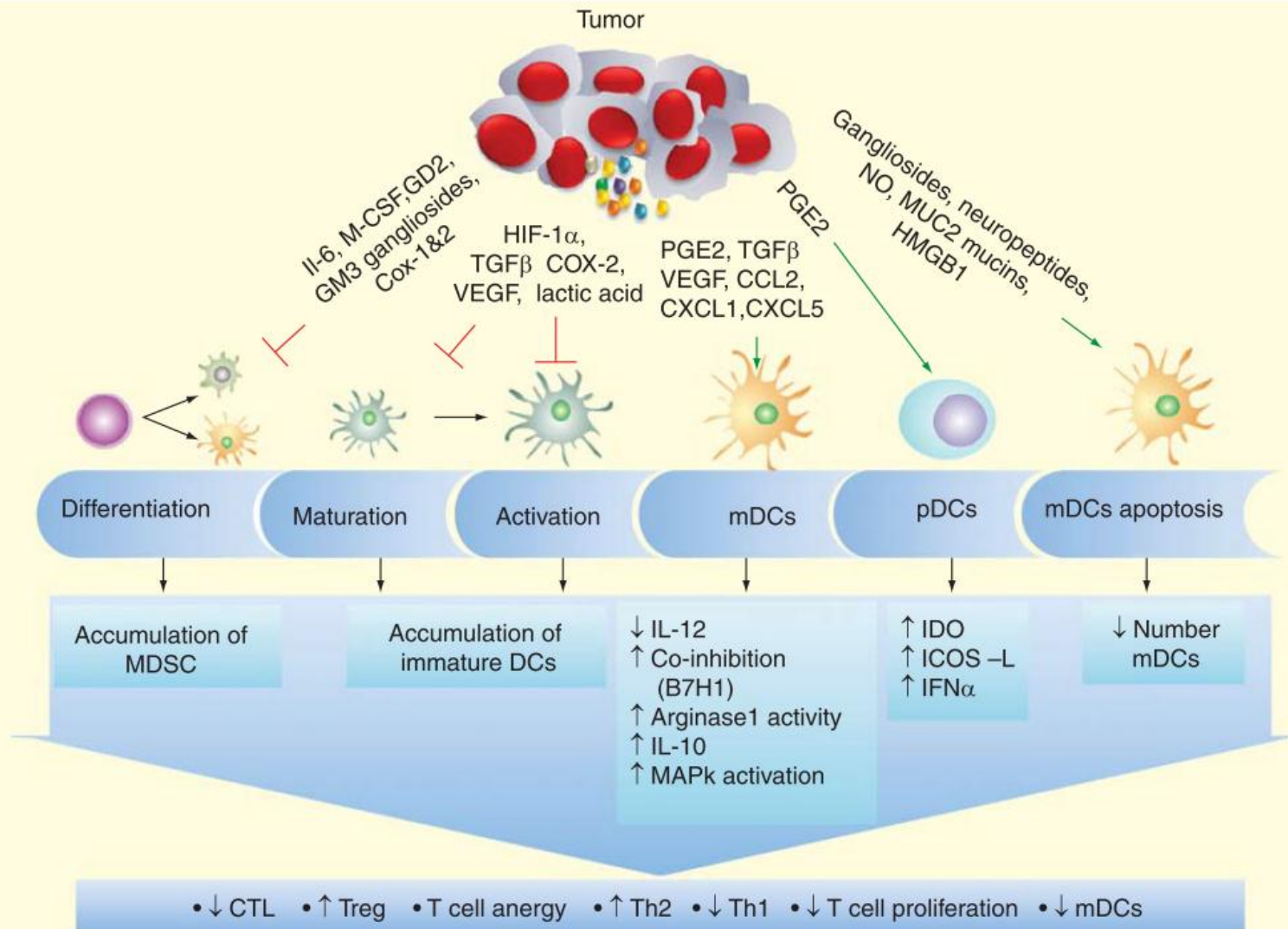
Elementos celulares supresores



Microambiente tolerogénico



Modulando las dendríticas



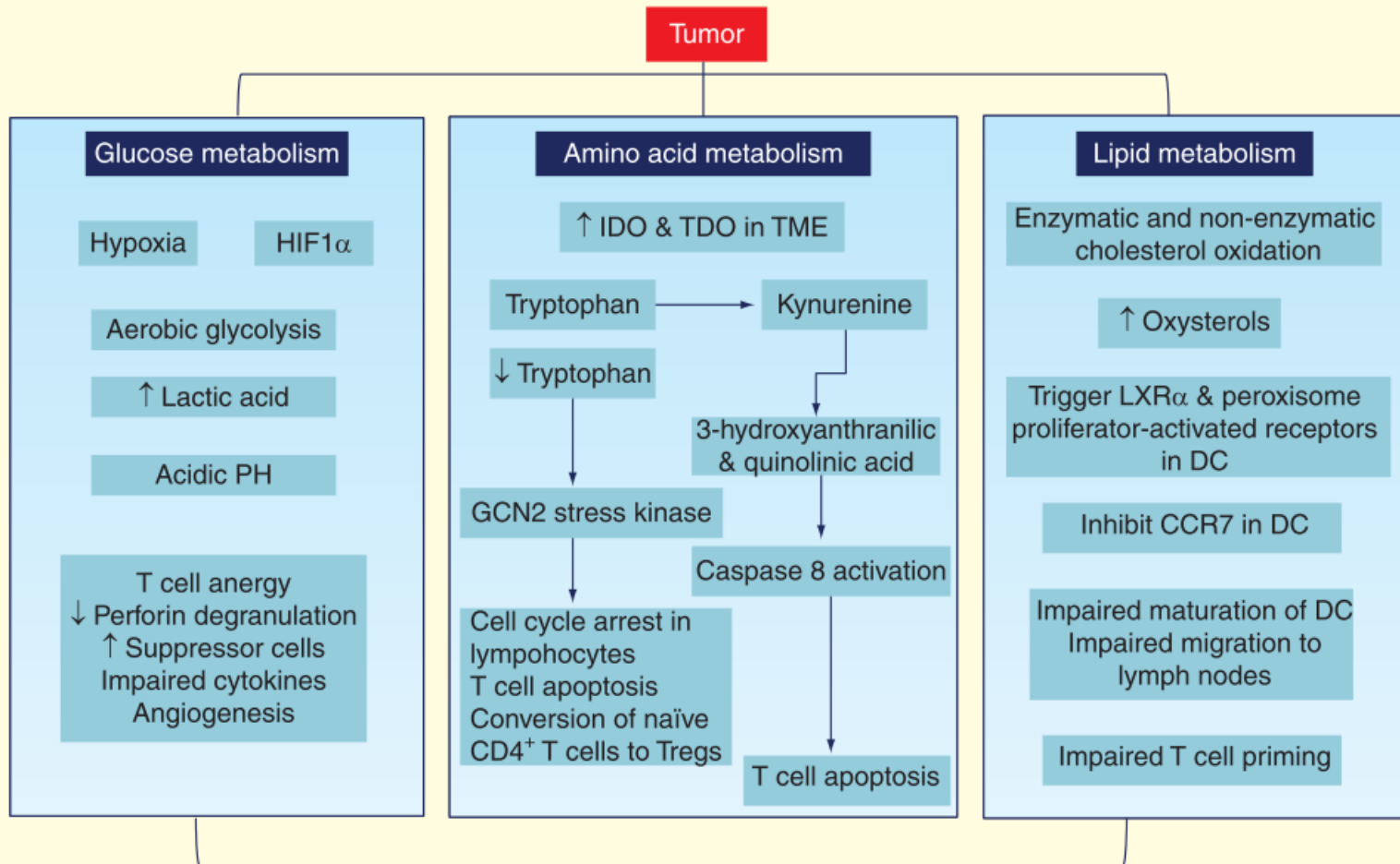
Citocinas evasoras

Table 4. Role of immune regulatory cytokines in cancer immune escape.

