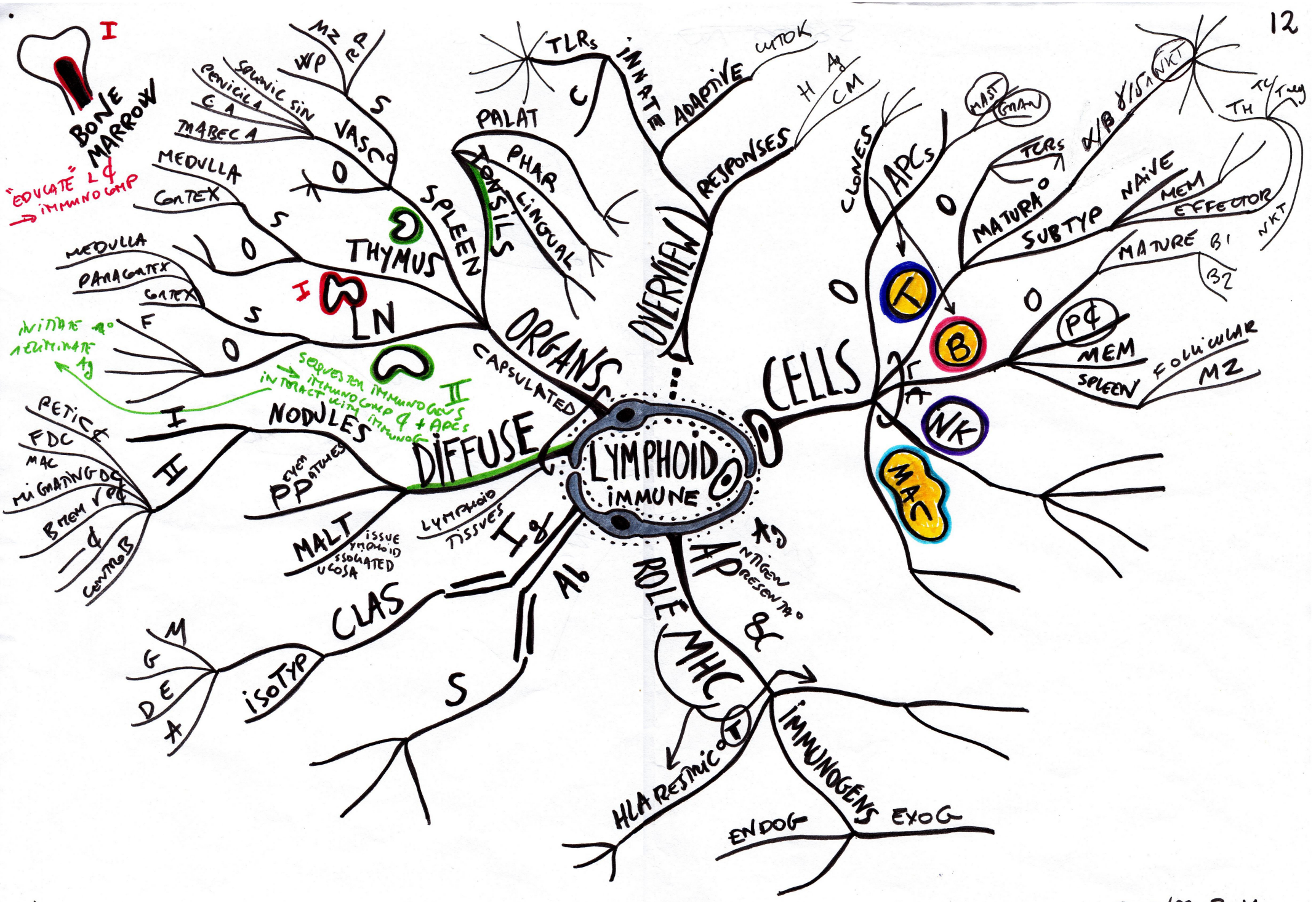
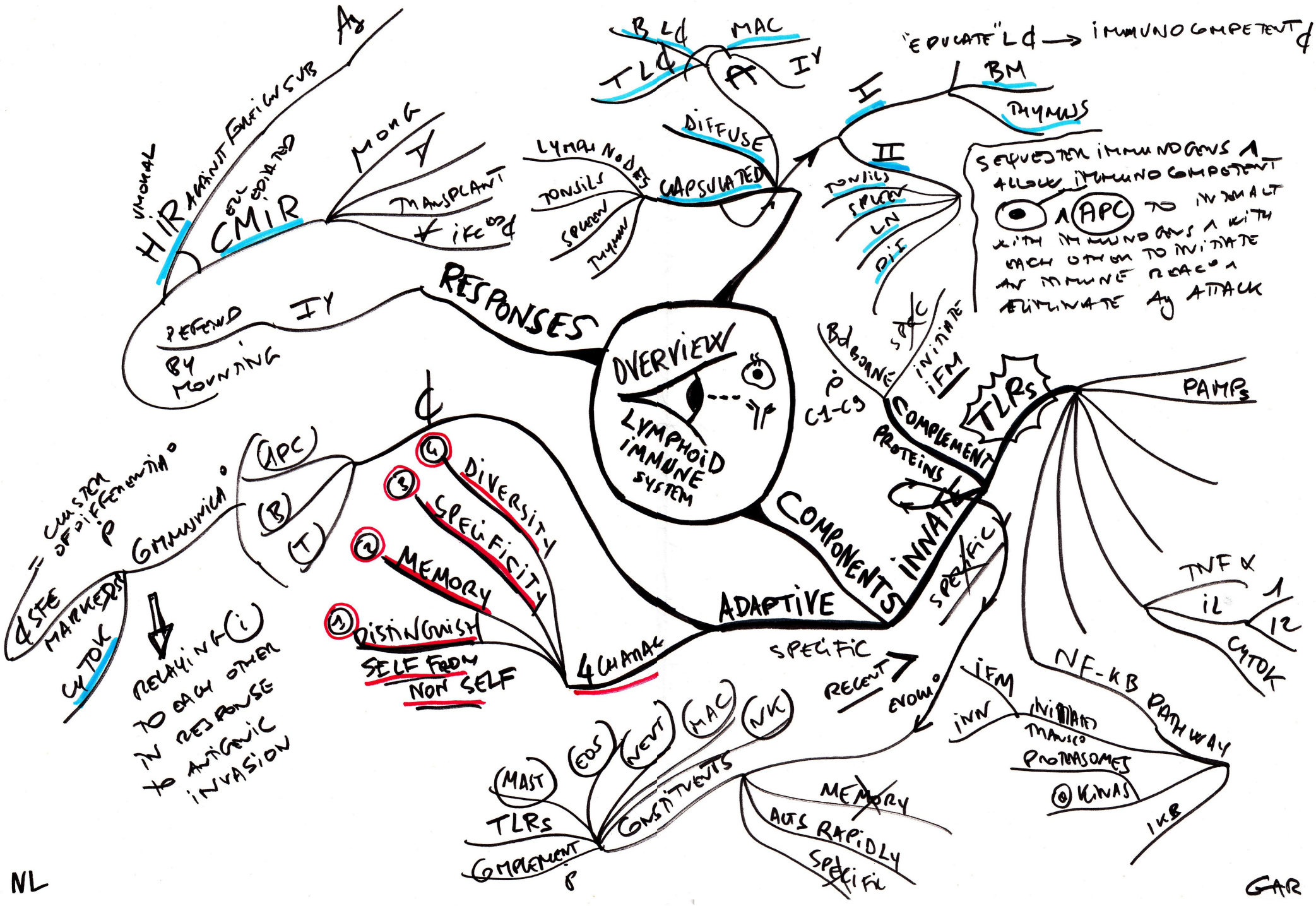
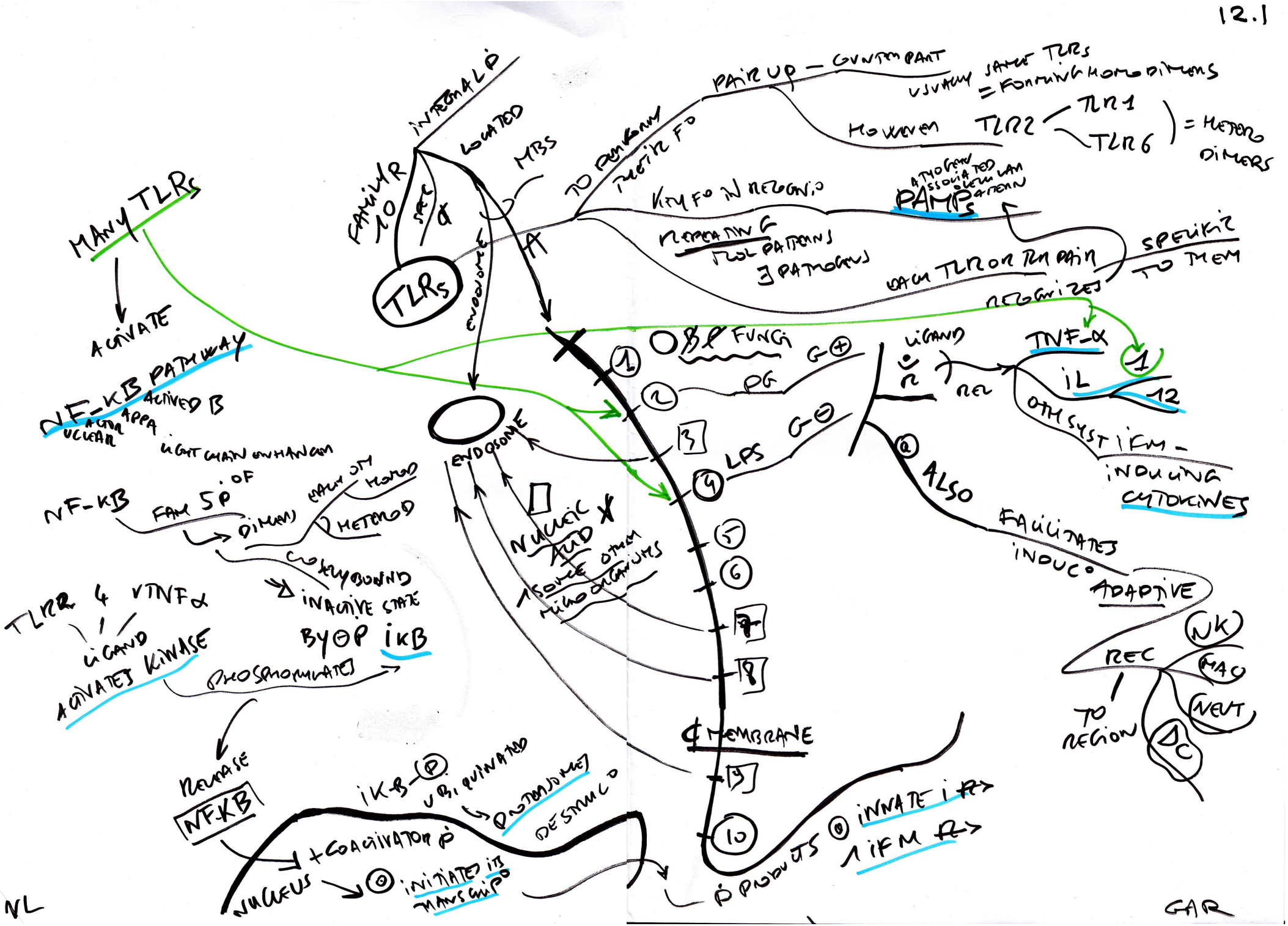



OVERVIEW
LYMPHOID IMMUNE SYSTEM
RESPONSES
COMPONENTS
INNATE
ADAPTIVE
4 CHARAC
DIVERSITY
SPECIFICITY
MEMORY
DISTINGUISH SELF FROM NON SELF
SPECIFIC
RECENT
EVOM°
HUMORAL
HIR AGAINST FOREIGN SUB
CMIR ESP EDUCATED
MONO
TRANSPLANT
IFE°S
DIFFUSE
LYMPH NODES
TONSILS
SPLEEN
THYMUS
CAPSULATED
BLd
MAC
TLd
IY
"EDUCATE" Ld → IMMUNOCOMPETENT d
I
BM
THYMUS
II
TONSILS
SPLEEN
LN
PIE
SEQUESTER IMMUNOGENS
ALLOW IMMUNOCOMPETENT
APC TO INGEST
WITH IMMUNOGENS WITH
EACH OTHER TO INITIATE
AN IMMUNE REACTION
ELIMINATE Ag ATTACK
DEFEND BY MOUNTING
IY
RELAYING (i) TO EACH OTHER IN RESPONSE TO ANTIGENIC INVASION
= CLUSTER OF DIFFERENTIA°
P
GMMUNOGLOBULIN°
APC
B
T
CD4 CD8 MARKERS
CYTOK
Bd SIGNAL
P C1-C9
SPC
INITIATE IFM
COMPLEMENT PROTEINS
TLRs
PAMPs
TNF α
il 1
12
CMTOK
NF-KB PATHWAY
IFM
INN
INITIATED
MANNOSE
PROTEASOMES
KINASES
IKB
SPECIFIC
MEMORY
ACTS RAPIDLY
SPECIFIC
CONSTITUENTS
MAST
EOS
NEUT
MAC
NK
TLRs
COMPLEMENT
P

