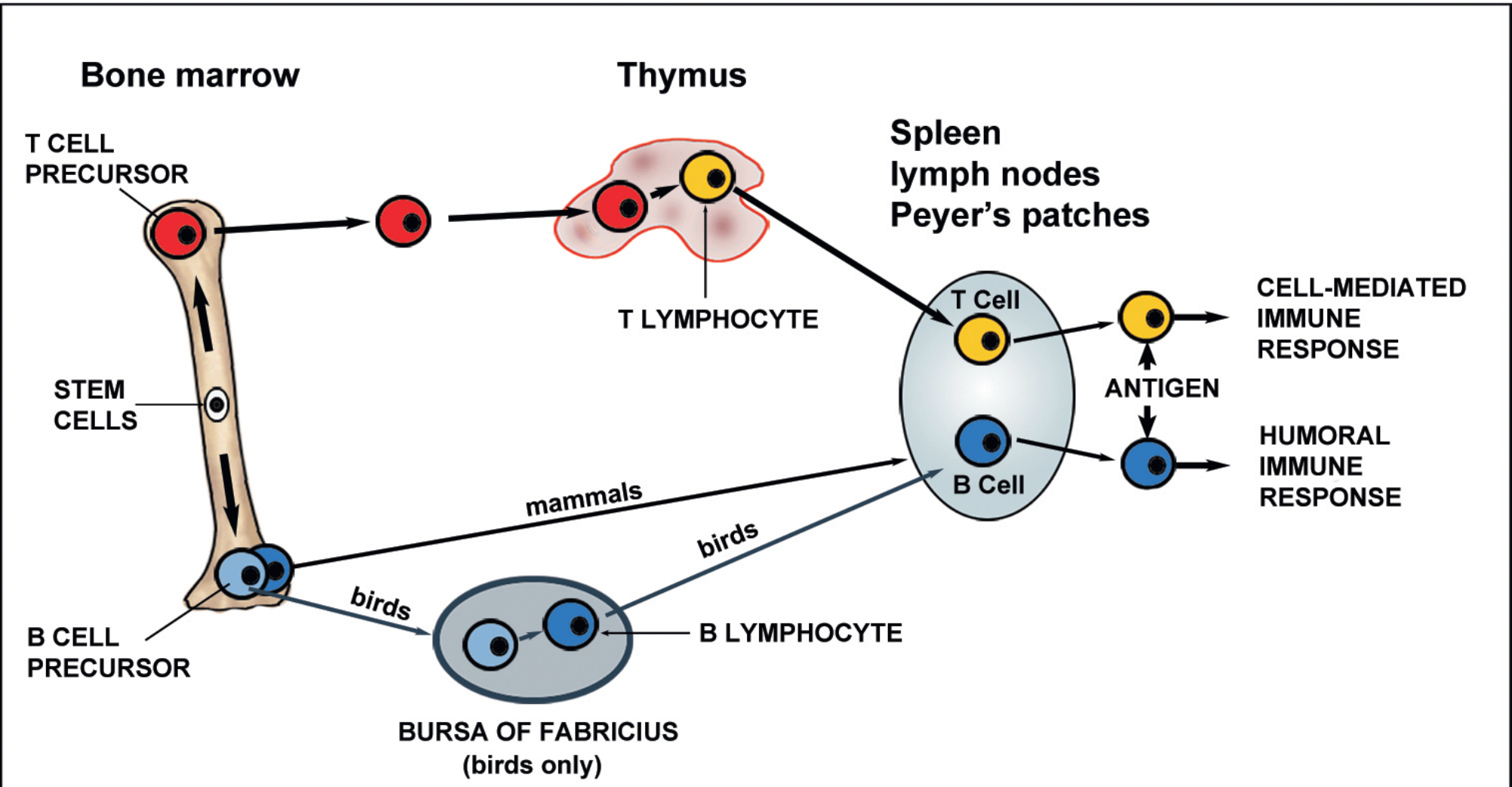
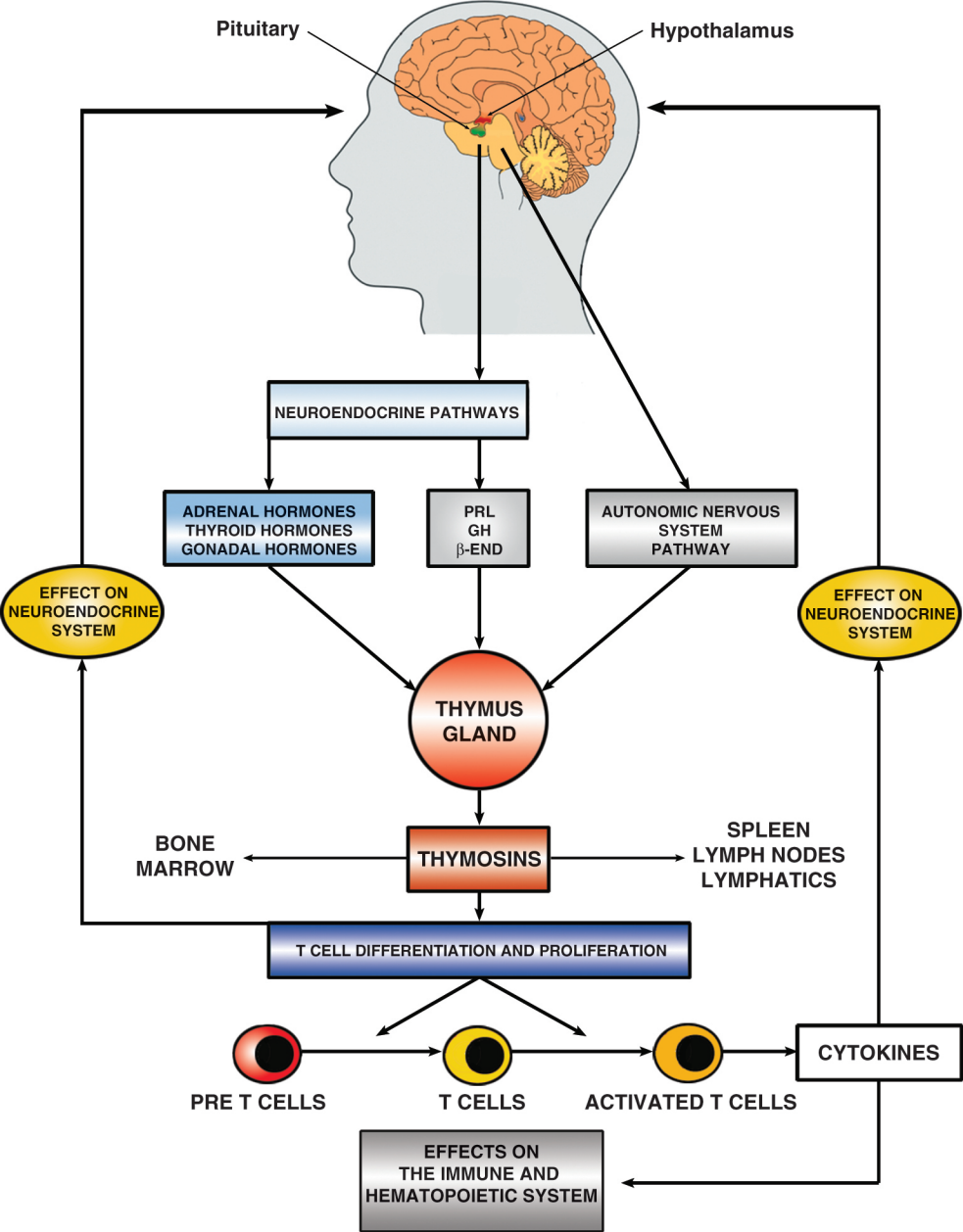
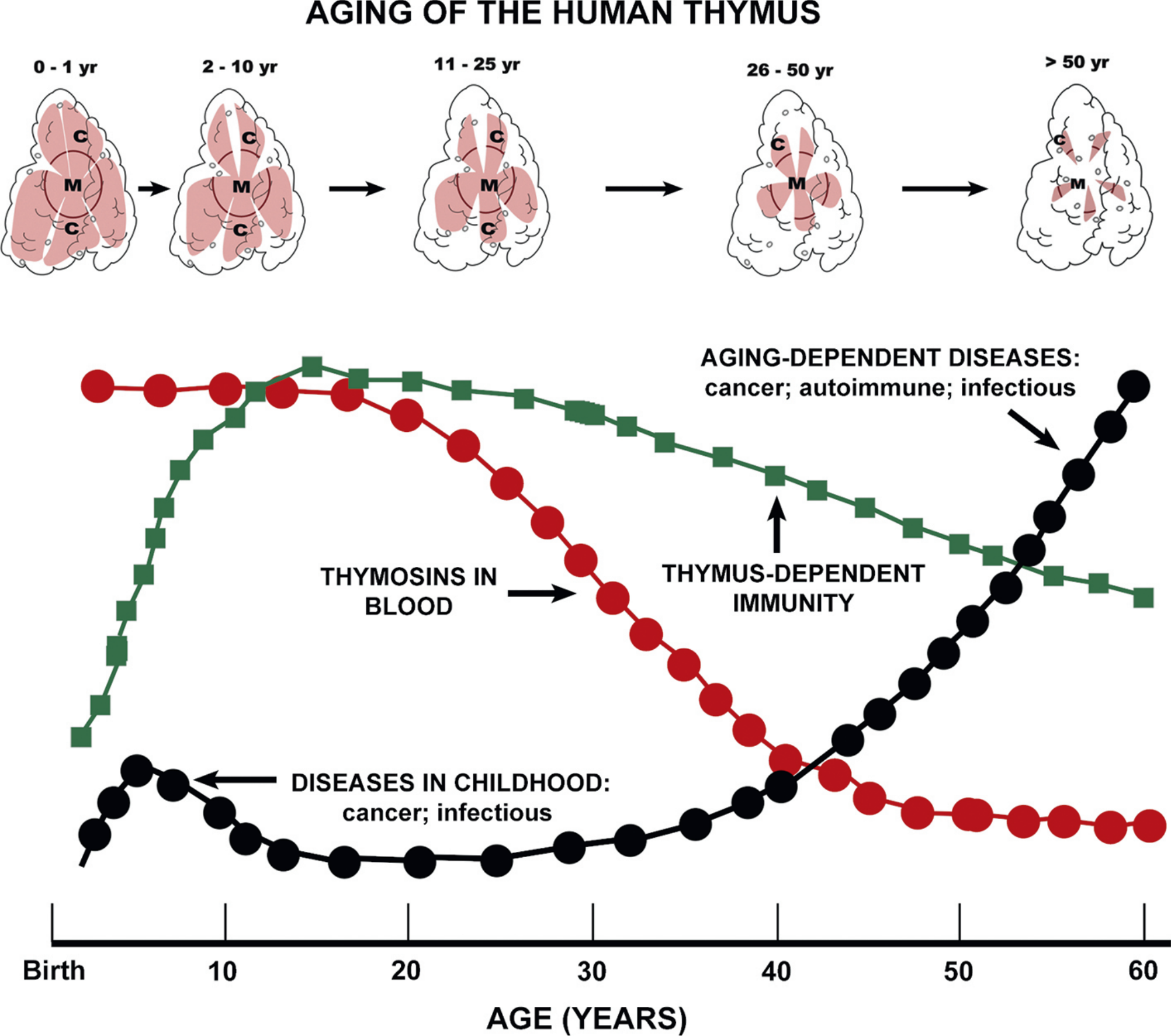