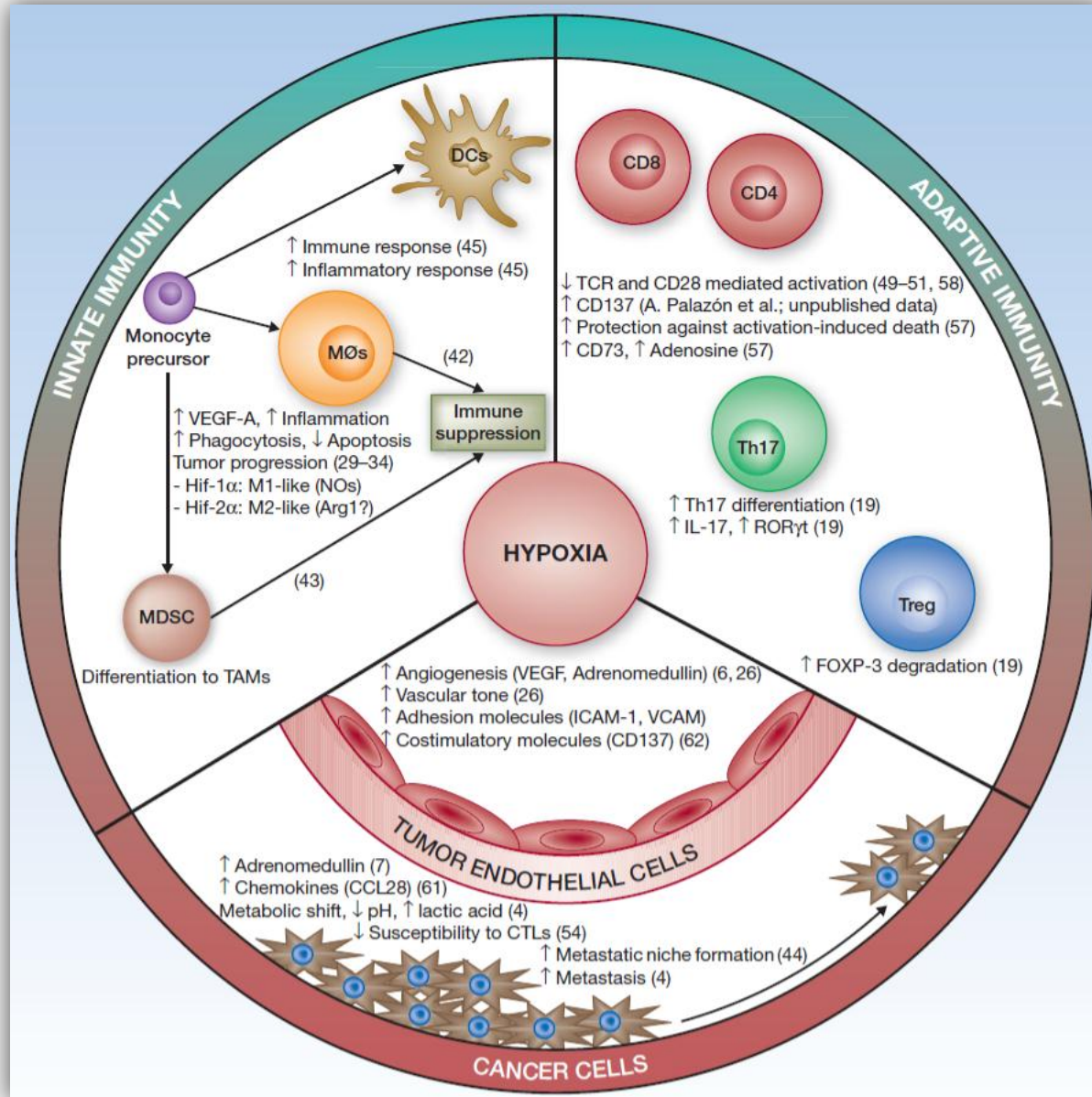
Cytokine type	Cellular source	Receptor types	Protumor effects	Antitumor effects
TGF- β	Treg, tumor cells	T β R I and II	<ul style="list-style-type: none"> ↑ Tregs secreting IL-10 and TGF-β ↓ CTL activity by inhibiting granzyme A and B, FasL and IFN-γ 	
IL-10	T and B cells, macrophages, monocytes, tumor cells		<ul style="list-style-type: none"> Tumor growth by downregulation of MHC-I, Th1 response, IL-2 and IFN-γ ↑ metastasis 	<ul style="list-style-type: none"> ↑ Tumor sensitivity to NK cell mediated lysis due to downregulation of MHC-I
IL-6	T and B cells, keratinocytes, macrophages		<ul style="list-style-type: none"> Tumor survival and growth by activation of STAT3 and epigenetic silencing of tumor suppressors (P53) ↑ metastasis, ↑ chemoresistance 	<ul style="list-style-type: none"> ↓ Tumor growth by non-specific proinflammatory responses
IL-8	Tumor cells, Endothelial cells, neutrophils, TAMs	G-protein coupled CXCR1 and CXCR2	<ul style="list-style-type: none"> ↑ Proliferation & survival of cancer cells by activation of various signaling pathways (PI3K, MAPK, AKT), ↑ STAT3 and β-catenin ↑ metastasis, ↑ chemoresistance 	
TNF- α	Macrophages, tumor cells, T cells	TNFR I and II	<ul style="list-style-type: none"> ↑ NF-κB, ↓ apoptosis ↑ Angiogenesis ↓ DNA repair ↑ Tumor growth 	<ul style="list-style-type: none"> At high doses causes tumor necrosis and inhibition of angiogenesis

CTL: Cytotoxic T lymphocyte; TAM: Tumor-associated macrophage.