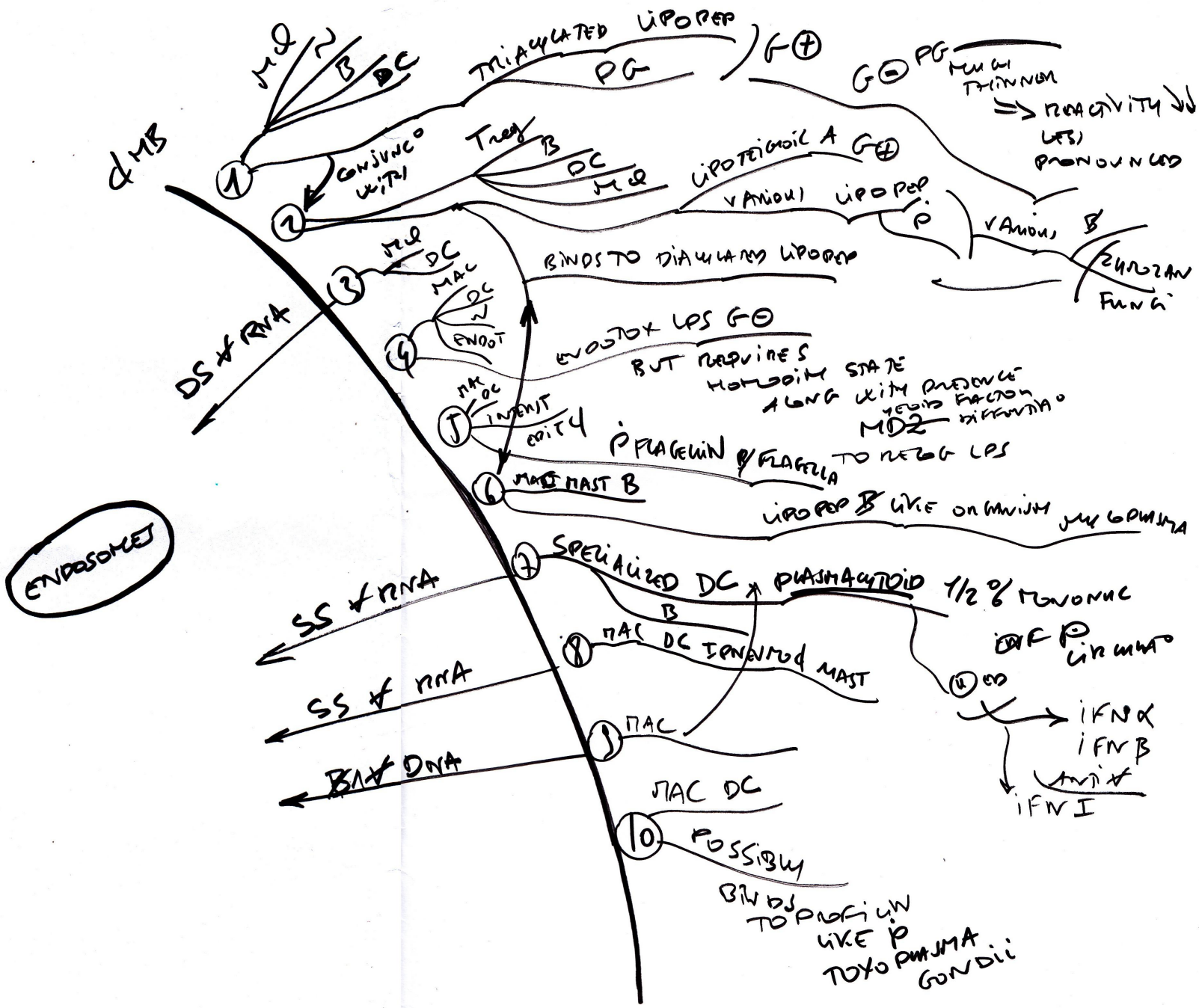
NL

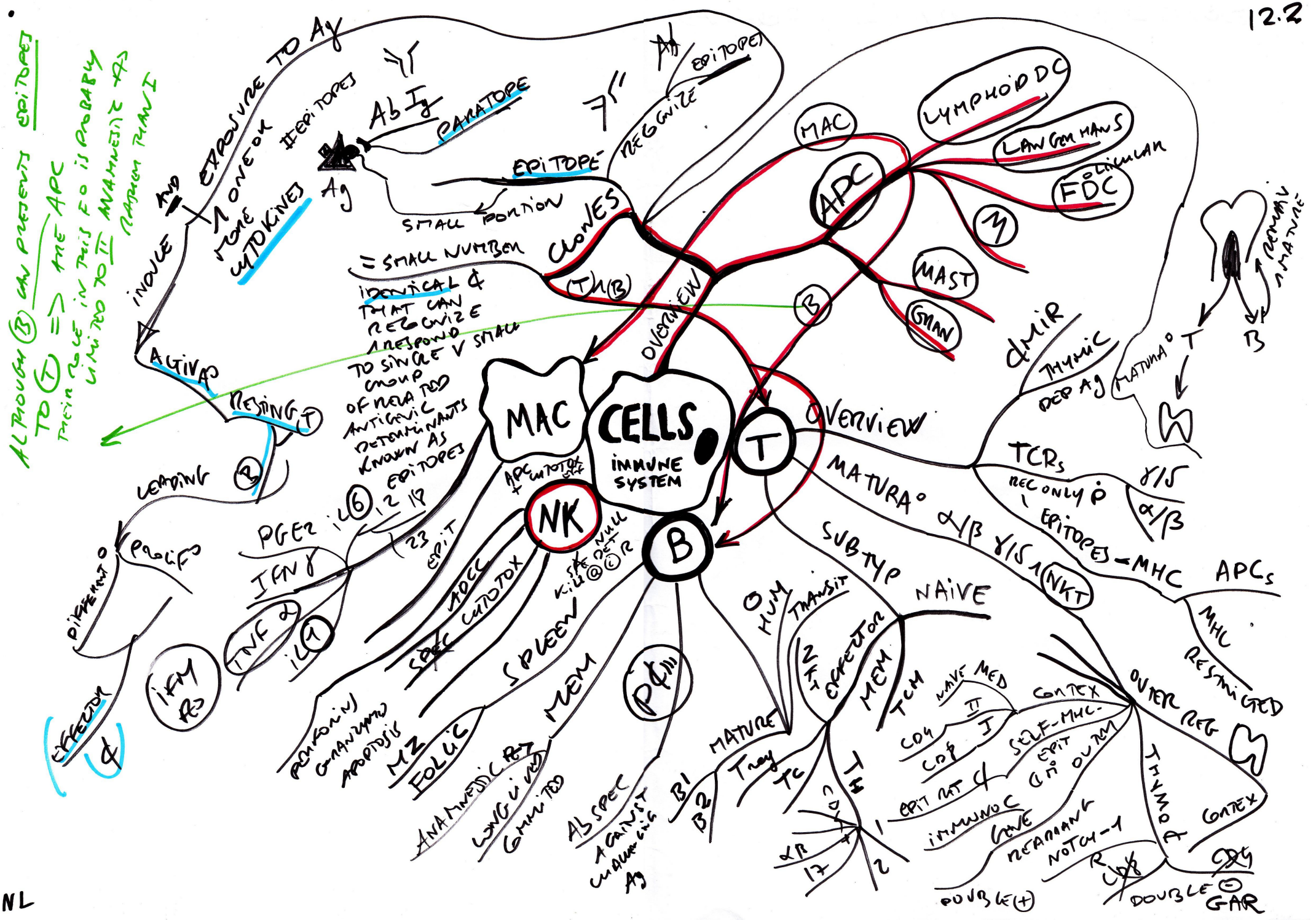
GAR


MANY TLRs
ACTIVATE
NF-KB PATHWAY
ACTIVATED B
NF-KB
FAM 5P OF
DIMERS
EACH OTHER
HOMO
HETERO
LIGHT CHAIN ENHANCER
TLR4 + rTNFα
LIGAND
ACTIVATES KINASE
PHOSPHORYLATES
BY⊖P IκB
INACTIVE STATE
RELEASE
NF-KB
IκB-Ⓟ
UBIQUINATED
PROTEOLYSED
DESTRUCTION
+ COACTIVATOR Ⓟ
NUCLEUS
INITIATES ITS
TRANSCRIPTION
Ⓟ PRODUCTS
INNATE IR
IFM IR
TLRs
INTRACELLULAR
LOCATED
MBS
FAMILY
10
SPEC
α
ENDOSOME
TO PATHOGEN
RECEPTOR
PAIR UP — CYTOPLASMIC
USUALLY SAME TLRs
= FORMING HOMODIMERS
HOWEVER TLR2 — TLR1
TLR6
= HETERO DIMERS
KEY TO INITIATING
RECOGNITION
PAMPs
ACTIVATION ASSOCIATED MOLECULAR PATTERN
RECEPTOR FOR MICROBIAL PATTERNS
PATHOGENS
EACH TLR ON TLR PAIR
SPECIFIC TO ITEM
RECOGNIZES
OBL FUNGI
G⊕
PG
LPS
G⊖
ENDOSOME
NUCLEIC ACID
SOME OTHER MICROORGANISMS
MEMBRANE
LIGAND
REC
TNF-α
IL
1
12
OTH SYSTEMIC INDUCING CYTOKINES
ALSO
FACILITATES
INDUC°
ADAPTIVE
REC
NK
MAC
NEUT
TO REGION
DC

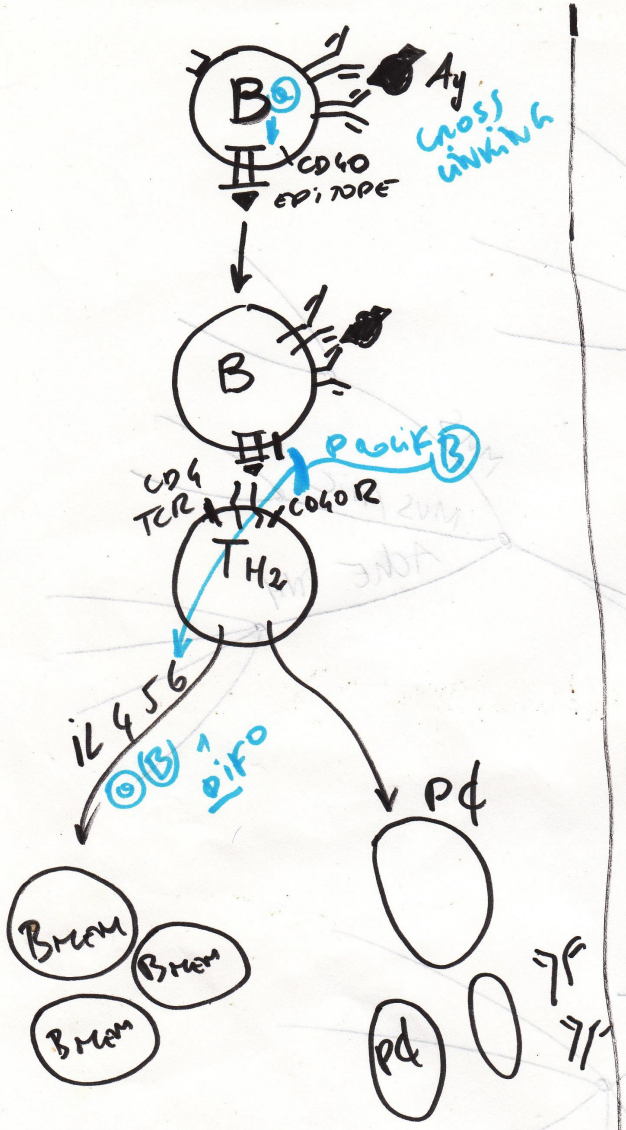
NL

GAR

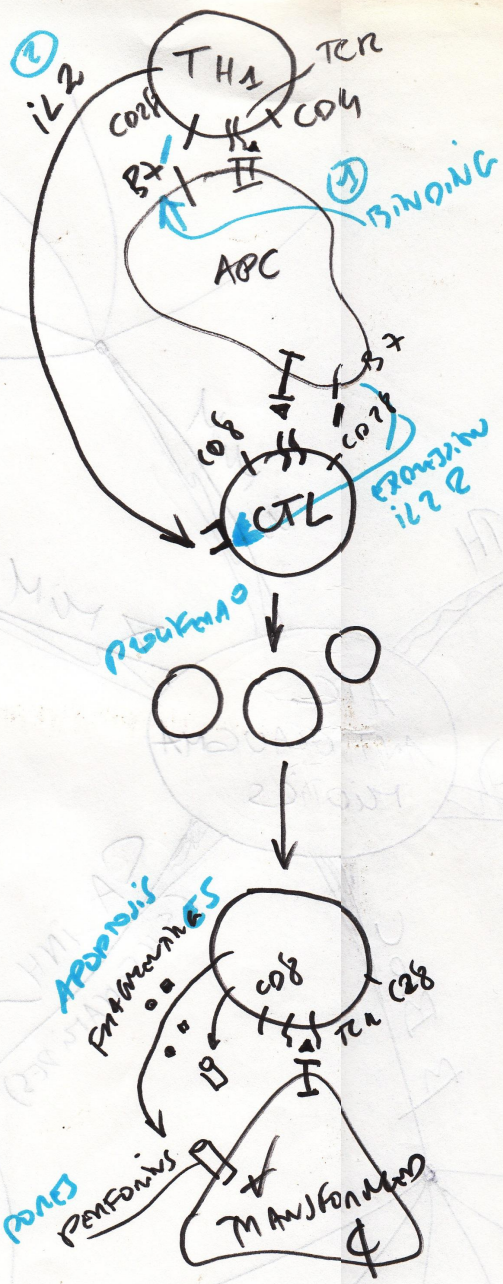

TRIACYLATED LIPOPEP
PG
G+
G-
PG
dMB
1
2
CONJUNC° WITH
Treg
B
DC
LIPOTEICHOIC A
G+
VARIOUS LIPOPEP
VARIOUS B
BINDS TO DIACYLATED LIPOPEP
3
DC
MAC
4
ENDOTOX LPS G-
BUT REQUIRES
5
INTERNT
6
MAST B
PFLAGELLIN
FLAGELLA
TO RECOG LPS
LIPOPEP
7
SPECIALIZED DC
PLASMACYTOID
1/2 % MONONUC
8
MAC DC INFECTED MAST
11
IFNα
IFNβ
IFNI
MAC
MAC DC
10
POSSIBLY
TOXOPLASMA
GONDII
ENDOSOMES
DS RNA
SS RNA
SS RNA
BAC DNA