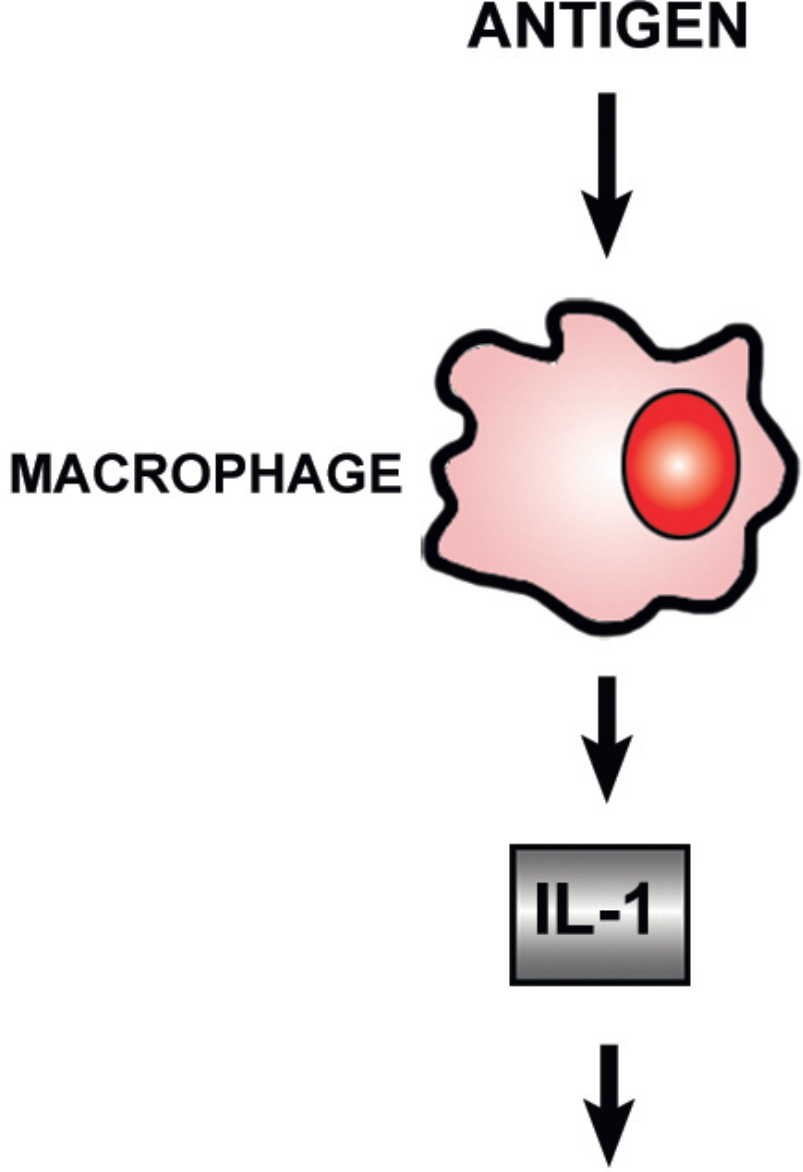
Primary Lymph Organs	Secondary Lymph Organs	Body

