Physiomodel 1.1

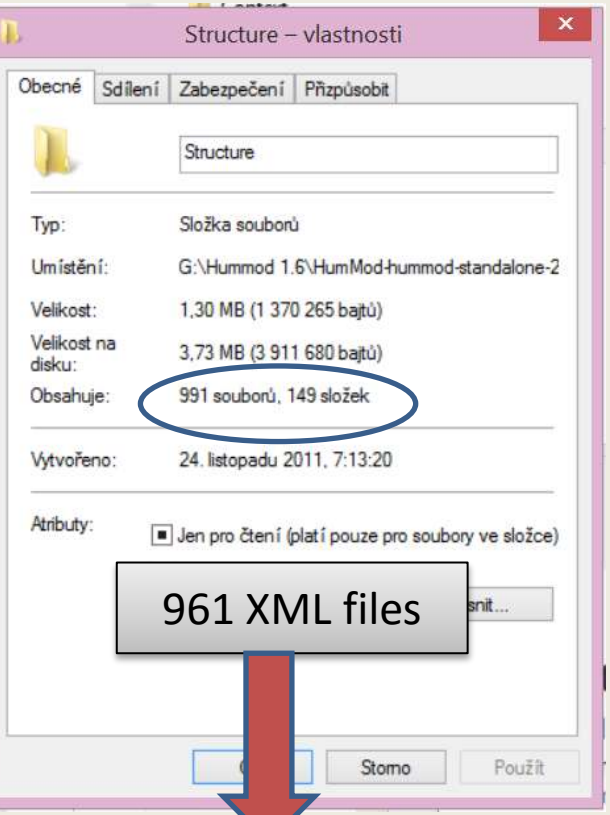
(příklad využití knihovny Physiolibrary)

www.physiomodel.org

www.physiolibrary.org

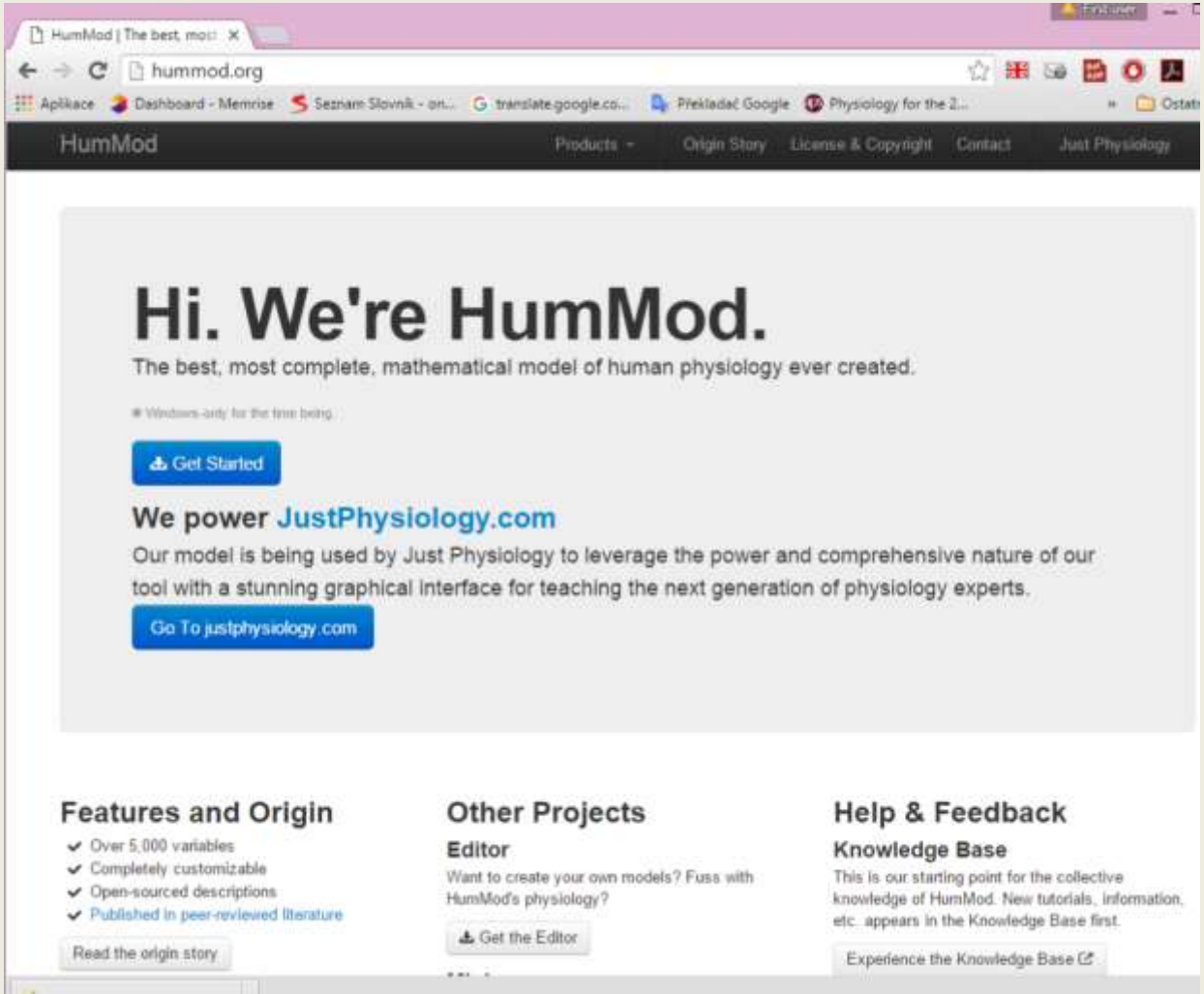
Reimplementation and extension of HumMod Model

hummod.org

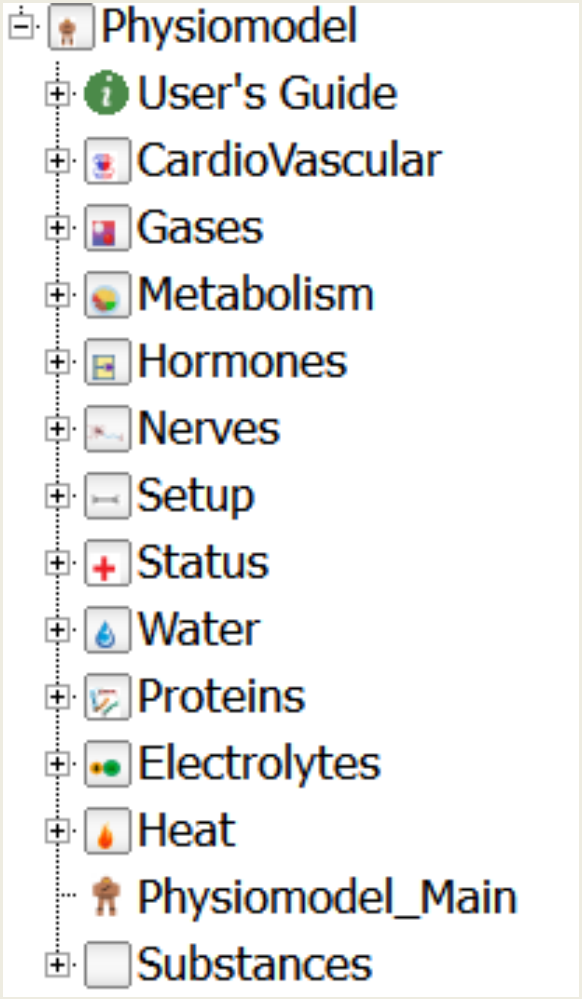


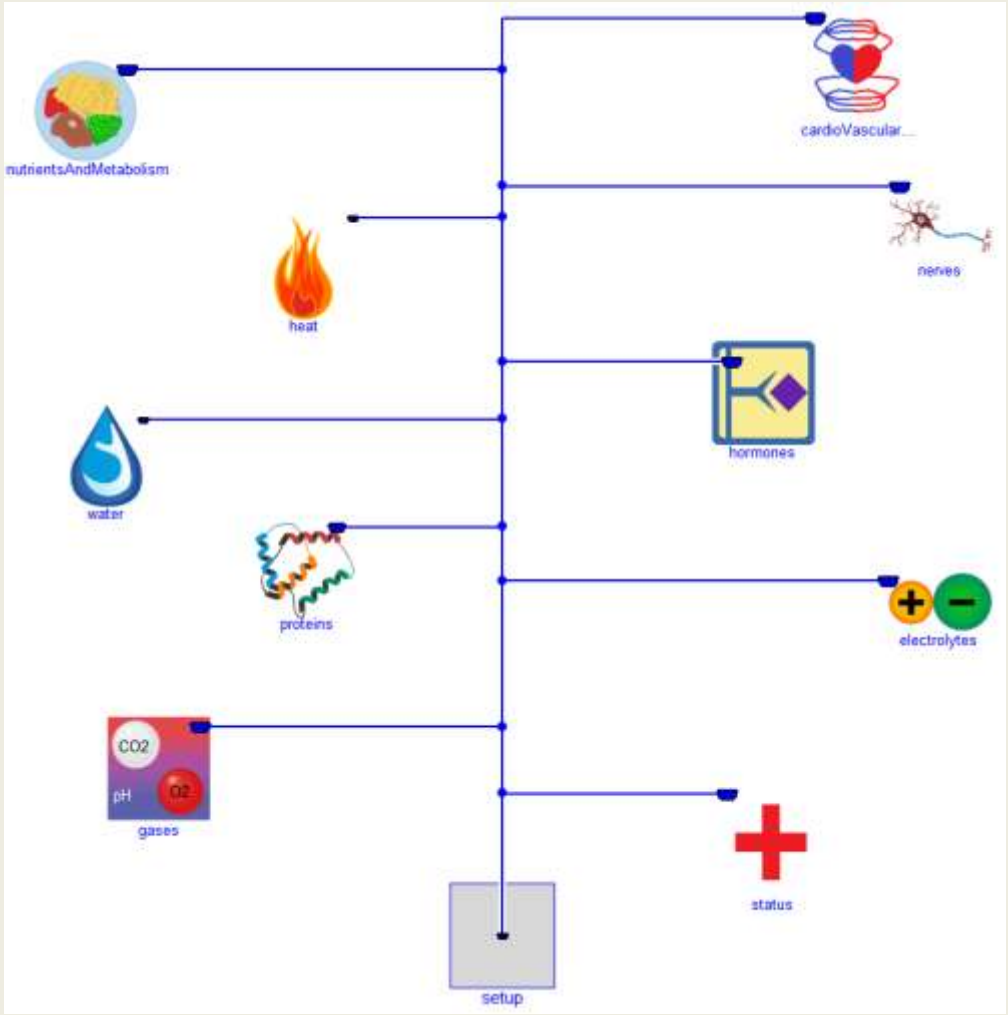
961 XML files

Modelica

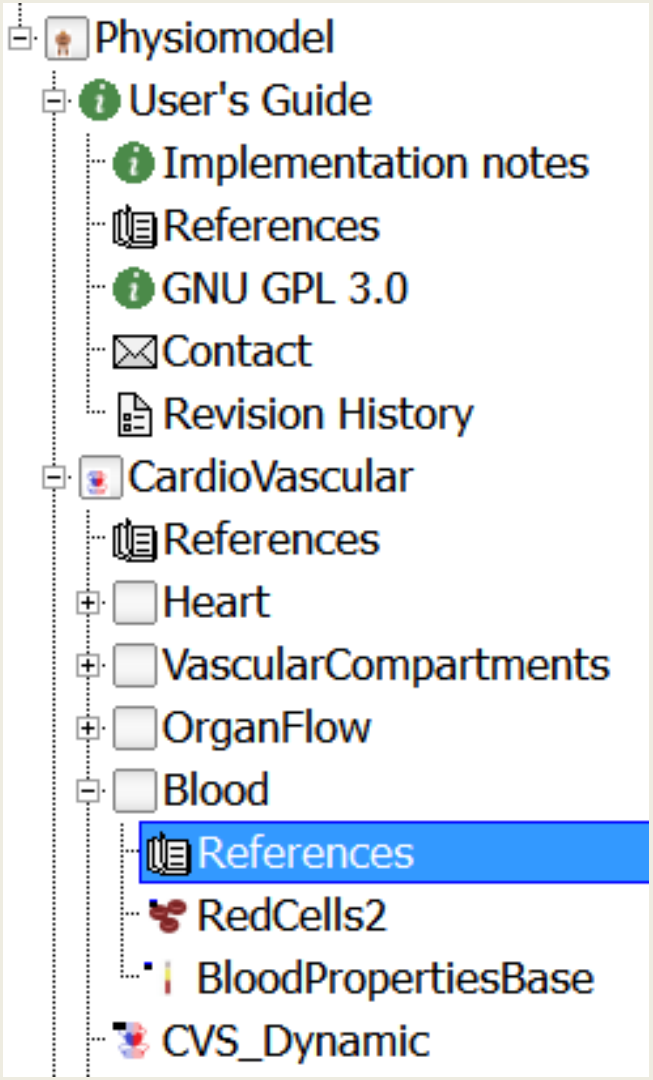


Physiomodel Structure





References

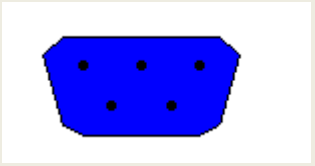



```
class References "References"
  extends Modelica.Icons.References;

  annotation (Documentation(info="<html>
<table>
        <tr>
                <td>[Begg1966]</td>
                <td>T. Begg and J. Hearns, \"Comp
onents in blood viscosity. The relative contrib
ution of haematocrit, plasma fibrinogen and ot
her proteins,\" Clinical science, vol. 31, pp. 87
-93, 1966. </td>
        </tr>

</table>
</html>"));
end References;
```

Expandable connector

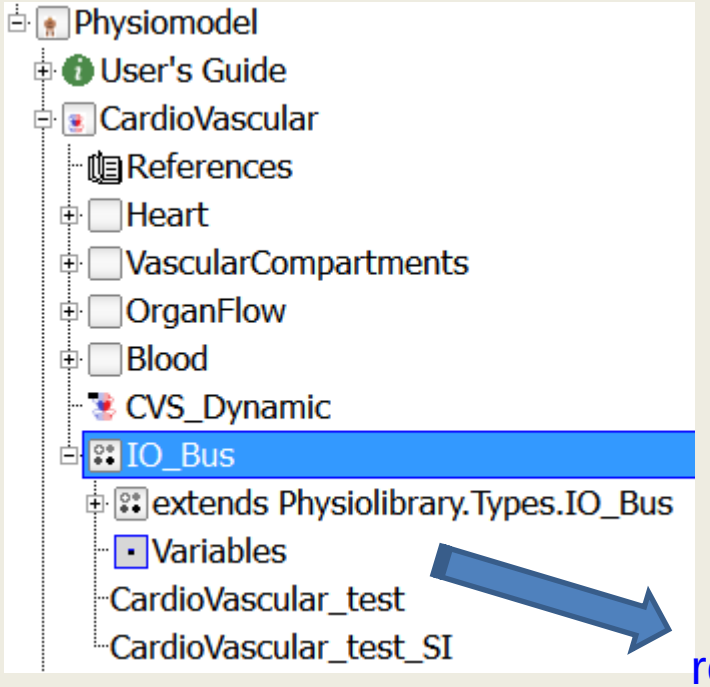


```
expandable connector BusConnector
      "Empty control bus that is adapted to the signals connected to it"

annotation (Documentation(info="<html>
<p>
This connector defines the \"expandable connector\" that is used
as bus in the Physiomodel.
Note, this connector is \"empty\". When using it, the actual content is
constructed by the signals connected to this bus.
</p>
</html>"));


end BusConnector;
```

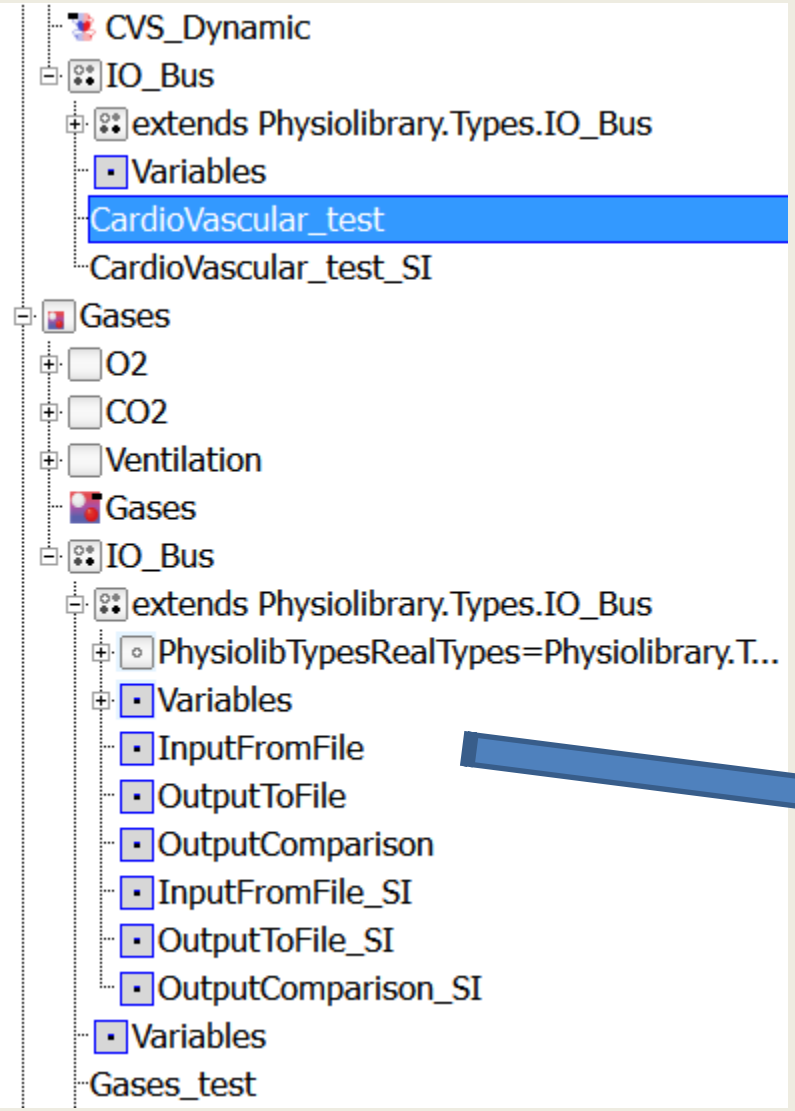
Input-Output Bus

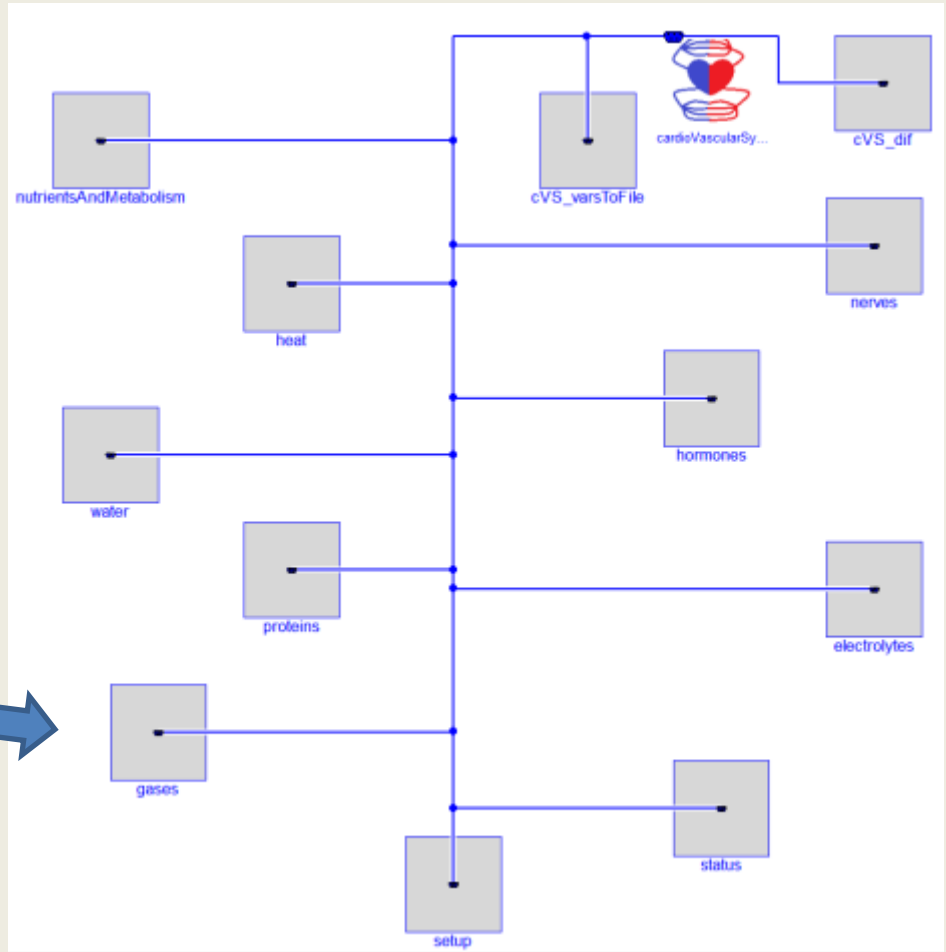


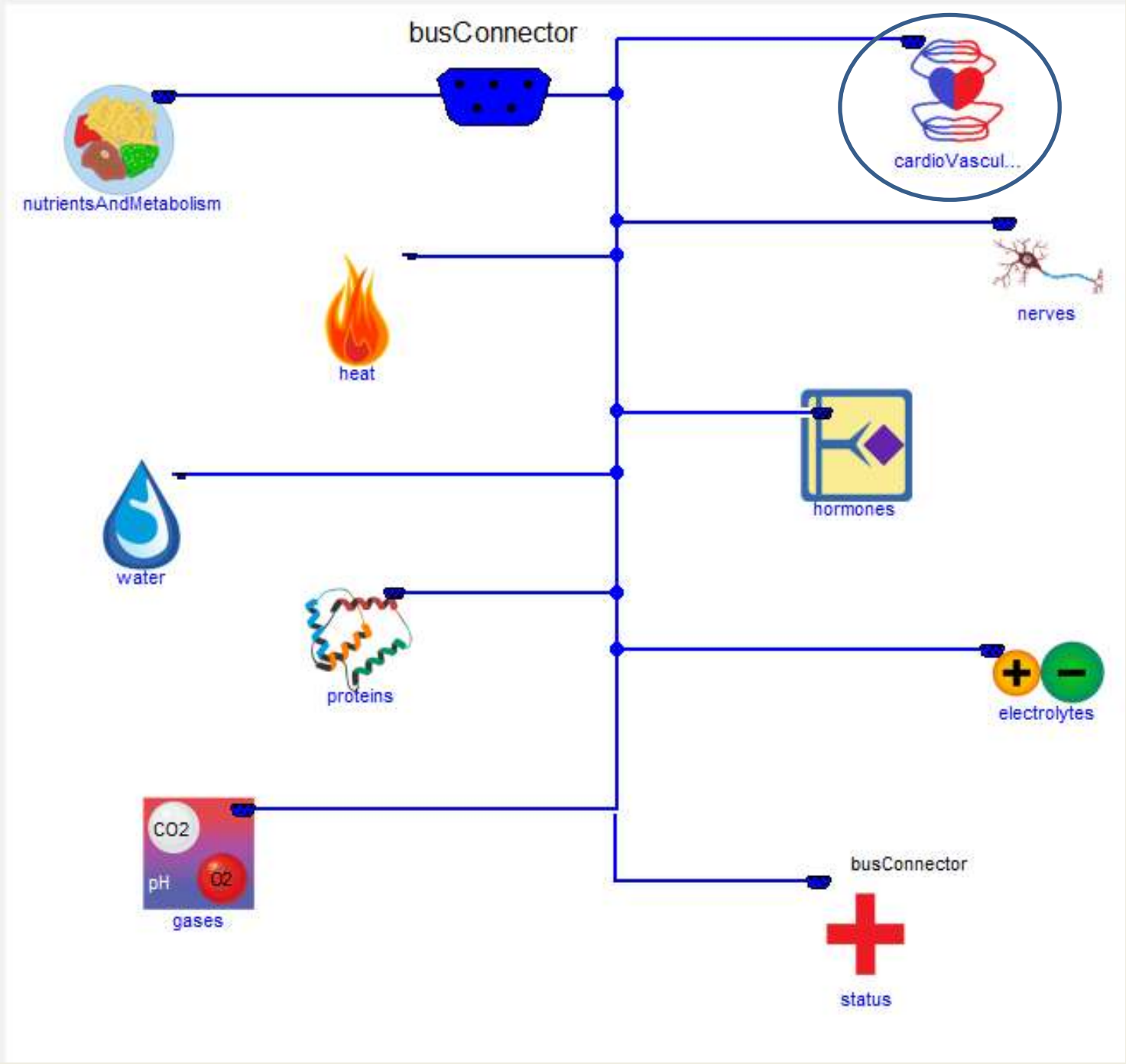

```
package IO_Bus
  extends Physiolibrary.Types.IO_Bus;
```

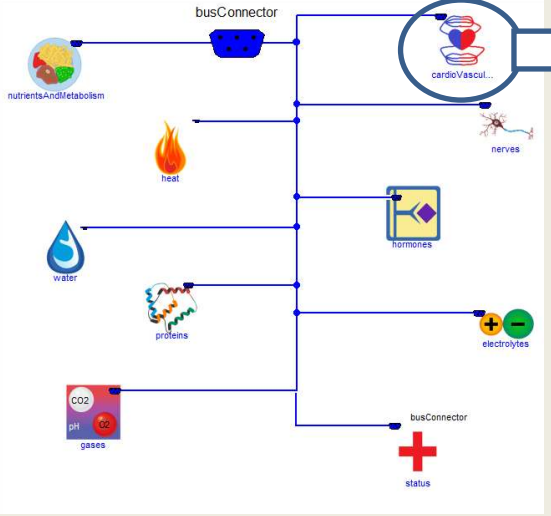
```
redeclare model extends Variables
   T.Volume ArtysVol(varName="ArtysVol.Vol")
            "Volume of oxygenated blood in body.";
   T.Fraction BloodVol_Hct(varName="BloodVol.Hct")
            "Heamatocrit = red cells / blood.";
…
equation
 connect(ArtysVol.y, busConnector.ArtysVol);
 connect(BloodVol_Hct.y, busConnector.BloodVol_Hct);
…
end Variables;
```