CELLS
IMMUNE SYSTEM
MAC
NK
B
T
OVERVIEW
APC
MAC
LYMPHOID DC
LANGERHANS
FDC
FOLLICULAR
M
MAST
GRAN
EXPOSURE TO Ag
ONE OR MORE CYTOKINES
AND
INDUCE
ACTIVATE
RESTING T
B
LEADING
Ag
EPITOPES
PARATOPE
Ab Ig
SMALL PORTION
EPITOPE
RECOGNIZE
CLONES
= SMALL NUMBER
IDENTICAL
THAT CAN RECOGNIZE
RESPOND
TO SINGLE V SMALL
GROUP
OF RELATED
ANTIGENIC
DETERMINANTS
KNOWN AS
EPITOPES
ALTHOUGH B CAN PRESENT EPITOPES
TO T => THE APC
MAIN ROLE IN THIS FO IS PROBABLY
LIMITED TO IT ANAMNESTIC AS
PRIMARY RXN I
PROLIFS
DIFFERENTIATE
EFFECTOR
IFN γ R
IFN α
IL 1
PGE
IL 6, 12, 18
IFN γ
23 EPIT
ADCC
SPEC CYTOTOX
NULL
KILLER
PERFORIN/GRANZYME
APOPTOSIS
MZ
FOLLIC
SPLEEN
MEM
ANAMNESTIC RX
LONG LIVED
IMMUNITY
PC
AB SPEC AGAINST CHARACTERISTIC Ag
B1
B2
MATURE
NUM TRANSIT
NAIVE
EFFECTOR
MEM
TCM
Tmy
TC
TH
1
2
IL 4
IL 5
IL 13
IFN γ
IL 2
IL 4
IL 10
IL 13
TGF β
NAIVE MED
CORTEX
CD4
CD8
SELF-MHC-EPIT RXT
IMMUNOC GENE
REARRANG
NOTCH-1
RAG
DOUBLE (+)
OUTER REG
THYMUS
CORTEX
DOUBLE (-)
GAR
SUBTYP
MATURA°
αβ γδ
NKT
TCRs
REC ONLY
EPITOPES-MHC
γδ
αβ
APCs
MHC RESTRICTED
dMIR
THYMIC
DEP Ag
MATURA° T
B
PRIMARY MATURE

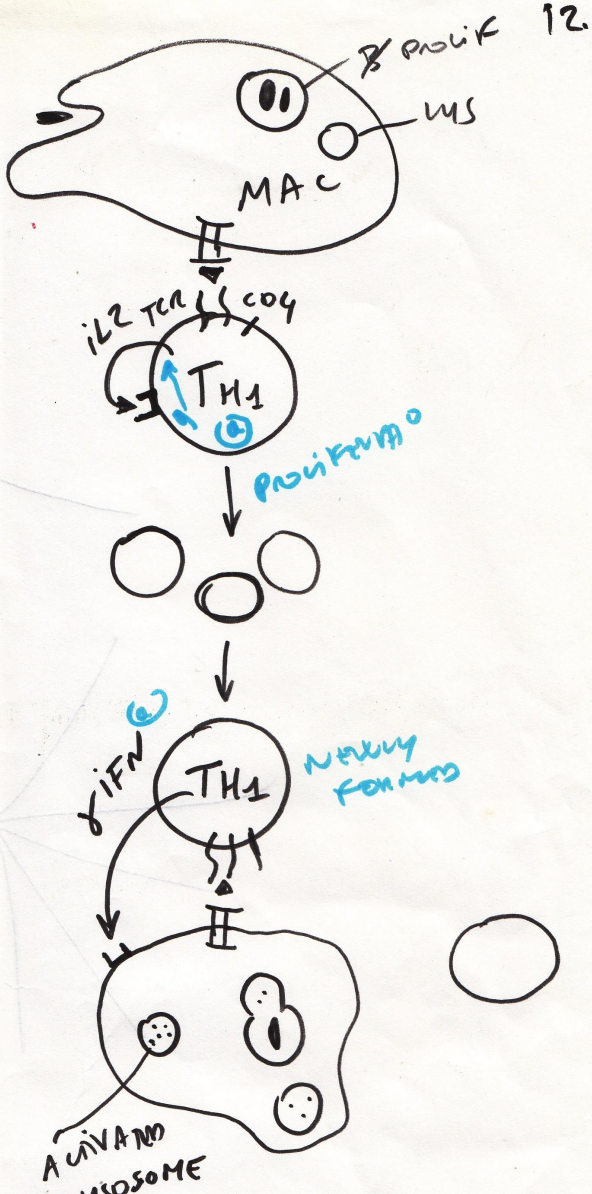
NL



THYMIC DEP Ag-INDUCED (B MEM) & (PC) FORM°

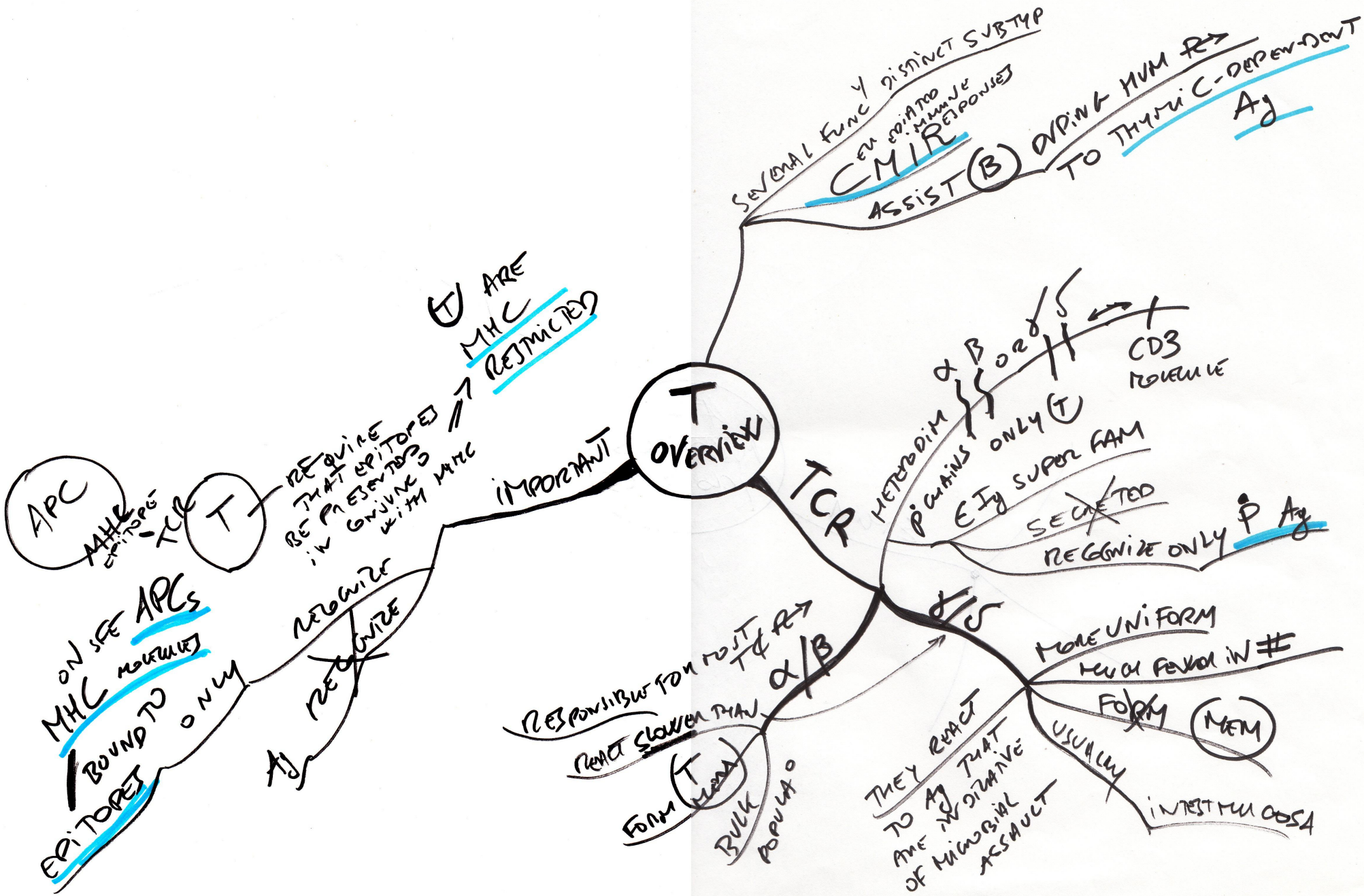


CYTOTOXIC (T) @ & KILLING



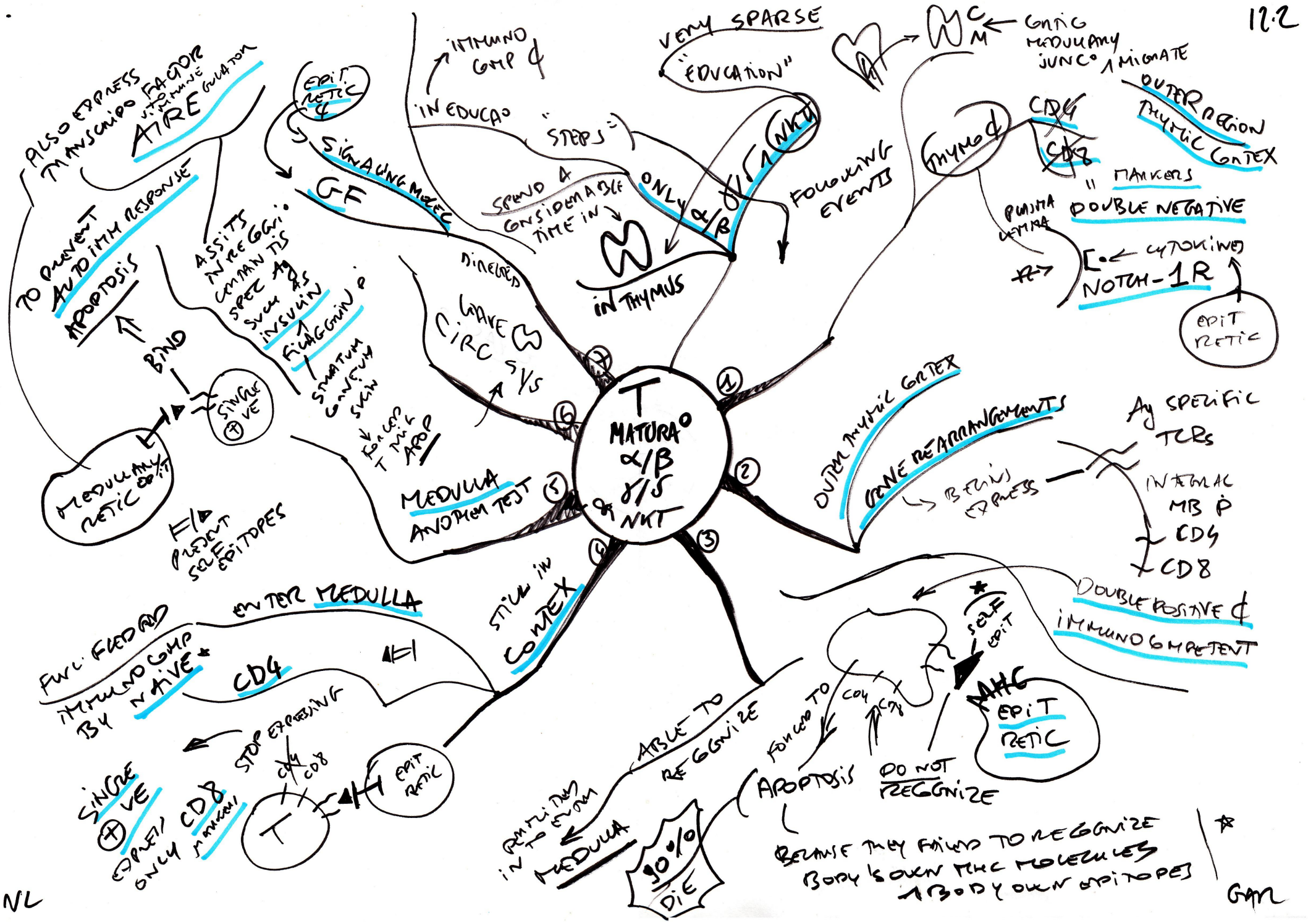
(MAC) @ BY (TH1)