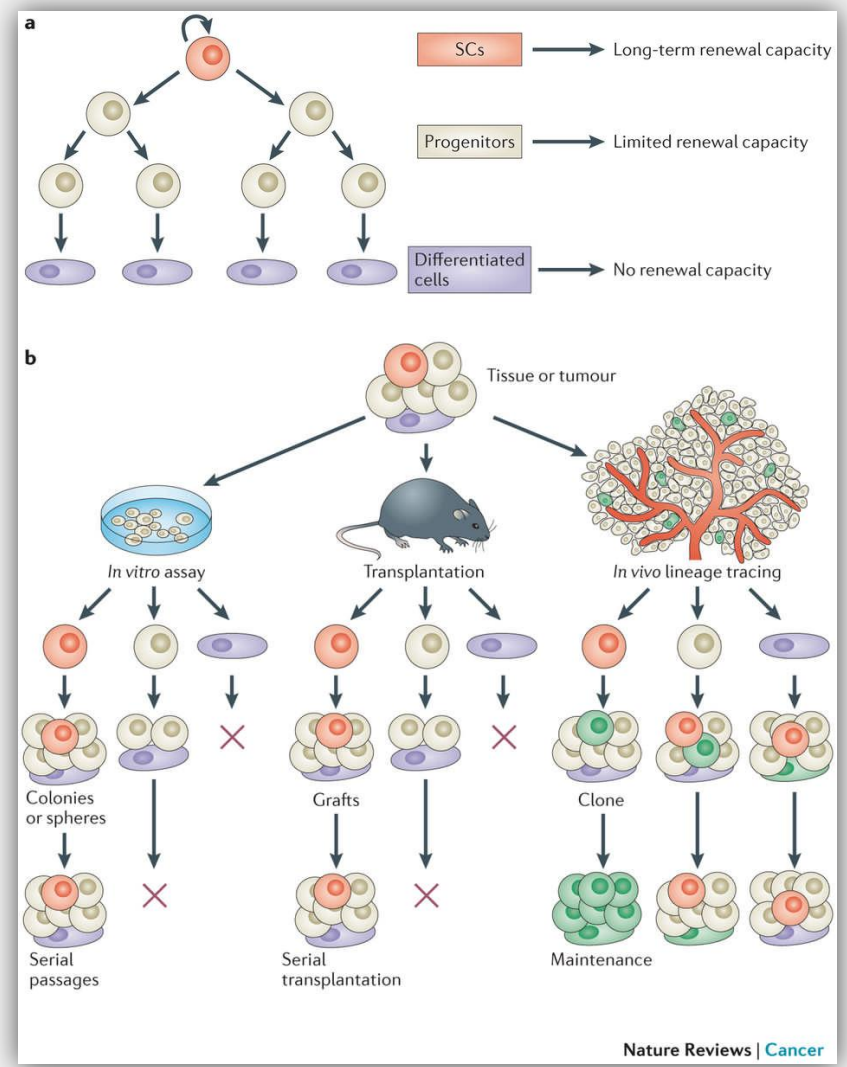
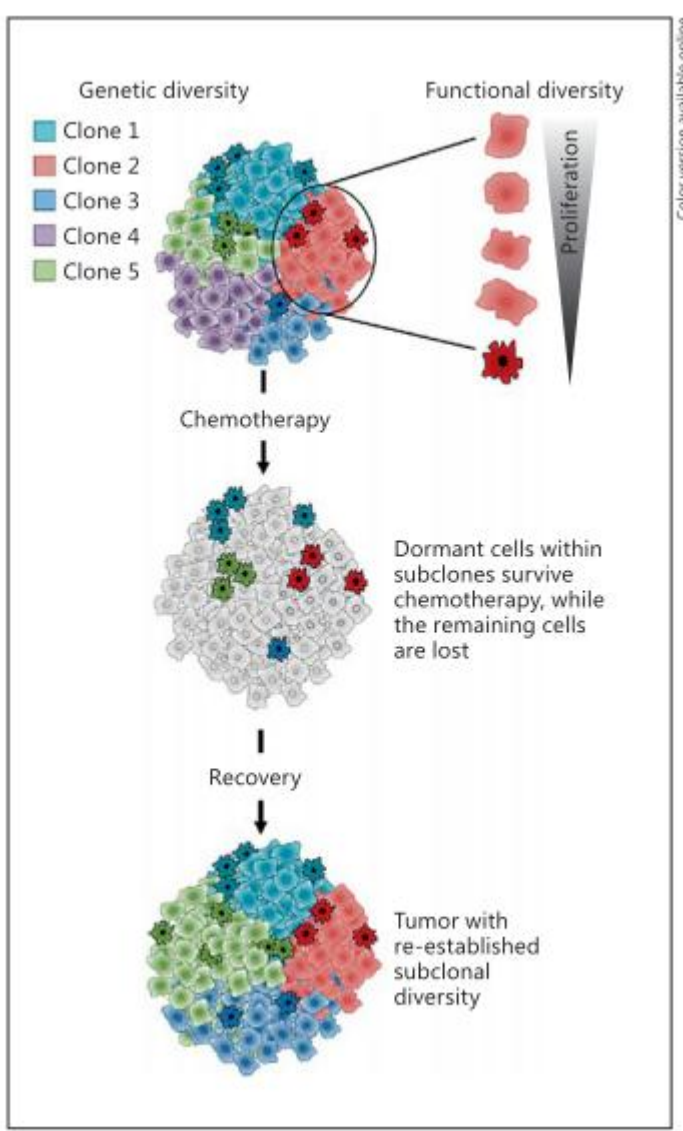
Desviación del metabolismo