IO_Bus usage

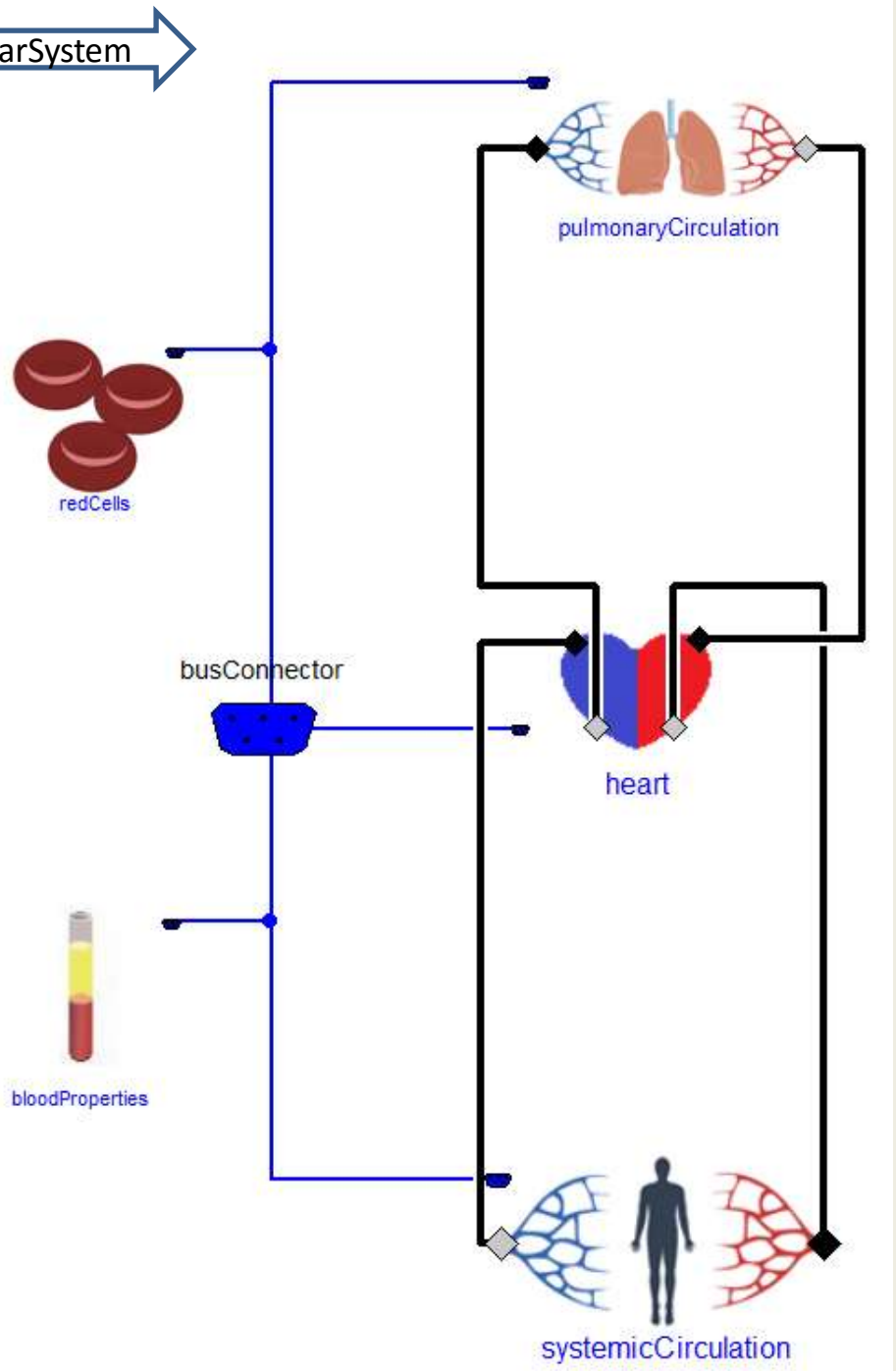

CVS_Dynamic
IO_Bus
extends Physiolibrary.Types.IO_Bus
Variables
CardioVascular_test
CardioVascular_test_SI
Gases
O2
CO2
Ventilation
Gases
IO_Bus
extends Physiolibrary.Types.IO_Bus
PhysiolibTypesRealTypes=Physiolibrary.T...
Variables
InputFromFile
OutputToFile
OutputComparison
InputFromFile_SI
OutputToFile_SI
OutputComparison_SI
Variables
Gases_test

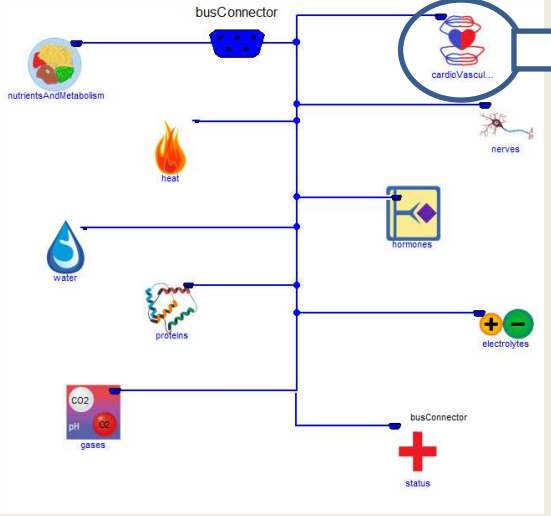

nutrientsAndMetabolism
cVS_varsToFile
cardioVascularSy...
cVS_dif
heat
nerves
hormones
water
proteins
electrolytes
gases
status
setup


busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status

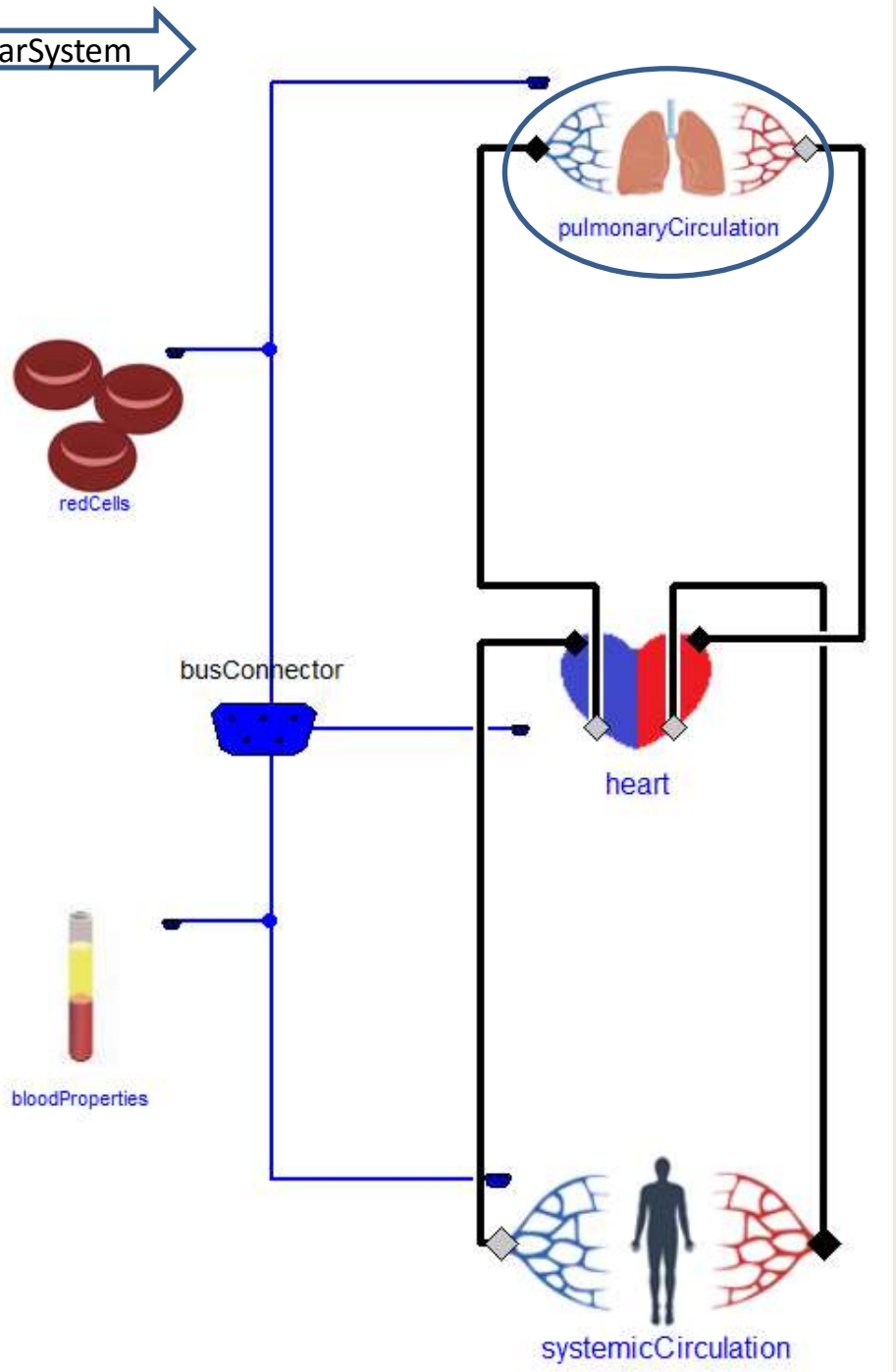


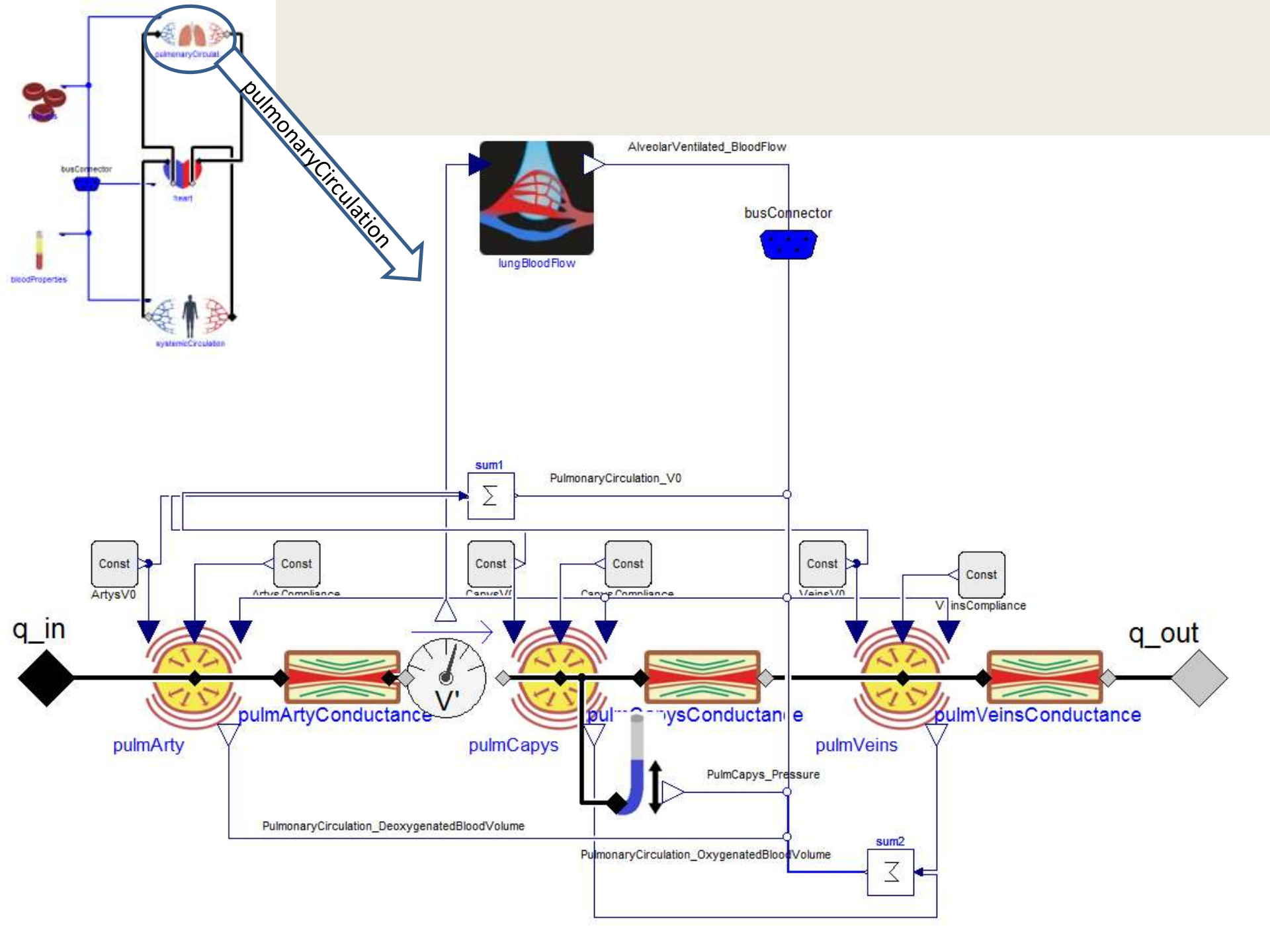
cardioVascularSystem

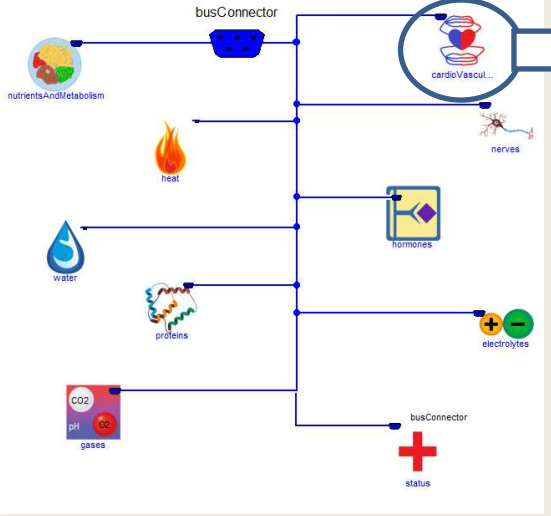




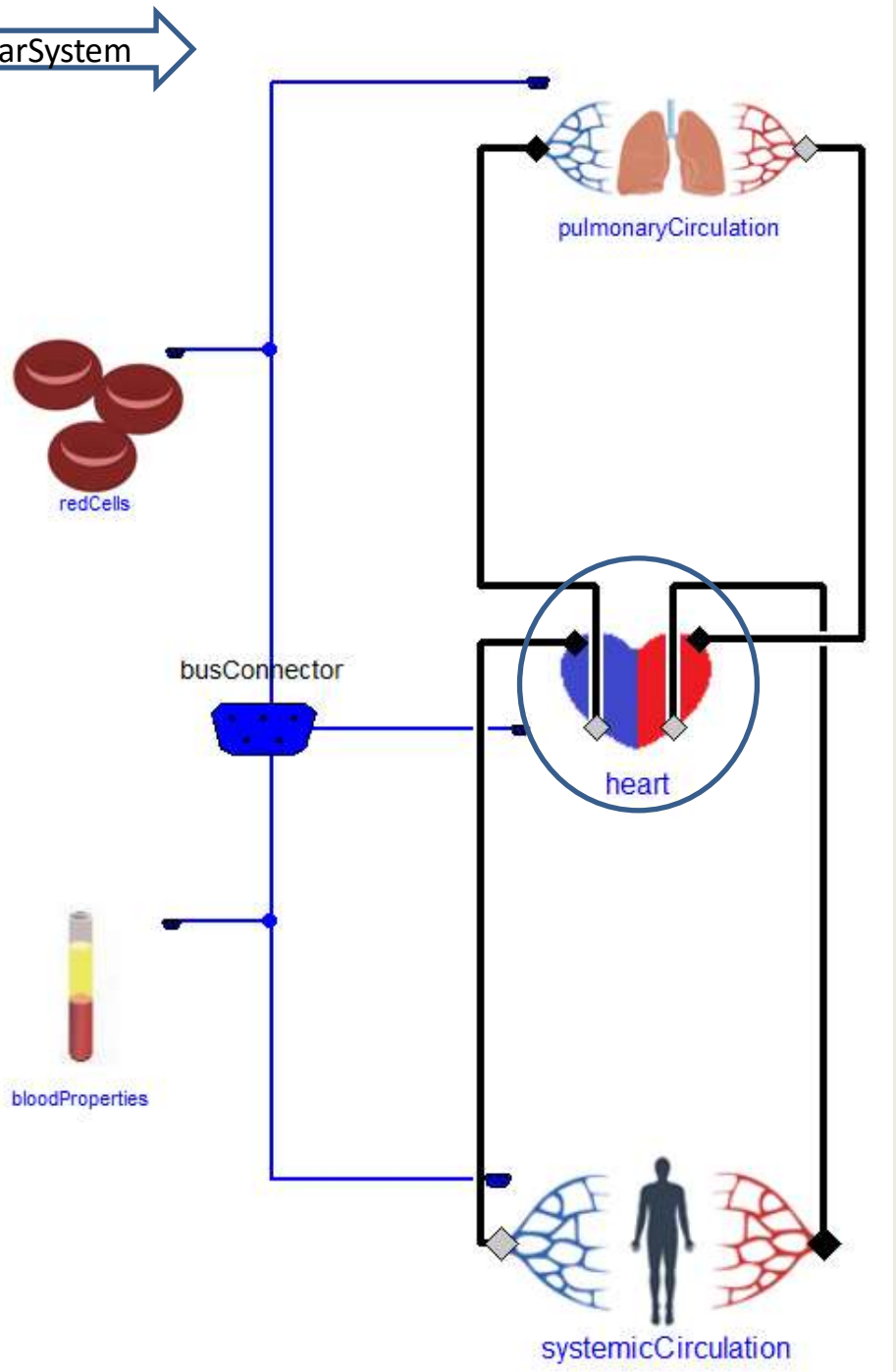
cardioVascularSystem

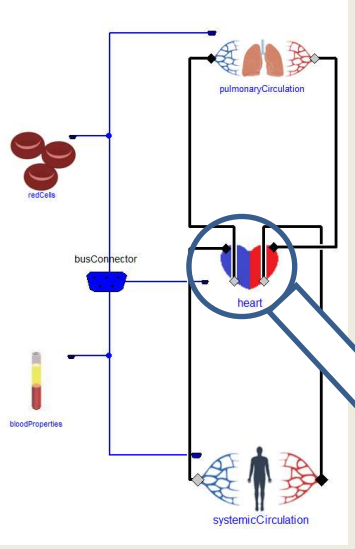



pulmonaryCirculation
busConnector
heart
bloodProperties
systemicCirculation
AlveolarVentilated_BloodFlow
lungBloodFlow
busConnector
sum1
PulmonaryCirculation_V0
Const
ArtysV0
Const
Const
Const
Const
Const
VeinsCompliance
q_in
q_out
V'
pulmArtyConductance
pulmVeinsConductance
pulmArty
pulmCapys
pulmVeins
PulmCapys_Pressure
PulmonaryCirculation_DeoxygenatedBloodVolume
PulmonaryCirculation_OxygenatedBloodVolume
sum2



cardioVascularSystem





heart

SA_node

BetaPool_Effect

BetaBlocade_Effect

GangliaGeneral_NA

VagusNerve_NA_Hz

HeartVentricleRate

atriopeptin

lowPressureReceptors

rightAtrium_TMP

avePressure

0.5

leftAtrium_TMP

0.5

AtrialLowPressureReceptors_NA

busConnector

Const

RightAtriumV

Pericardium_Pressure

CardiacOutput

fromLeftVentricle

Const

LeftAtriumV

fromRightVentricle

rightAtrium

RightAtrium

LeftAtrium

leftAtrium

rightVentricle

leftVentricle

sum1

Heart_V

sum3

Heart_DeoxygenatedBloodVolume

Heart_OxygenatedBloodVolume

sum2

RightAtrium_Pressure

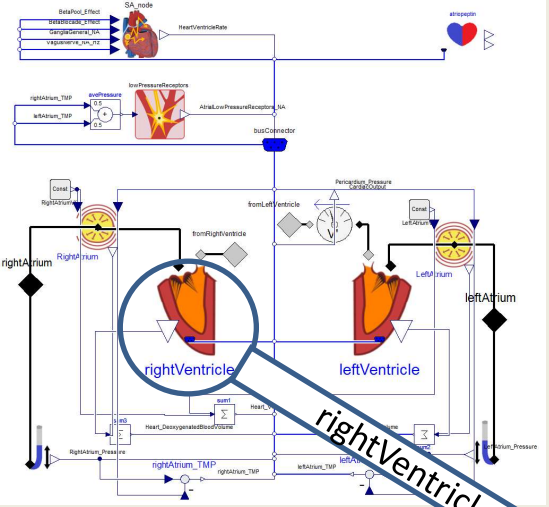
LeftAtrium_Pressure

rightAtrium_TMP

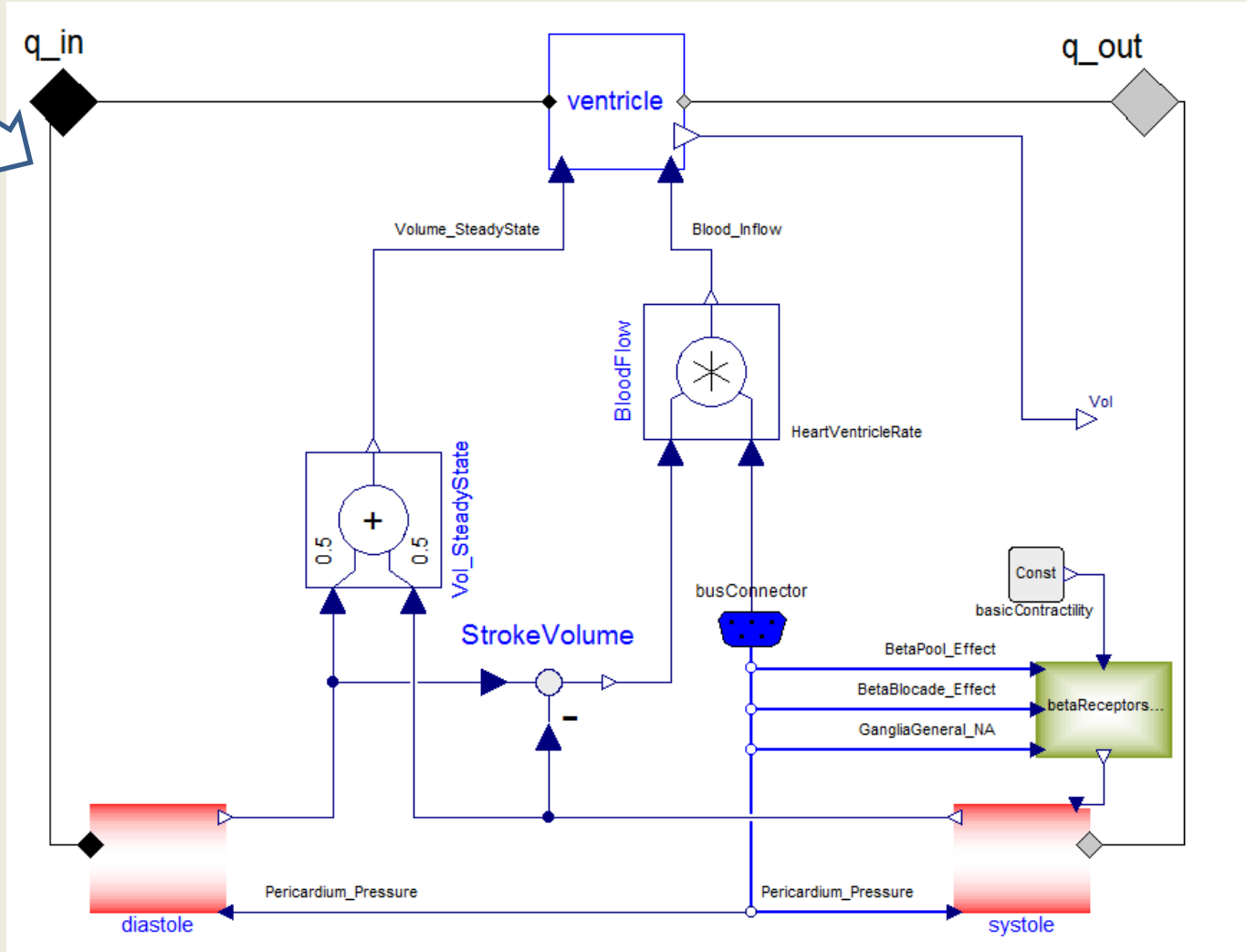
rightAtrium_TMP

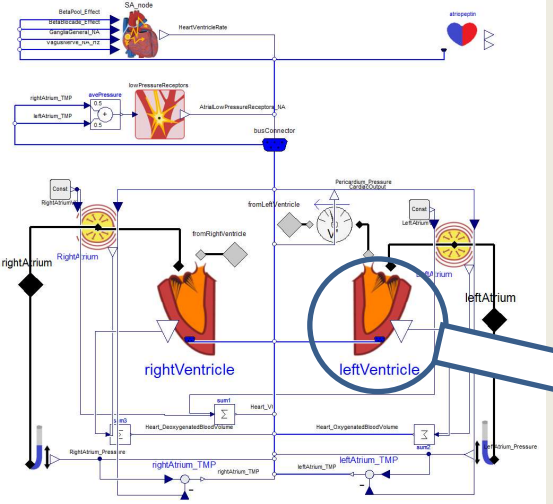
leftAtrium_TMP

leftAtrium_TMP

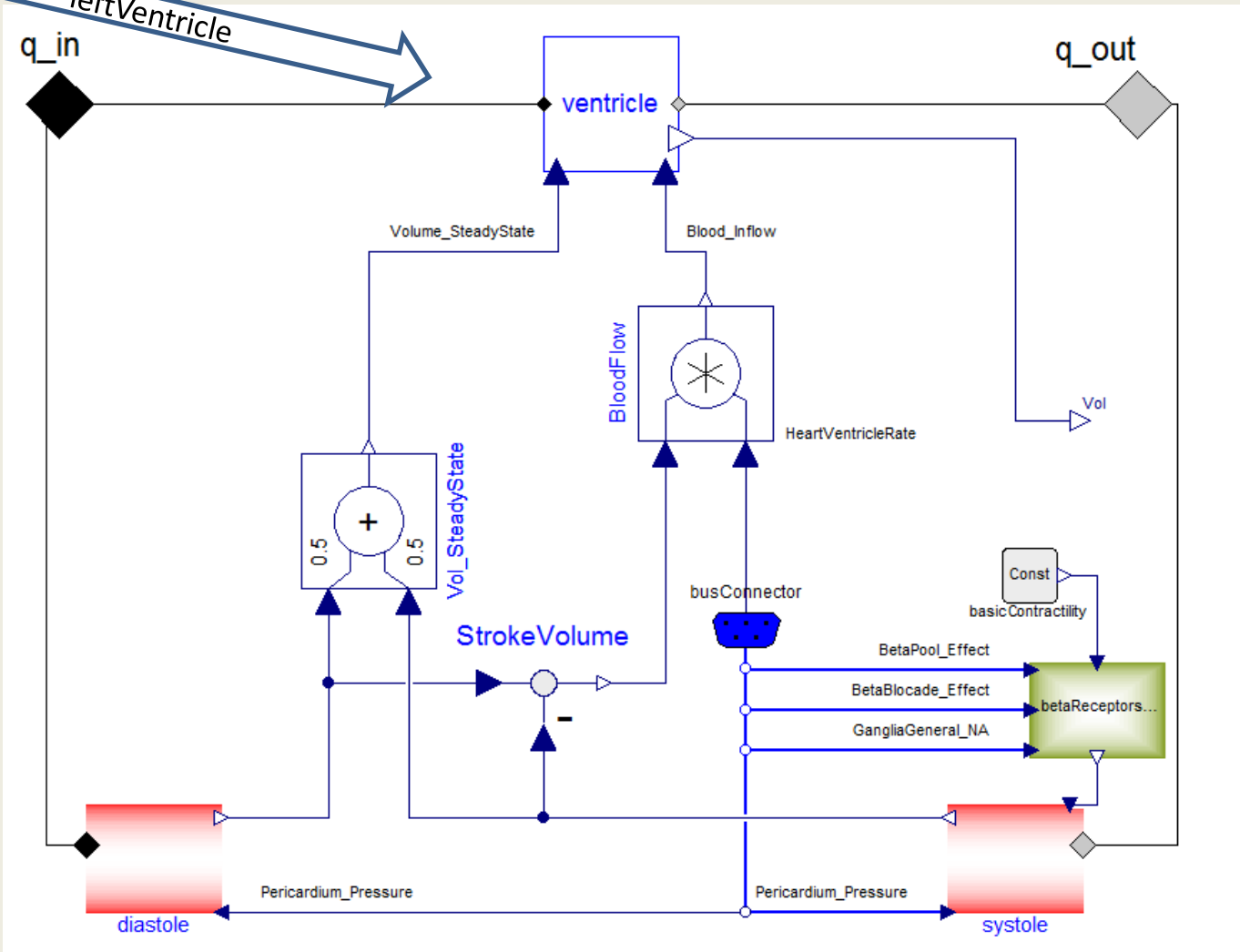


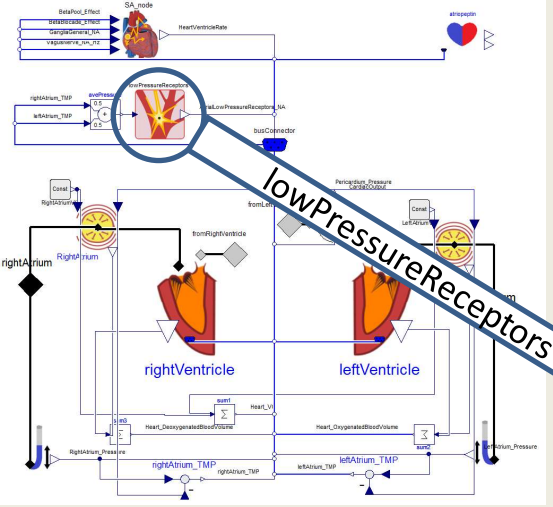
rightVentricle

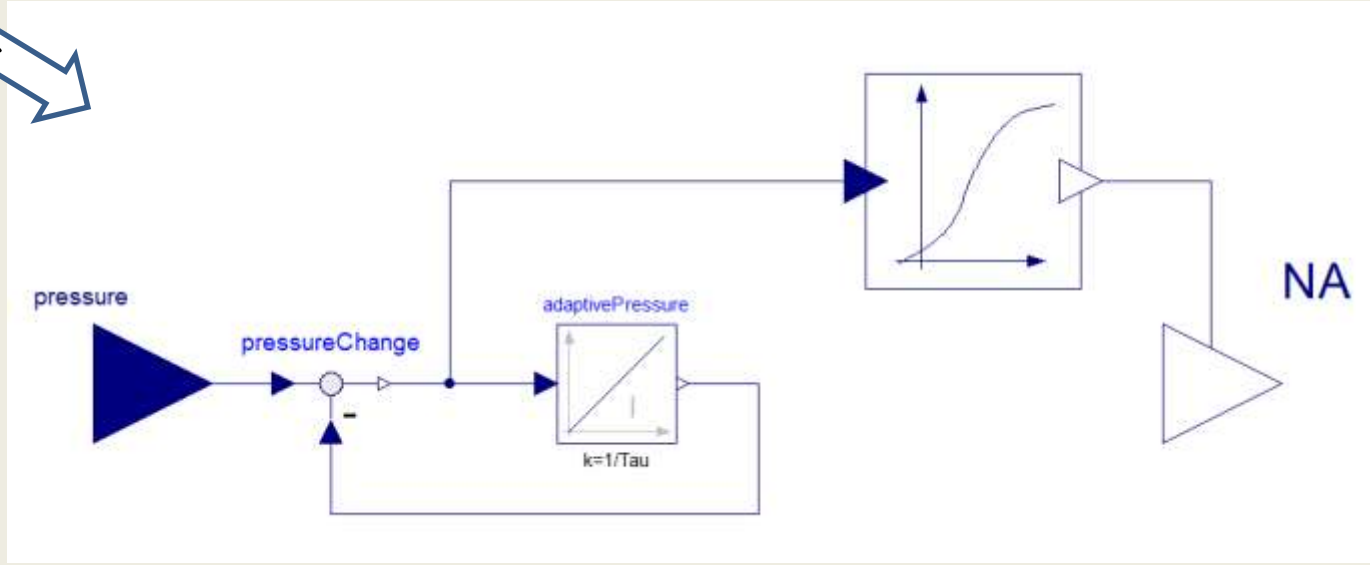


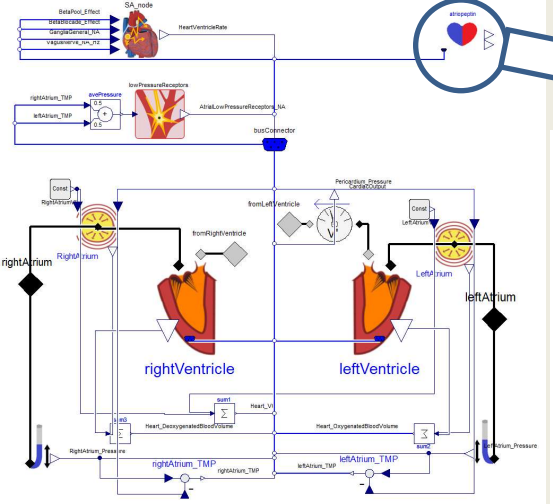


leftVentricle




SA_node
HeartVentricleRate
atropeptin
lowPressureReceptors
busConnector
Pericardium_Pressure
rightAtrium
RightAtrium
fromRightVentricle
rightVentricle
leftVentricle
Heart_DeoxygenatedBloodVolume
Heart_OxygenatedBloodVolume
rightAtrium_TMP
leftAtrium_TMP