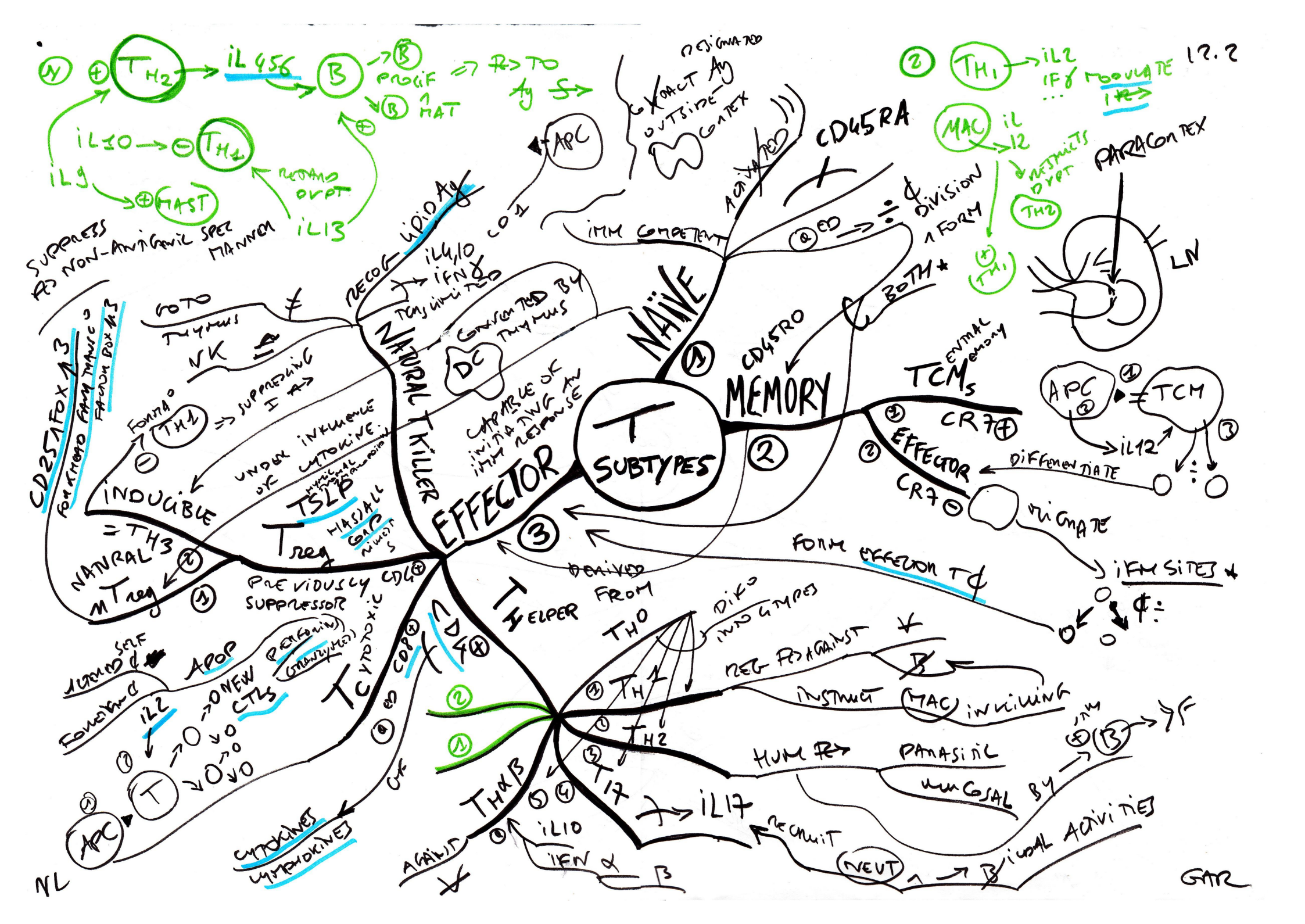
CTL = CYTOTOXIC (T)

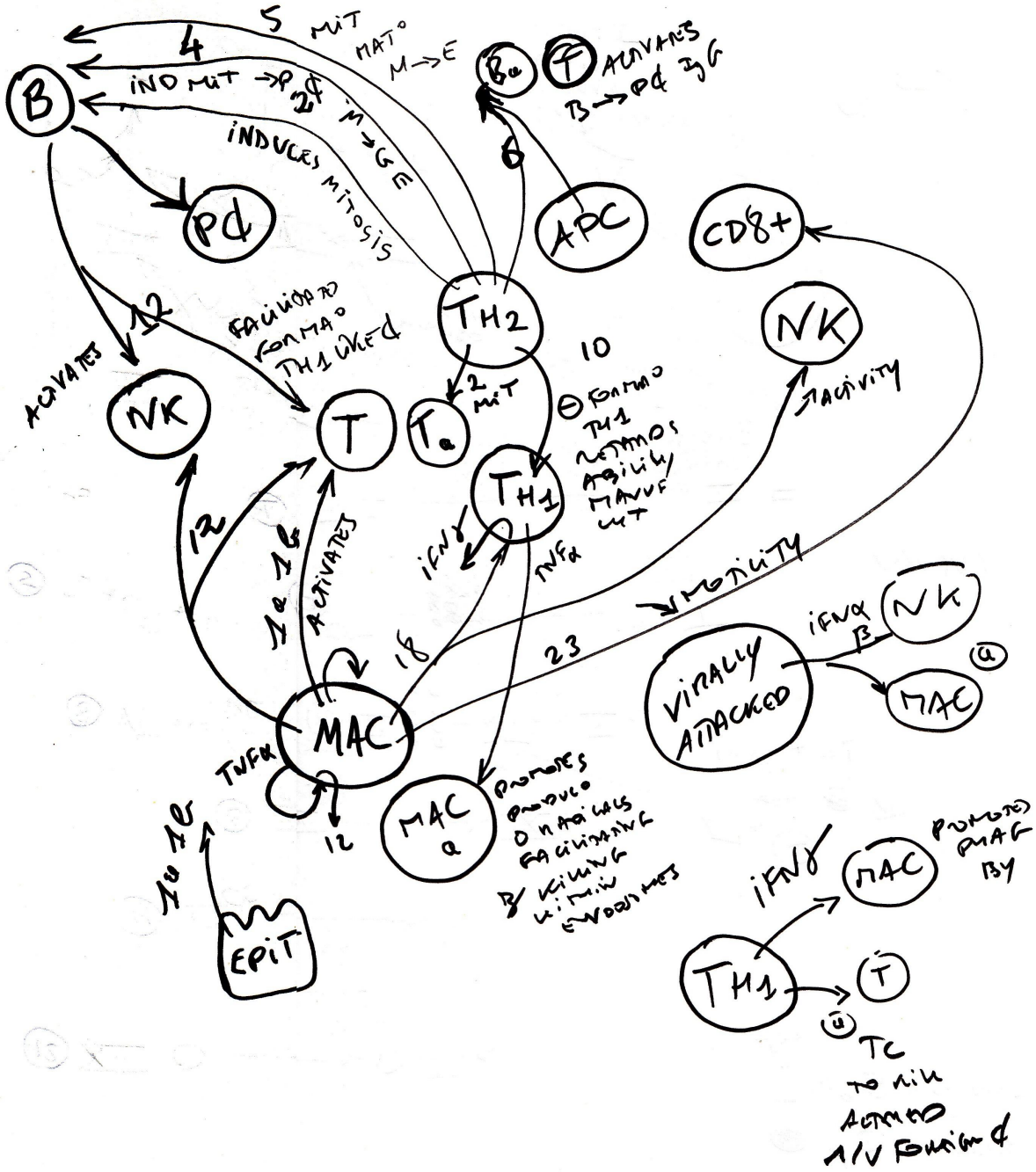

T OVERVIEW
IMPORTANT
RECOGNIZE
RECOGNIZE
Ag
APC
MHC EPITOPE
T
REQUIRE THAT EPITOPES BE PRESENTED IN CONJUNC WITH MHC
T ARE MHC RESTRICTED
ON SEE APCs
MHC MOLECULES
BOUND TO
EPITOPES ONLY
TCR
HETERODIM α β or γ δ
CD3 MOLECULE
PAIRS ONLY T
EIg SUPER FAM
SECRETED
RECOGNIZE ONLY Ag
RESPONSIBLE FOR MOST TH RX
REACT SLOWER THAN
FORM T MEM
α/β
BULK POPULA
γ/δ
MORE UNIFORM
MUCH FEWER IN #
FORM
MEM
USUALLY
INTESTINAL MUCOSA
THEY REACT TO Ag THAT ARE INVOLVED IN MICROBIAL ASSAULT
SEVERAL FUNC Y DISTINCT SUBTYP
CELL MEDIATED IMMUNE RESPONSES
CMIR
ASSIST B DURING HUM RX
TO THYMIC-DEPENDENT Ag