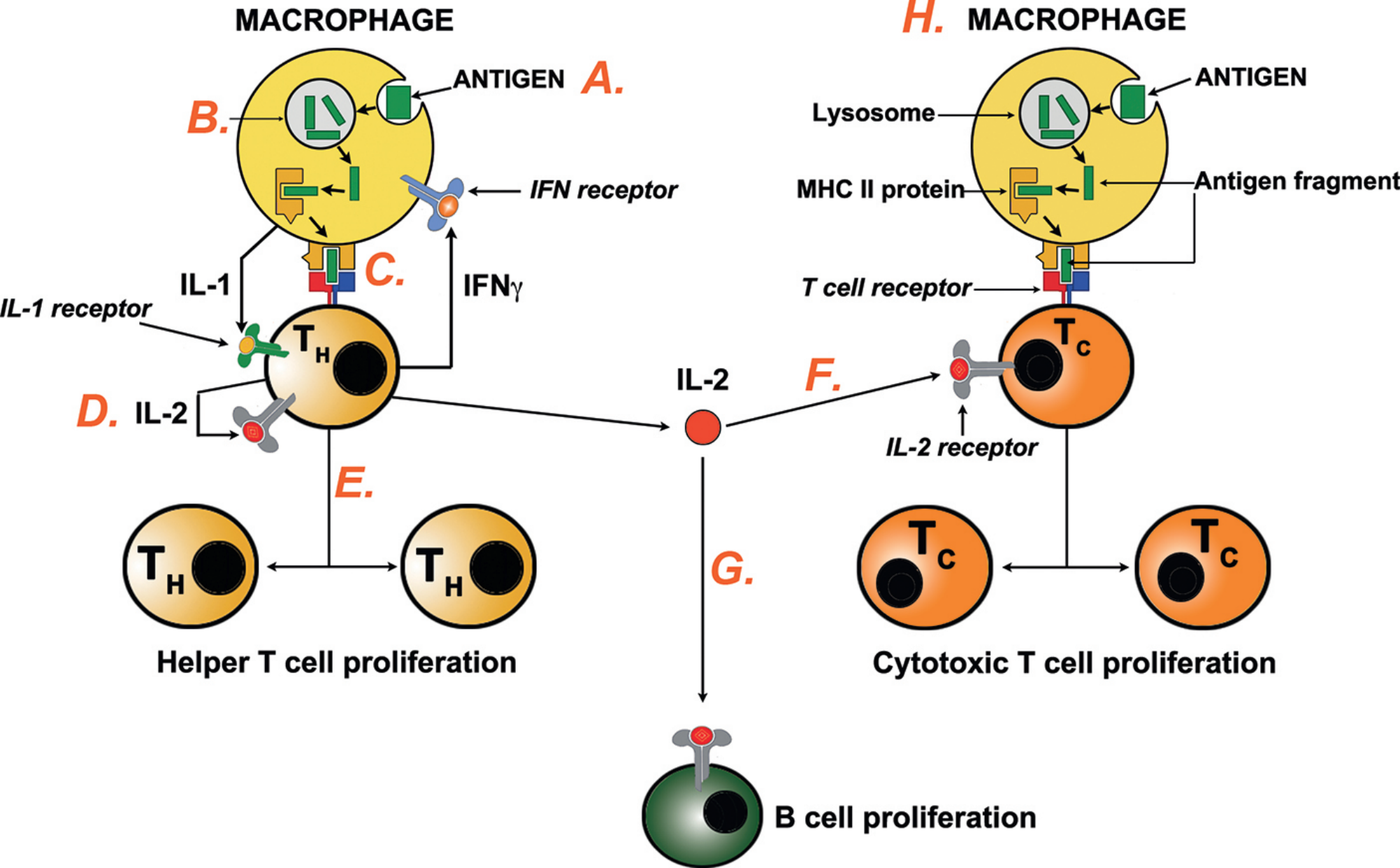


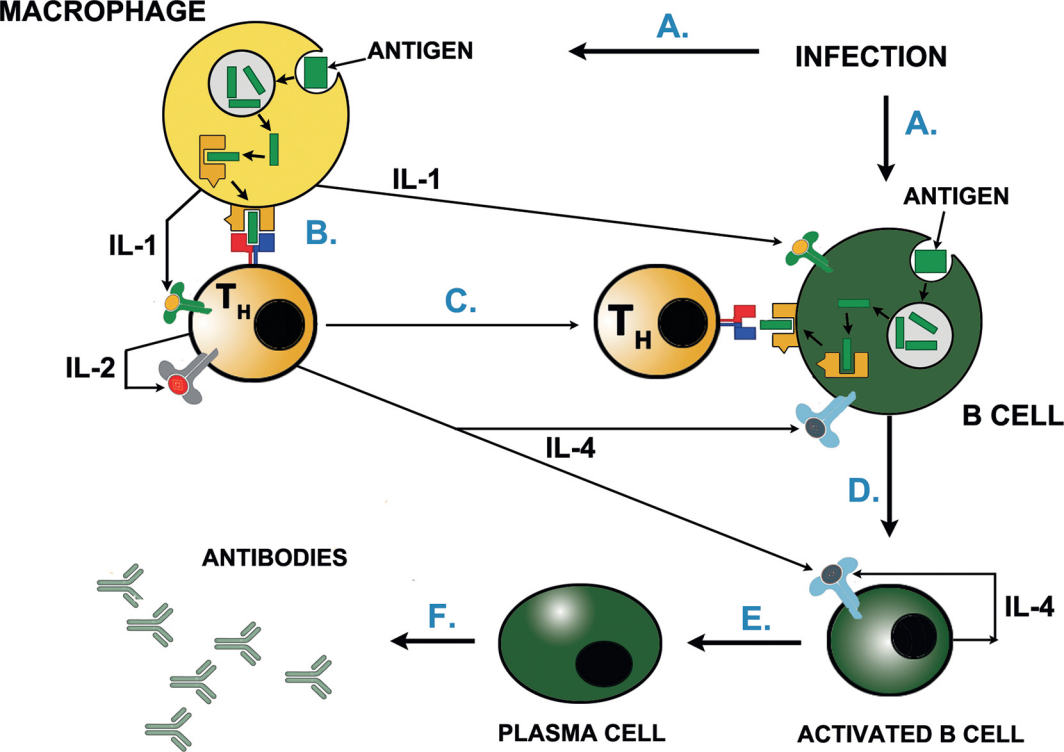

Pituitary
Hypothalamus
NEUROENDOCRINE PATHWAYS
ADRENAL HORMONES
THYROID HORMONES
GONADAL HORMONES
PRL
GH
β-END
AUTONOMIC NERVOUS SYSTEM PATHWAY
EFFECT ON NEUROENDOCRINE SYSTEM
EFFECT ON NEUROENDOCRINE SYSTEM
THYMUS GLAND
BONE MARROW
THYMOSINS
SPLEEN
LYMPH NODES
LYMPHATICS
T CELL DIFFERENTIATION AND PROLIFERATION
PRE T CELLS
T CELLS
ACTIVATED T CELLS
CYTOKINES
EFFECTS ON THE IMMUNE AND HEMATOPOIETIC SYSTEM

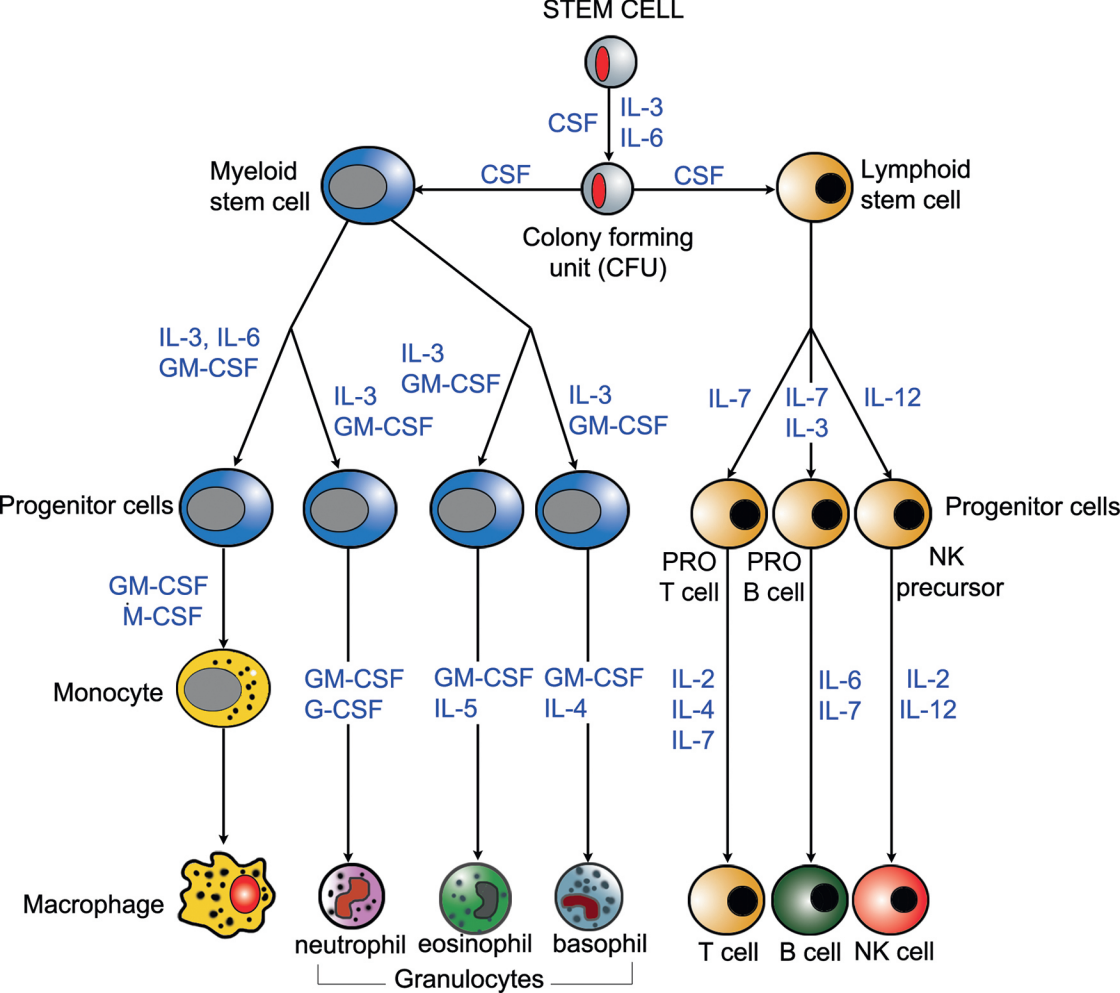

AGING OF THE HUMAN THYMUS
0 - 1 yr
2 - 10 yr
11 - 25 yr
26 - 50 yr
> 50 yr
C
M
C
AGING-DEPENDENT DISEASES:
cancer; autoimmune; infectious
THYMOSINS IN
BLOOD
THYMUS-DEPENDENT
IMMUNITY
DISEASES IN CHILDHOOD:
cancer; infectious
Birth
10
20
30
40
50
60
AGE (YEARS)