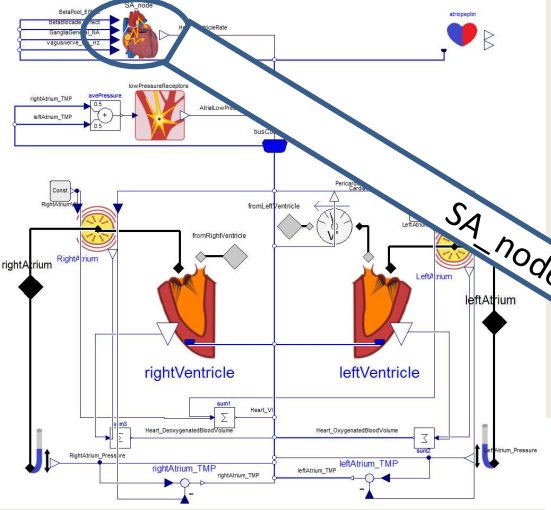

pressure
pressureChange
adaptivePressure
k=1/Tau
NA



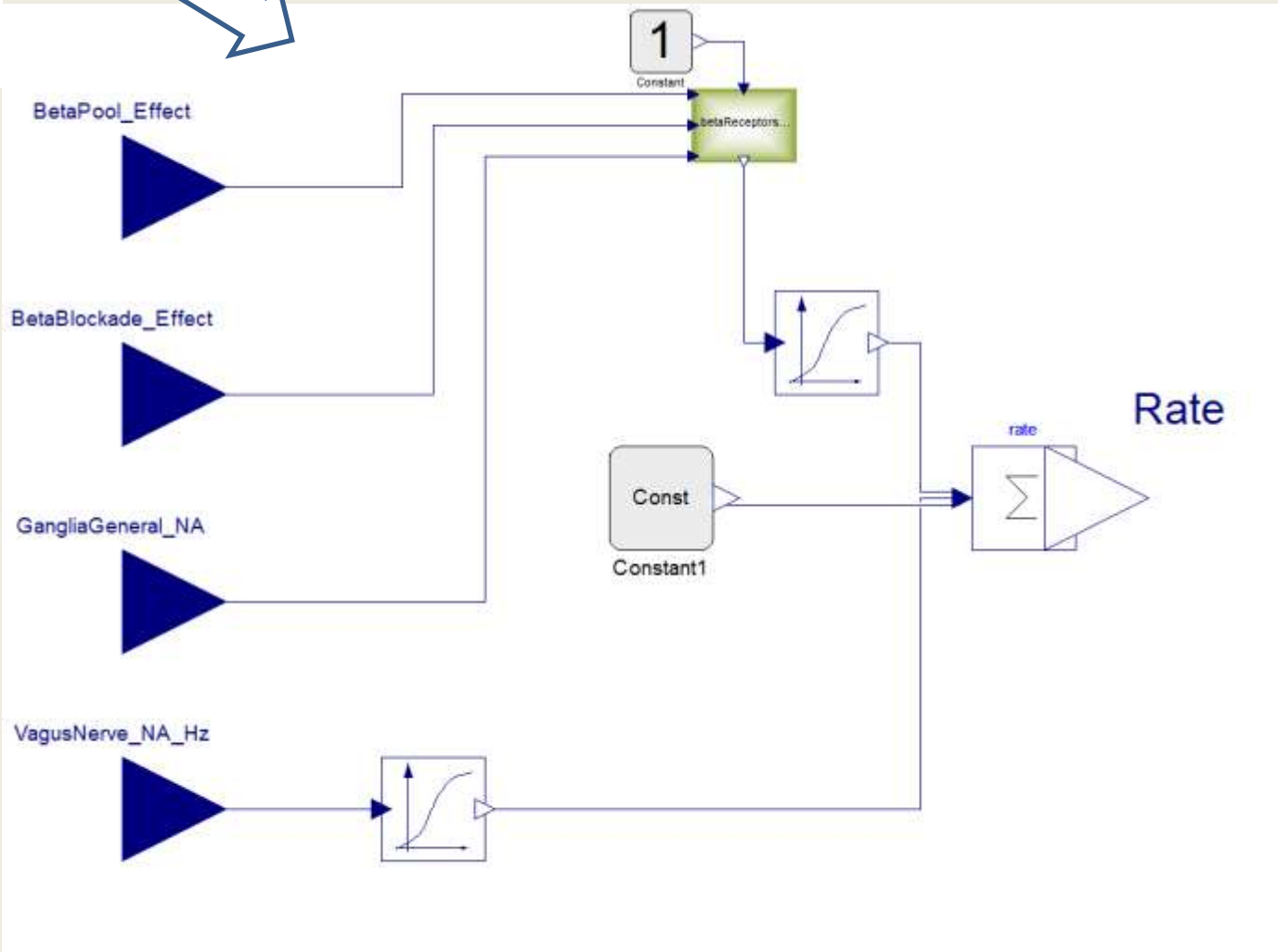
atriopeptid

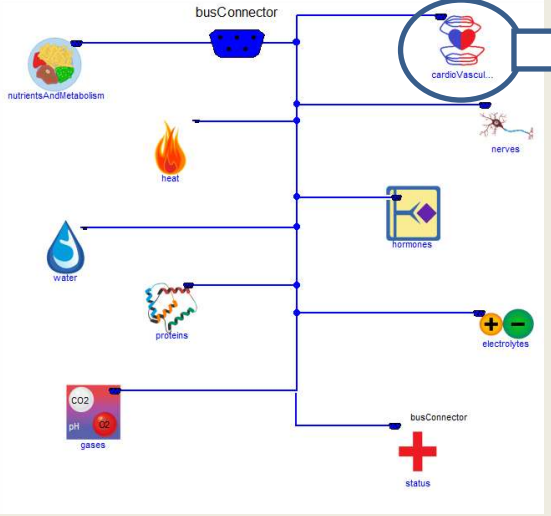
busConnector

Const
hormoneFlowCo...
rightAtrium_TMP
RAPEffect
LAPEffect
leftAtrium_TMP
SteadyState
feedback
integrator
k=(1/20)/60
secretion
log10_1
ANP
ANPPool_Log10Conc
max(l...
ANP
ECFV_Vol
ANPPool
NephronANP_Log10Conc
feedback1
integrator1
k=(1/20)/60
Degra...
k=0.2...
Degradation
log10_2
NephronANP_Log10Conc
max(l...

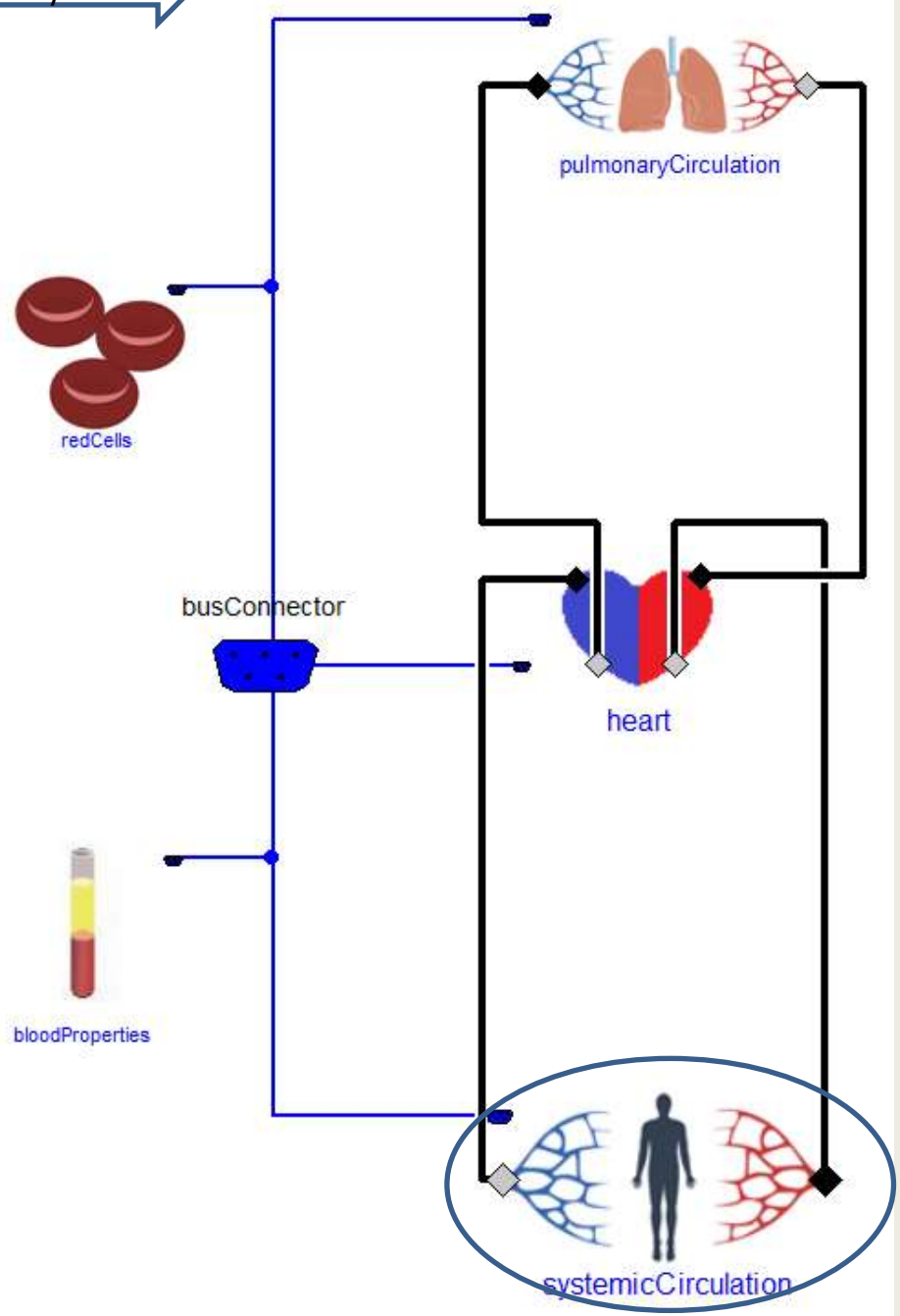

SA_node
rightVentricle
leftVentricle
rightAtrium
leftAtrium
rightAtrium_TMP
leftAtrium_TMP

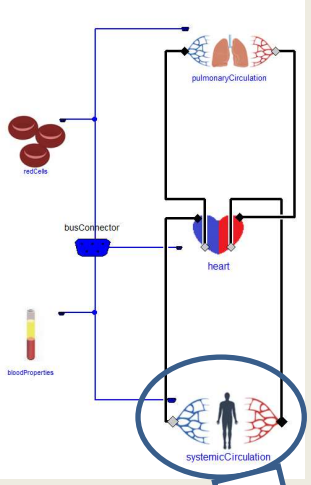
SA_node


1
Constant
BetaPool_Effect
betaReceptors...
BetaBlockade_Effect
Rate
rate
Const
Constant1
GangliaGeneral_NA
VagusNerve_NA_Hz

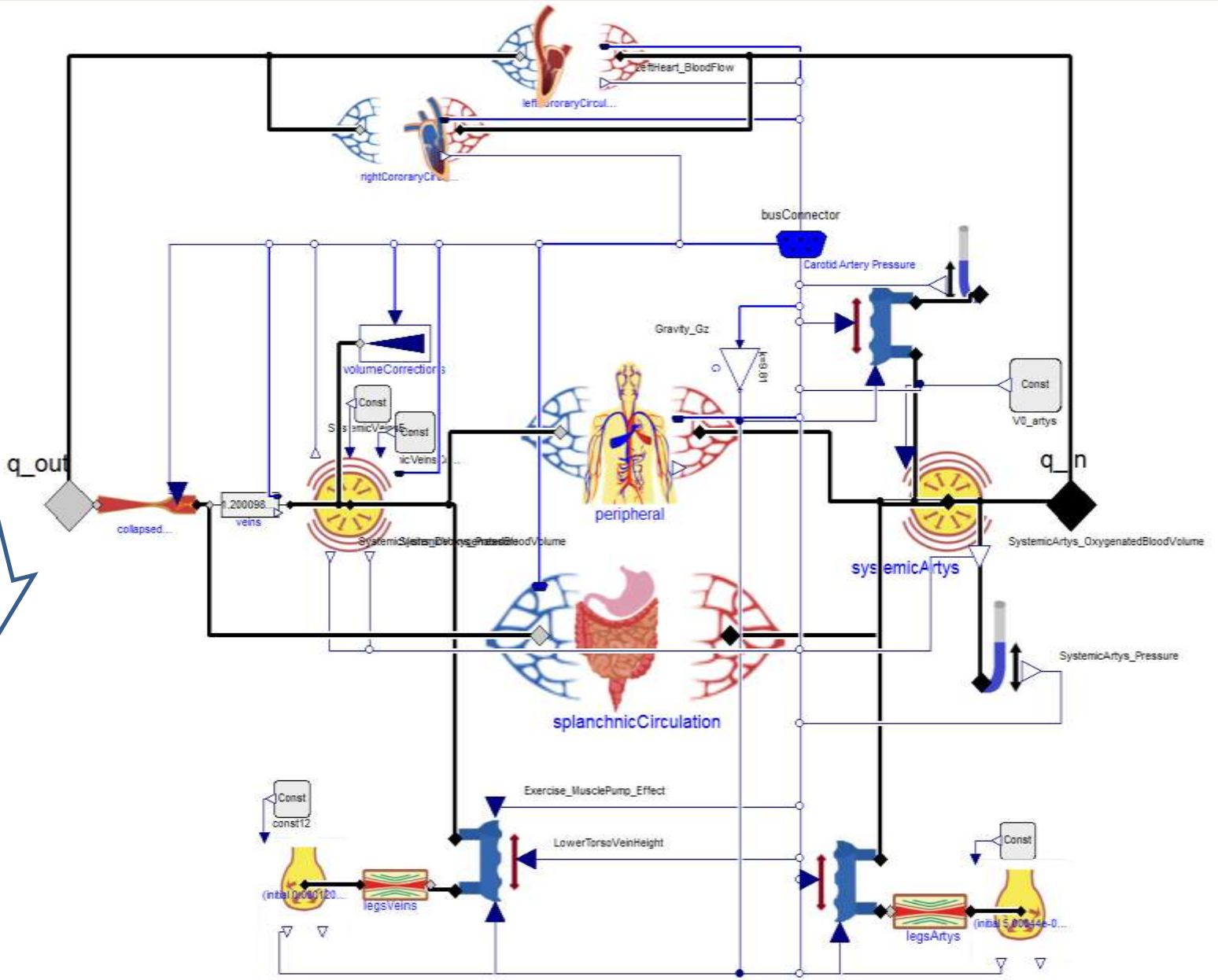


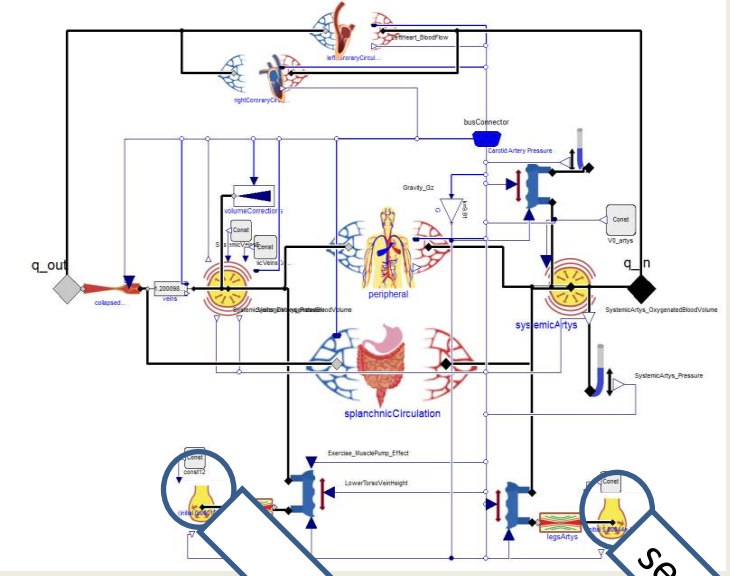
cardioVascularSystem





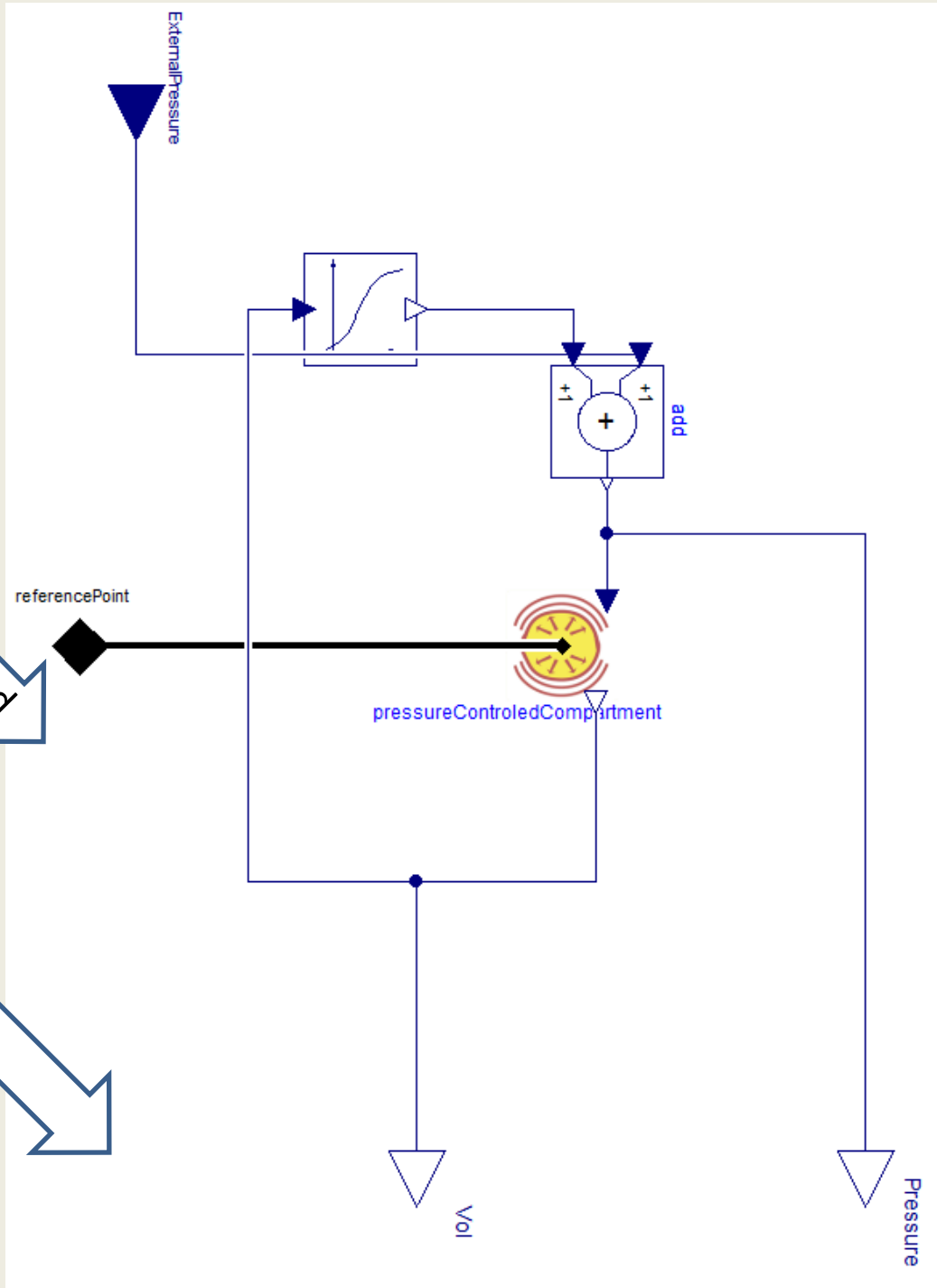
systemicCirculation

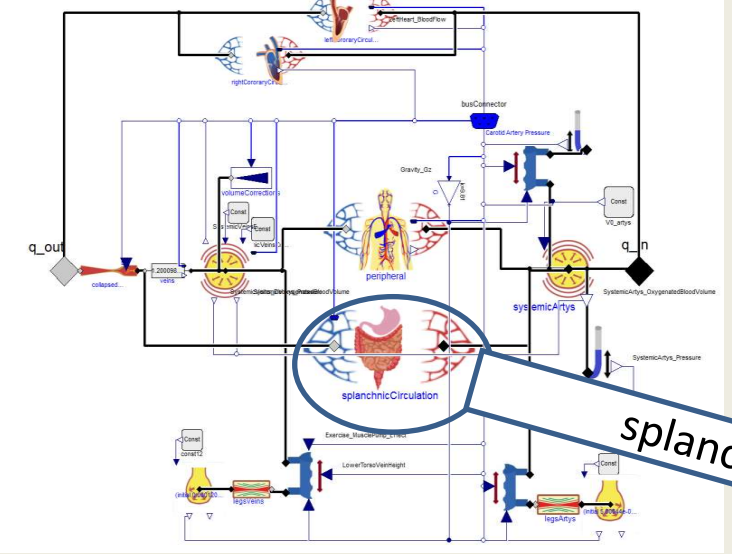




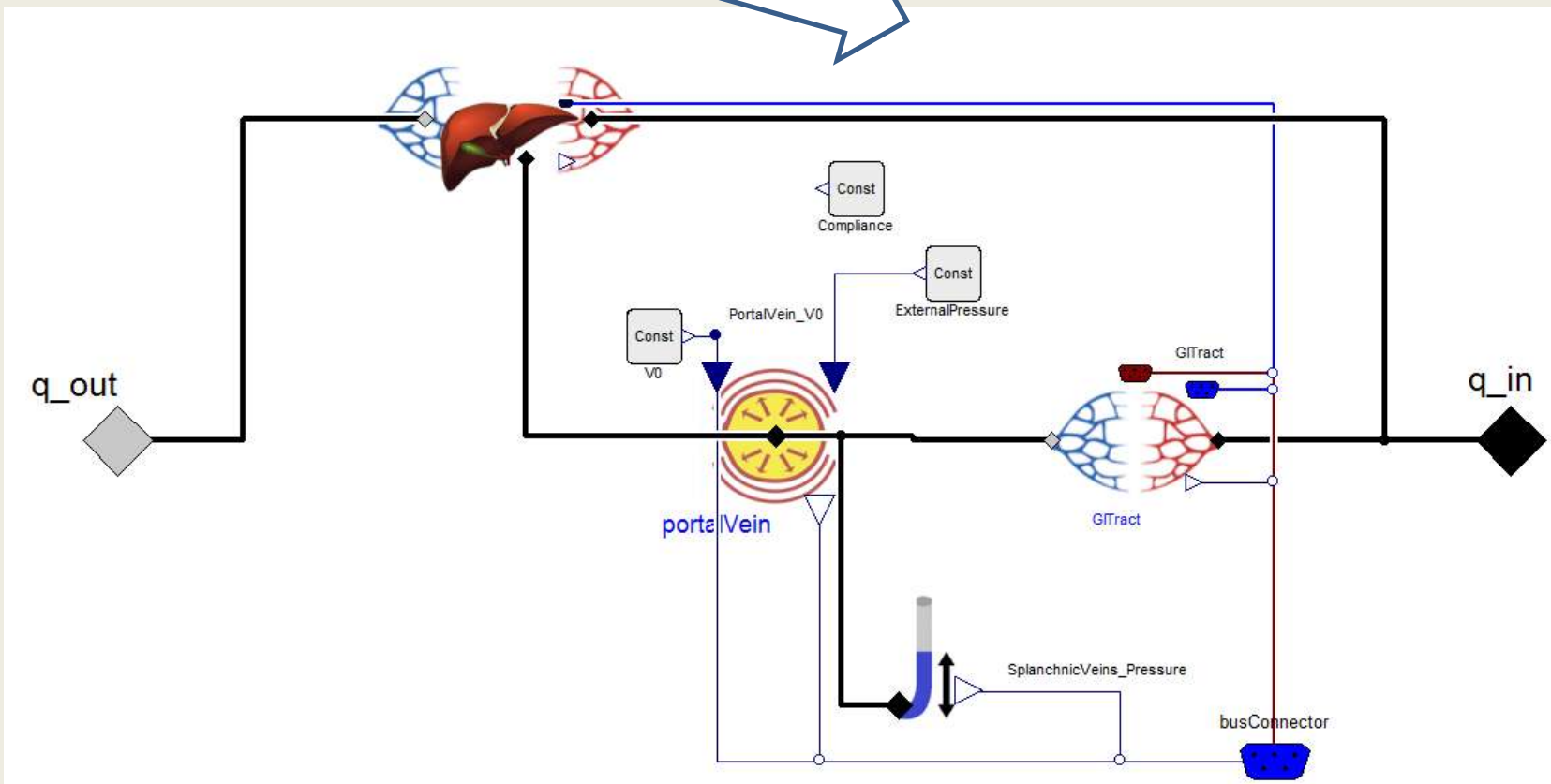
sequesteredBlood

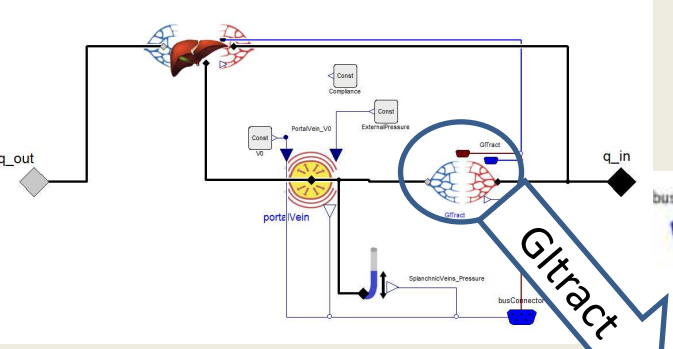
sequesteredBlood1





splanchnicCirculation





GItract

busConnector

Const

BasicConductance

Viscosity_ConductanceEffect

Viscosity

Anesthesia_VascularConductance

Anesthesia

Angiotensin2

A2Effect

Vasopressin

ADHEffect

AlphaPool_Effect

AlphaBlocade_Effect

GanglaGeneral_NA

AlphaReceptors

1

one1

IntensityEffect

Exercise_Metabolism_MotionWatts

RateEffect

Exercise_Metabolism_ContractionRate

psw

MusclePumping

tissueConnector

Function_Failed

pO2

Vasculature

pO2

pO2

one

pO2

pCO2

TensionEffect

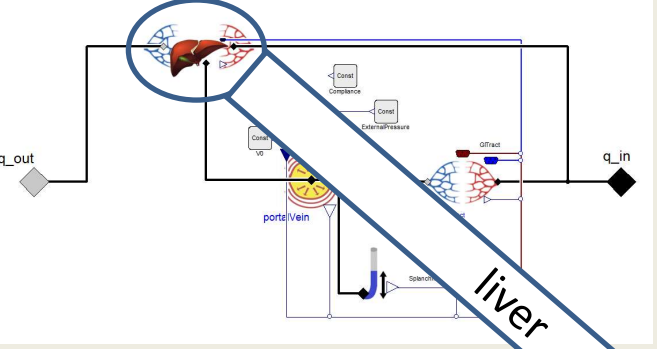
O2Need

BloodFlow

q_out

resistor

q_in



busConnector

HepaticArty_BloodFlow

HepaticArtyConductance

V'