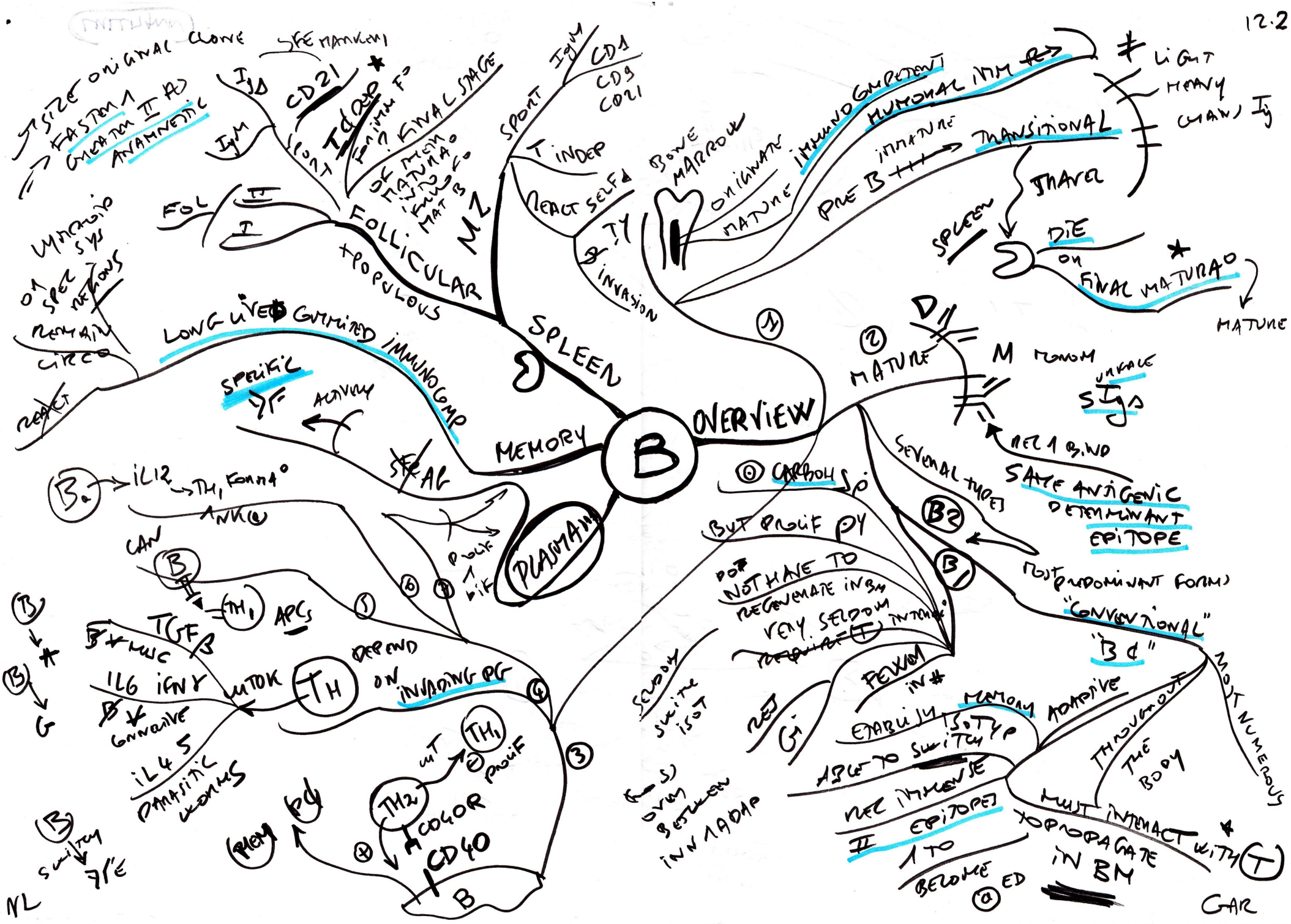
NL

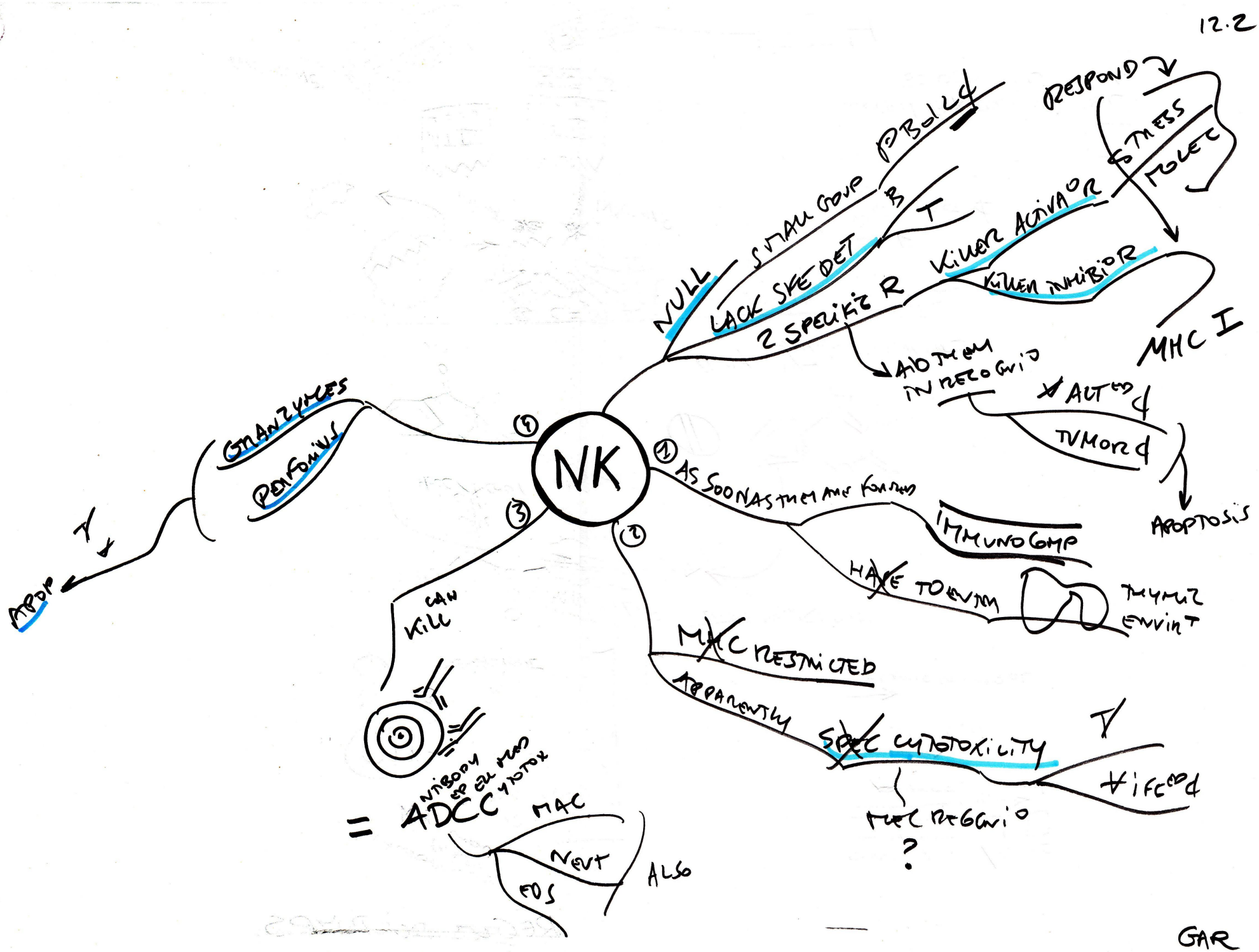
GAR

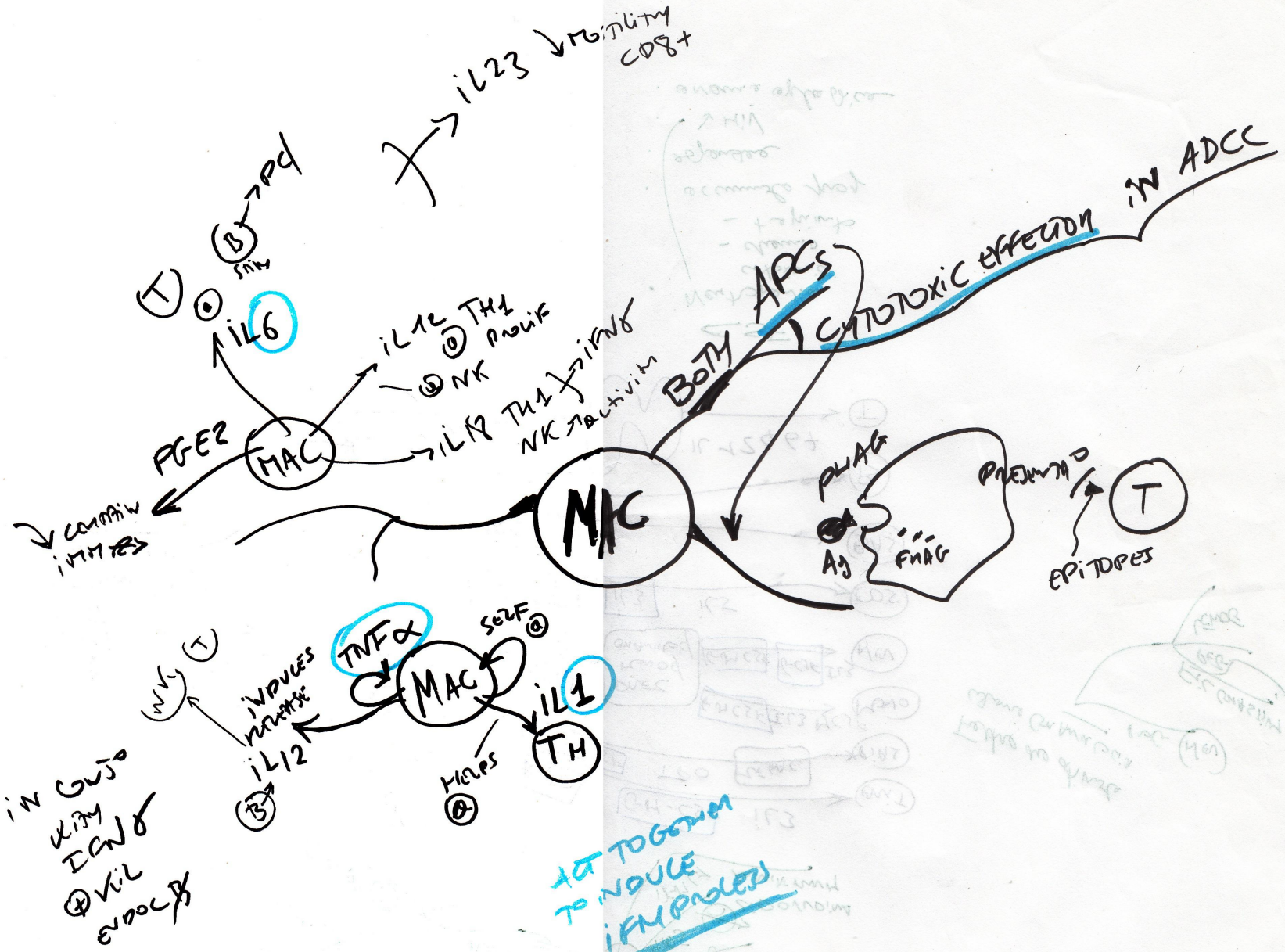

T MATURA αβ γδ NKT
1
2
3
4
5
6
DIFFERENZIA
GRAVE CIRC SYS
MEDULLA ANOPHEN TEST
STILL IN CONTEX
OUTER THYMIC CORTEX
GENE REARRANGEMENTS
Ag SPECIFIC TCRs
INTERAC MHC P CD4 CD8
DOUBLE POSITIVE
IMMUNOGMATENT
ENTER MEDULLA
FULLY FLEDGED IMMUNOGMP NAIVE
CD4
SINGLE VE
EXPRESS ONLY CD8
STOP EXPRESSING CD4 CD8
EPIT RETIC
ABLE TO RECOGNIZE
APOPTOSIS
90%
DIE
DO NOT RECOGNIZE
MHC
EPIT RETIC
SELF EPIT
BECAUSE THEY FAILED TO RECOGNIZE BODY'S OWN MHC MOLECULES + BODY OWN EPITOPES
THYMO
CD4
CD8
MARKERS
DOUBLE NEGATIVE
NOTCH-1R
CYTOKINES
EPIT RETIC
OUTER REGION THYMIC CORTEX
MIGRATE
IMMUNO GMP
"EDUCATION"
VERY SPARSE
"STEPS"
SPEND A CONSIDERABLE TIME IN
ONLY αβ
FOLLOWING EVENTS
IN THYMUS
SIGNALING MOLEC
GF
EPIT RETIC
ALSO EXPRESS TRANSCRIPO FACTOR AIRE REGULATION
TO PREVENT AUTOIMM RESPONSE
APOPTOSIS
BIND
SINGLE VE
MEDULLARY RETIC EPIT
PRESENT SELF EPITOPES
ASSITS IN REGGNI COMMAN TIS SPEC Ag SUCH AS INSULIN
FLAGGING
SIGNALING CONFLICT SWITH
FOR LOSS T MATE APOP
NAIVE
NL
GMP


T SUBTYPES
NAIVE
MEMORY
EFFECTOR
CD45RA
CD45RO
TCM
TEM
EFFECTOR
CR7
LN
PARACORTEX
APC
MAC
IL12
IL2
IFNγ
TH1
TH2
TH17
IL17
IL10
IFNγ
TH0
TH1/TH2
NATURAL T KILLER
INDUCIBLE
NATURAL Treg
TSLP
Treg
DC
NK
TH1
TH3
TCYTOTOXIC
CD8
CD4
APOP
IL2
APC
CYTOKINES
IMMUNOKINES
IMMUNE SITES
NEUT
EOS
BASO
MONO
LYMPHO
PLASMO
MEM B
NL
GAR

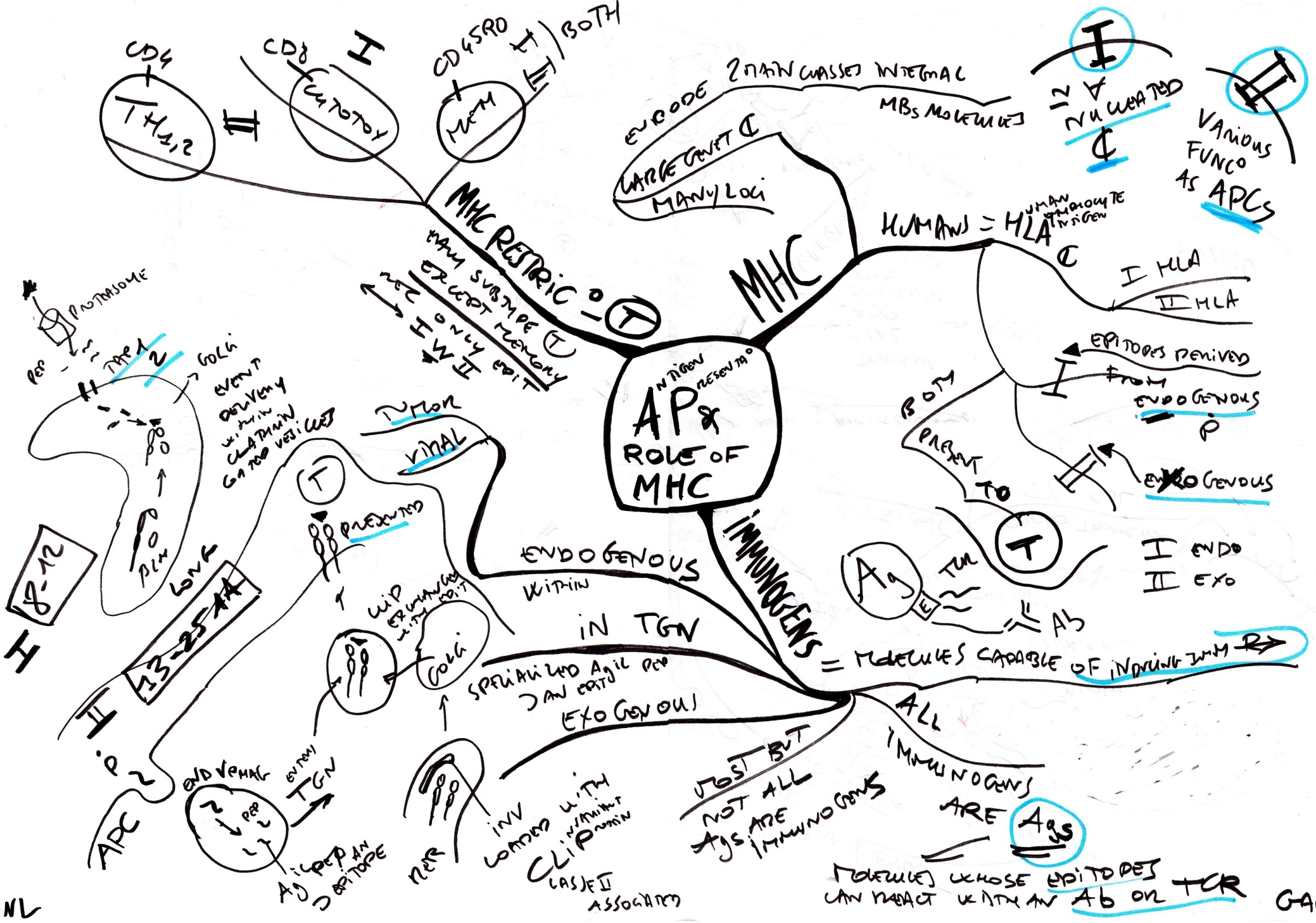

B
PC
NK
T
Ta
TH2
TH1
APC
CD8+
MAC
MAC a
EPIT
VIRALLY ATTACKED
5 MIT MAT° M→E
4
INDUCES MITOSIS
6
ACTIVATES B→PC IgG
12
ACTIVATES
FACILITATES FORMAT° TH1 like-C
2 MIT
10
ACTIVITY
MOBILITY
IFNγ
TNFα
IFNγ β
23
18
TNFα
12
IFNγ
PROMOTES MAC BY
TC


B OVERVIEW
SPLEEN
FOLLICULAR
MZ
LONG LIVED
MEMORY
PLASMA
SPECIFIC
ACTIVATION
SPONT
IgM
CD1
CD9
CD21
T INDEP
REACT SELF
INVASION
BONE MARROW
ORIGINATE
MATURE
IMMUNOCOMPETENT
HUMORAL IMM R
PRE B
TRANSITIONAL
LIGHT
HEAVY
CHAIN Ig
SPLEEN
TRANSIT
DIE
OR
FINAL MATURAO
MATURE
MATURE
M
MONOM
LINKAGE
Sig
REC 1 BIND
SAME ANTIGENIC
DETERMINANT
EPITOPE
SEVERAL TYPES
B2
B1
MOST PREDOMINANT FORM
"CONVENTIONAL"
"B c"
MOST NUMEROUS
THROUGHOUT
THE
BODY
MUST INTERACT WITH
TO PROPAGATE
IN BM
GAR
CARBOH
BUT PROLIF PC
DO NOT HAVE TO
REGENERATE IN BM
VERY SELDOM
FEW IN #
MEMORY ADAPTIVE
ESTABLISH ISOTYP
ABLE TO SWITCH
REC IMMUNE
II EPITOPES
1 TO
BECOME
ED
SECOND
SWITCH
ISOT
REC
Gi
(from 3)
OVER
GESTATION
IN UTERO
B
B.
IL12
TH1 FORM°
ANK
CAN
TH1
APCs
TGFβ
IL6 IFNγ
MTOK
TH
DEPEND
ON
INVADING PG
IL4 5
PARASITIC
WORMS
PROLIF
DIF
PROLIF
TH2
TH1
CD40
B
PROLIF
PC
B
SWITCH
TYPE
NL


NK
GRANZYMES
PERFORIN
APOP
CAN KILL
ANTIBODY
ADCC
MAC
NEUT
FDS
ALSO
NULL
SMALL GRAN
LACK SPECIFICITY
B
T
2 SPECIFIC R
KILLER ACTIVATOR
KILLER INHIBITOR
RESPOND
MHC I
ALTERED
TUMORD
APOPTOSIS
AS SOON AS THEY ARE FORMED
IMMUNOGMP
TUMOR ENVIRN
MHC RESTRICTED
APPARENTLY
CYTOTOXICITY
T
MHC REGN
?