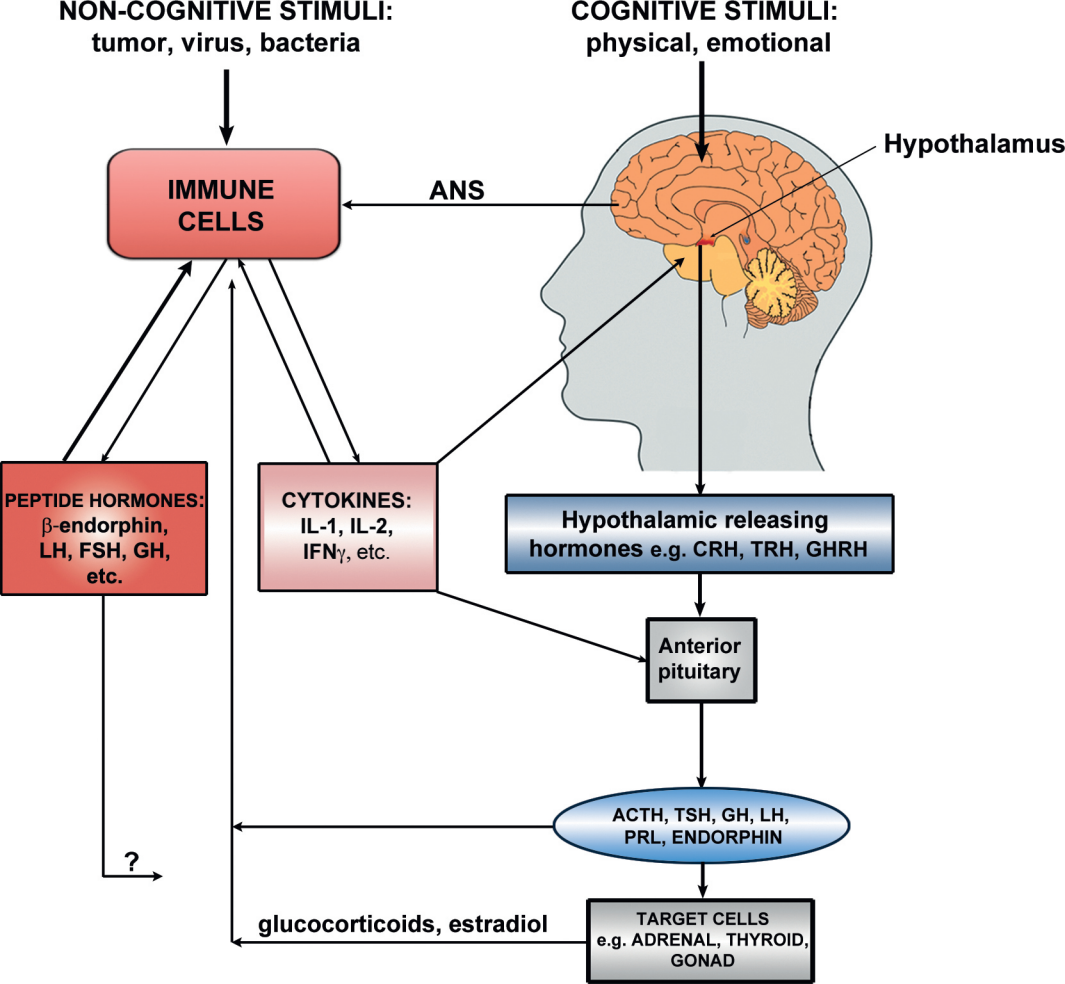


1. BRAIN: prostaglandin synthesis, sleep, anorexia, fever.
2. NEUROENDOCRINE SYSTEM: modulates release of hormones.
3. LYMPHOCYTES: promotes T and B cell proliferation and synthesis of cytokines.
4. BONE MARROW: hematopoiesis.
5. LIVER: acute phase proteins.
6. MUSCLE: protein synthesis.
7. BONE AND CARTILAGE: synthesis of prostaglandins.
8. ENDOTHELIUM AND EPITHELIUM: local inflammation and wound healing.


MACROPHAGE
A.
ANTIGEN
B.
IFN receptor
IL-1
C.
IFNγ
IL-1 receptor
T H
D.
IL-2
E.
T H
T H
Helper T cell proliferation
IL-2
G.
B cell proliferation
H.
MACROPHAGE
ANTIGEN
Lysosome
MHC II protein
Antigen fragment
T cell receptor
F.
T C
IL-2 receptor
T C
T C
Cytotoxic T cell proliferation


MACROPHAGE
ANTIGEN
A.
INFECTION
A.
IL-1
ANTIGEN
IL-1
B.
T_H
C.
T_H
IL-2
B CELL
IL-4
D.
ANTIBODIES
IL-4
F.
E.
PLASMA CELL
ACTIVATED B CELL


STEM CELL
CSF
IL-3
IL-6
Myeloid stem cell
CSF
CSF
Lymphoid stem cell
Colony forming unit (CFU)
IL-3, IL-6
GM-CSF
IL-3
GM-CSF
IL-3
GM-CSF
IL-3
GM-CSF
IL-7
IL-7
IL-3
IL-12
Progenitor cells
Progenitor cells
PRO T cell
PRO B cell
NK precursor
GM-CSF
M-CSF
Monocyte
GM-CSF
G-CSF
GM-CSF
IL-5
GM-CSF
IL-4
IL-2
IL-4
IL-7
IL-6
IL-7
IL-2
IL-12
Macrophage
neutrophil
eosinophil
basophil
T cell
B cell
NK cell
Granulocytes