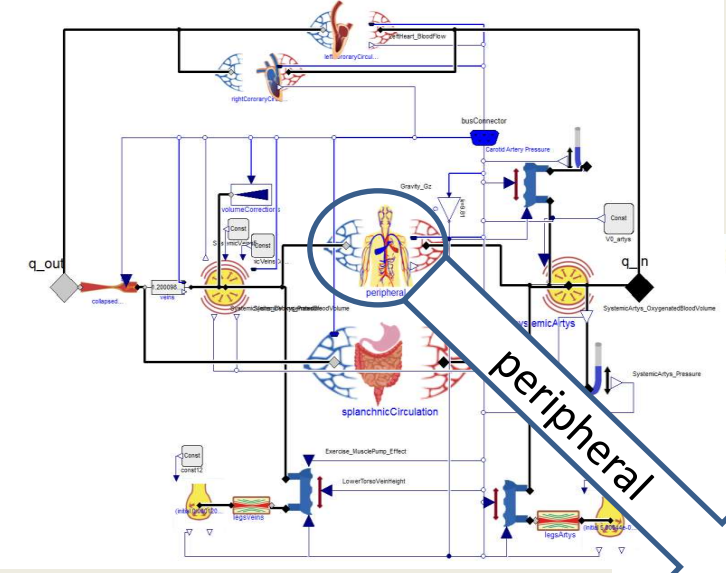
q_out

liverPortalConduit...

portalVein

q_in

BloodFlow



peripheral

busConnector

bone

brain

fat

kidney

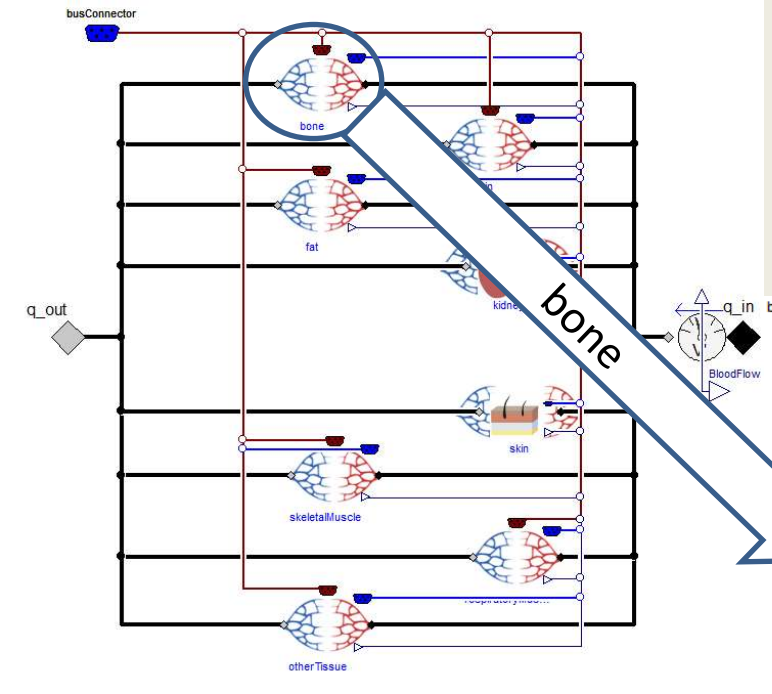
skin

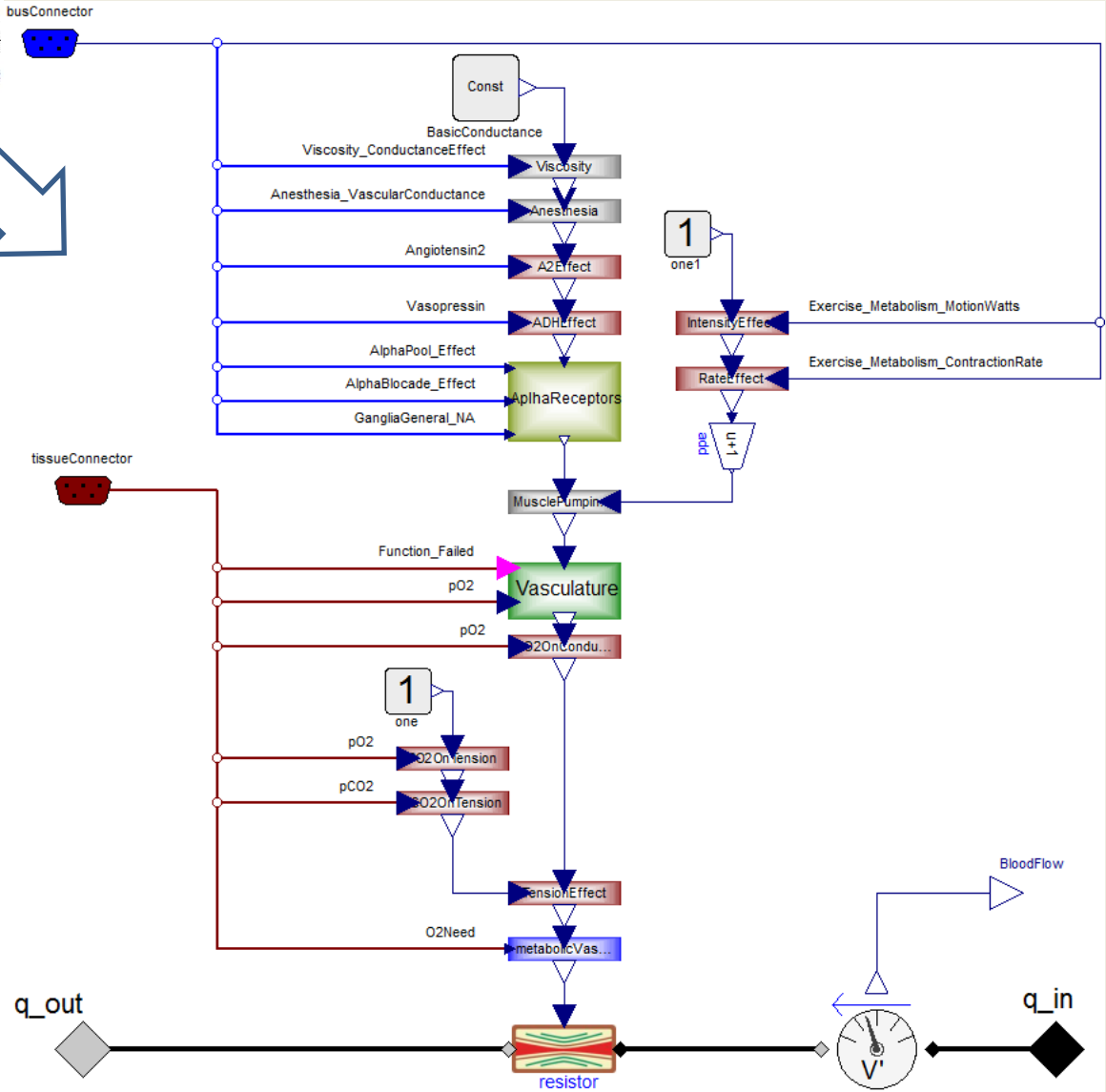
skeletalMuscle

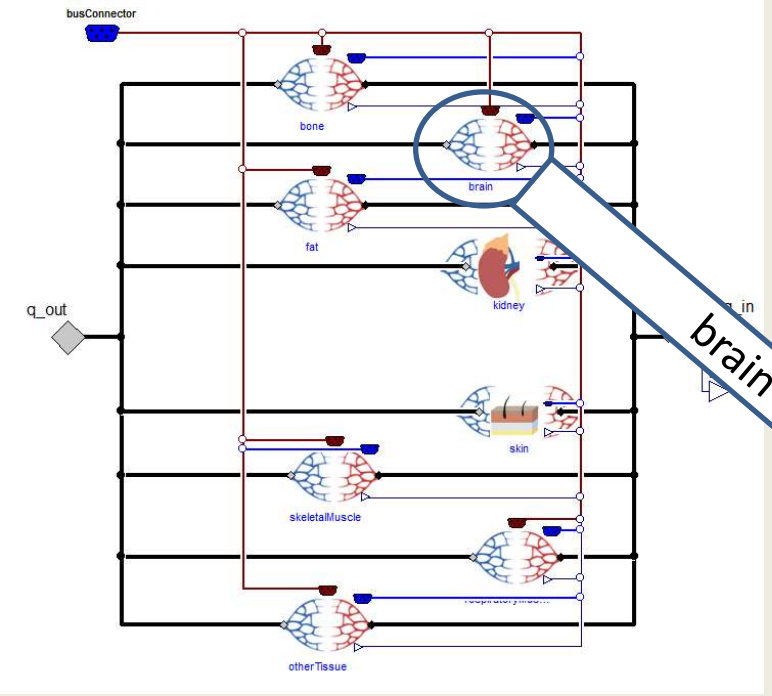
otherTissue

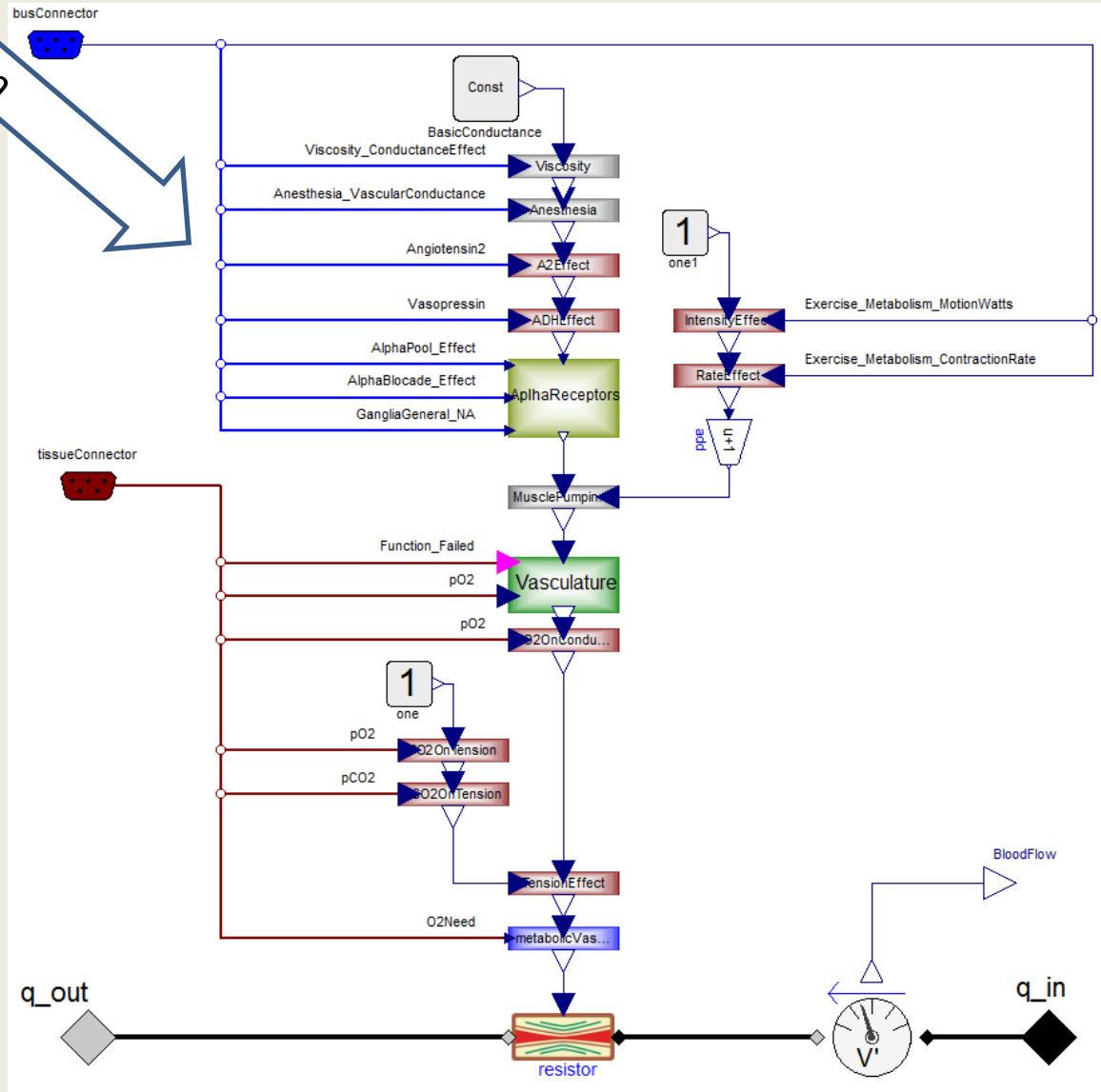
q_out

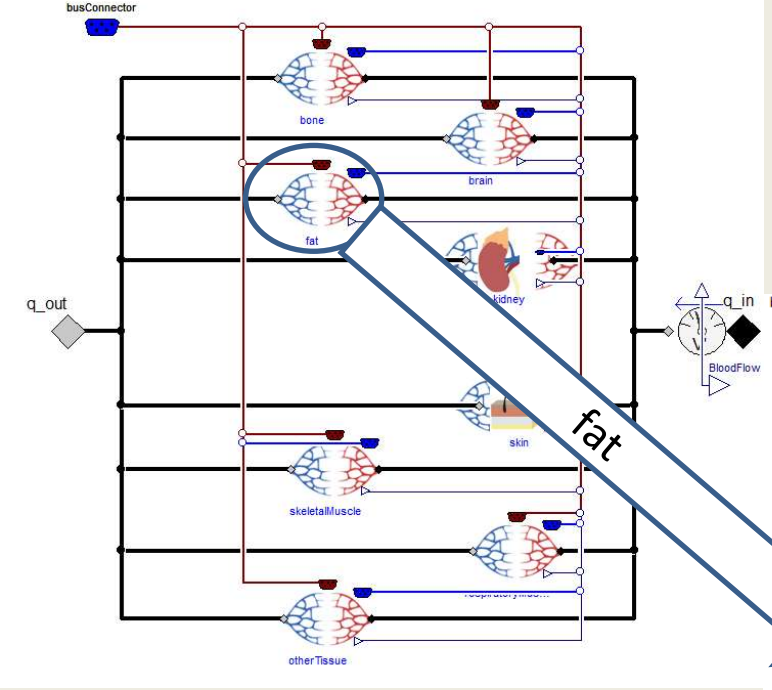
q_in

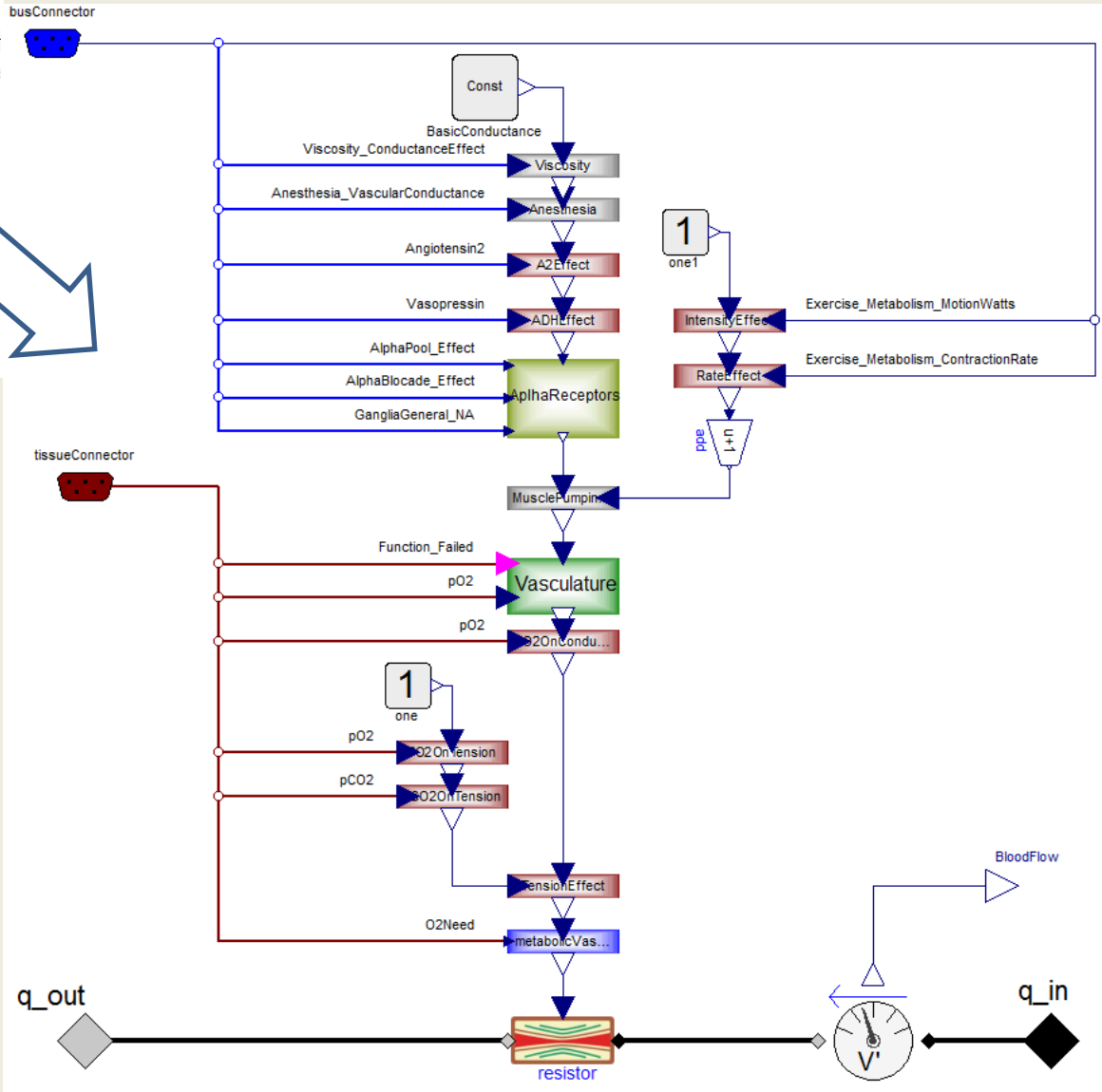

busConnector
bone
fat
kidney
skin
skeletalMuscle
otherTissue
q_out
q_in
BloodFlow
bone


busConnector
Const
BasicConductance
Viscosity_ConductanceEffect
Viscosity
Anesthesia_VascularConductance
Anesthesia
Angiotensin2
A2Effect
Vasopressin
ADHEffect
AlphaPool_Effect
AlphaBlocade_Effect
GangliaGeneral_NA
AlphaReceptors
1
one1
IntensityEffect
Exercise_Metabolism_MotionWatts
RateEffect
Exercise_Metabolism_ContractionRate
add
tissueConnector
MusclePumpin...
Function_Failed
pO2
Vasculature
pO2
1
one
pO2
pCO2
O2Tension
CO2Tension
ExtensionEffect
O2Need
metabolicVas...
BloodFlow
q_out
resistor
V'
q_in


busConnector
bone
brain
fat
kidney
skin
skeletalMuscle
otherTissue
q_out
q_in
brain


busConnector
Const
BasicConductance
Viscosity_ConductanceEffect
Viscosity
Anesthesia_VascularConductance
Anesthesia
Angiotensin2
A2Effect
Vasopressin
ADHEffect
AlphaPool_Effect
AlphaBlocade_Effect
GangliaGeneral_NA
AlphaReceptors
1
one1
IntensityEffect
Exercise_Metabolism_MotionWatts
RateEffect
Exercise_Metabolism_ContractionRate
gain
u+1
tissueConnector
MusclePumping
Function_Failed
pO2
Vasculature
pO2
pO2
one
pO2
pCO2
TensionEffect
O2Need
metabolicVas...
BloodFlow
q_out
resistor
V'
q_in


busConnector
bone
brain
fat
kidney
skin
skeletalMuscle
otherTissue
q_out
q_in
BloodFlow
fat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Const
BasicConductance
Viscosity_ConductanceEffect
Viscosity
Anesthesia_VascularConductance
Anesthesia
Angiotensin2
A2Effect
Vasopressin
ADHEffect
AlphaPool_Effect
AlphaBlocade_Effect
GangliaGeneral_NA
AplhaReceptors
1
one1
IntensityEffect
Exercise_Metabolism_MotionWatts
RateEffect
Exercise_Metabolism_ContractionRate
ppe
u+1
tissueConnector
MusclePumpin...
Function_Failed
pO2
Vasculature
pO2
pO2Oncondu...
1
one
pO2
pO2OnTension
pCO2
pCO2OnTension
TensionEffect
O2Need
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BloodFlow
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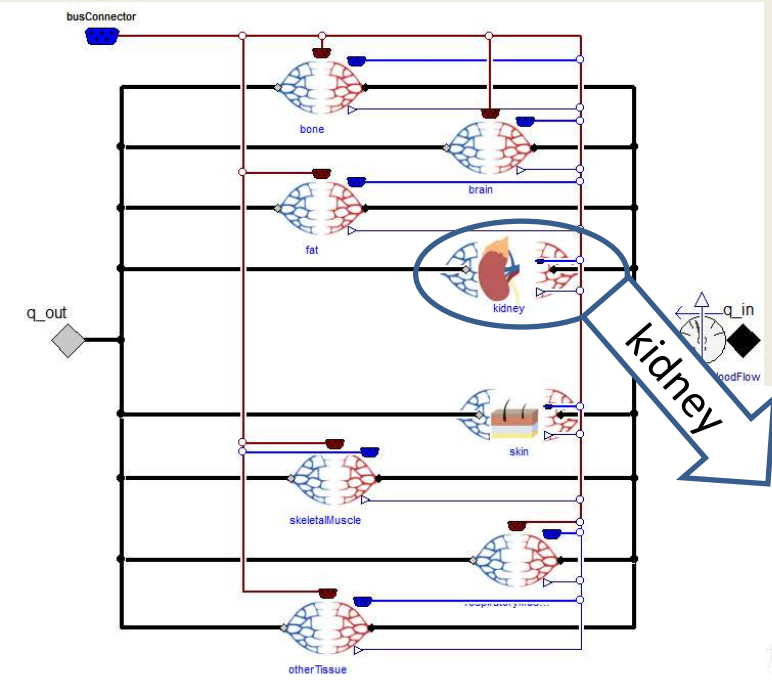
q_in
V'
resistor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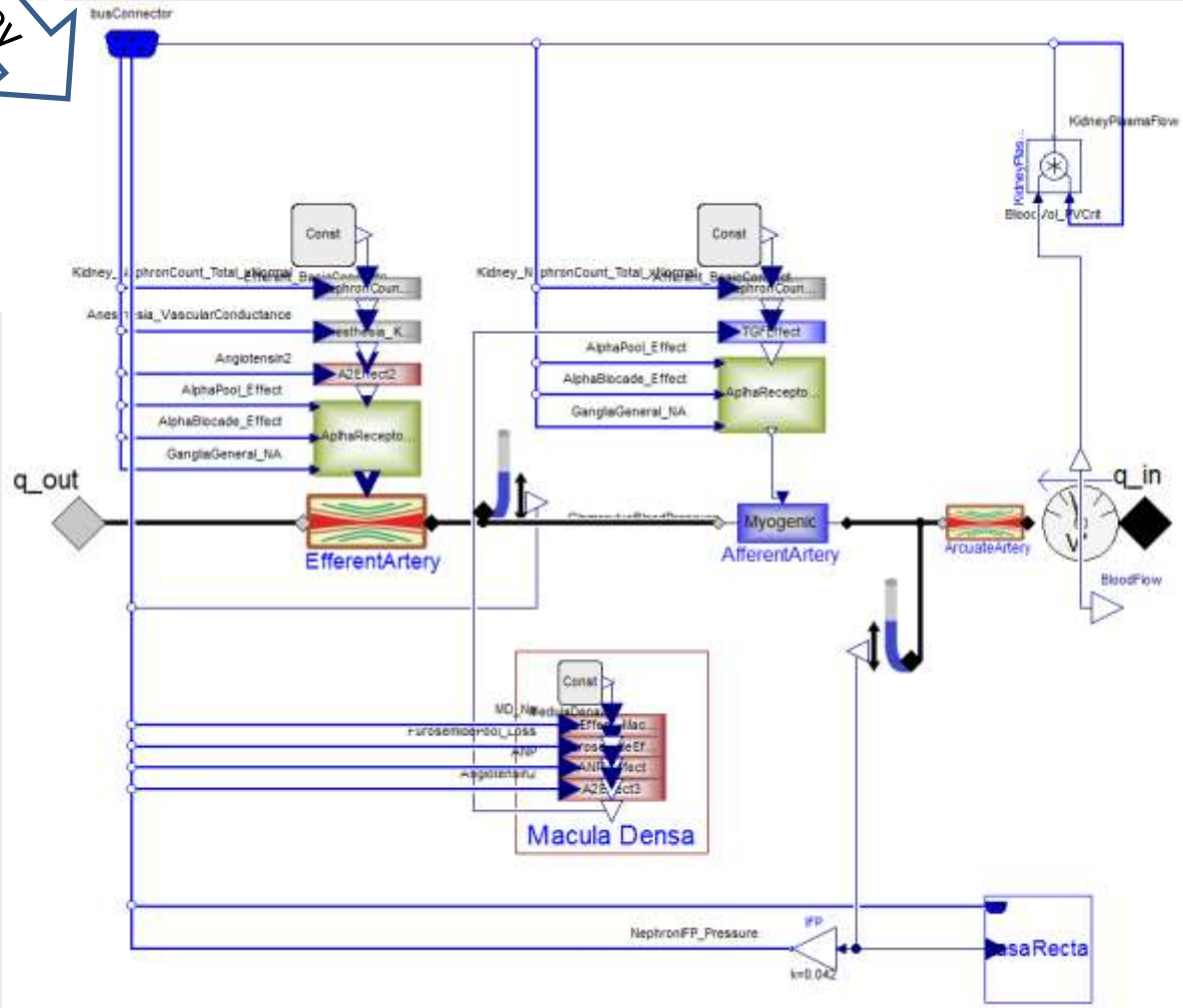
bone
brain
fat
kidney
skin
skeletalMuscle
otherTissue
q_out
q_in
BloodFlow