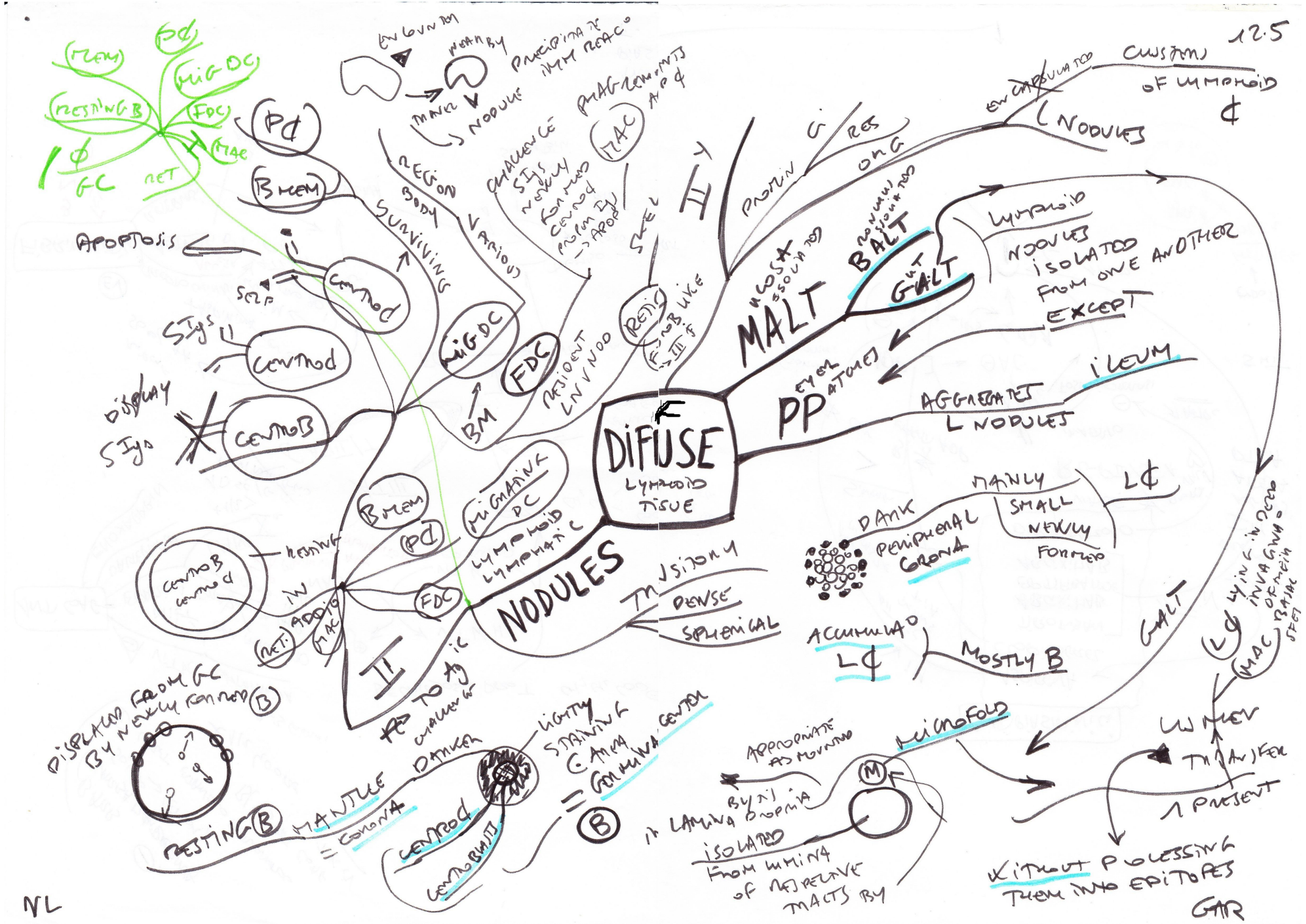
AT TOGETHER TO INDUCE INFLAMMATORY

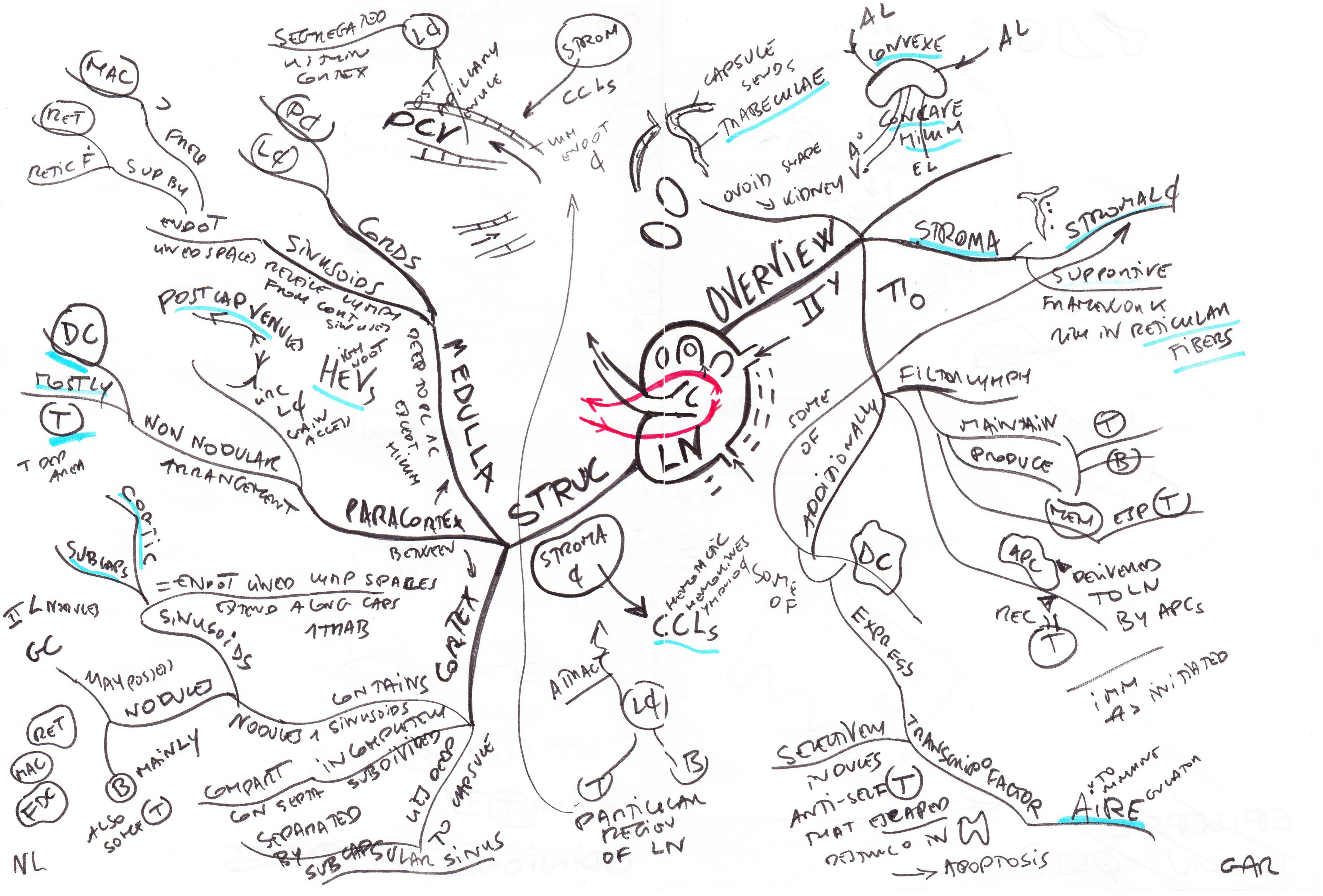

APs & ROLE OF MHC
MHC
MHC RESTRIC = T
CD4
THELP
CD8
CYTOTOX
CD45RO
MEM
BOTH
ENCODE 2 MAIN CLASSES INTEGRAL MBs MOLECULES
LARGE GENET
MANY LOCI
HUMANS = HLA
I HLA
II HLA
I
II
NUCLEATED
VARIOUS FUNCO AS APCs
EPITOPES DERIVED FROM ENDOGENOUS
ENDOGENOUS
BOTH PRESENT TO T
I ENDO
II EXO
IMMUNOGENS = MOLECULES CAPABLE OF INDUCING IMM R
Ag
Ab
ALL IMMUNOGENS ARE Ags
MOST BUT NOT ALL Ags ARE IMMUNOGENS
MOLECULES WHOSE EPITOPES CAN REACT WITH AN Ab OR TCR
EXOGENOUS
SPECIALIZED Ag IL PCP IN CERTAIN
IN TGN
ENDOGENOUS
WITHIN
TUMOR
VIRAL
T
PRESENTS
LIP EXCHANGE WITH EPIT
GOLGI
PROTEASOME
PEP
TYPE 1
2
GOLGI
ENTRY DELIVERY WITHIN CYTOPLASM TO VESICLES
PIM
LONG
8-12
13-25 AA
II
P
APC
ENDOSOMAL
ENTRY TGN
PEP
AG
EPITOPE
NEF
INV LOADING WITH INVARIANT CHAIN CLIP
CLASS II ASSOCIATED
MHC RESTRICTION
HUMAN SYSTEM T EXCEPT MEMORY
NEF ONLY HIV
NL
GAR

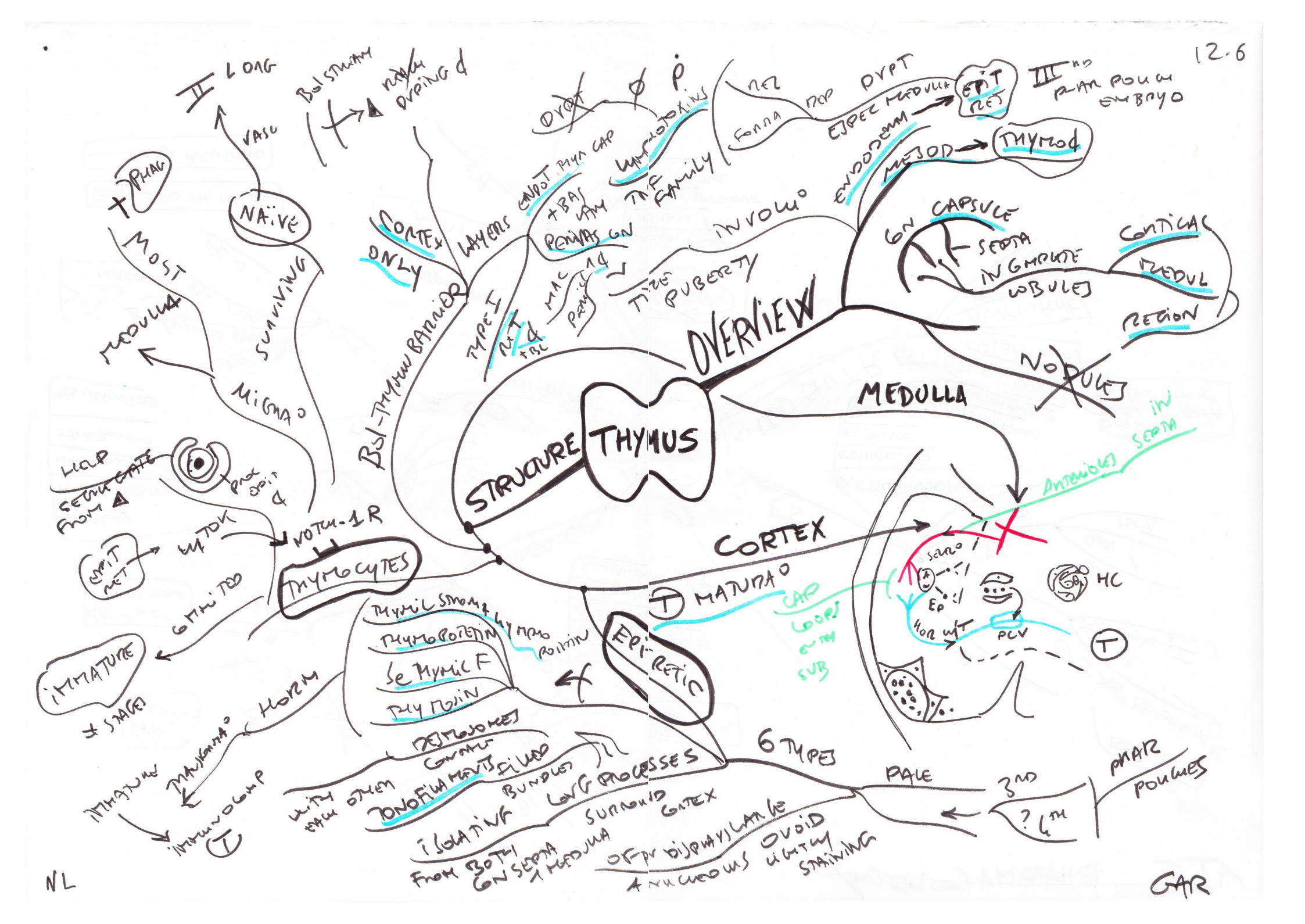

Ig
CLASSES
STR
HUM
ACTIVE AGENT
SPEC AB ACTIVITY
1 Ag
Ag-Ab C CLEARED
EOS
COMPLEMENT
VARIOUS MEANS
2H
2L
C
V
≠ IN Ab TOLER MAT RECOG ≠ Ag
DET SPECIFICITY
HUMSe
5 CLASSES = ISOTYPES
≠ AA COMPOSIO
HEAVY CHAIN CONSTANT REGIONS
LONG Ag
MULTIPLE Ag IC DETERMINANTS
SWITCH
M
PENTAM
FAL ≠
COMPLEMENT
1 RIT ISTOT FORMED
MONOM
PRINCIPAL PLACE FORMATION IS SPLEEN
G
IGG1 IL4 IL6
PHAG NOT MAC
ADCC
NK
OPS
PLACENTA
PASSIVE
MOT ABUNDANT
A
TGFβ
SECRETORY
DIMERS
BILE
SALIVA
MILK
NASAL DISCHARGE
HUMAN GUT PASSIVE INFANTS
BOOM
NURSING INFANT
HEPATOC
TEMP ATTACH EPIT
PIECE COMPONENT
DIGESTIVE ENZ SENSITIVE
MAST BAS
IMMEDIATE HS RESPONSE
IL4 15
DIE
REAGINIC
B
REC DIF
P
P