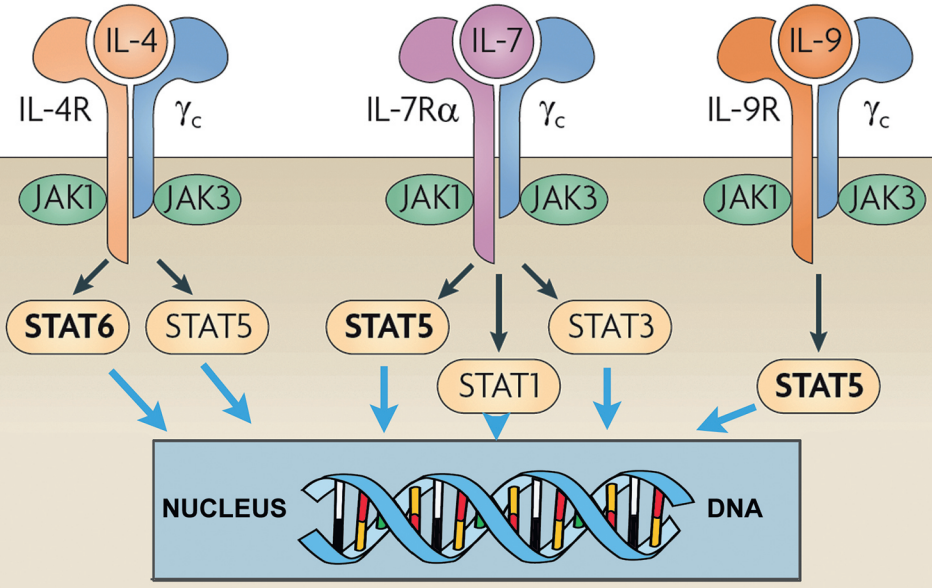

NON-COGNITIVE STIMULI:
tumor, virus, bacteria
COGNITIVE STIMULI:
physical, emotional
Hypothalamus
IMMUNE CELLS
ANS
PEPTIDE HORMONES:
β-endorphin,
LH, FSH, GH,
etc.
CYTOKINES:
IL-1, IL-2,
IFNγ, etc.
Hypothalamic releasing hormones e.g. CRH, TRH, GHRH
Anterior pituitary
ACTH, TSH, GH, LH,
PRL, ENDORPHIN
?
glucocorticoids, estradiol
TARGET CELLS
e.g. ADRENAL, THYROID,
GONAD

CYTOKINE PRODUCED BY:

IL-4: T cells, NKT cells, eosinophils and mast cells

IL-7: stromal cells, epithelial cells and fibroblasts

IL-9: T cells

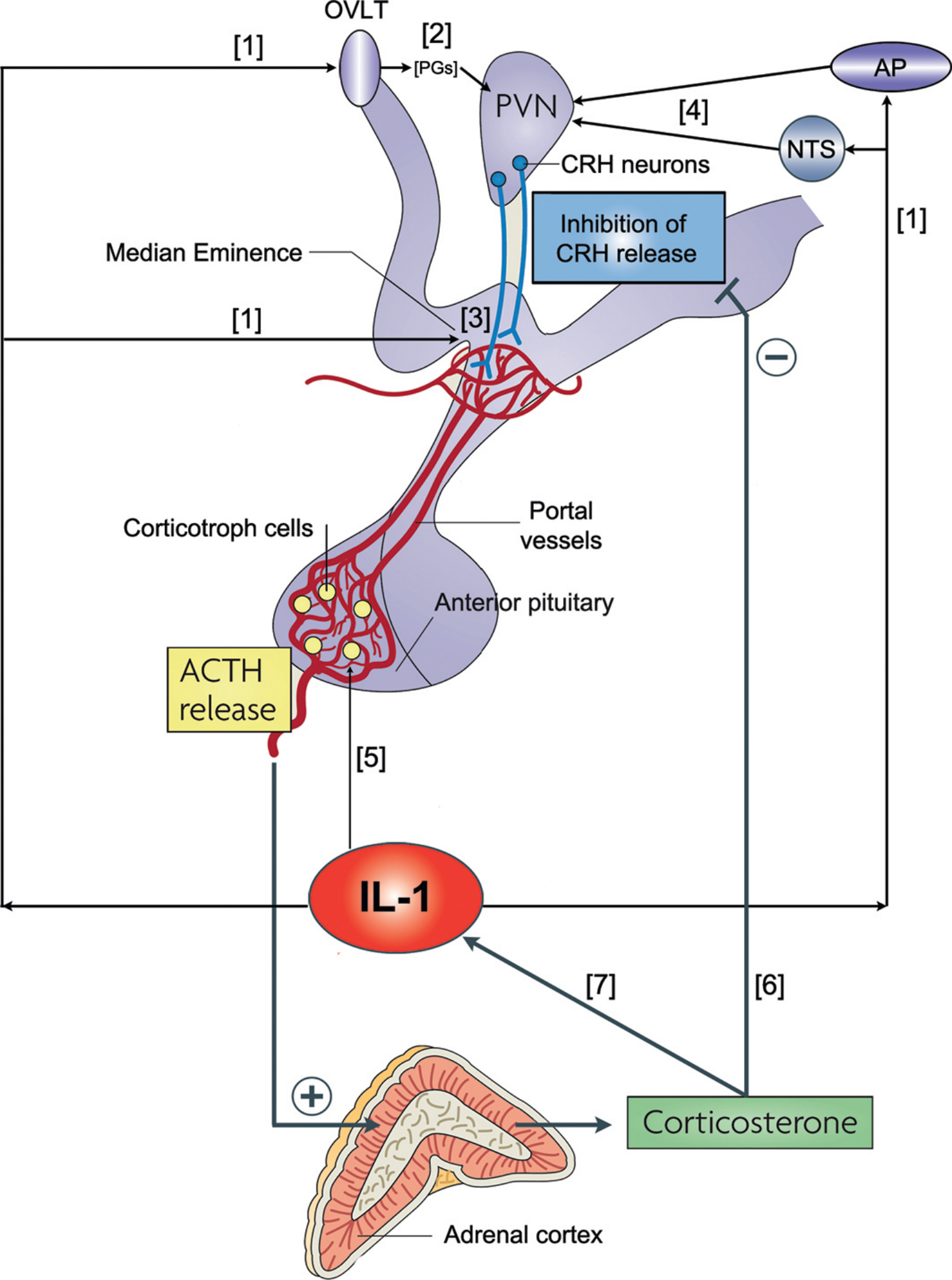