kidney


busConnector
KidneyPlasmaFlow
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AlphaBlocade_Effect
GangliaGeneral_NA
Angiotensin2
q_out
q_in
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Myogenic
AfferentArtery
ArcuateArtery
BloodFlow
Macula Densa
NephronIFP_Pressure
IFP
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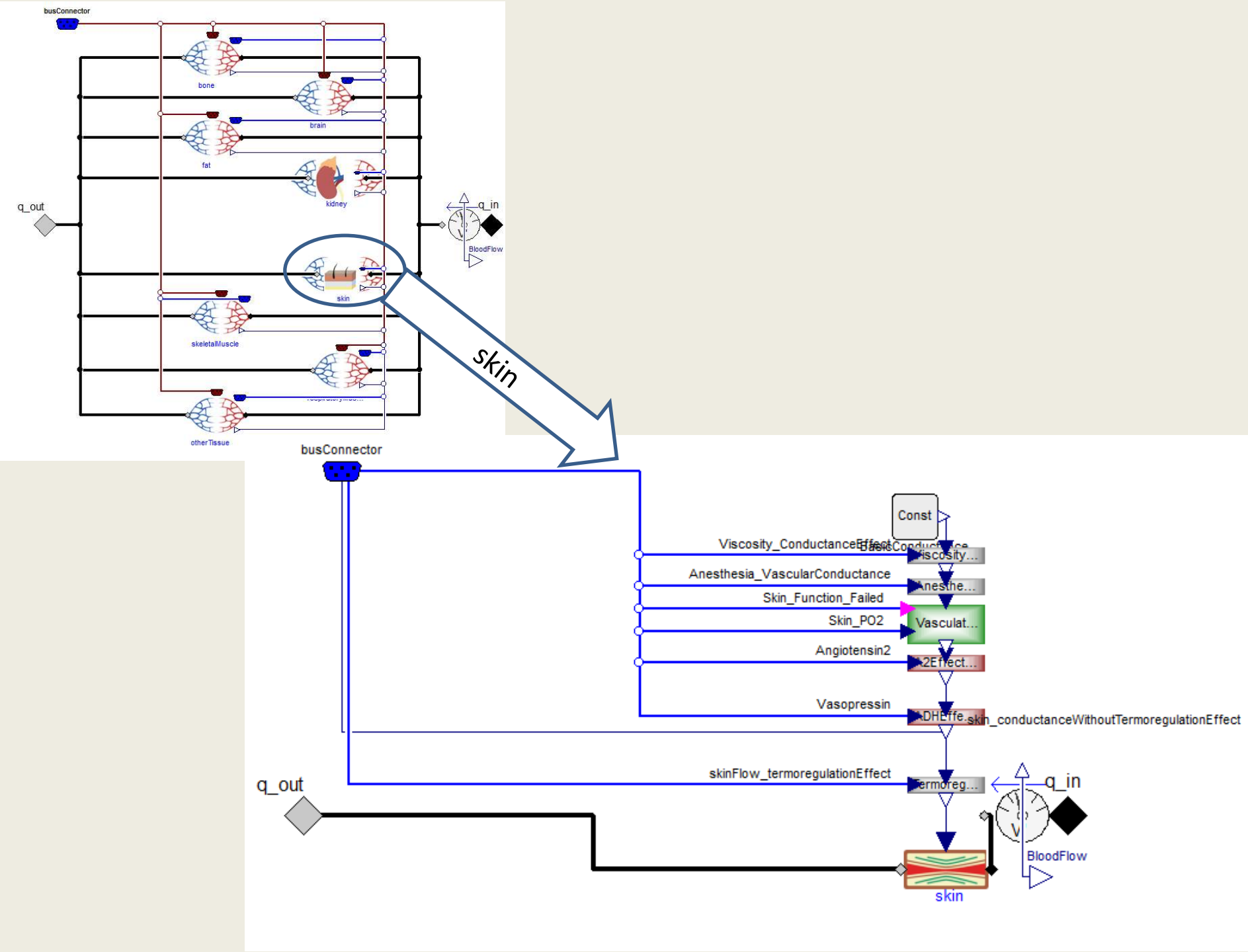
busConnector
bone
brain
fat
kidney
q_out
q_in
BloodFlow
skin
skeletalMuscle
otherTissue
skin
busConnector
Const
Viscosity_ConductanceEffect
Anesthesia_VascularConductance
Skin_Function_Failed
Skin_PO2
Angiotensin2
Vasopressin
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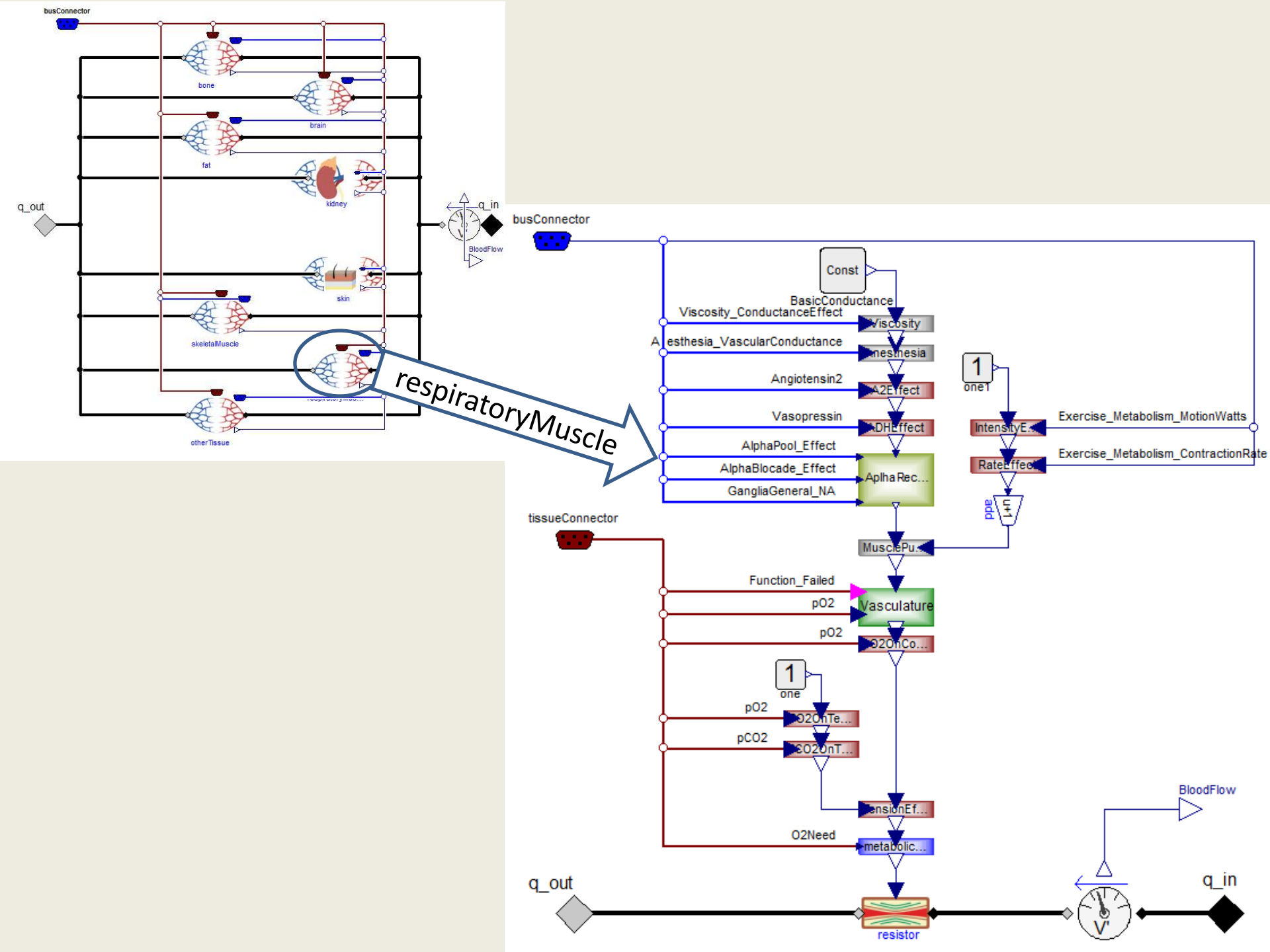
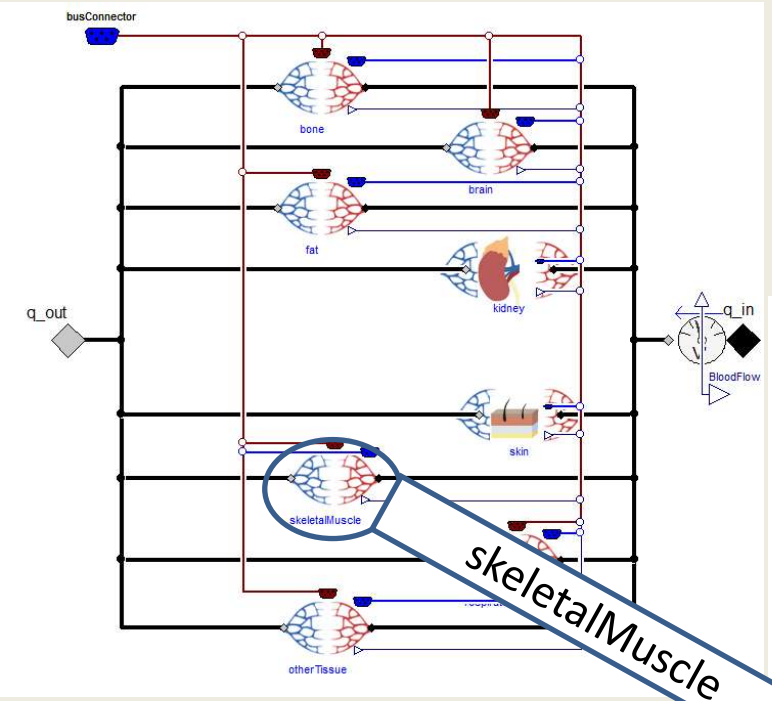
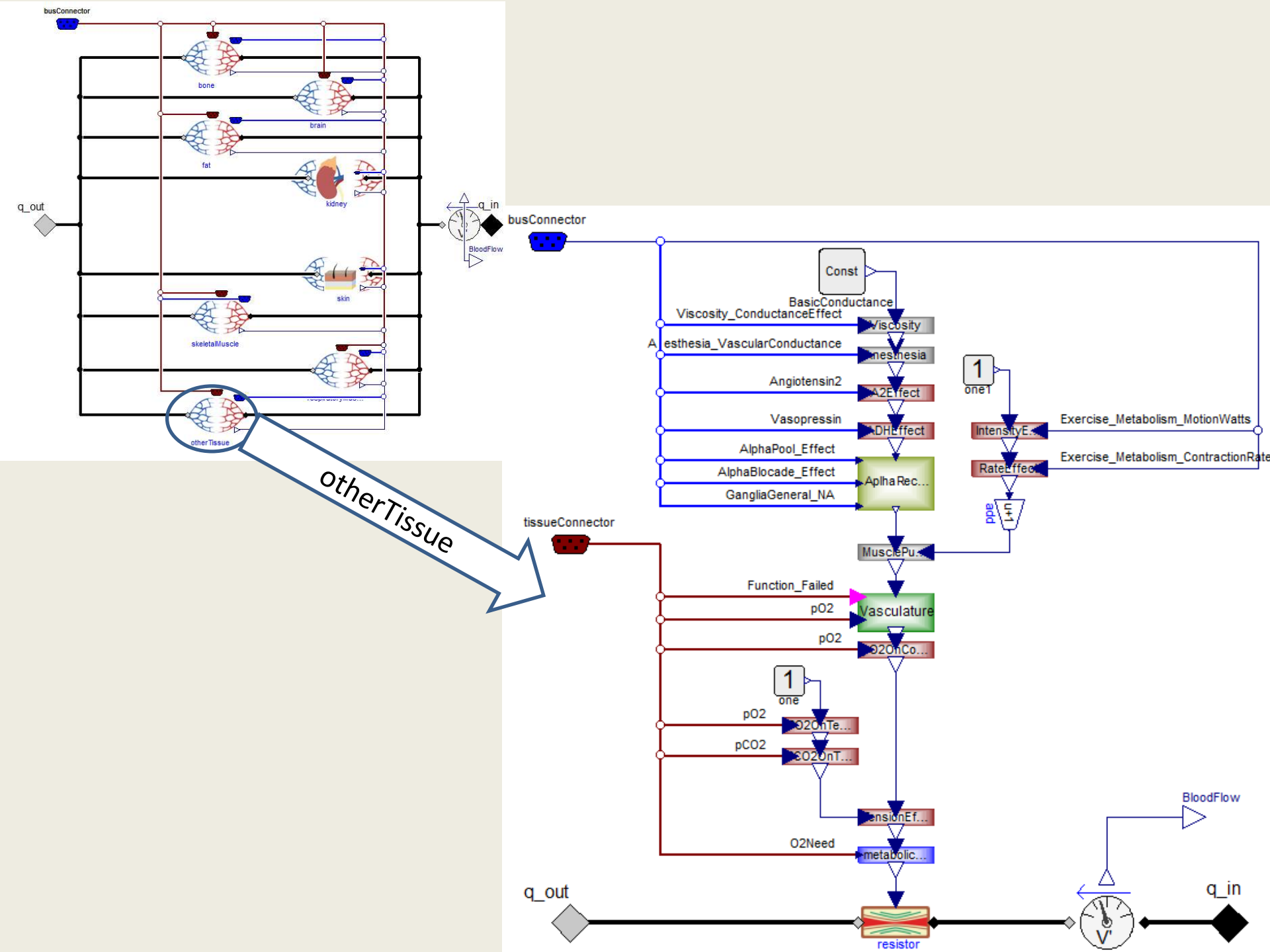
q_out
q_in
BloodFlow
skin


busConnector
bone
brain
fat
kidney
skin
skeletalMuscle
otherTissue
q_out
q_in
BloodFlow
respiratoryMuscle
busConnector
Const
BasicConductance
Viscosity_ConductanceEffect
Viscosity
A_esthesia_VascularConductance
nesthesia
Angiotensin2
A2Effect
Vasopressin
ADHEffect
AlphaPool_Effect
AlphaBlocade_Effect
GangliaGeneral_NA
AplhaRec...
1
one1
IntensityE...
RateEffect
Exercise_Metabolism_MotionWatts
Exercise_Metabolism_ContractionRate
add
tissueConnector
MusclePu...
Function_Failed
pO2
Vasculature
pO2
O2OnCo...
1
one
pO2
O2OnTe...
pCO2
CO2OnT...
ensionEf...
O2Need
metabolic...
BloodFlow
q_out
q_in
resistor
V



skeletalMuscle

busConnector
Const
BasicConductance
Viscosity_ConductanceEffect
Viscosity
A_esthesia_VascularConductance
Angiotensin2
A2Effect
Vasopressin
ADHEffect
AlphaPool_Effect
AlphaBlocade_Effect
GangliaGeneral_NA
AplhaRec...
1
one1
Exercise_Metabolism_MotionWatts
Exercise_Metabolism_ContractionRate
ppa
u+1
tissueConnector
Function_Failed
pO2
Vasculature
pO2
1
one
pO2
pCO2
O2Need
metabolic...
BloodFlow
q_out
q_in
resistor
V


busConnector
bone
brain
fat
kidney
skin
skeletalMuscle
otherTissue
q_out
q_in
BloodFlow
otherTissue
busConnector
Const
BasicConductance
Viscosity_ConductanceEffect
Viscosity
A_esthesia_VascularConductance
nesthesia
Angiotensin2
A2Effect
Vasopressin
ADHEffect
AlphaPool_Effect
AlphaBlocade_Effect
GangliaGeneral_NA
AplhaRec...
1
one1
Exercise_Metabolism_MotionWatts
IntensityE...
RateEffect
Exercise_Metabolism_ContractionRate
add
MusclePu...
tissueConnector
Function_Failed
pO2
Vasculature
pO2
O2OnCo...
1
one
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O2OnTe...
pCO2
CO2OnT...
ensionEf...
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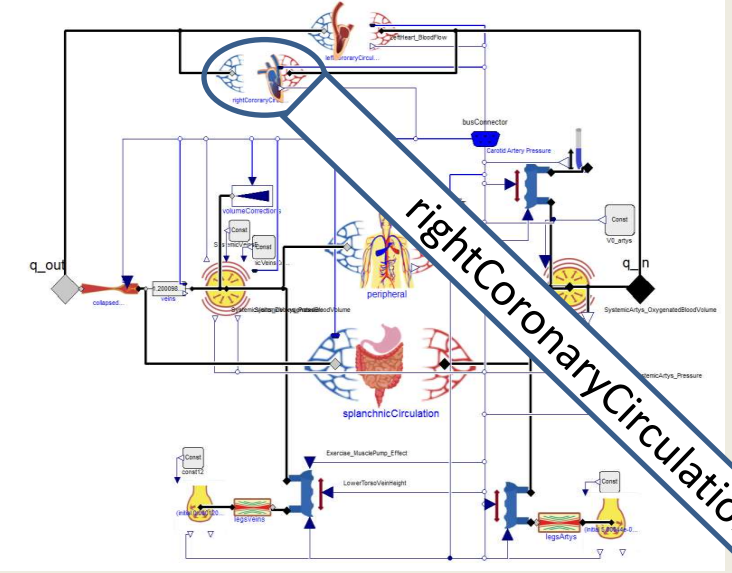
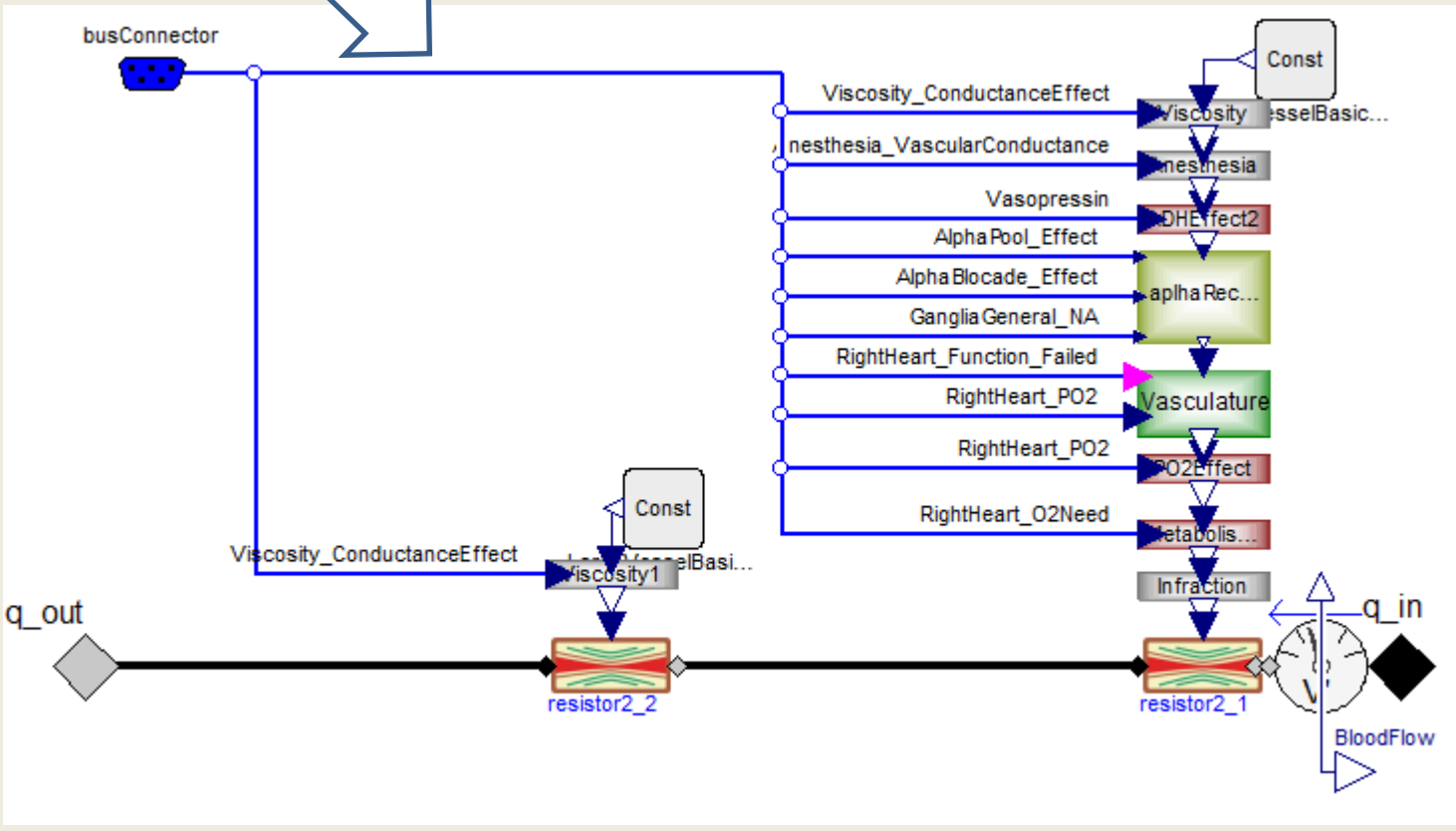
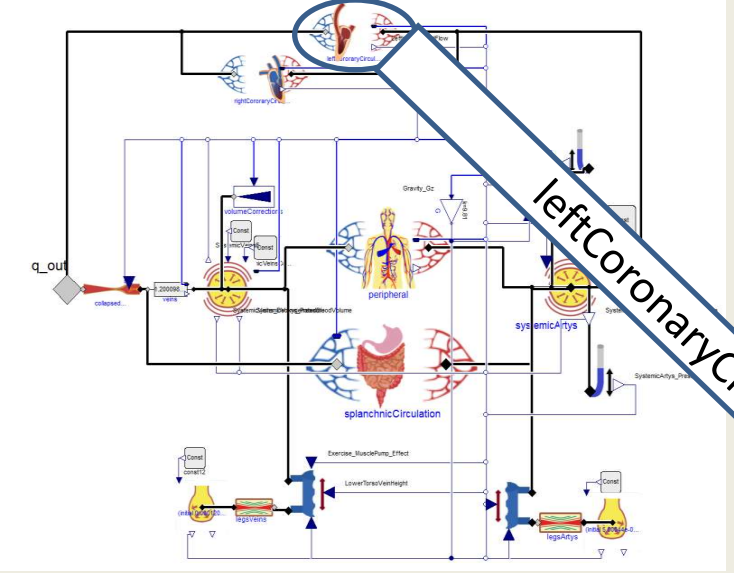
metabolic...
BloodFlow
q_out
q_in
resistor
V