NL

GAR

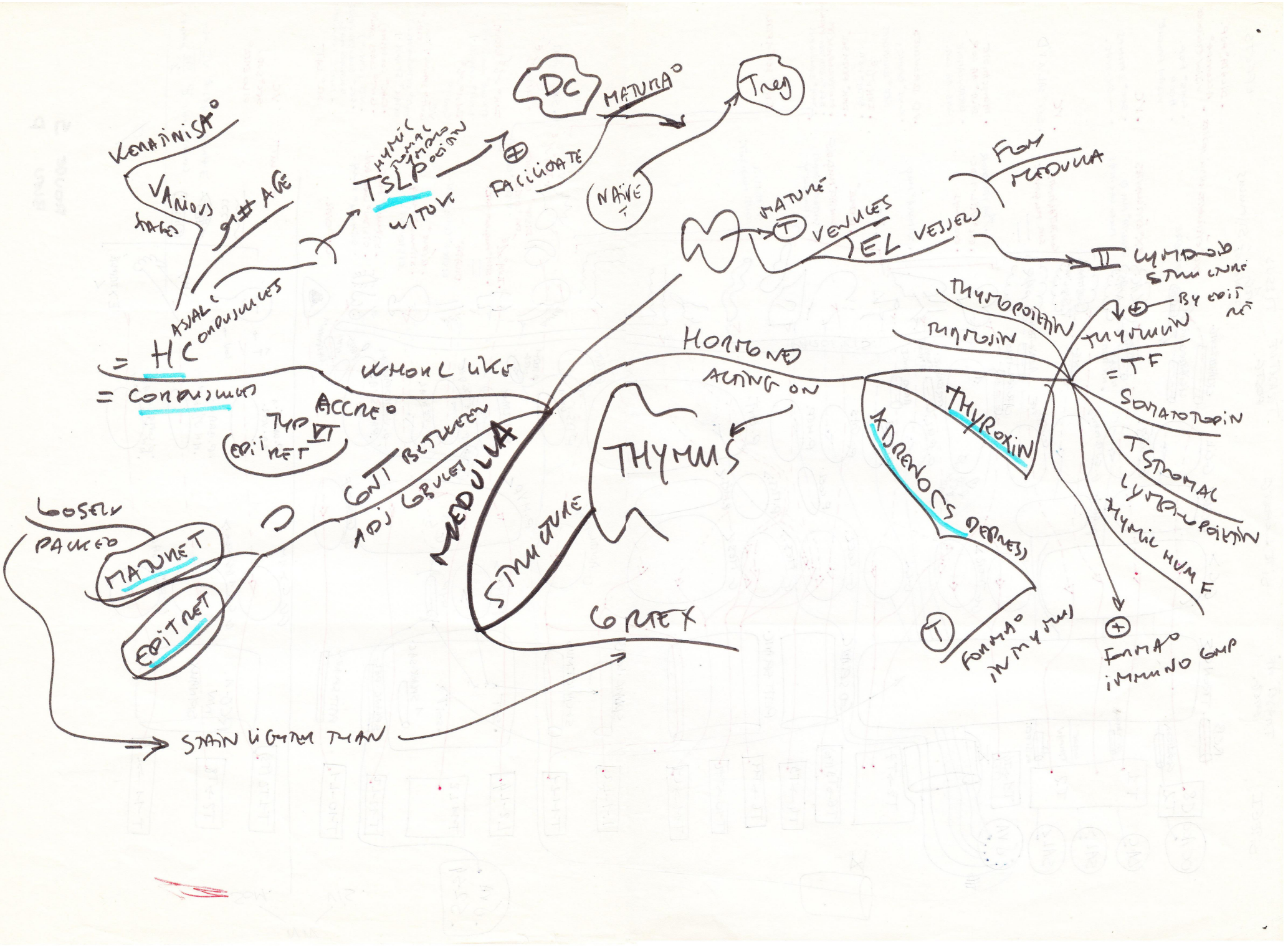

DIFUSE
LYMPHOID TISUE
NODULES
PP
MALT
BALT
GALT
LYMPHOID NODULES ISOLATED FROM ONE ANOTHER EXCEPT
AGGREGATED NODULES
ILEUM
DARK PERIPHERAL CORONA
MANLY SMALL NEWLY FORMED
LC
ACCUMULATED LC
MOSTLY B
TRANSITION
DENSE
SPHERICAL
MANTLE = CORONA
RESTING (B)
DISPLACED FROM GC BY NEWLY FORMED (B)
LIGHTLY STAINING GERMINAL CENTER = GERMINAL CENTER (B)
CENTROCYTES
CENTROBLASTS
APOPTOSIS
SURVIVING
REGION
BODY
VARIOUS
CHALLENGE SIGS NEWLY FORMED CENTRED PROTEIN → APOP
PHAGOCYTOSIS APP
PRECIPITATE IMM REACT
ENCAPSULATED
CUSTOMS OF LYMPHOID
NODULES
PROTEIN
RES
ORG
SKEL
II
RETIC
FDC
FDC
BM
LIGDC
CENTROB
CENTROCYTE
SIGS
DISPLAY SIGS
SCAP
PC
BMEM
RESTING
IN
ADDTO
MAC
MACROPHAGE
LYMPHOID LYMPHATIC
MIGRATING DC
TO Ag CHALLENGE
APPROPRIATE AS MOVING
IN LAMINA BY NJ
ISOLATED FROM MIXING OF REL MACTS BY
MICROFOLD
M
WITHOUT PROCESSING THEM INTO EPITOPES
GAR
NL

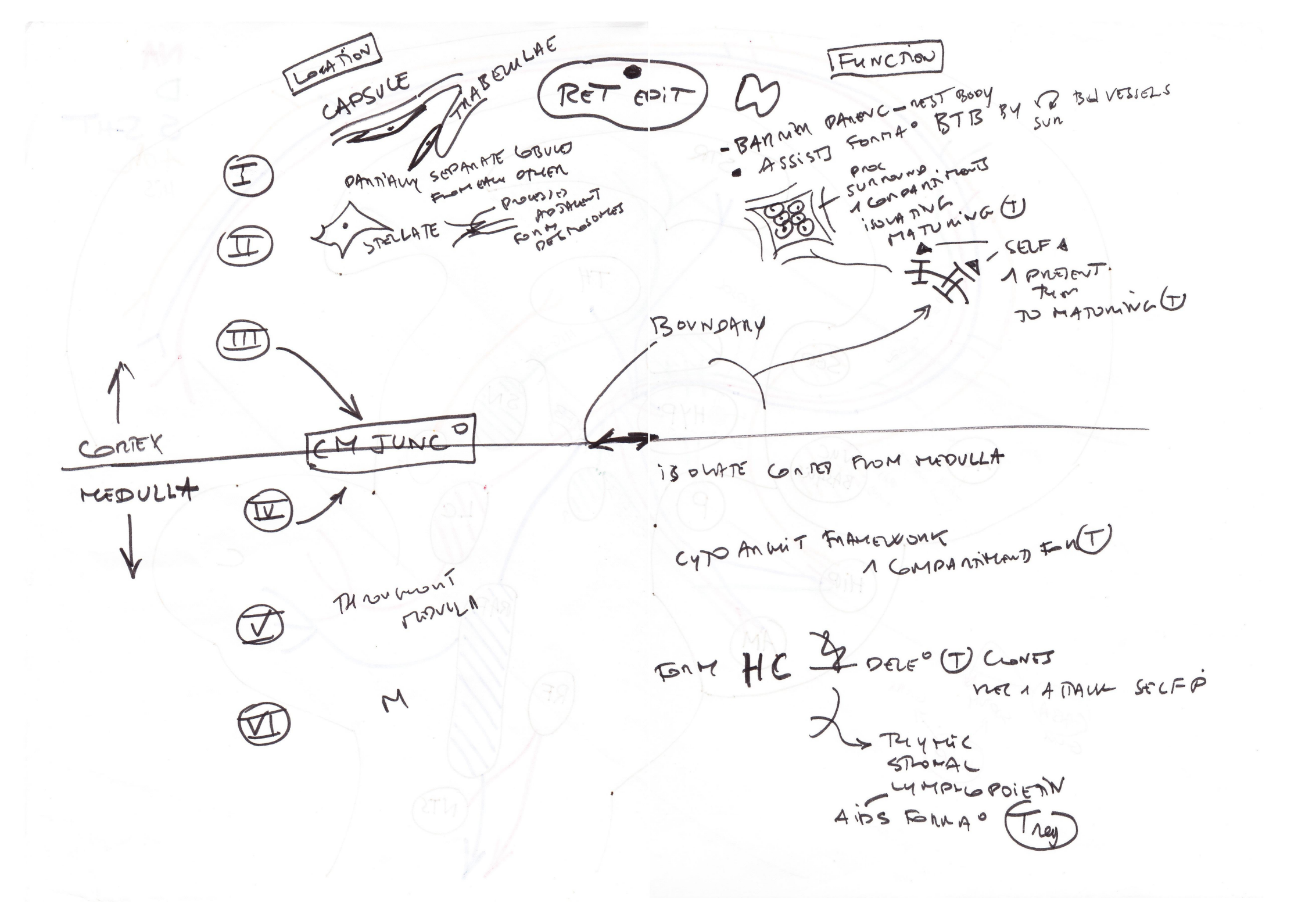

LN
STRUC
OVERVIEW
MEDULLA
CORTEX
PARACORTEX
CORDS
SINUSOIDS
PCV
STROM
CCLs
SEGREGATED
Lф
MAC
RET
RETIC F
SUP BY
ENDOT
Pd
POST CAP VENULES
HEV
DC
MOSTLY
T
T DEP AREA
NON NODULAR ARRANGEMENT
BETWEEN
CORTIC
SUBCAPS
= ENDOT LINED LYMP SPACES
EXTEND ALONG CAPS
SINUSOIDS
GC
NODULES
MAINLY
B
ALSO SOME T
RET
MAC
FDC
CONTAINS
NODULES + SINUSOIDS
COMPART
SEPARATED BY SUBCAPSULAR SINUS
CAPSULE
STROMA ф
CCLs
ATTRACT
T
B
PARTICULAR REGION OF LN
CAPSULE SENDS TRABECULAE
OVOID SHAPE
KIDNEY
CONVEXE
AL
CONCAVE
HILUM
EL
II Y
T O
STROMA
STROMAL ф
SUPPORTIVE FRAMEWORK
RETICULAR FIBERS
FILTER LYMPH
MAINTAIN
PRODUCE
MEM
APC
DELIVERED TO LN BY APCs
REC
DC
EXPRESS
TRANSCRIP FACTOR
AIRE
SELECTIVELY
INDUCES
ANTI-SELF T
THAT ESCAPED
APOPTOSIS
NL
GAR

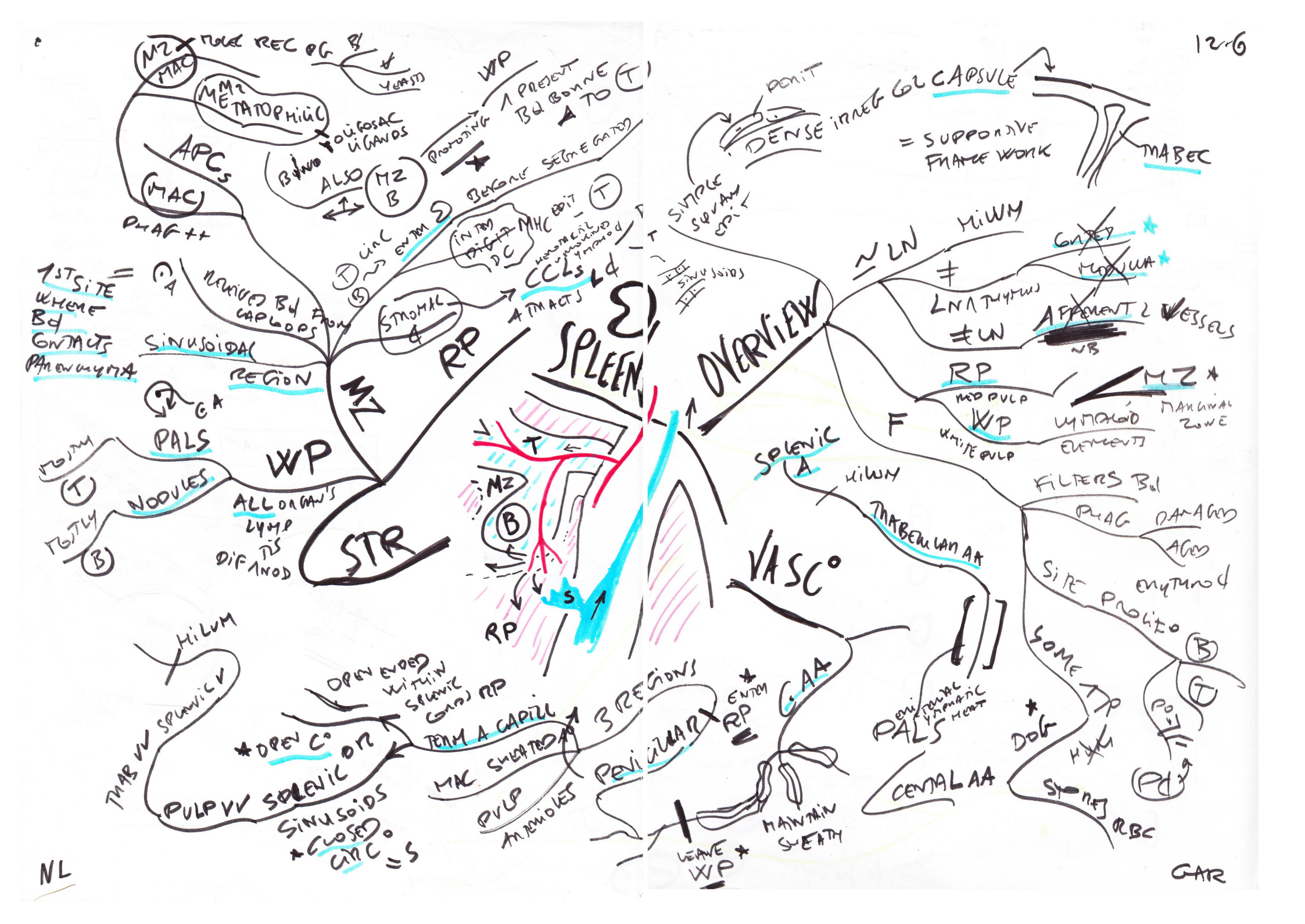

12.6
OVERVIEW
STRUCTURE
THYMUS
CORTEX
MEDULLA
REGION
NAÏVE
MIGRATE
MOST
SURVIVING
MEDULLA
ONLY
CORTEX
BBB
LAYERS
TYPE I
INVOLUTION
PUBERTY
THYMOCYTES
NOTCH-1R
IMMATURE
MATURATION
HORM
EPITHELIC
THYMIC STROMAL
THYMOPOIETIN
THYMOSIN
ISOLATING
FROM BOTH GN SEPTA + MEDULLA
SURROUND CORTEX
ANUCLEOUS
AVOID LIGHTLY STAINING
6 TYPES
PALE
3RD
4TH
DARK
POLYGONES
GN CAPSULE
SEPTA
INCOMPLETE
LOBULES
CORTICAL
MEDULL
MEJOD
THYMOCYTE
EPIT RET
III RD
EMBRYO
HC
Ep
PCV
ANNULUS
SEPTA
IN
CAP
LOOPS
IN
SUB