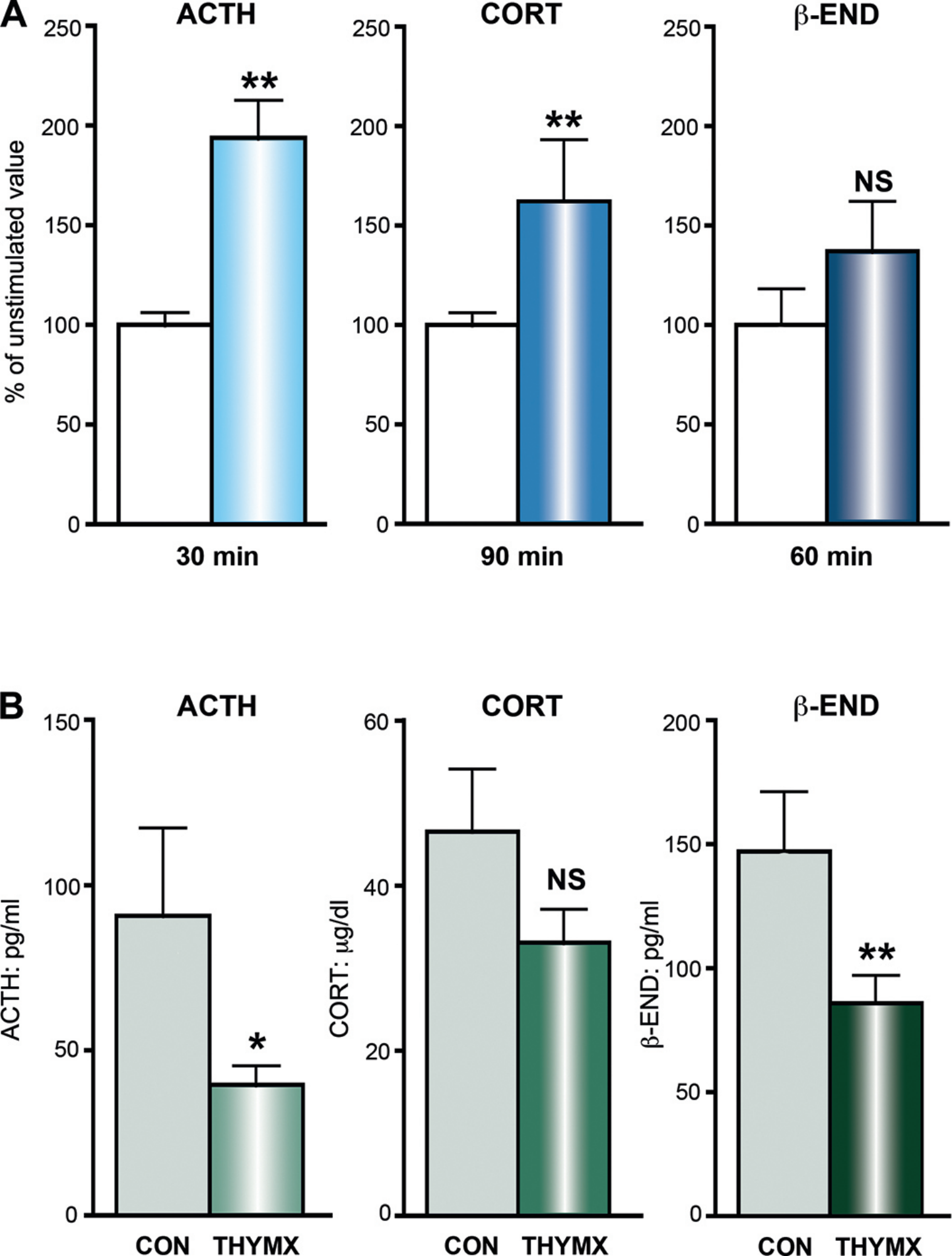
TARGET CELLS

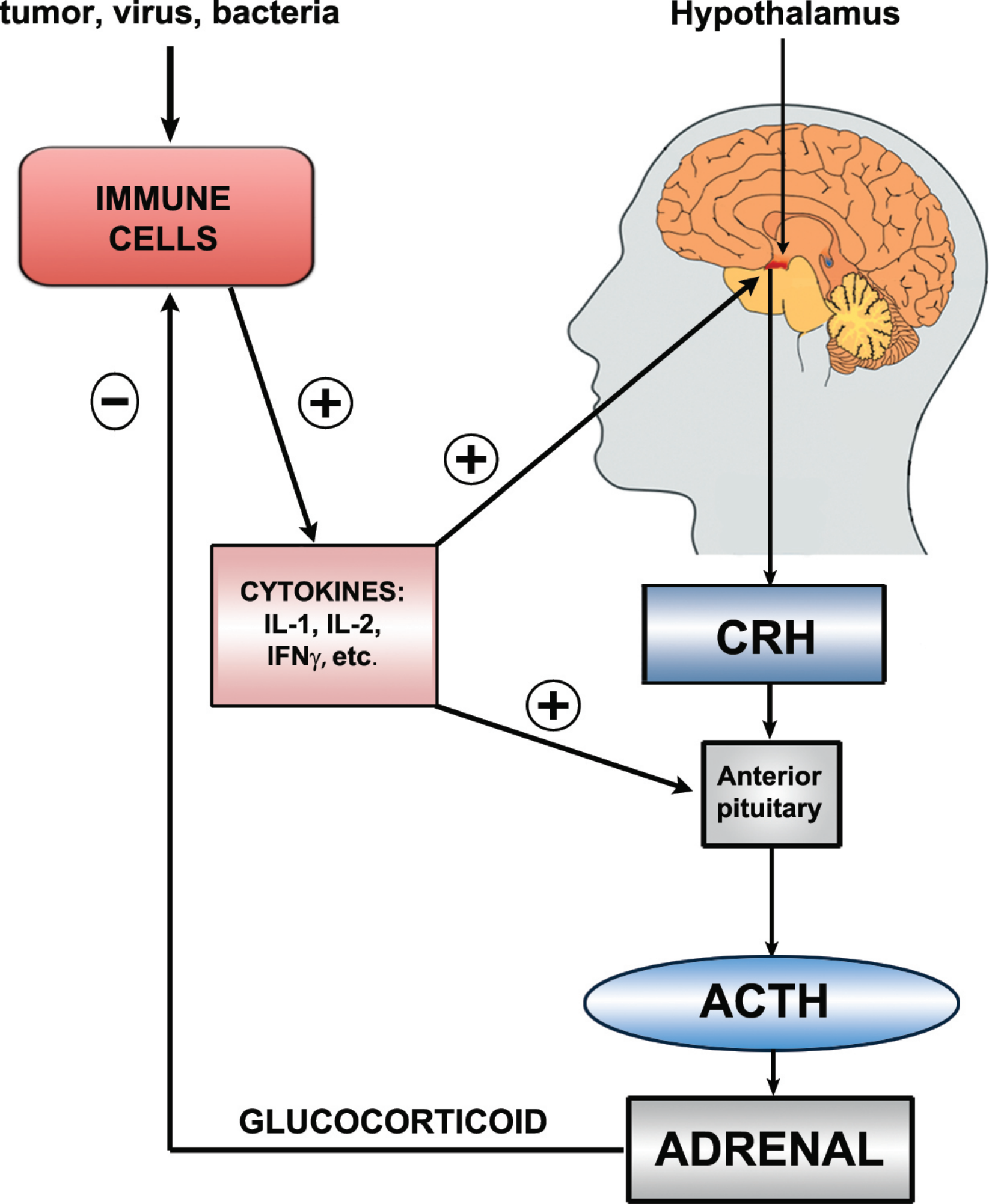
T cells, B cells, NK cells, mast cells and basophils