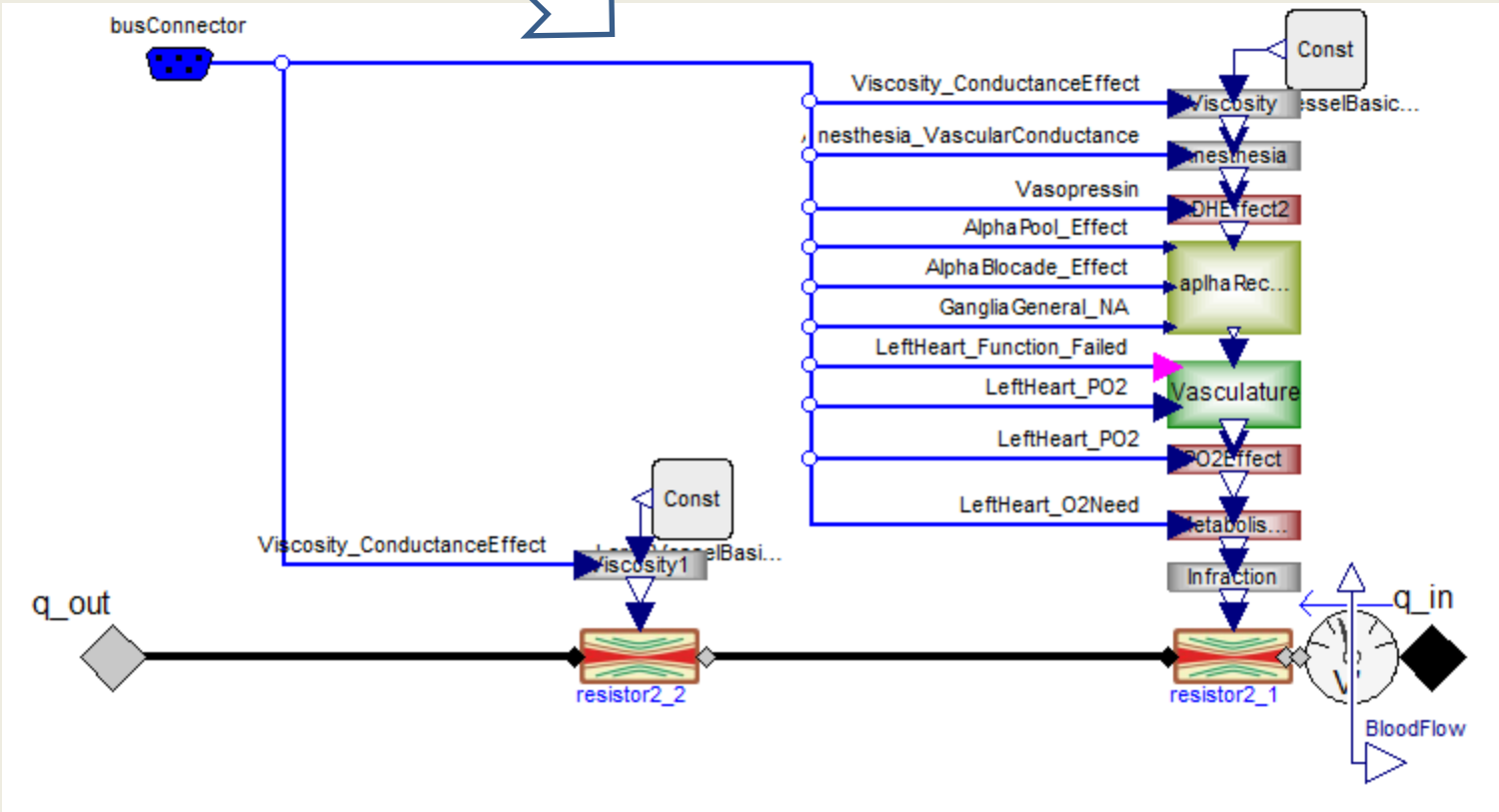


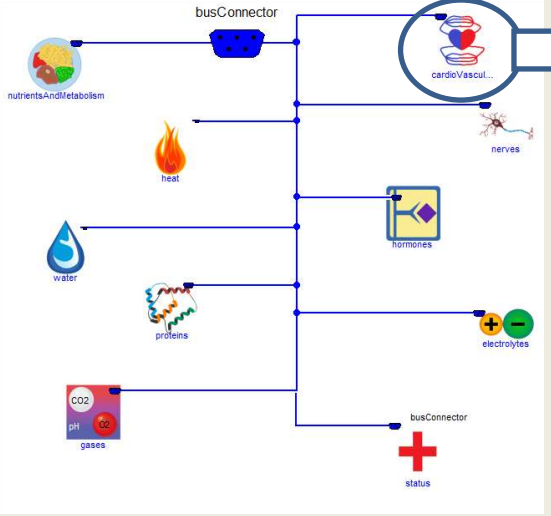
rightCoronaryCirculation



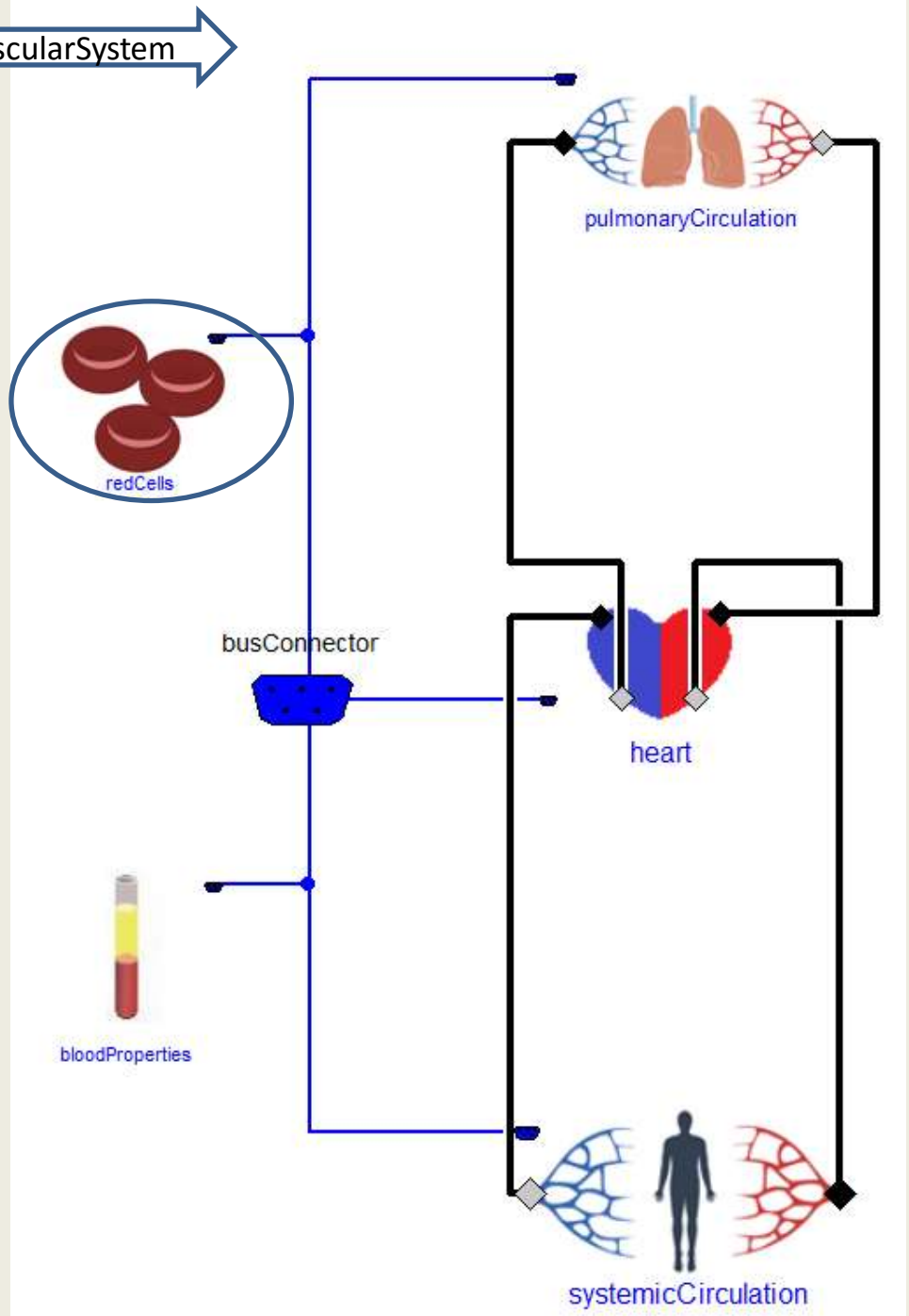


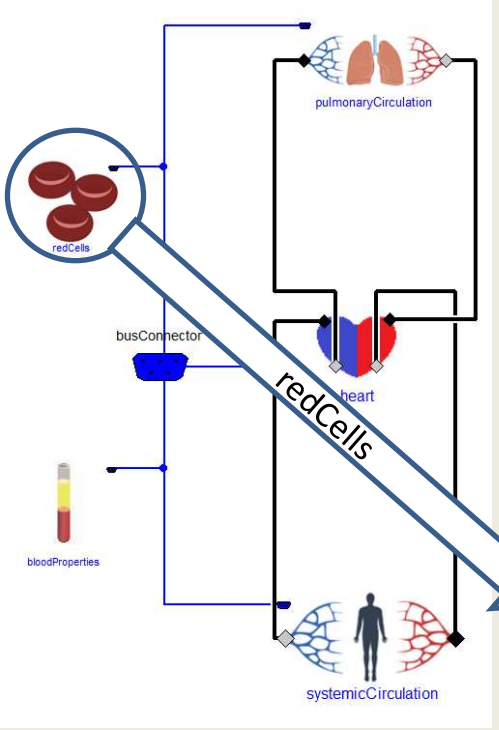
leftCoronaryCirculation

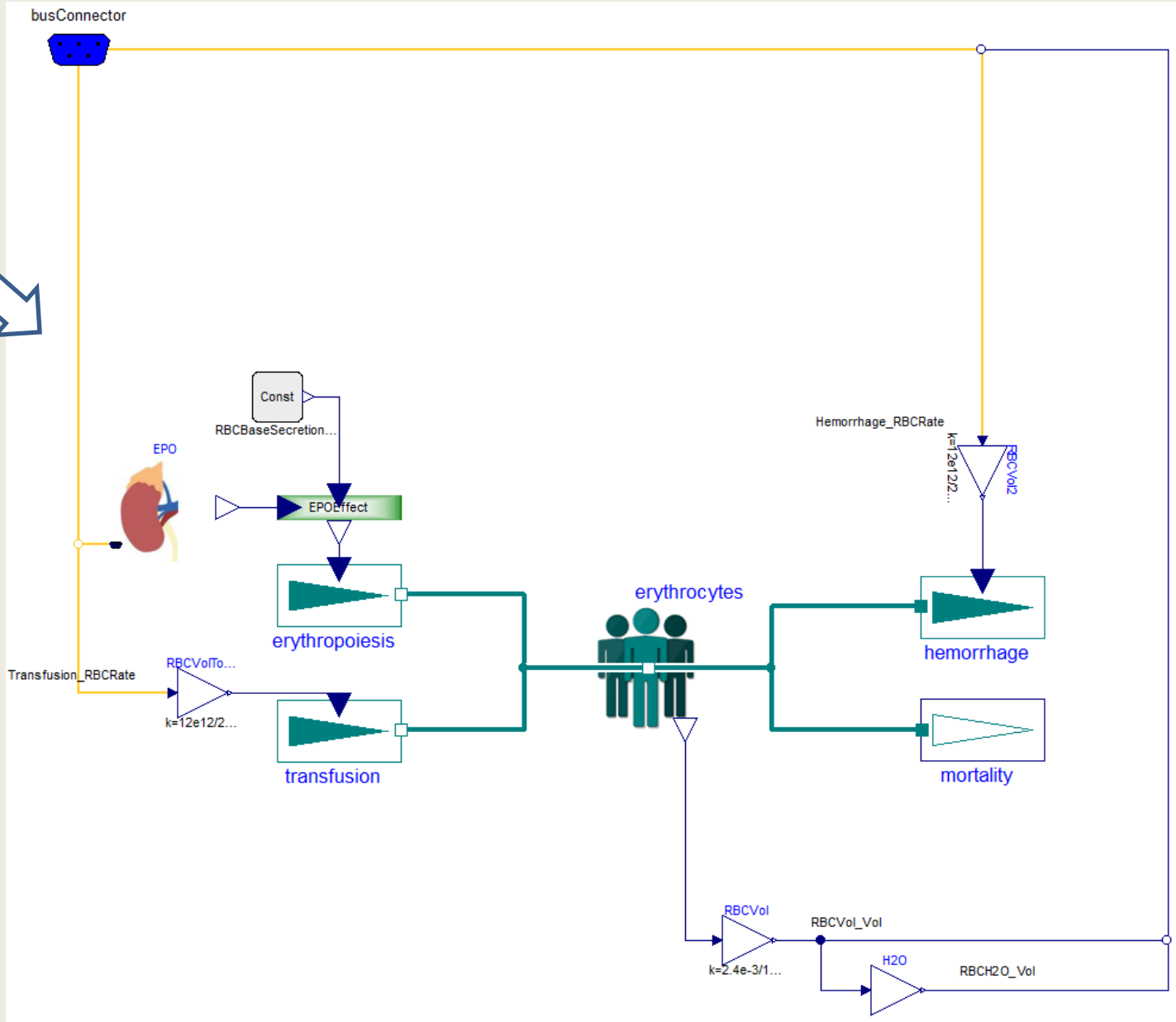


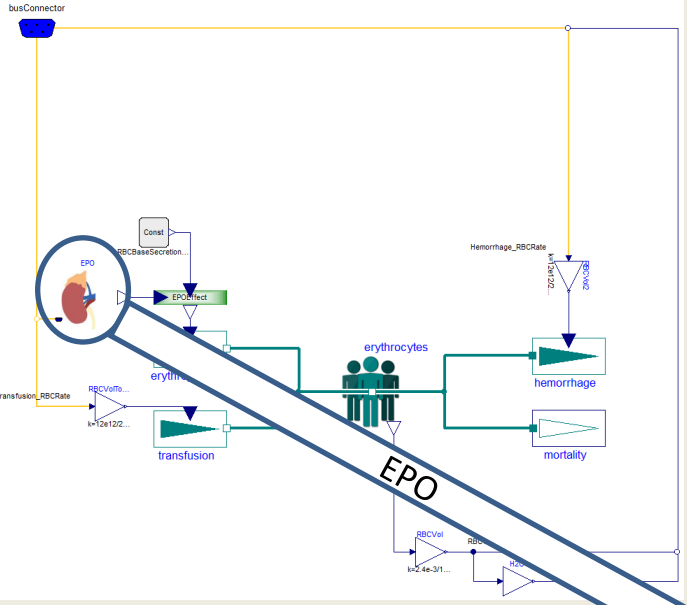


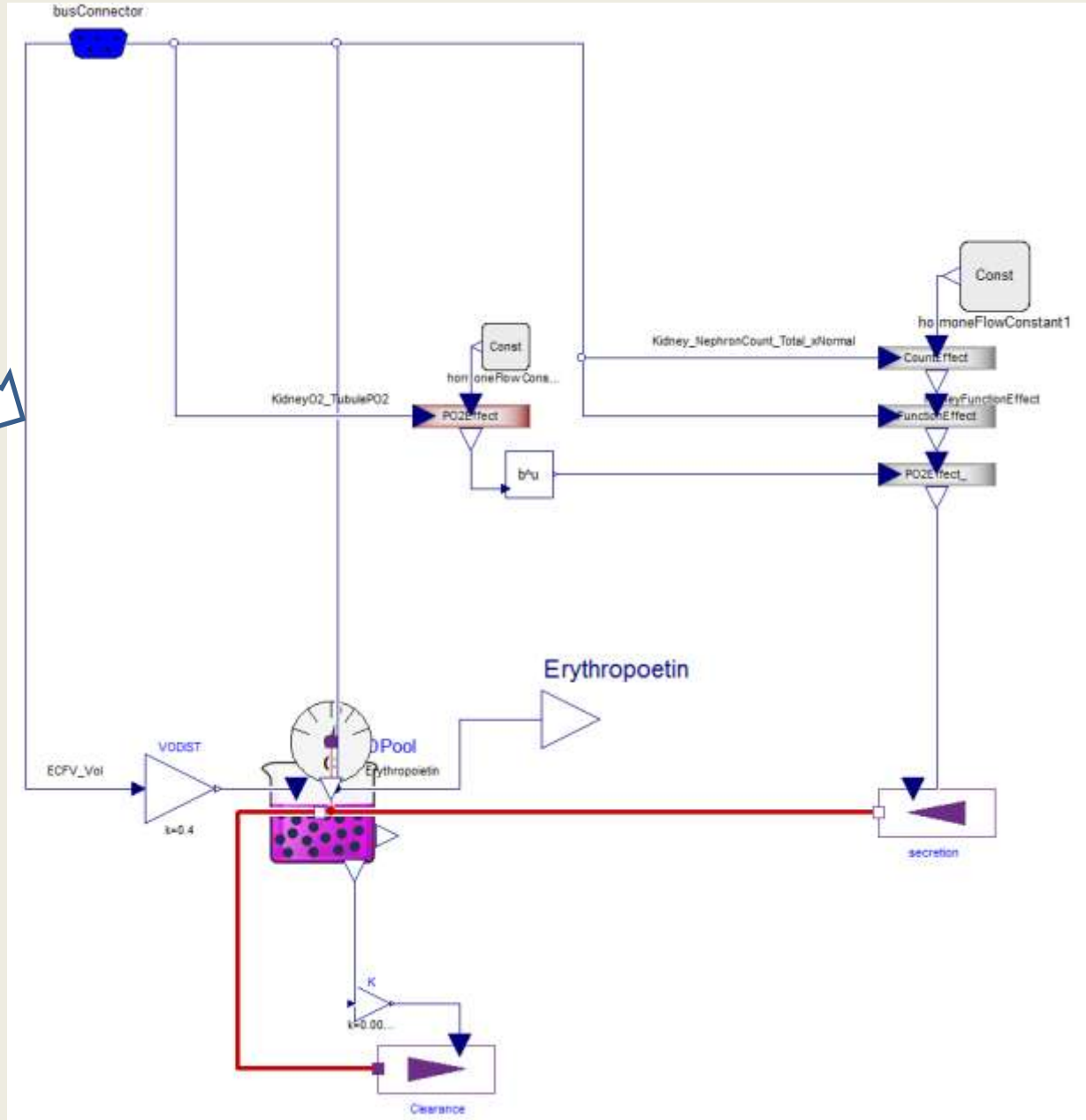
cardioVascularSystem




pulmonaryCirculation
redCells
busConnector
heart
redCells
bloodProperties
systemicCirculation


busConnector
Const
RBCBaseSecretion...
EPO
EPOEffect
erythropoiesis
Transfusion_RBCRate
RBCVolTo...
k=12e12/2...
transfusion
erythrocytes
Hemorrhage_RBCRate
k=12e12/2...
RBCVol2
hemorrhage
mortality
RBCVol
k=2.4e-3/1...
RBCVol_Vol
H2O
RBCH2O_Vol


busConnector
Const
RBCBaseSecretion...
EPO
EPOEffect
Hemorrhage_RBCRate
erythrocytes
hemorrhage
transfusion_RBCRate
RBCVolTo...
k=12e12/2...
transfusion
mortality
EPO
RBCVol
k=2.4e-3/1...


busConnector
Const
hormoneFlowConstant1
Kidney_NephronCount_Total_xNormal
KidneyO2_TubulePO2
PO2Effect
b*u
PO2Effect_
Erythropoetin
VDIST
ECFV_Vol
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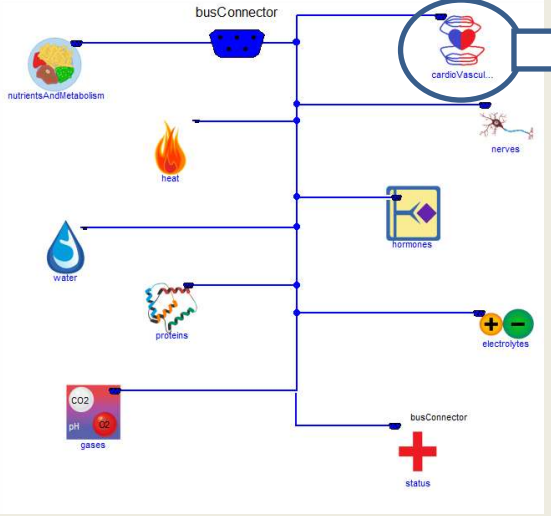
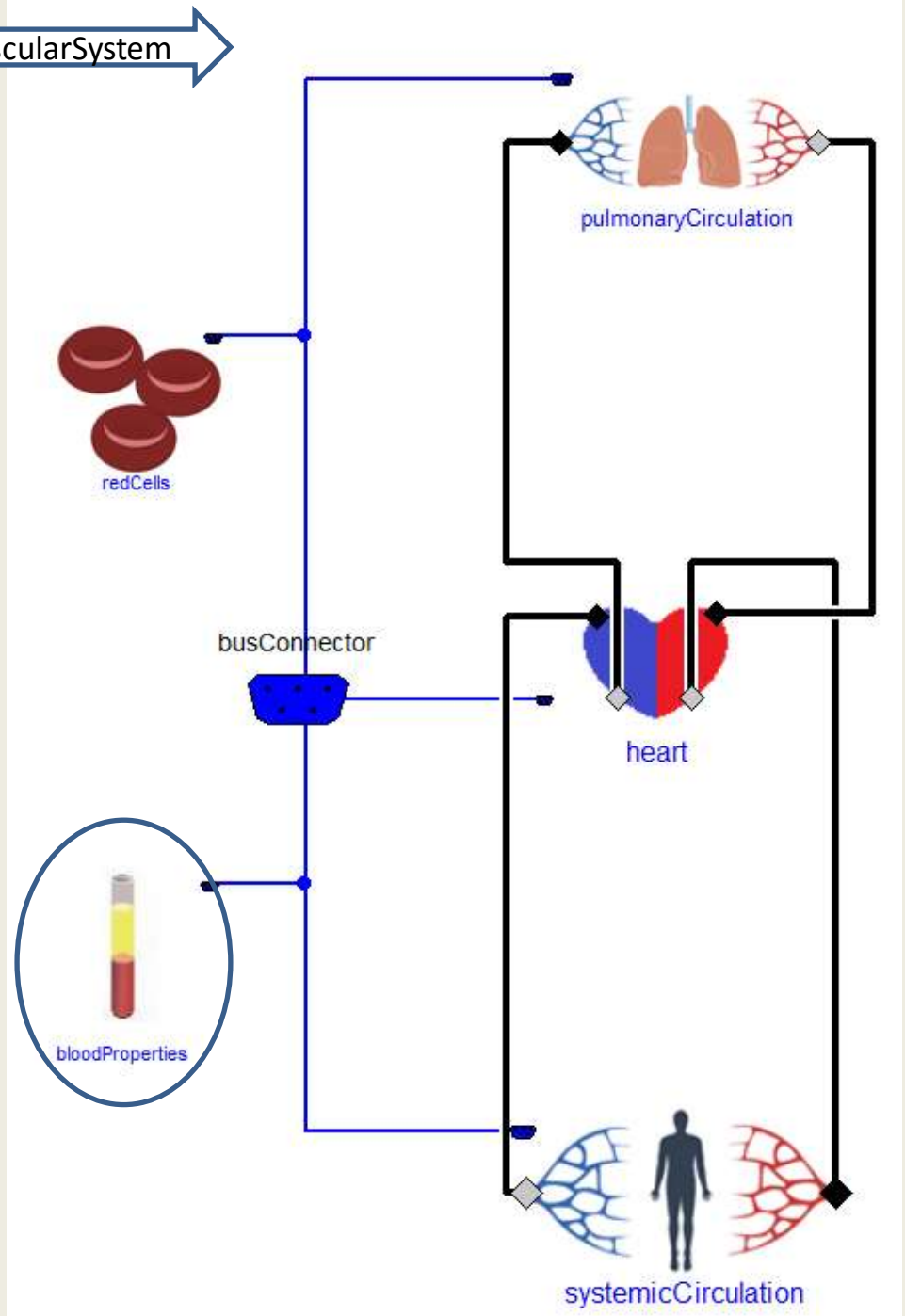
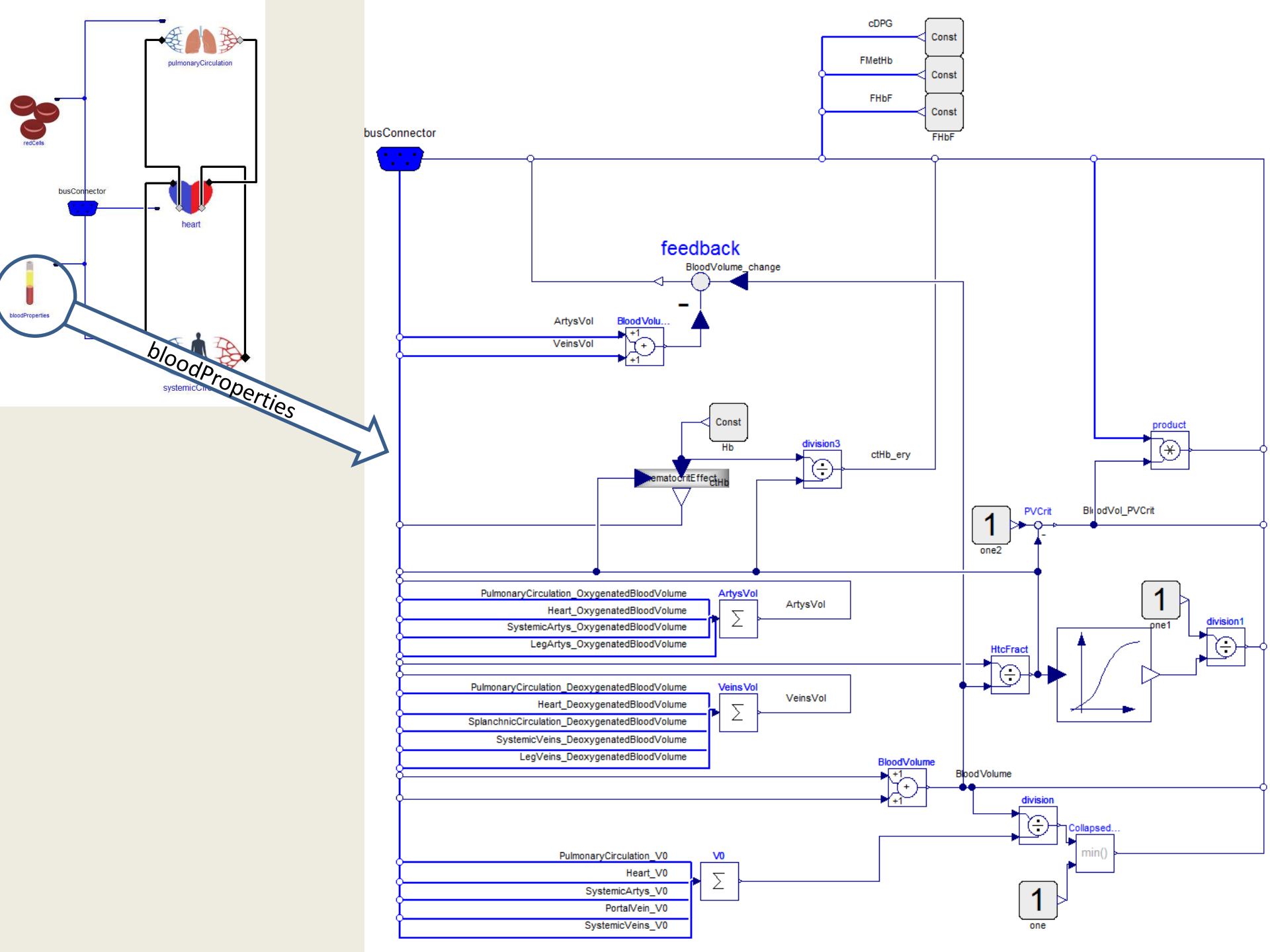
Erythropoetin
secretion
K
k=0.00...
Clearance



cardioVascularSystem




pulmonaryCirculation
redCells
busConnector
heart
bloodProperties
systemicCirc
bloodProperties
busConnector
cDPG
Const
FMetHb
Const
FHbF
Const
FHbF
feedback
BloodVolume_change
ArtysVol
VeinsVol
BloodVolu...
Const
Hb
division3
ctHb_ery
ctHb
product
1
one2
PVCrit
BloodVol_PVCrit
PulmonaryCirculation_OxygenatedBloodVolume
Heart_OxygenatedBloodVolume
SystemicArtys_OxygenatedBloodVolume
LegArtys_OxygenatedBloodVolume
ArtysVol
ArtysVol
1
one1
division1
HtcFract
PulmonaryCirculation_DeoxygenatedBloodVolume
Heart_DeoxygenatedBloodVolume
SplanchnicCirculation_DeoxygenatedBloodVolume
SystemicVeins_DeoxygenatedBloodVolume
LegVeins_DeoxygenatedBloodVolume
VeinsVol
VeinsVol
BloodVolume
BloodVolume
division
Collapsed...
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Heart_V0
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SystemicVeins_V0
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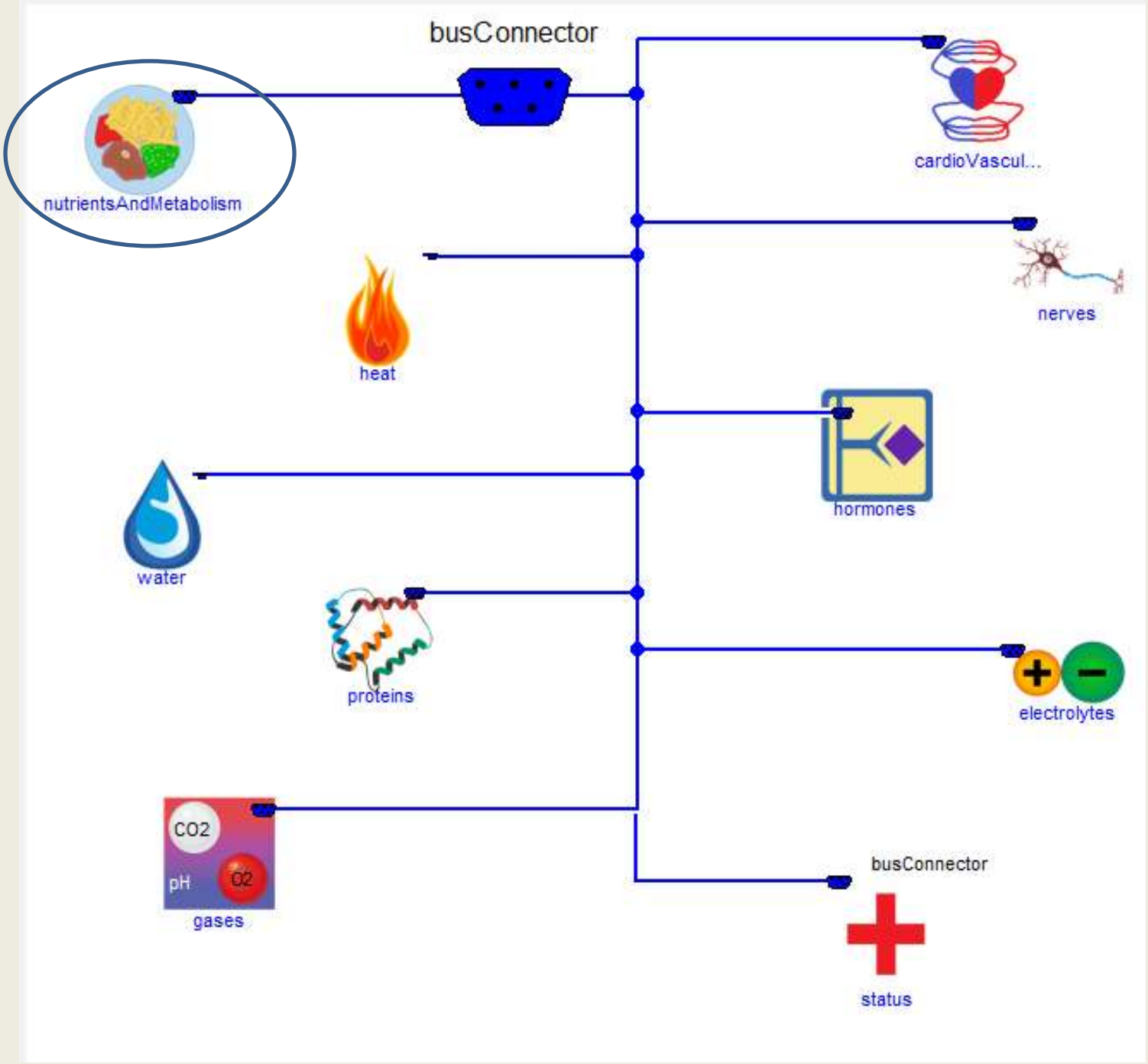
1
one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CO2
pH
O2
gases
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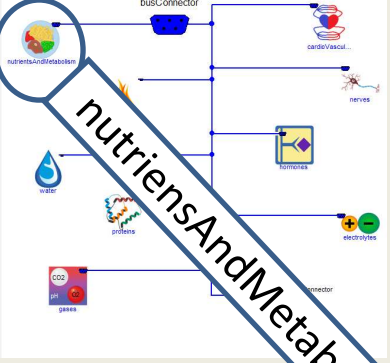
status



nutriensAndMetabolism

insulin

glucagon

busConnector

thyrotropin

thyroxine

leptin

Lipids

KetoAcids

liverMetabolism

tissuesMetabolism

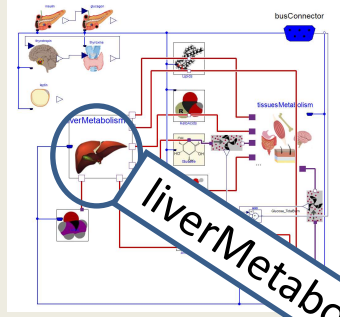
Glucose

lactate

aminoAcids

Glucose_TotalBurn

GILumen



busConnector

Glucose

Glycogen

triglicerides

Urea

AminoAcids

fattyAcids

Ketoacids

LM_Glycogenesis

LM_Glycogenolysis

LM_FA_Glucose

LM_Gluconeogenesis

LM_FA_AminoAcids

LM_Ketoacids

GLU_TO_FA

AA_TO_GLU

AA_TO_FA

FA_TO_KA

Const

PortalVein_Insulin

PortalVein_Glucose

Epinephrine

PortalVein_Glucagon

BaseGlycogenesis

BaseGlycogenolysis

BaseGlucose2FA

BaseAminoAcids2Glucose

BaseAminoAcids2FA

BaseKetogenesis

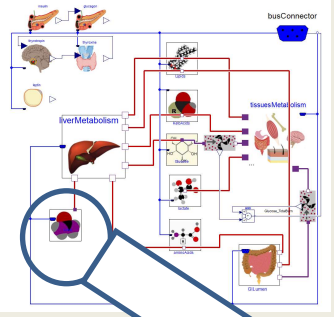
Constant1

Constant3

Constant5

Constant7

Constant8



urea

busConnector

ureaFromM...