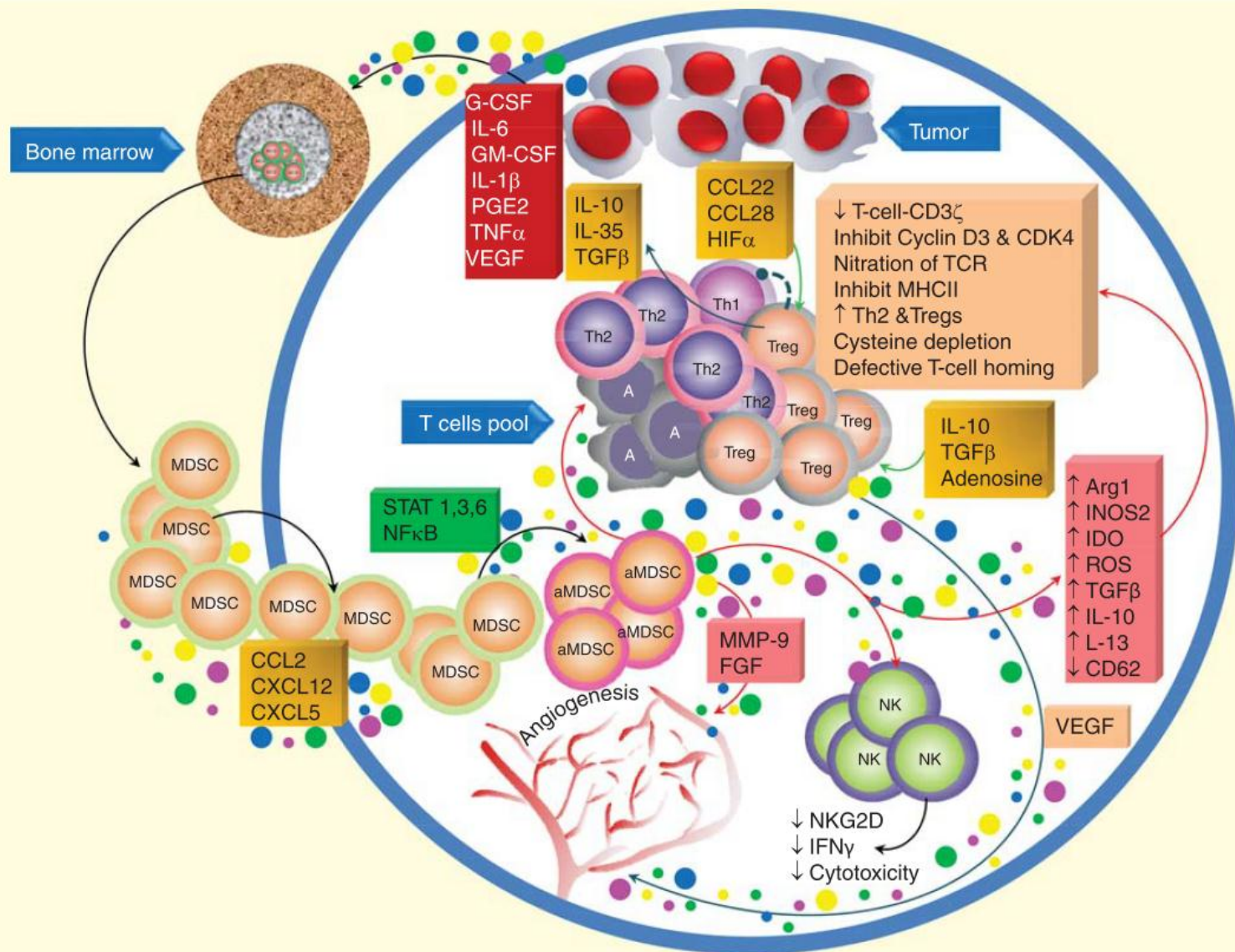
Importancia de la hipoxia



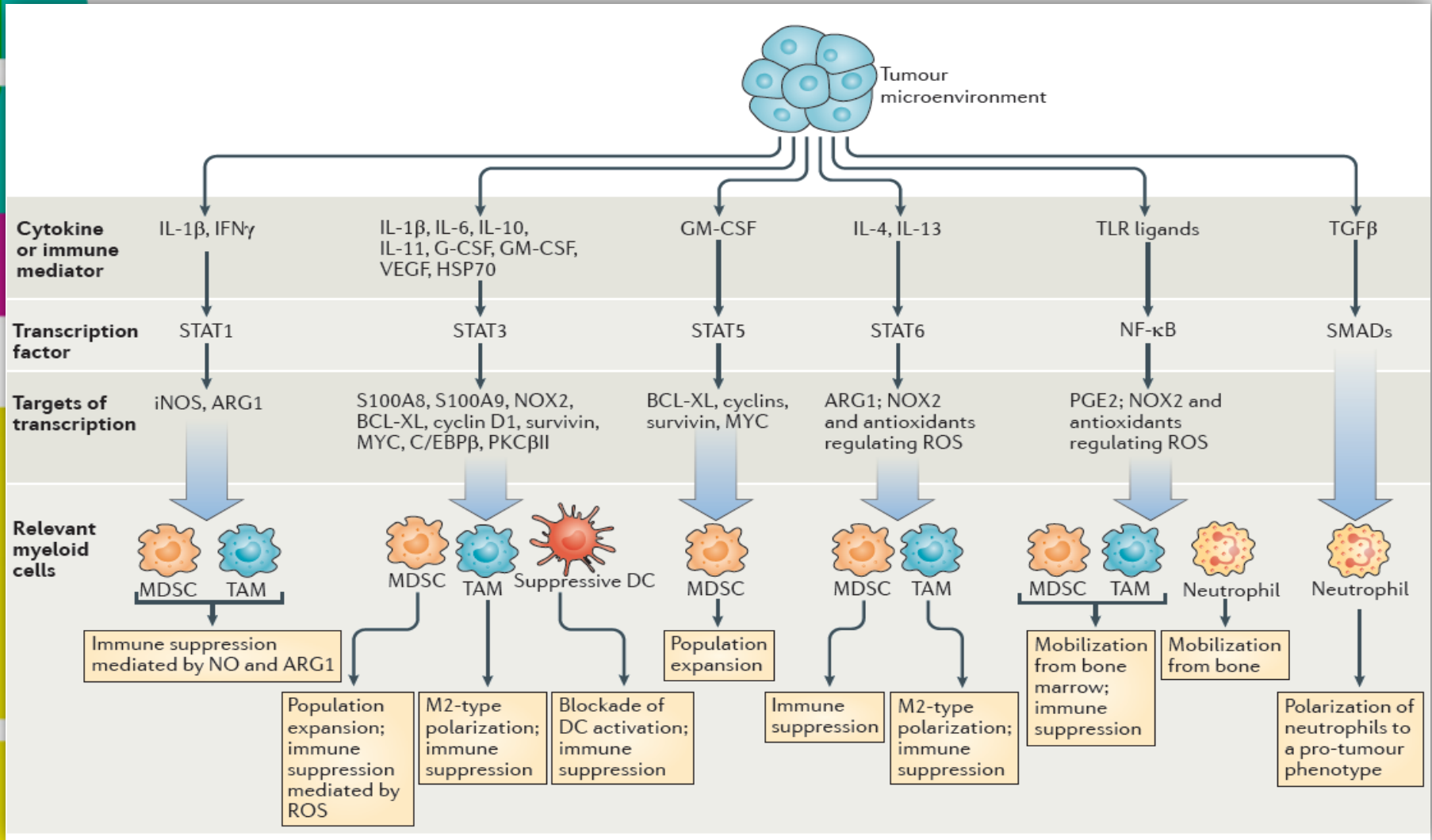
Células madre cancerosas