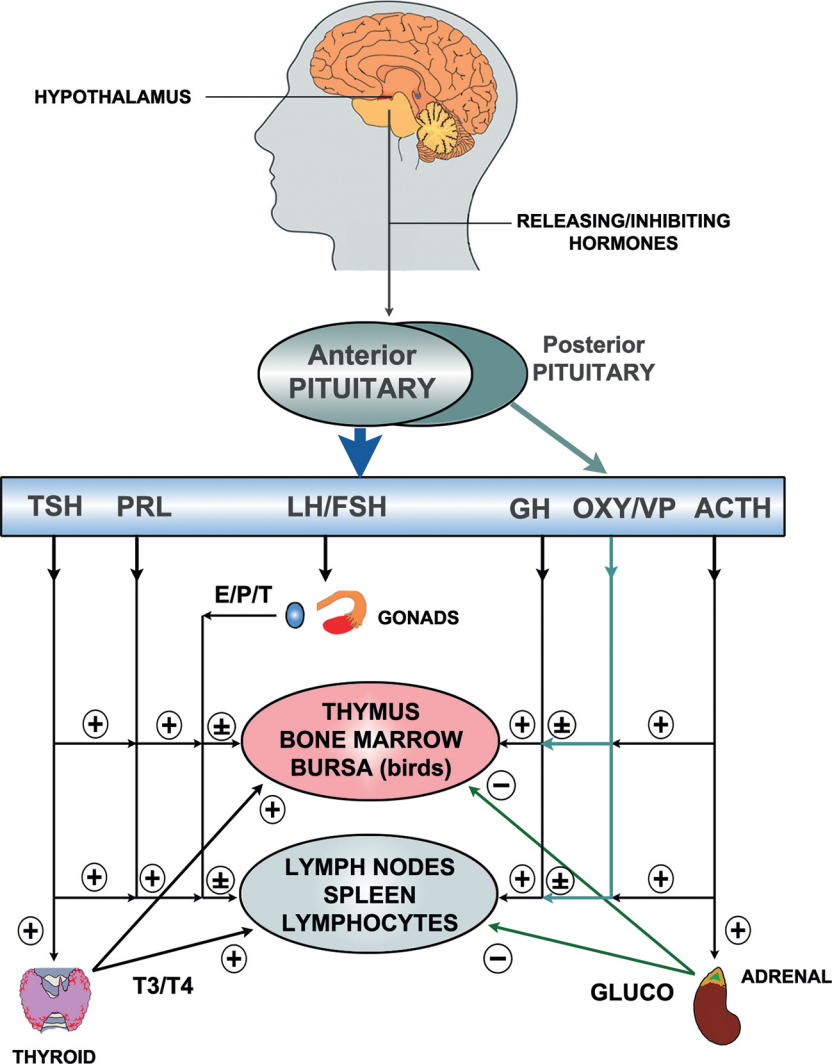
T cells, pre-B cells

T cells, mast cells, epithelial cells and eosinophils


OVLT
[1]
[2]
[PGs]
PVN
AP
[4]
NTS
CRH neurons
Inhibition of CRH release
[1]
Median Eminence
[1]
[3]
Corticotroph cells
Portal vessels
Anterior pituitary
ACTH release
[5]
IL-1
[7]
[6]
Corticosterone
Adrenal cortex


A
ACTH
CORT
β-END
% of unstimulated value
250
200
150
100
50
0
**
**
NS
30 min
90 min
60 min
B
ACTH
CORT
β-END
ACTH: pg/ml
CORT: μg/dl
β-END: pg/ml
150
100
50
0
60
40
20
200
150
100
50
0
*
NS
**
CON
THYMX
CON
THYMX
CON
THYMX


tumor, virus, bacteria
Hypothalamus
IMMUNE CELLS
CYTOKINES: IL-1, IL-2, IFNγ, etc.
CRH
Anterior pituitary
ACTH
ADRENAL
GLUCOCORTICOID


HYPOTHALAMUS
RELEASING/INHIBITING HORMONES
Anterior PITUITARY
Posterior PITUITARY
TSH
PRL
LH/FSH
GH
OXY/VP
ACTH
E/P/T
GONADS
THYMUS
BONE MARROW
BURSA (birds)
LYMPH NODES
SPLEEN
LYMPHOCYTES
T3/T4
THYROID
GLUCO
ADRENAL