Urea

ECFV_Vol

UreaECF_Osmoles

UreaCell

ICFV_Vol

UrealCF_Osmoles

Glomerulus

GlomerulusFiltrate_GFR

fractConstant

Const

CD_H2O_Outflow

CD_Urea_Outflow

CD_Outflow

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Medulla

Medulla_Volume

VasaRecta_Outflo

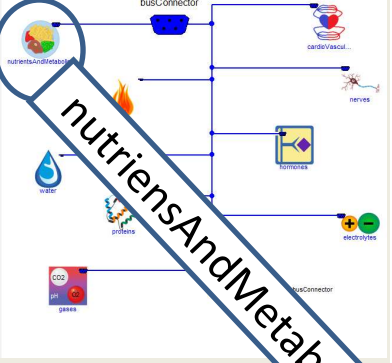
MedullaUrea_Osmolarity

VasaRecta_Outflow

product

Const

CCK



nutriensAndMetabolism

insulin

glucagon

busConnector

thyrotropin

thyroxine

leptin

Lipids

KetoAcids

liverMetabolism

tissuesMetabolism

Glucose

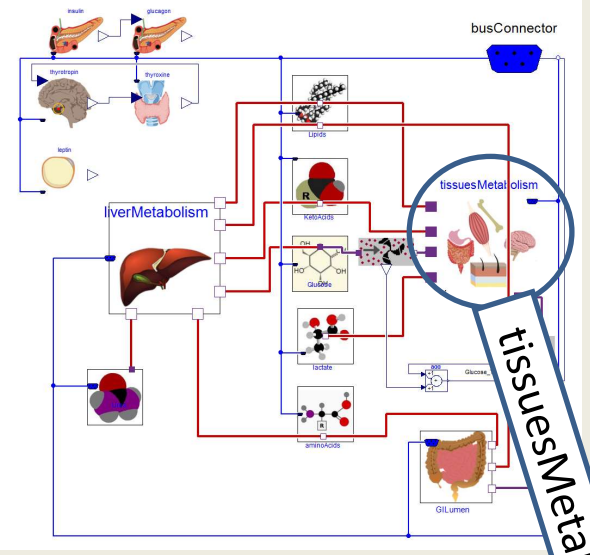
lactate

add

Glucose_TotalBurn

aminoAcids

GILumen



tissuesMetabolism

ketoAcids

lactate

glucose

fattyAcids

Heat

MotionCals

gain

Bone_BloodFlow
bone.pO2
Bone_LiquidVol
Bone_StructureEffect
bone_T

Liver_PO2
Liver_LiquidVol
Liver_StructureEffect
liver_T

kidney_T

GITract_BloodFlow
GITract.pO2
GITract_LiquidVol
GITract_StructureEffect
GITract_T

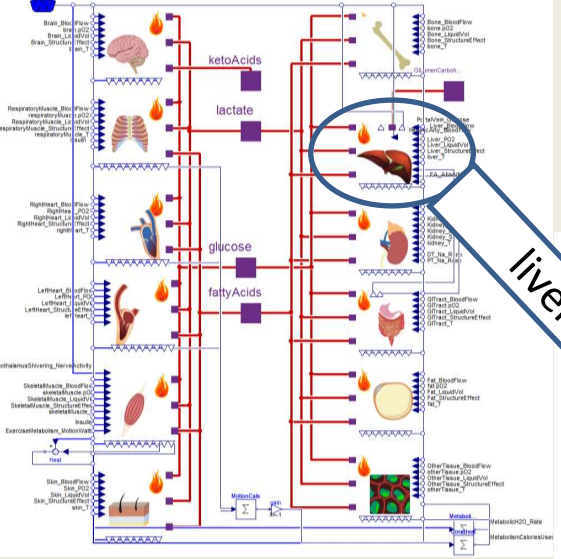
Fat_BloodFlow
fat.pO2
Fat_LiquidVol
Fat_StructureEffect
fat_T

OtherTissue_BloodFlow
otherTissue.pO2
OtherTissue_LiquidVol
OtherTissue_StructureEffect
otherTissue_T

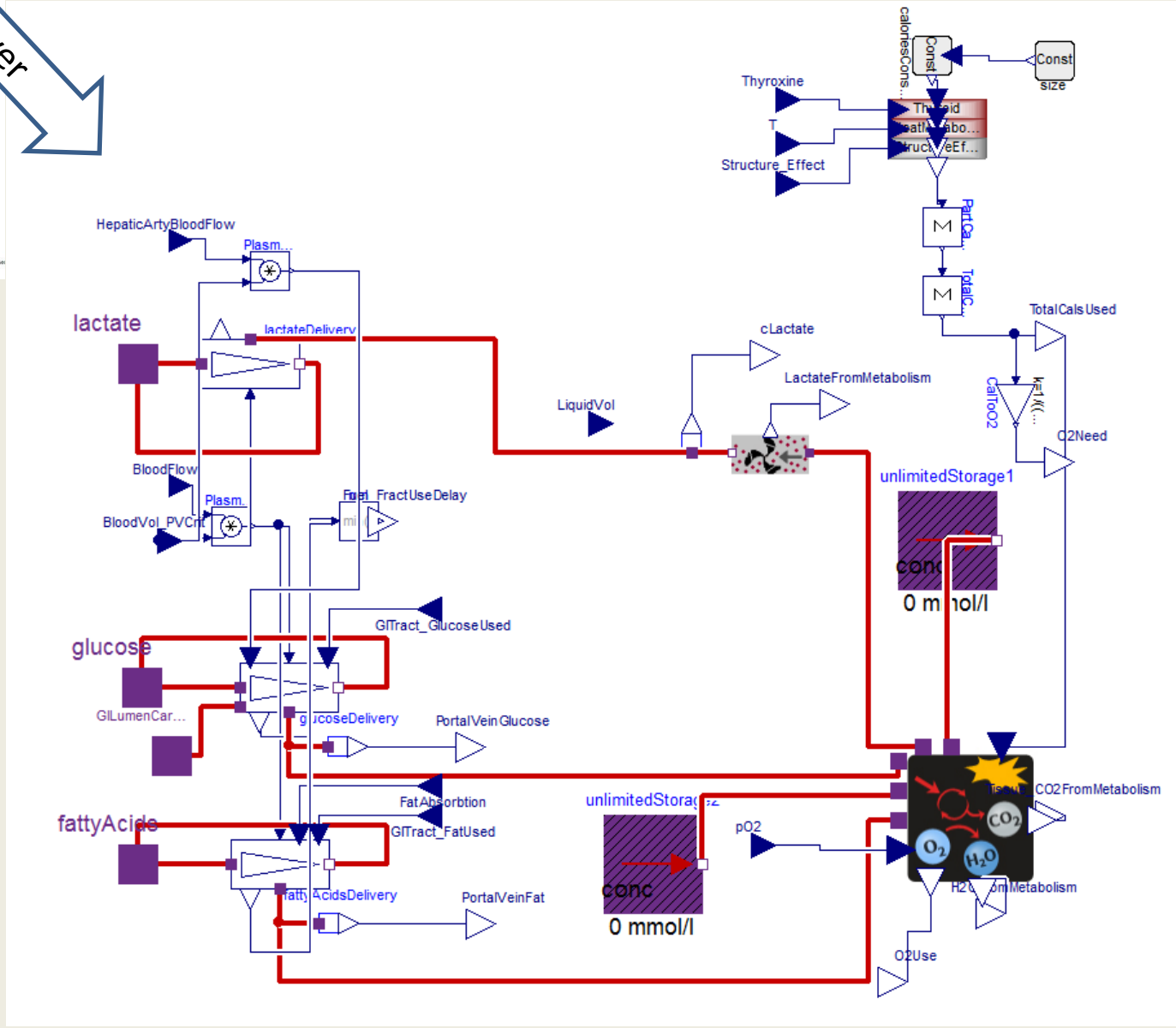
Skin_BloodFlow
Skin_PO2
Skin_LiquidVol
Skin_StructureEffect
skin_T

Insulin

MetabolicH2O_Rate


ketoAcids
lactate
glucose
fattyAcids

liver


caloriesCons...
Const
Const
size
Thyroxine
T
Structure_Effect
HepaticArtyBloodFlow
Plasm...
lactate
lactateDelivery
cLactate
LactateFromMetabolism
LiquidVol
TotalCals Used
CalToO2
O2Need
BloodFlow
Plasm...
BloodVol_PVCnt
unlimitedStorage1
conc
0 mmol/l
GITract_GlucoseUsed
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GILumenCar...
glucoseDelivery
PortalVeinGlucose
FatAbsorbtion
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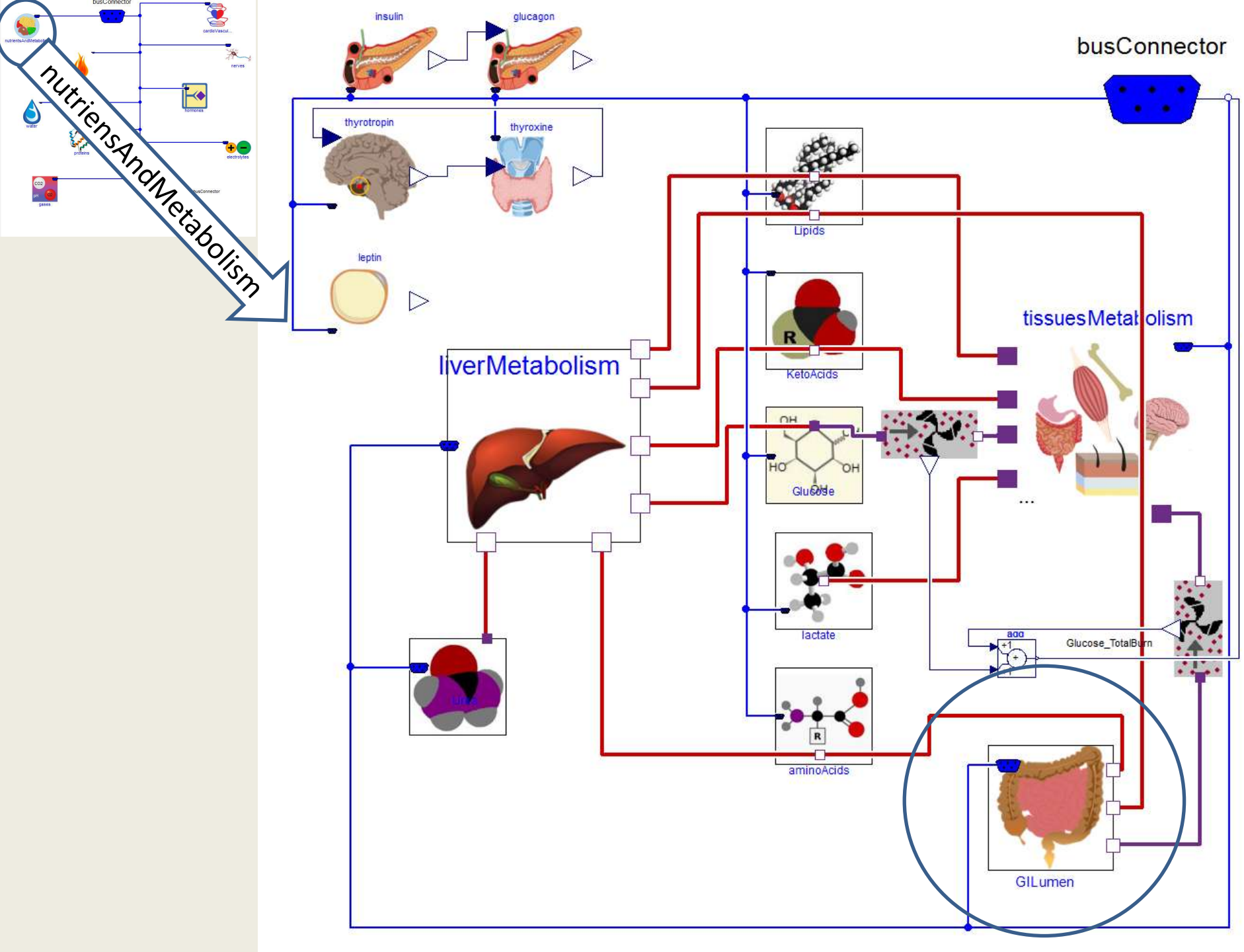
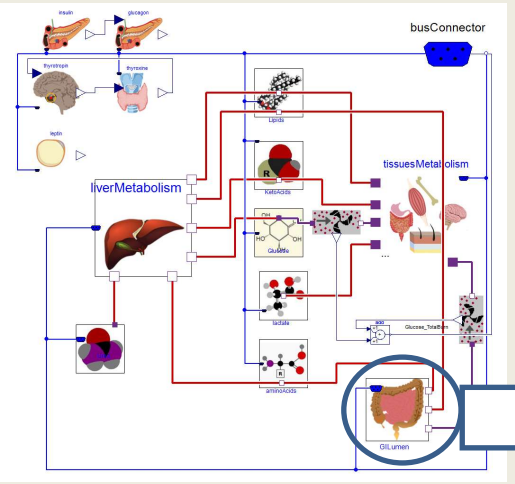
O2Use


nutriensAndMetabolism
insulin
glucagon
busConnector
thyrotropin
thyroxine
leptin
Lipids
KetoAcids
liverMetabolism
tissuesMetabolism
Glucose
lactate
aminoAcids
add
Glucose_TotalBurn
GILumen



GILumen

busConnector
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Leptin
LeptinEffect2
Carbohydrate...
Glucose_GILumenAbsorpt
Cons...
GILumenVolume_Mass
Const
DietGoalNutriti...
Leptin
LeptinEffect1
Protein_Absor...
Protein_GILumenAbsorptio
Const
Constant2
GILumenVolume_DietMass
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LeptinEffect
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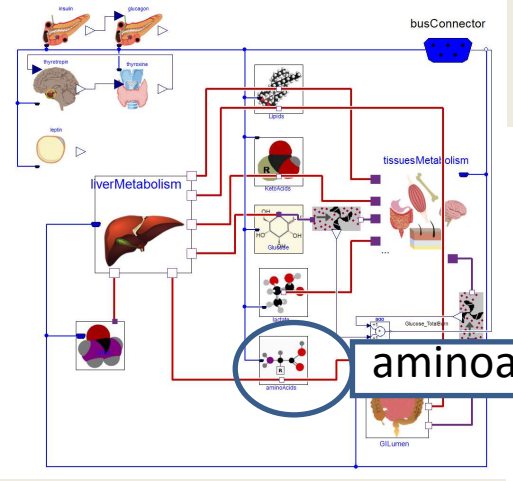
FA_Absorption
Const
Constant1
Fat
GILumenVolume_DietMass



busConnector

AminoAcidsPool

AminoAcids

ECFV_Vol

Const

Constant

Outflow

CellProteir

ICFV_Vol

CellProteinAA

Const

Constant1

Inflow

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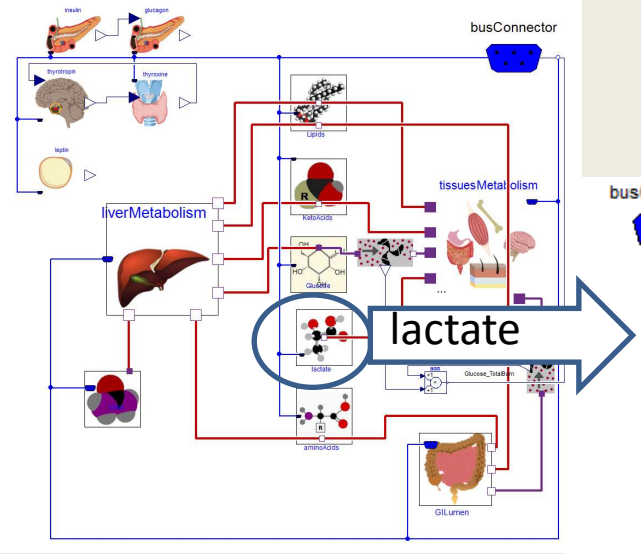
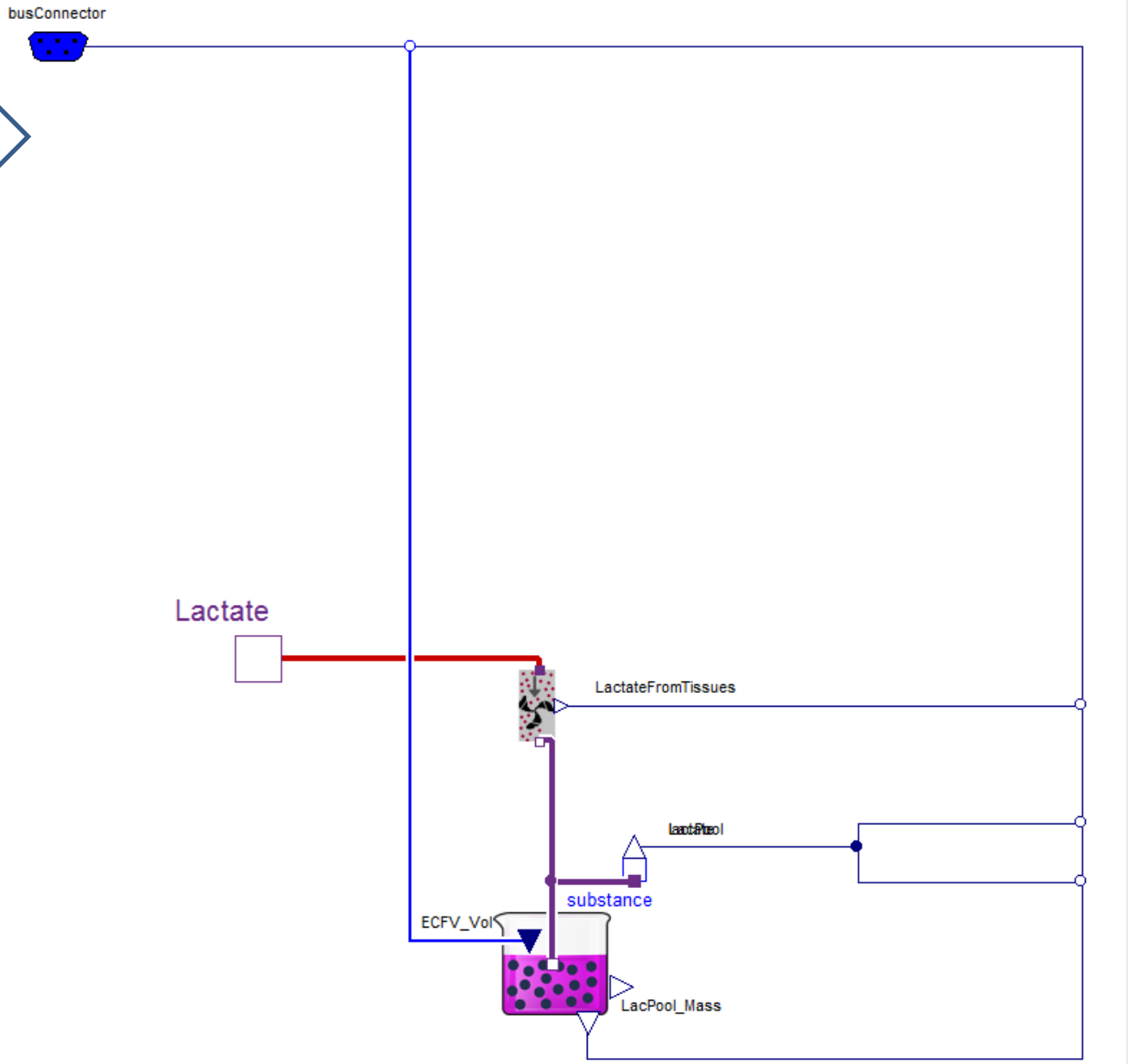
K

Degradation


busConnector
liverMetabolism
tissuesMetabolism
lactate
GILumen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Lactate
LactateFromTissues
substance
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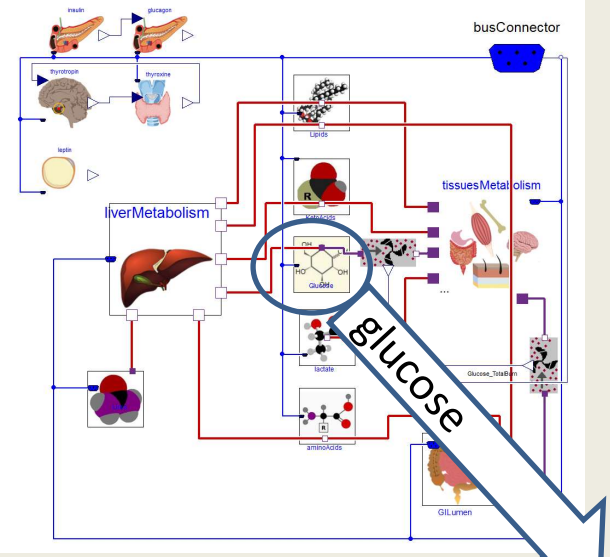
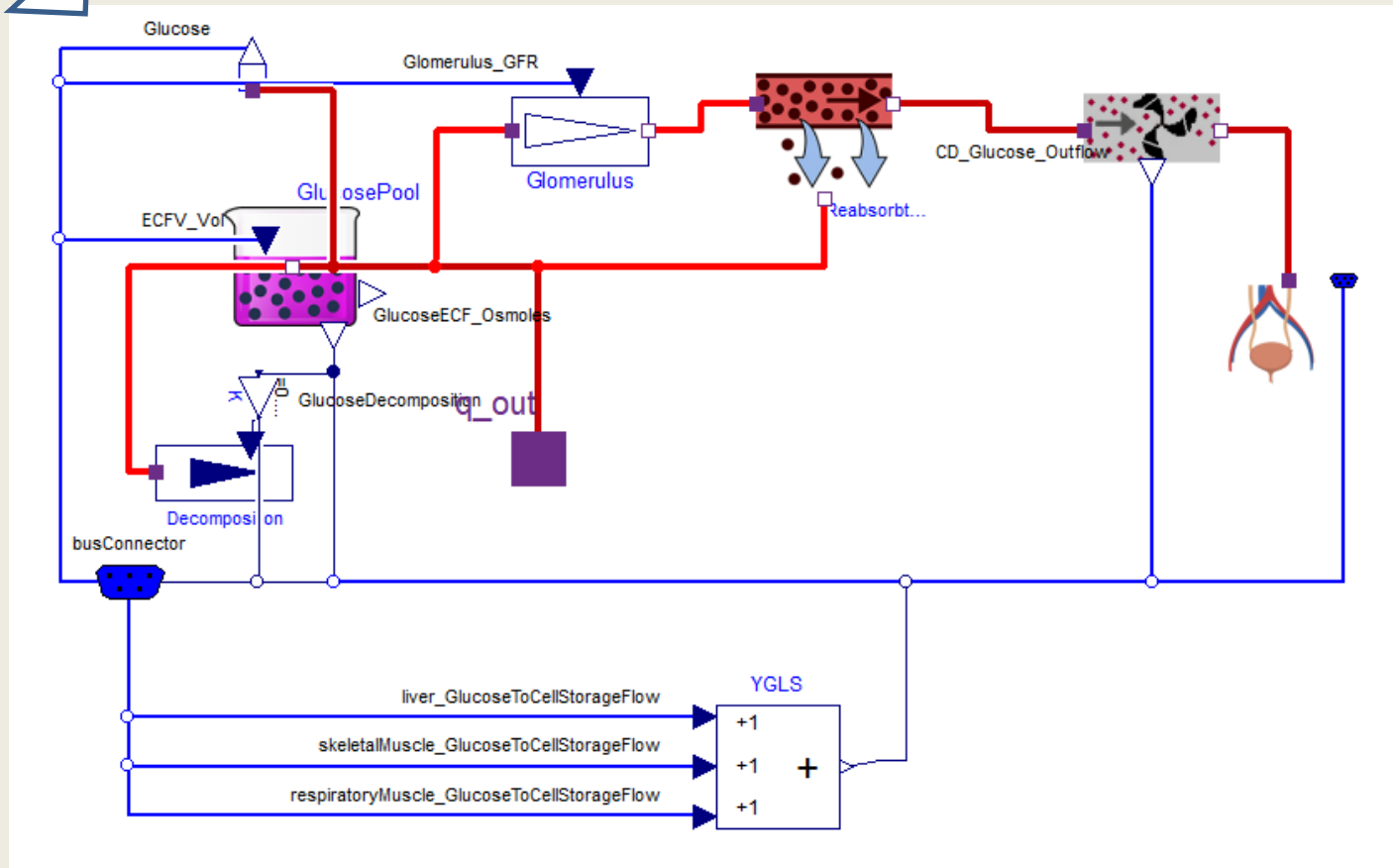
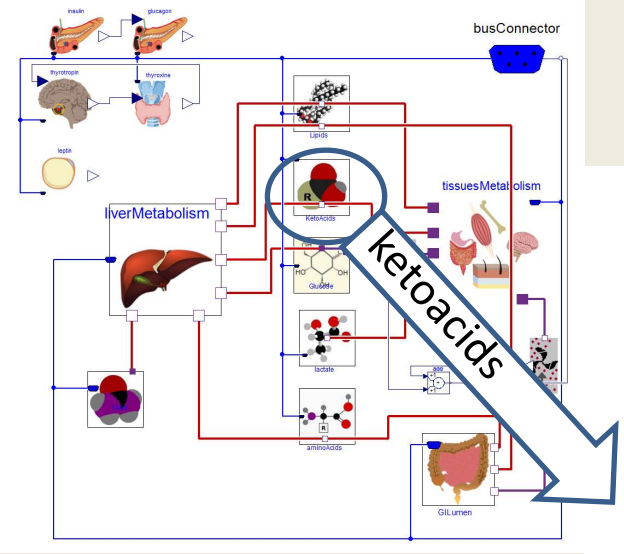
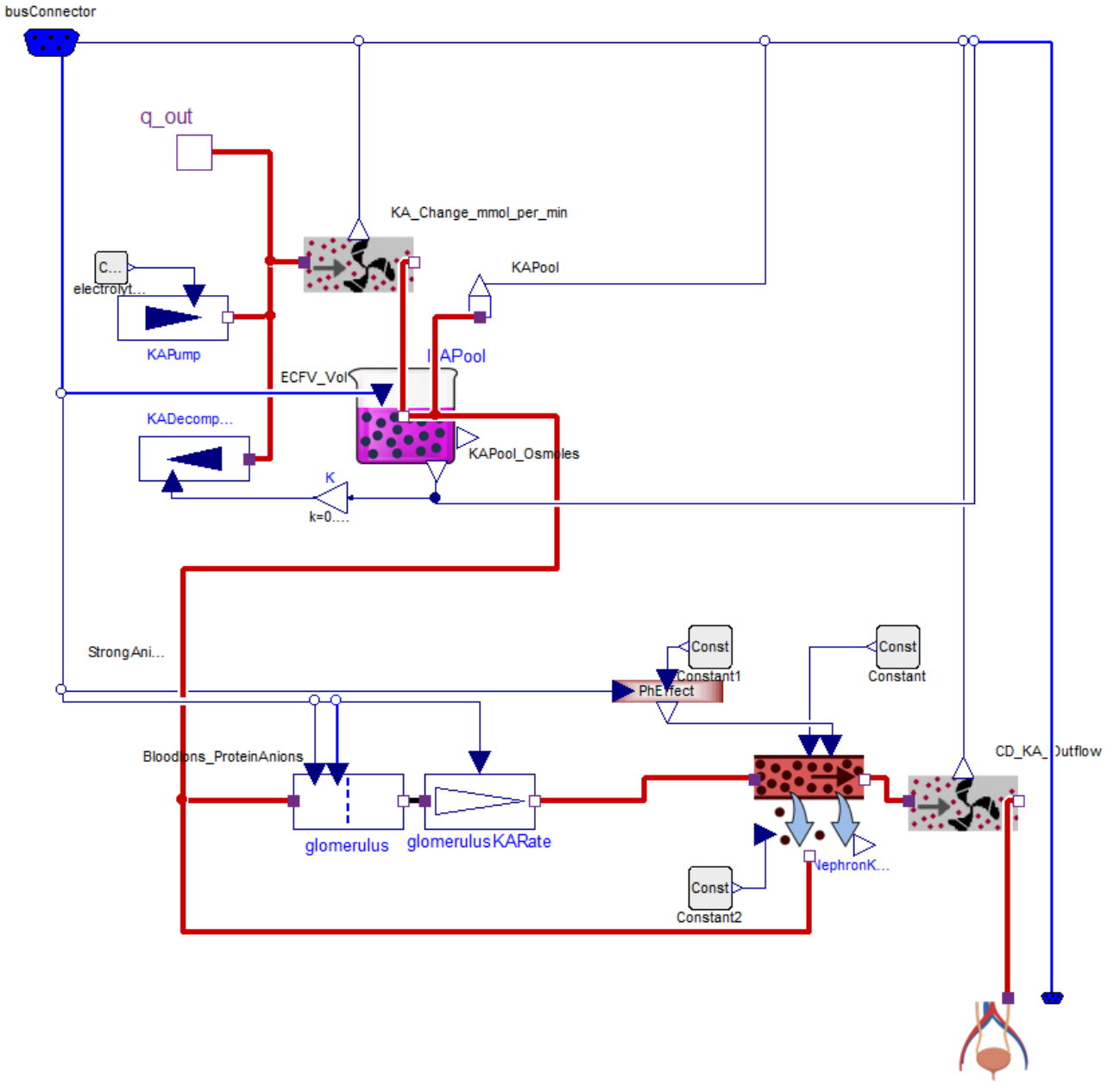
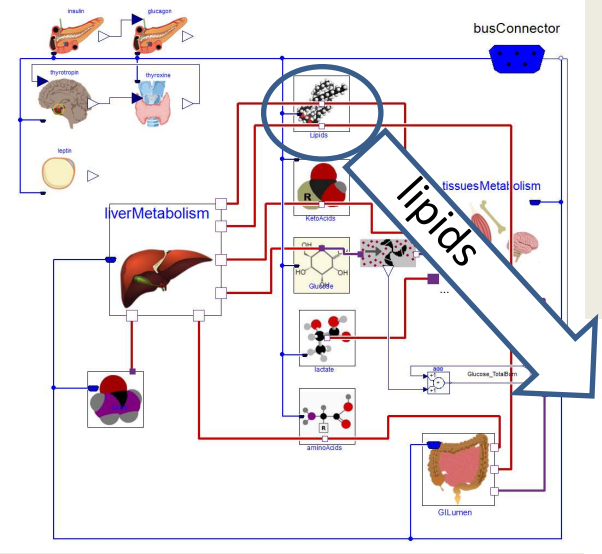
LacPool_Mass