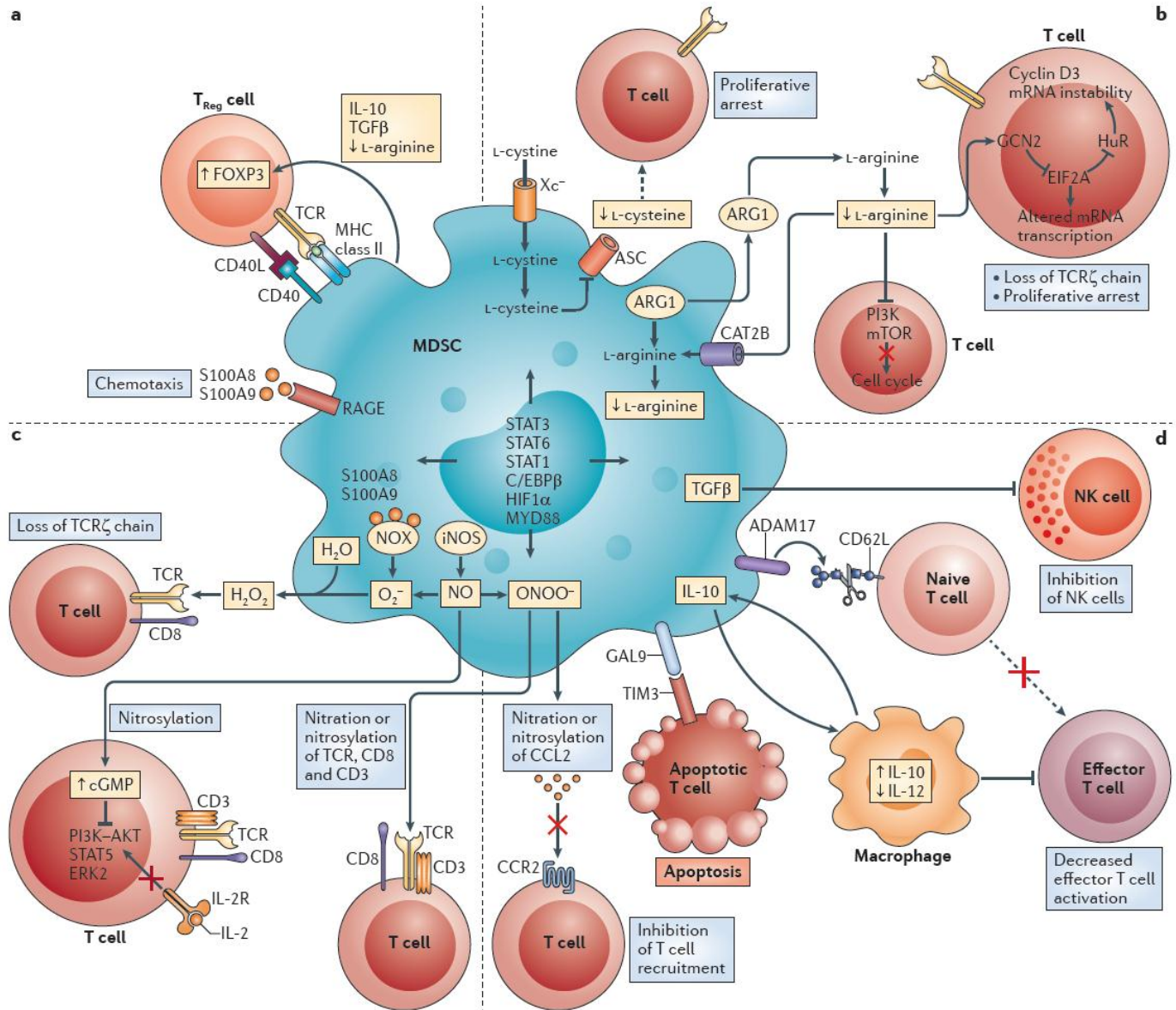
Estableciendo las MDSC



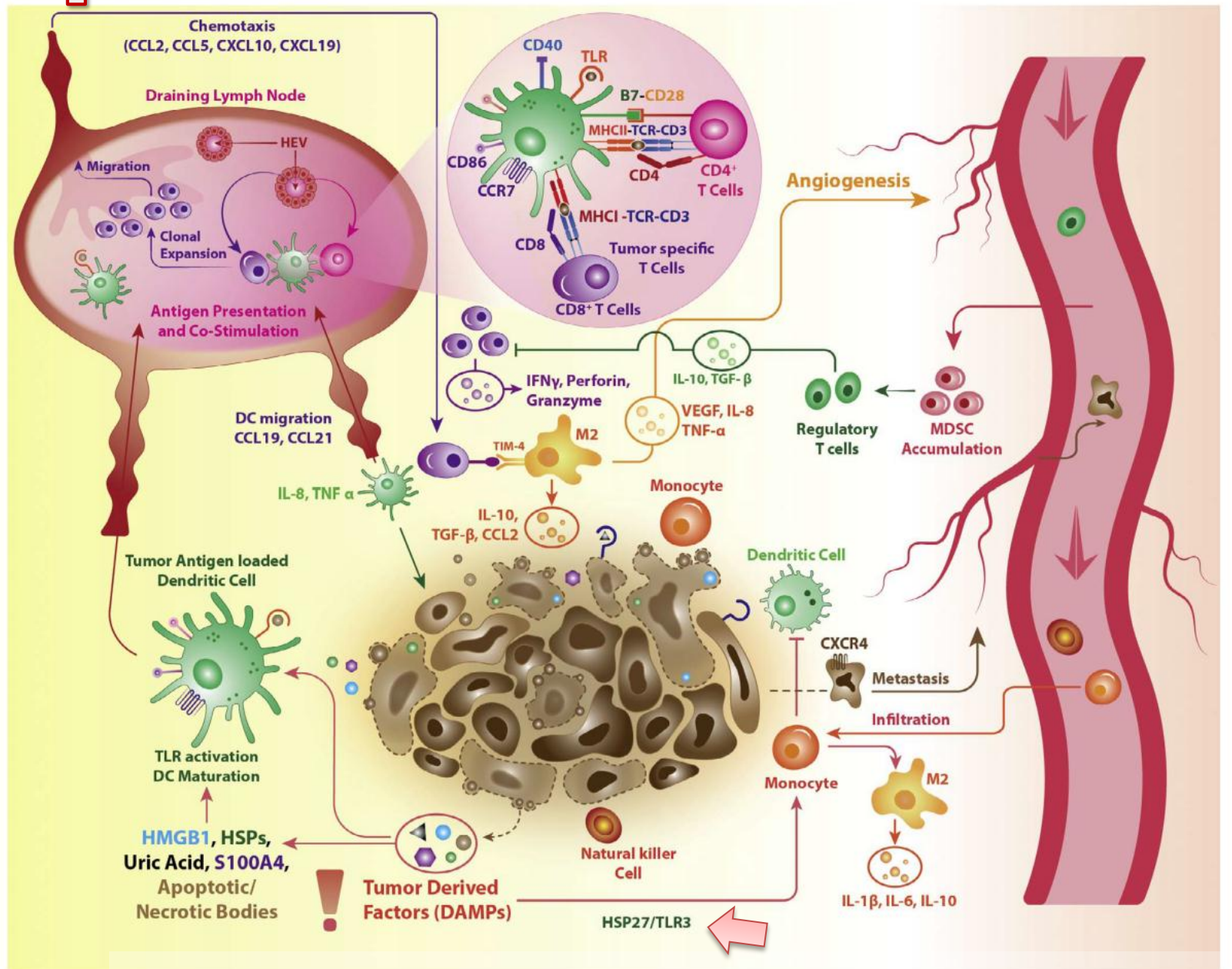
Células supresoras (MDSCs)