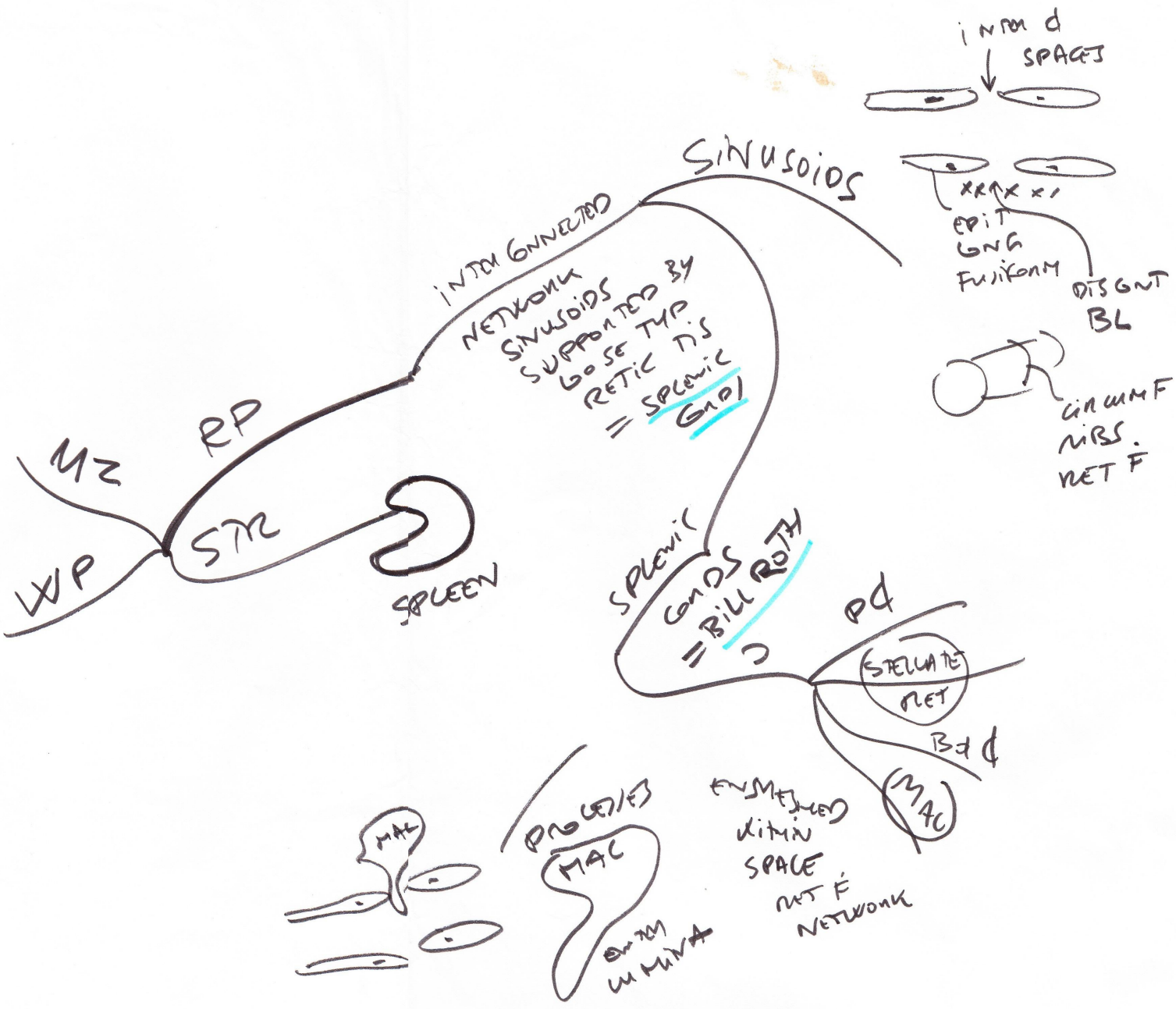
NL

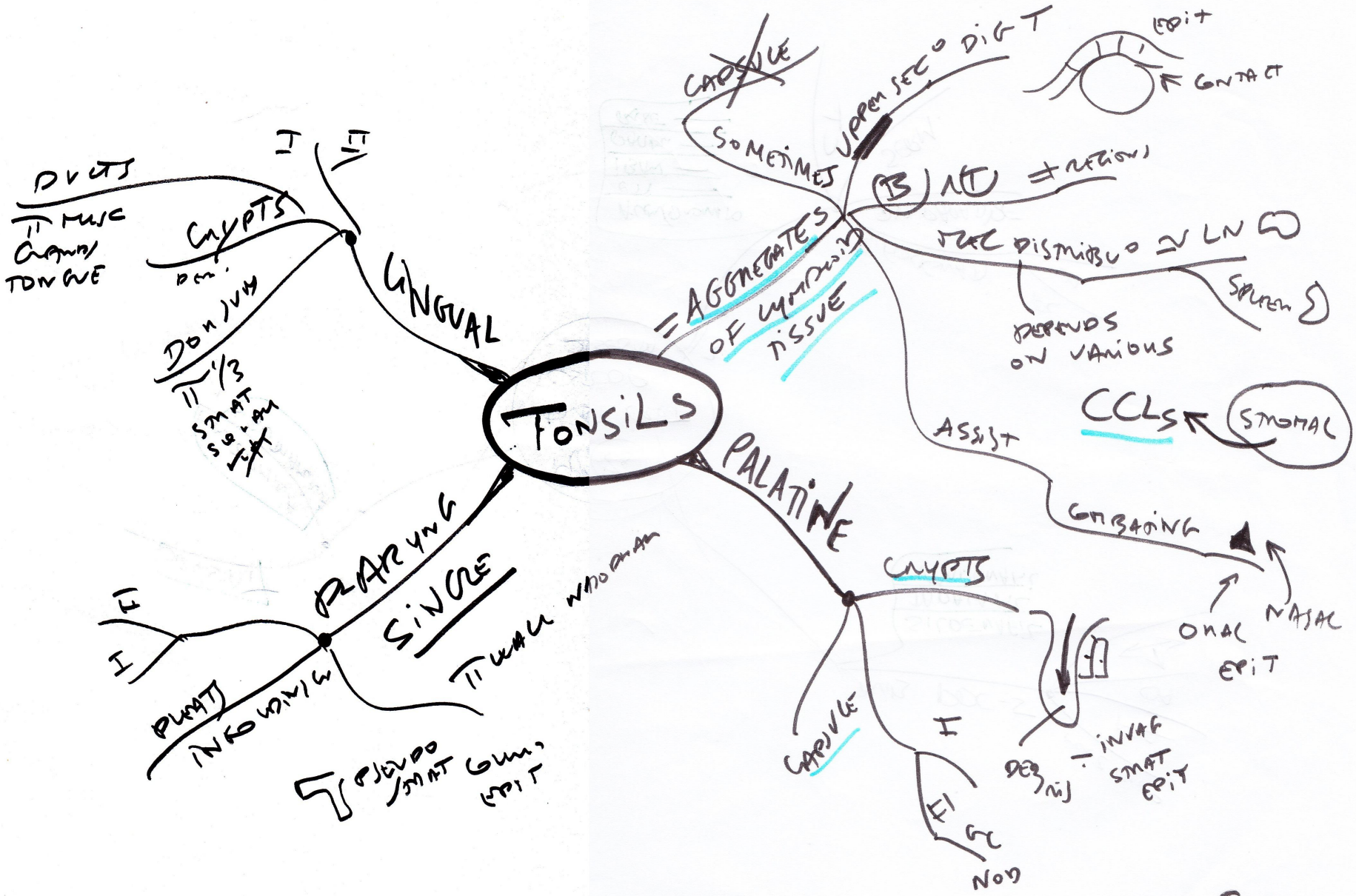
GAR


DC
MATURA°
Treg
TSLP
NAÏVE T
MATURE T
VESSELS
EL VESSEL
FROM MEDULLA
HORMONE LIKE
HORMONE ACTING ON
THYMUS
THYMOPOIETIN
THYMOSIN
THYMULIN
= TF
SOMATOTROPIN
THYROXIN
ADRENOCS
CORTEX
MEDULLA
STRUCTURE
CNT BETWEEN
ADJ GRUELS
LOOSELY PACKED
MATURE T
EPITHET
STAIN LIGHTER THAN
EPITHET
ACCRE°
THYMIC HUM F
FORMA° IN THYMUS
FORMA° IMMUNO COMP


LOCATION
CAPSULE
TRABECULAE
RET EDIT
PARTIALLY SEPARATE LOBULES FROM EACH OTHER
STELLATE
PROMOTE ADJACENT FORM DESMOSOMES
I
II
III
IV
V
VI
CORTEX
MEDULLA
CM JUNC°
THYMUS MEDULLA
M
FUNCTION
- BARRIER BETWEEN BLOOD VESSELS
• ASSIST FORM° BTB BY SUR
PROX SURROUND 1 COMPARTMENTS ISOLATING MATURING (T)
SELF Ag
1 PRESENT. THEM TO MATURING (T)
BOUNDARY
ISOLATE CORTEX FROM MEDULLA
CYTO ARCHIT FRAMEWORK
1 COMPARTMENTAL FUN (T)
FORM HC
DELE° (T) CLONES
REC 1 ATTACK SELF-Ag
THYMIC STROMAL LYMPHOPOIETIN
AIDS FORM° (Treg)


SPLEEN
OVERVIEW
STR
RP
WP
MZ
PALS
NODULES
ALLORGAN'S
LYMP TIS
DIFFNOD
1ST SITE
WHERE
B4
CONTACTS
PARENCHYMA
SINUSOIDAL
REGION
CA
PALS
T
B
T
B
HILUM
MAB W/ SPLENIC V
PULP W/ SPLENIC
SINUSOIDS
*CLOSED
CIRC
=S
OPEN ENDED
WITHIN
SPLENIC
CORD RP
*OPEN C°
TERM A CAPIL
3 REGIONS
MAC SHEATED
PULP
ARTERIOLES
PERI
ARTERIAL
ENTER
RP
LEAVE
WP *
MAINTAIN
SHEATH
C.AA
VASC°
SPLENIC
A
HILUM
TRABECULAR AA
CENTRAL AA
PERI
ARTERIAL
CAPILLARY
SYNOVIAL
MEMBRANE
PALS
HEART
DOG
*
SOME TP
HUM
SPLEEN
RBC
PULP
T
B
SITE PROLIFO
ENTERED
FILTERS B4
PLAC DAMAGED
AGED
F
RP
RED PULP
WP
WHITE PULP
MZ *
MARGINAL
ZONE
LYMPHOID
ELEMENTS
AFFERENT
VESSELS
NB
LN
HILUM
LYMPHATICS
EFF
LN
MODULE
*
=
~LN
=
SIMPLE
SQUAMOUS
EPI
SINUSOIDS
DENSE IRREG CT CAPSULE
= SUPPORTIVE
FRAME WORK
TRABEC
DONUT
MZ
MACROPHAGES
METALLOPHILIC
MACROPHAGES
B/WO
FOLLICLES
ALSO
MZ
B
PROVIDING
A PROJECT
B4 BONNE
A TO
T
BECOME SEGREGATED
T
ENTER
MHC EDIT
DC
INTRO
T
CCLs
ATTRACTS
STROMAL
CT
T
B
REMOVED B4
CAPLOOPS
CA
NL
GAR
12.6


SPACES
SINUSOIDS
INTERCONNECTED
NETWORK
SINUSOIDS
SUPPORTED BY
LOOSE TYP
RETIC TIS
= SPLENIC
CORD
RP
SPLEEN
SPLENIC
CORDS
= BILLROTH
CORDS
PULP
STELLATE
RET
MAC
MAC
PROJECTED
MAC
SPACE
NET F
NETWORK


TONSILS
LINGUAL
DUCTS
CRYPTS
DORSUM
1/3
PHARYNG
SINGLE
PALATINE
AGGREGATES
OF LYMPHOID
TISSUE
SOMETIMES
CRYPTS
CAPSULE
ASSIST
CCLS
STROMAL
EPIT
CONTACT
SPLEEN
DEPENDS
ON VARIOUS
ONAL
NASAL
EPIT
GAR

NL