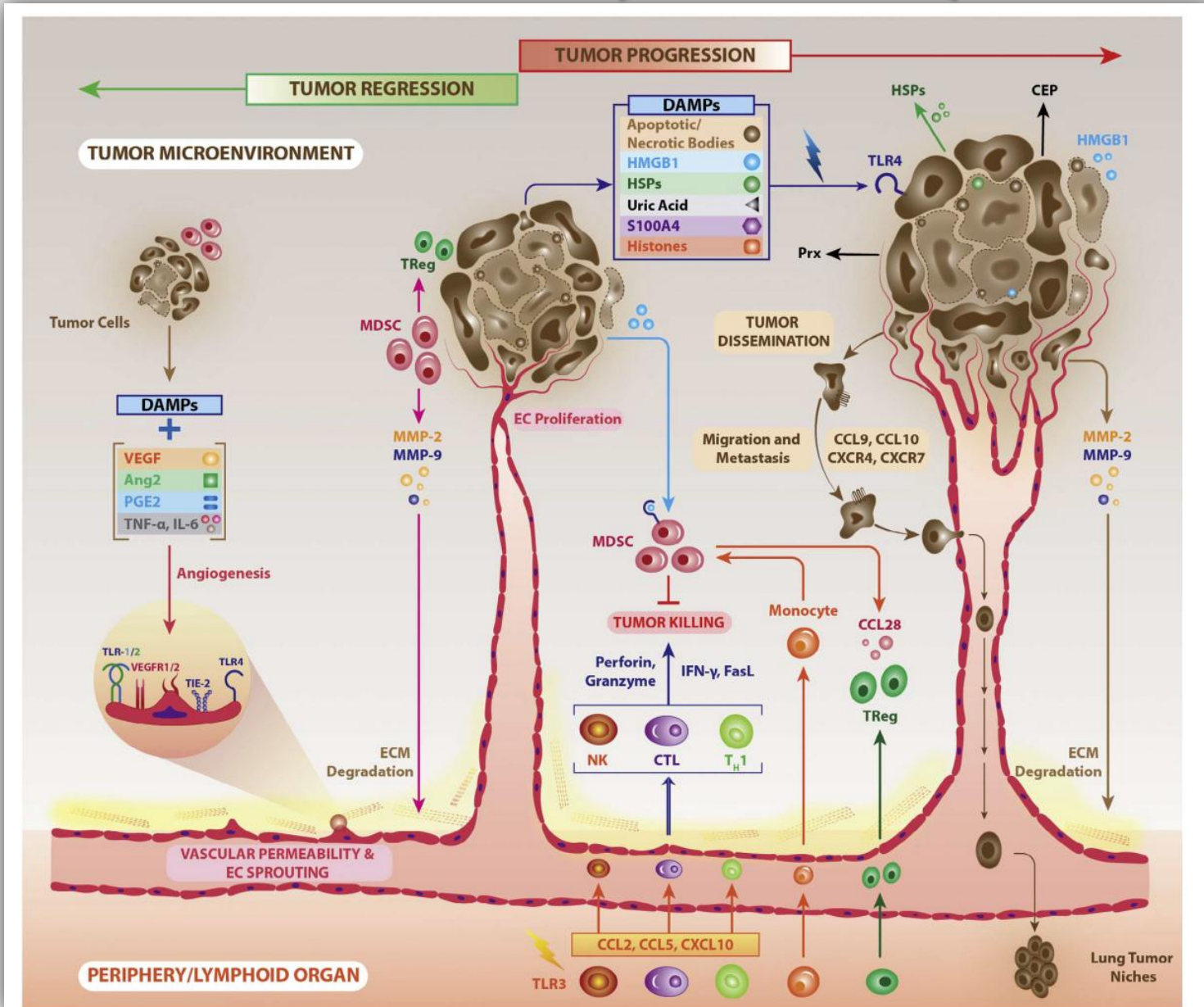
MDSCs



Bipolaridad de los DAMPs



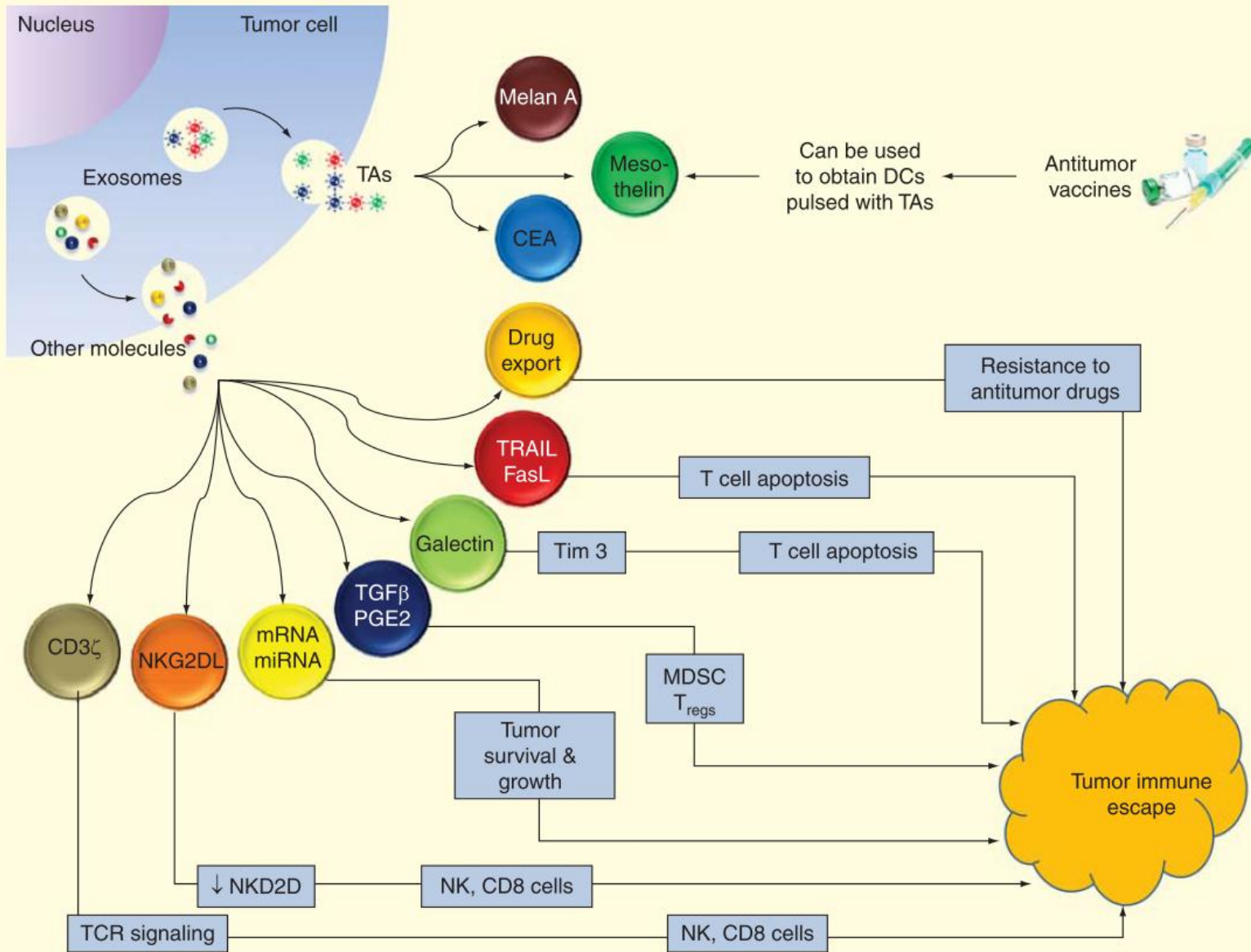
Señales de daño (DAMPs)



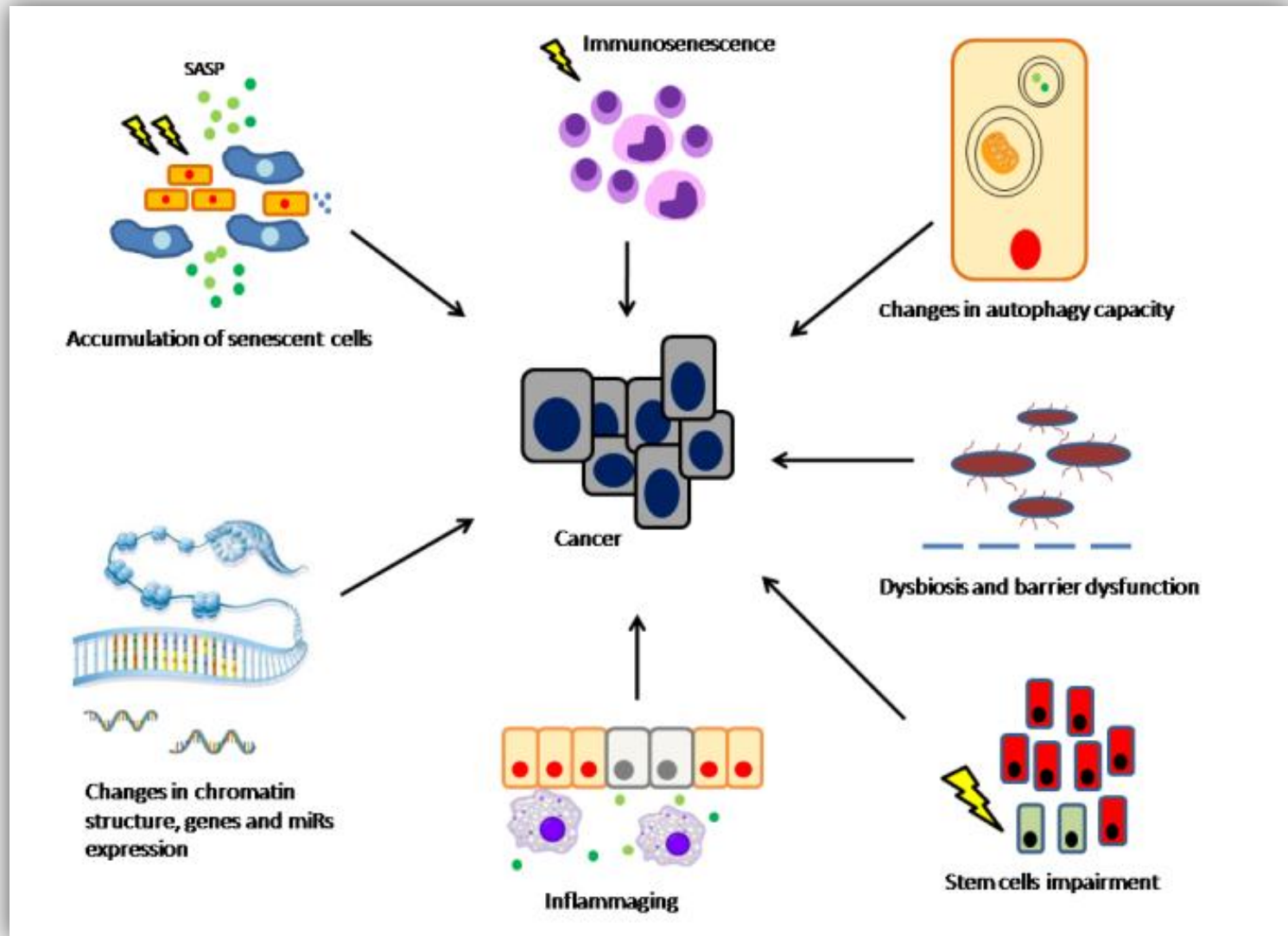
Señales de daño (DAMPs)

DAMPs	TLRs	Cell type	Cytokines	Pro-tumor functions
CEP	TLR1/2	ECs	-	Promotes angiogenesis in VEGF independent manner
Histones	TLR4	HCC cells	CCL9, CCL10	Promotes migration and metastasis of HCC
HSP27	TLR3	HMECs, Monocytes	VEGF, IL-8	Promotes EC migration and angiogenesis Enhances monocyte differentiation to M2 and inhibits differentiation into DCs
HSP60	TLR2	T cells	CXCR4, CCR7	Attenuation of effector and memory T cell behavior and chemotaxis
MMP-2	TLR2	DCs	TNF- α , IL-6, IL-8,	Immunosuppression due to Th ₂ skewness
Prx1	TLR4	ECs, TAMs	VEGF, IL-6, TNF- α , TGF- β	Promotes tumor vasculature by EC proliferation and migration
S100A8/9	TLR4	TAMs, HMECs	TNF- α , MIP2, SAA3 (not considered as cytokine)	Enhances MDSCs accumulation in tumor, Develops pre-metastatic niches in the lungs
SAA3	TLR4	Lung ECs	-	Develops pre-metastatic niches in the lung
Versican	TLR2/6	MDSCs	TNF- α , IL-6	Enhances metastasis of the Lewis lung cancer (LCC)
DAMPs	TLRs	Cell type	Cytokines	Anti-tumor functions
HMGB1	TLR2	Intra-tumor DCs	IL-6, TNF- α	Enhances clonal expansion, infiltration of T cells and tumor killing
HMGB1	TLR2	Macrophage, DCs	IL-1 β , IL-6, IL-10 from M ϕ , and TNF- α in DC.	Induce pro-inflammatory cytokine secretion and expression of co-stimulatory molecules
HMGB1	TLR4	Intra-tumor DCs	IL-6, IL-12, TNF- α , IFN- γ	Increased Dc maturation, tumor antigen processing and cross presentation
HMGNI	TLR4	DCs	IL-6, IL-12, TNF- α , IL-8	Promotes activation and recruitment of antigen specific DCs
HSP70	TLR4	Mouse LCC, DCs from tumor	CCR7, CXCR4	Releases chemokine to attract DCs and T cells into tumor, promoting anti-tumor immunity
HSP70	-	T cells	Granzyme B	Enhances the cytolytic activity of CD4 ⁺ and CD8 ⁺ T cells
SP-A	TLR2/4	TAMs	Reduced TNF- α	Tumor suppression by M1 polarization and NK cell recruitment
Uric acid	TLR2/4	DCs	IFN- γ	Enhances anti-tumor activity of DCs by CD80 and CD86 up-regulation, and CD8 ⁺ T cell activation

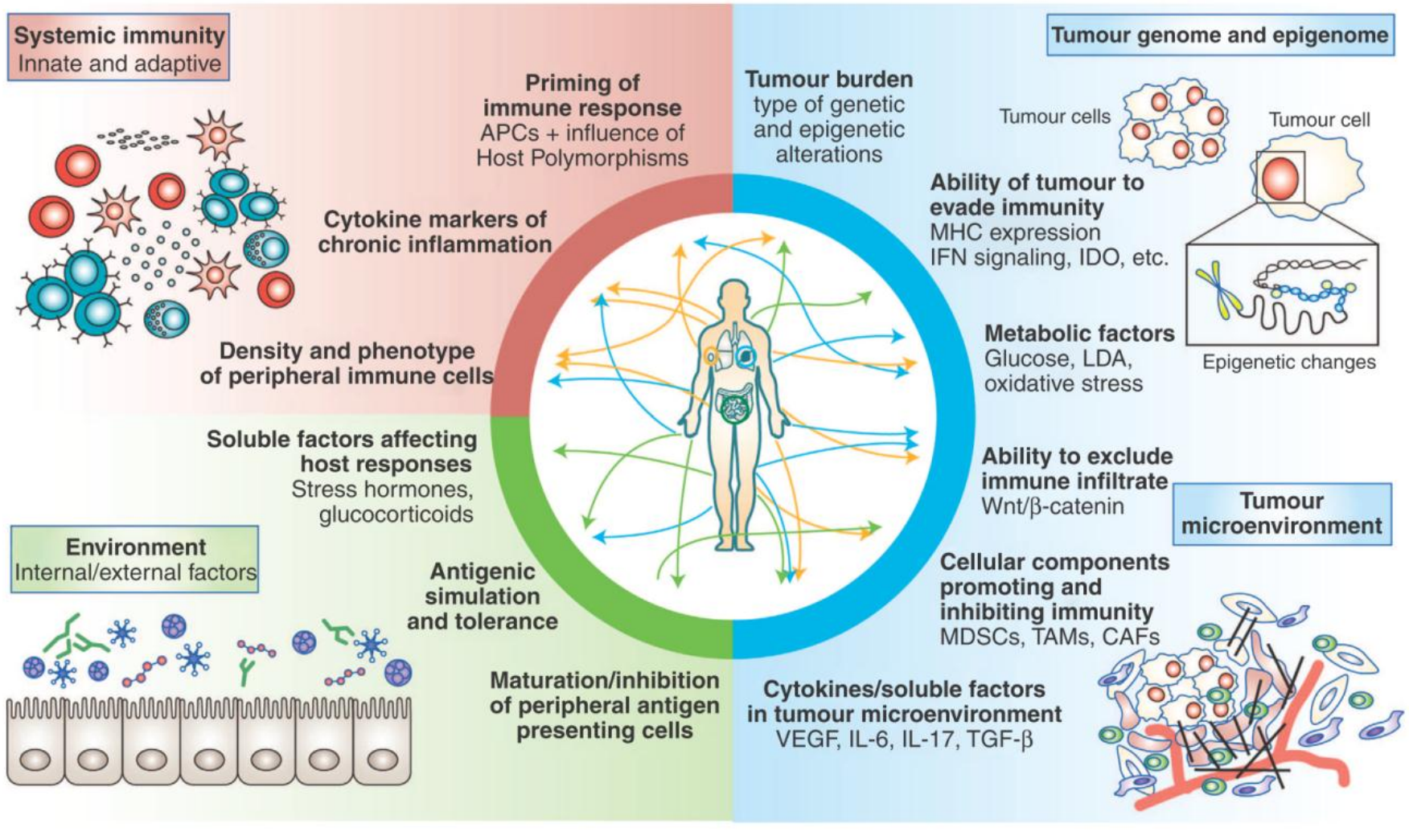
Bolsitas para llevar



Ligado al envejecimiento



Multifactorial



Marcadores

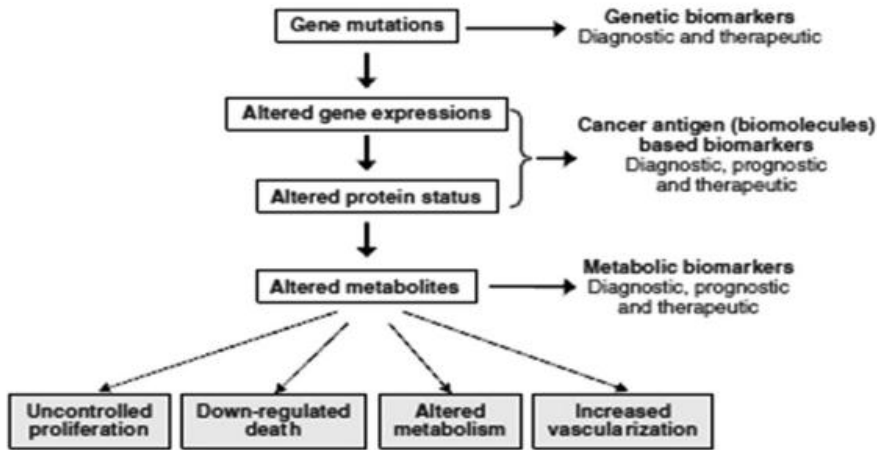
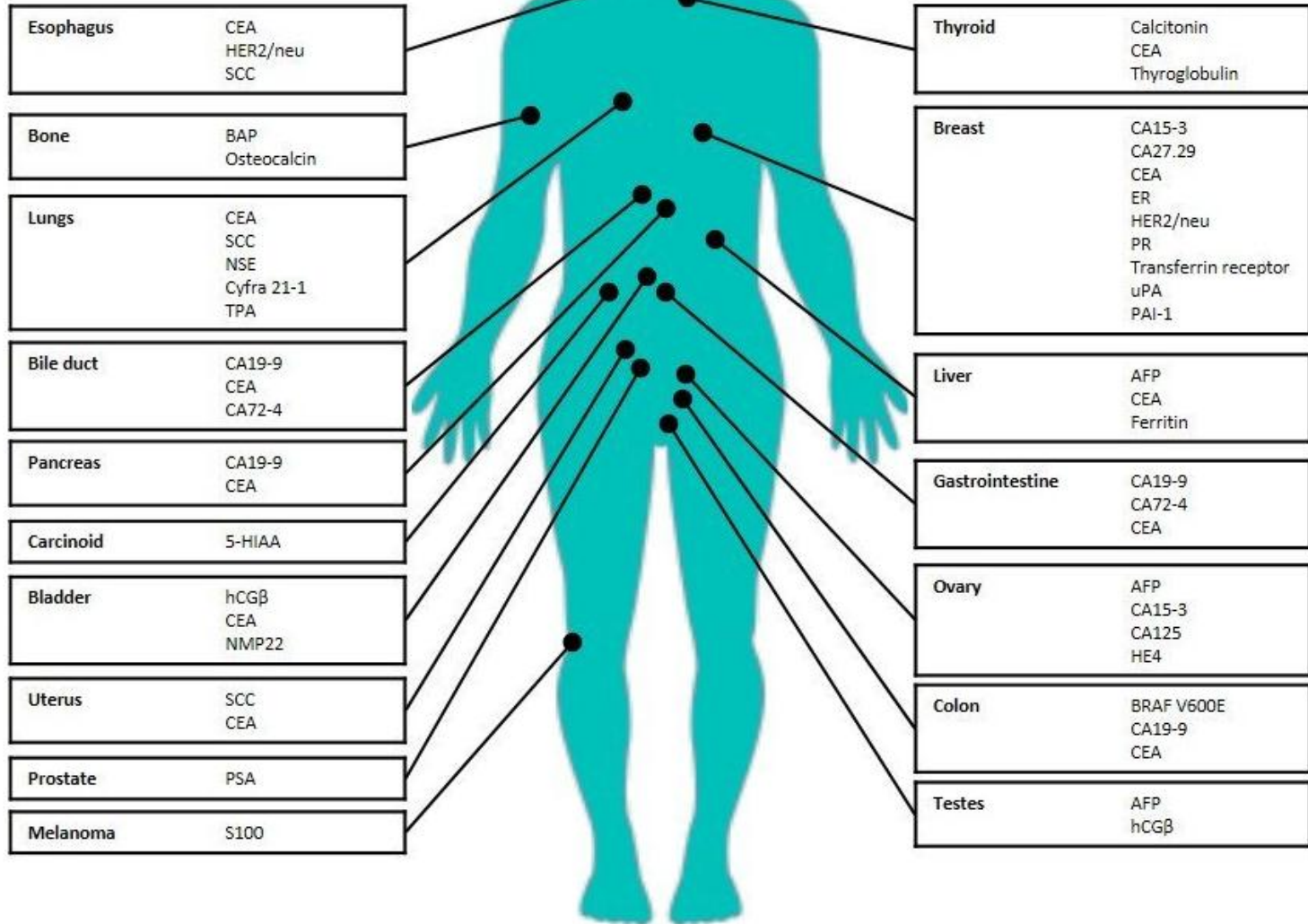


Table 1: Classification scheme of tumor markers

Marker	Associated cancer
Hormones	
Calcitonin	Follicular carcinoma thyroid
Catecholamine	Pheochromocytoma
Ectopic hormones	Paraneoplastic syndrome
Human chorionic gonadotropin	Trophoblastic tumor and nonseminomatous testicular tumor
Oncofetal antigen	
α fetoprotein	Liver cancer and cancer of testis
Carcino-embryonic antigen	Cancer of liver, pancreas, lung, stomach, and heart
Isoenzyme	
Prostatic acid phosphatase	Cancer prostate
Neuron-specific enolase	Neuroblastoma
Proteins	
Immunoglobulins	Multiple myeloma
PSA, PSMA	Prostate cancer
Calcium-binding protein MRP14	OSCC
CD59	OSCC
Profilin 1	OSCC
Catalase	OSCC
Mitochondrial markers	
mtDNA	Breast, colon, esophageal, endometrial, head and neck, liver, kidney, leukemia, lung, melanoma, oral, prostate, and thyroid cancers
Mucin and other glycoprotein	
Cancer 125	Ovarian cancer
Cancer 19.9	Colon cancer
Cancer 15.3	Breast cancer
New molecular markers	
p53, APC, RAS mutation in stool and serum	Cancer colons
p53, RAS mutation in sputum and serum	Lung cancer
P53 mutation in urine	Bladder cancer
p53, RAS mutation in stool and serum	Pancreas cancer

PSMA: Prostate-specific membrane antigen, PSA: Prostatic-specific antigen, OSCC: Oral squamous cell carcinoma, MRP14: Myeloid-related protein 14, APC: Adenomatous polyposis coli^[2,8-11]

Marcadores tumorales



Marcadores tumorales

Marker	Gene	ALL	AML	BDC	BNC	BRC	CAC	CD	CML	CLL	CRC	CSC	EC	GIC	GCT	HC	LC	LY	MM	MY	NET	NTC	PC	SC	TC	THC	UBC	UC
OA Alpha-fetoprotein	AFP														•	•									•			
OA Carcinoembryonic antigen (CEA)	CEACAM5			•		•					•		•	•			•									•	•	•
OA Carcinoembryonic antigen (CEA)	CEACAM6			•		•					•		•	•			•									•	•	•
OA Carcinoembryonic antigen (CEA)	CEACAM1			•		•					•		•	•			•									•	•	•
OA Carcinoembryonic antigen (CEA)	CEACAM7			•		•					•		•	•			•									•	•	•
TA 5-HIAA	-							•																				
TA CA15-3	MUC1					•																						
TA CA19-9	-						•				•			•			•											•
TA CA27.29	MUC1					•																						
TA CA72-4	-													•														
TA CA125	MUC16														•		•											•
HR Beta-human chorionic gonadotropin (hCGβ)	CGA, CGB														•	•									•			
HR Calcitonin	CALC1																									•		
HR Chromogranin A (CgA)	CHGA																				•							
HR EGFR mutation analysis	EGFR																•											
HR Estrogen receptor (ER)	ESR1					•																						
HR Estrogen receptor (ER)	ESR2					•																						
HR HER2/neu	ERBB2					•							•	•														
HR Osteocalcin	BGLAP				•																							
HR Progesterone receptor (PR)	PGR					•																						
HR transferrin receptor	TFRC					•																						
HR transthyretin	TTR														•													

ALL Acute lymphoblastic leukemia
AML Acute myelogenous leukemia
BDC Bile duct cancer
BNC Bone cancer
BRC Breast cancer
CAC Cholangiocarcinoma

CD Carcinoid
CML Cutaneous melanoma
CLL Chronic lymphocytic leukemia
CRC Colorectal cancer
CSC Cancer stem cell
EC Esophageal cancer

GIC Gastrointestinal cancer
GCT Germ cell tumor
HC Liver cancer
LC Lung cancer
LY Lymphoma
MM Mucosal melanoma

MY Multiple myeloma
NET Neuroendocrine tumor
NTC Nervous tissue cancer
PC Prostate cancer
SC Skin cancer
TC Testicular cancer

THC Thyroid cancer
UBC Bladder cancer
UC Uterine cancer

OA Oncofetal antigens
TA Tumor associated antigens
HR Hormes and receptors
EM Enzymes and modulators
ST Serum and tissue proteins
CS Cancer stem cells

Marcadores tumorales

		ALL	AML	BDC	BNC	BRC	CAC	CD	CML	CLL	CRC	CSC	EC	GIC	GCT	HC	LC	LY	MM	MY	NET	NTC	PC	SC	TC	THC	UBC	UC
EM	Alkaline phosphatase (BAP)				•																							
EM	BCR-ABL fusion gene	•	•						•																			
EM	BRAF V600E										•													•				
EM	KIT													•					•									
EM	KRAS mutation analysis																											
EM	Prostate-specific antigen																						•					
EM	Lactate dehydrogenase													•	•													
EM	Lactate dehydrogenase													•	•													
EM	Lactate dehydrogenase													•	•													
EM	Neuron specific enolase (NSE)																	•							•			
EM	Nuclear matrix protein 22 (NMP22)																									•		
EM	plasminogen activator inhibitor (PAI-1)					•																						
EM	SCC												•		•									•				•
EM	SCC												•		•									•				•
EM	Urokinase plasminogen activator (uPA)					•																						
ST	Apolipoprotein A1														•													
ST	Beta-2-microglobulin									•										•								
ST	Cytokeratin fragments 21-1 (Cyfra 21-1)					•							•											•				•
ST	Epididymal secretory protein E4 (HE4)														•													
ST	Ferritin															•												
ST	Fibrinogen																											•
ST	Fibrin D-dimer																											•
ST	S100																							•				
ST	Tissue polypeptide antigen (TPA)																											•
ST	Thyroglobulin																								•			
CS	Aldehyde dehydrogenase			•		•						•		•				•						•				
CS	CD20											•																
CS	CD24			•		•						•		•	•	•												
CS	CD44			•		•						•		•	•	•												
CS	Nestin			•								•										•						

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¡Ha sido todo un placer!



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