busConnector
tissuesMetabolism
liverMetabolism
glucose


Glucose
Glomerulus_GFR
Glomerulus
CD_Glucose_Outflow
ECFV_Vol
GlucoseECF_Osmoles
GlucoseDecomposition
q_out
busConnector
liver_GlucoseToCellStorageFlow
skeletalMuscle_GlucoseToCellStorageFlow
respiratoryMuscle_GlucoseToCellStorageFlow
YGLS
+1
+1
+1
+


busConnector
liverMetabolism
tissuesMetabolism
ketoacids


busConnector
q_out
KA_Change_mmol_per_min
KAPool
electrolyt...
KAPump
ECFV_Vol
KADecomp...
KAPool_Osmoles
K
k=0....
StrongAni...
Const
Constant1
PhEffect
Const
Constant
BloodIons_ProteinAnions
glomerulus
glomerulusKARate
NephronK...
Const
Constant2
CD_KA_Outflow



busConnector
toTriglicerides
FFA_TO_TRIG
Triglyceride
ECFV_Vol
K
k=0....
Decomposition
Const
Insulin
massFlowConstant2
LipidDeposits_Uptake
LipidDepositsFA
FA_releaseB...
k=0.0075e-3/60
Triglycerides
TriglycerideHydrolysis
Insulin
Glucagon_conc
Epinephrine
Cons
massFlowCons nt1
LipidDeposits_Release
TRIG_TO_FFA
FattyAcids
FAPool
ECFV_Vol
FattyAcids
K1
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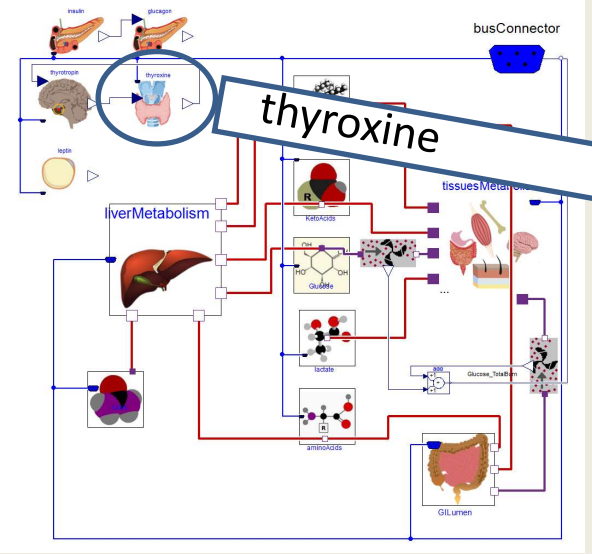
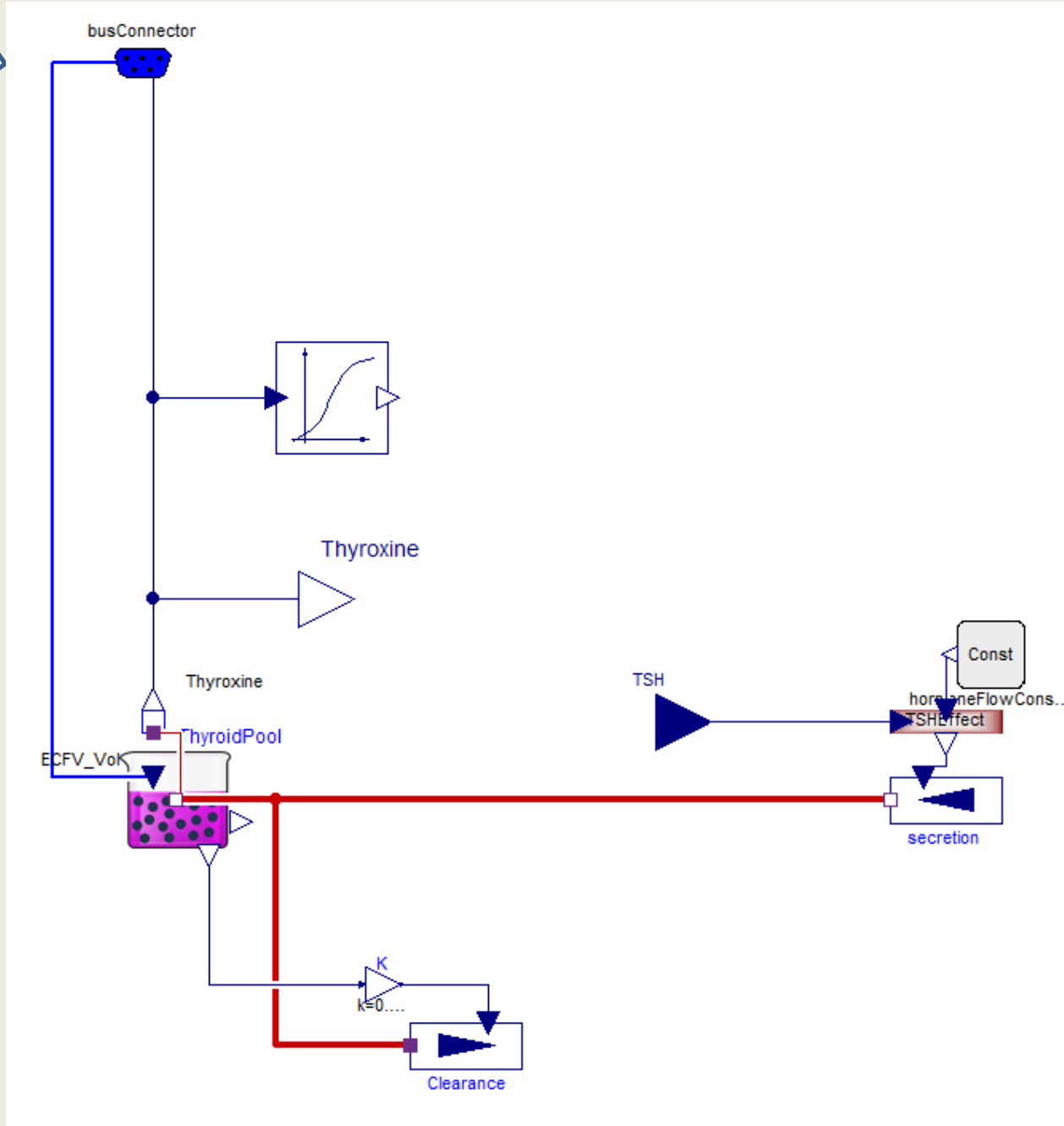
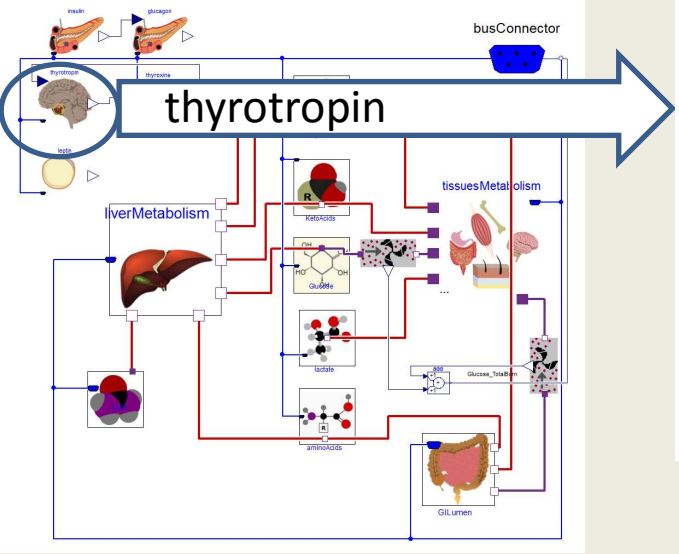
FADecomp...


busConnector
thyroxine
liverMetabolism
tissuesMetabo...
GILumen


busConnector
Thyroxine
Thyroxine
TSH
Const
horm neFlowCons...
TSHEffect
ThyroidPool
ECFV_VoK
secretion
K
k=0....
Clearance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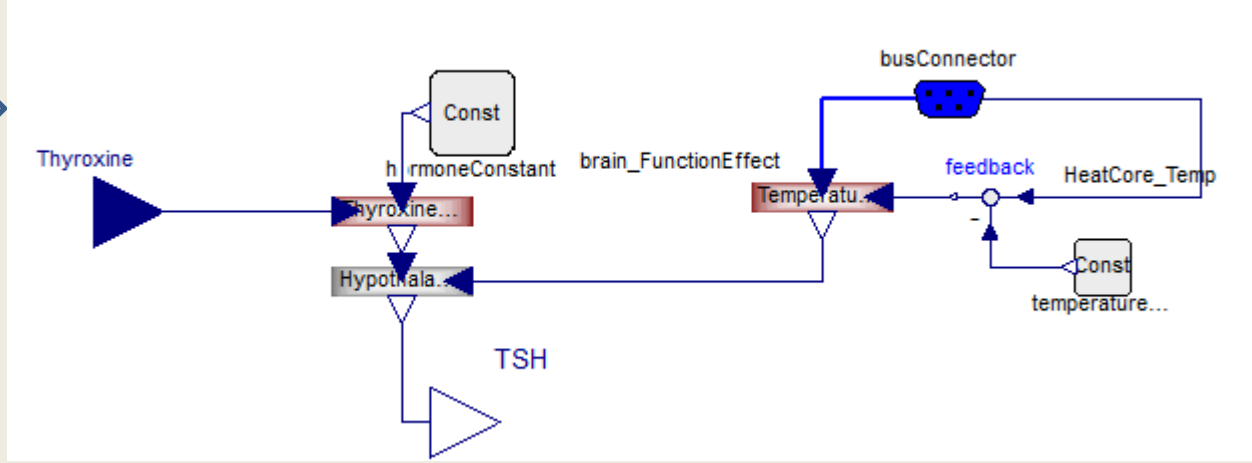
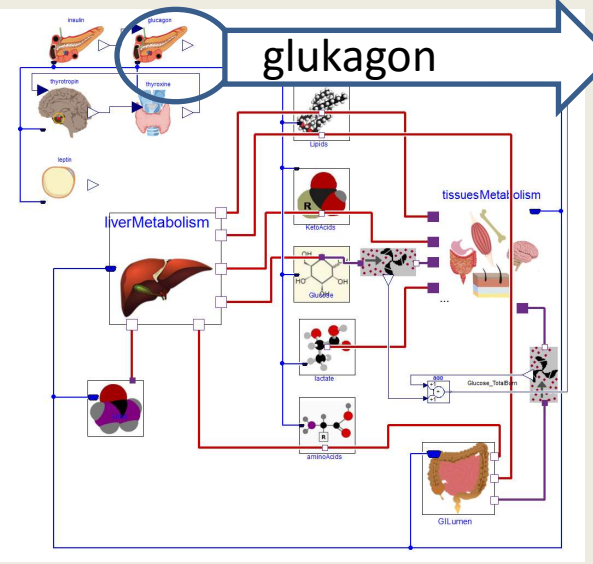
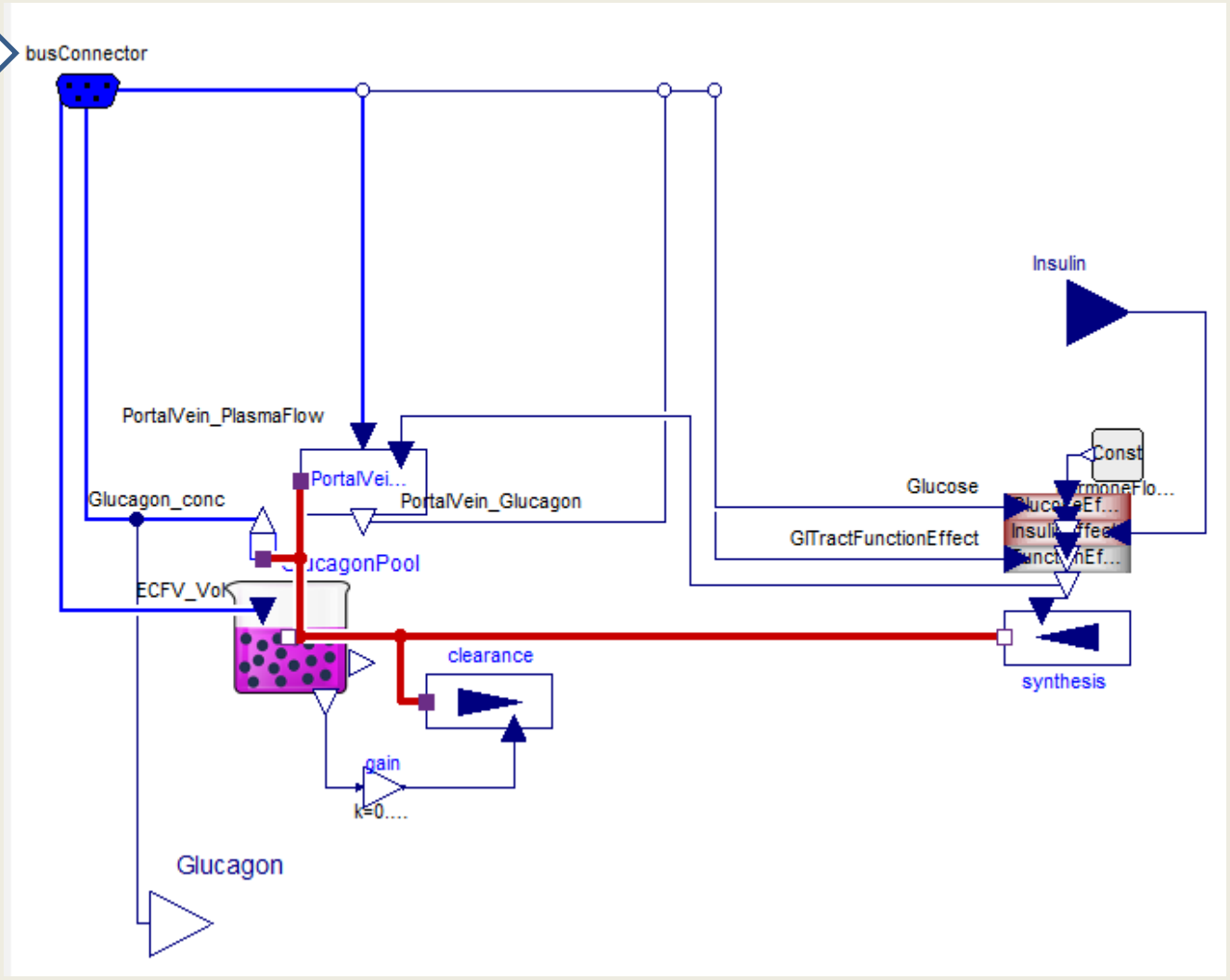
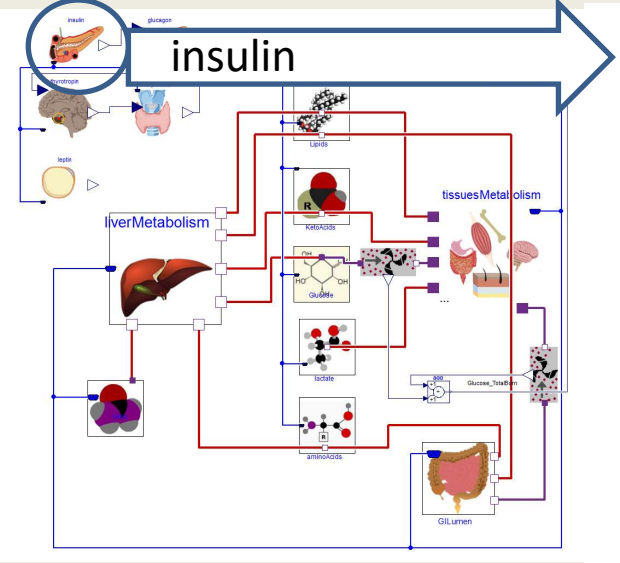
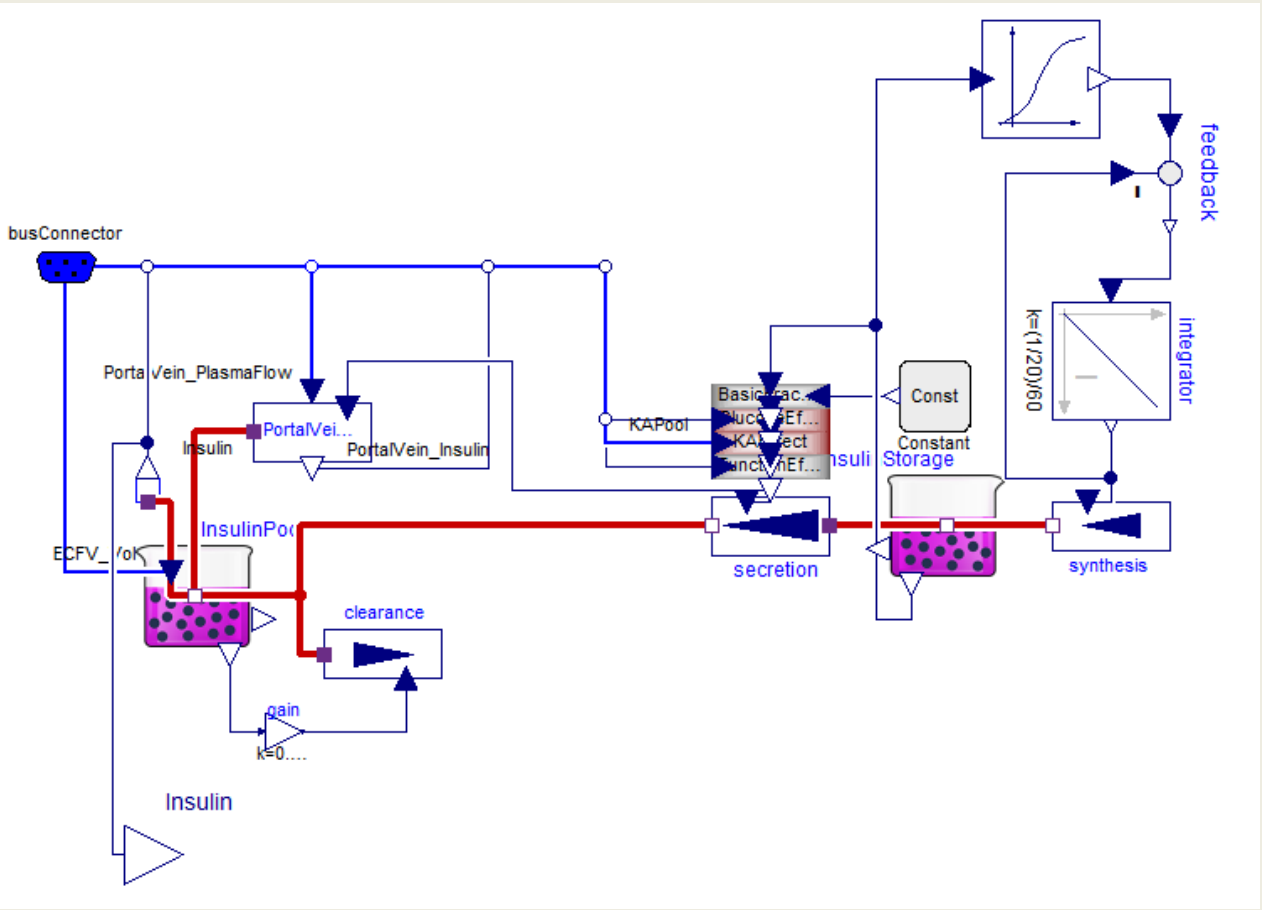
thyrotropin
liverMetabolism
tissuesMetabolism
KetoAcids
lactate
aminoAcids
GILumen

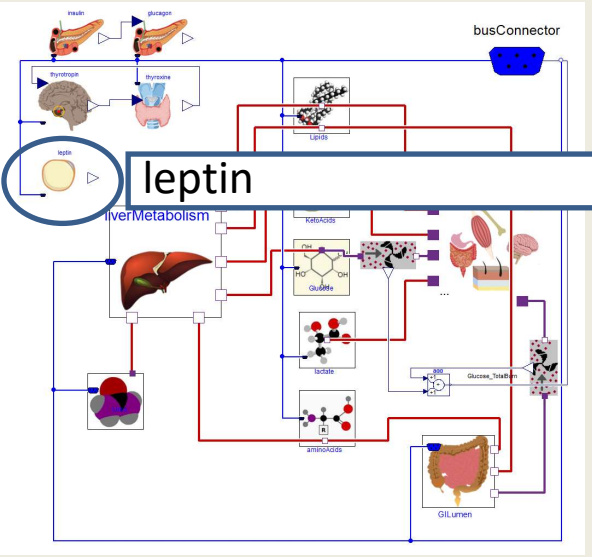

busConnector
Const
Thyroxine
h rmoneConstant
brain_FunctionEffect
feedback
HeatCore_Temp
hyroxine...
Temperatu...
Hypothala...
Const
temperature...
TSH


glukagon
liverMetabolism
tissuesMetabolism


busConnector
Insulin
PortalVein_PlasmaFlow
PortalVei...
Glucagon_conc
PortalVein_Glucagon
Glucose
GITractFunctionEffect
Const
ECFV_Vol
clearance
synthesis
gain
k=0....
Glucagon


insulin
glucagon
Pyrotropin
leptin
Lipids
KetoAcids
liverMetabolism
tissuesMetabolism
Glucose
Lactate
aminoAcids
Glucose_Totalbody
GILumen


busConnector
PortalVein_PlasmaFlow
PortalVei...
Insulin
PortalVein_Insulin
KAPool
Basic...
Gluc...Ef...
KA...fect
...nctionEf...
Const
Constant
Storage
feedback
integrator
k=(1/20)/60
InsulinPo
ECFV_...
secretion
synthesis
clearance
gain
k=0....
Insulin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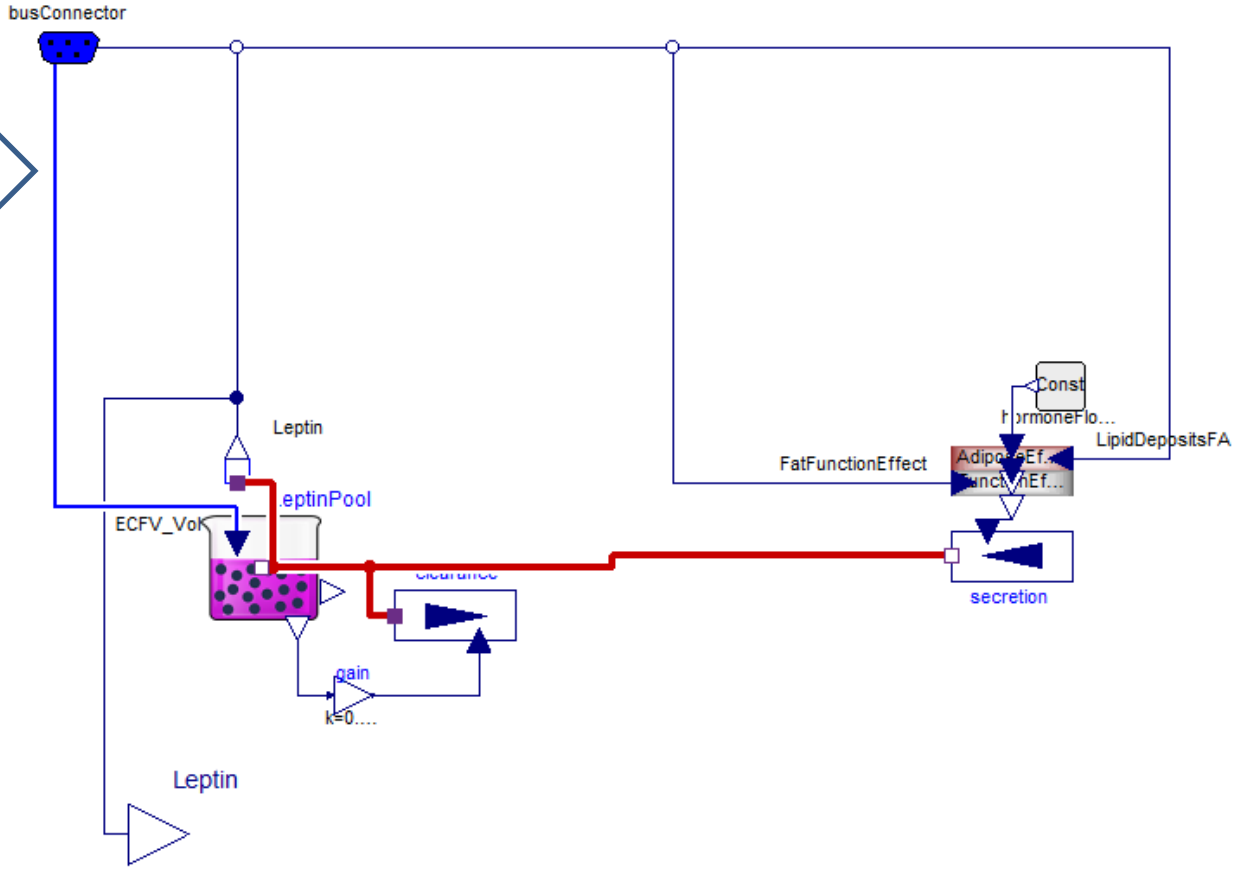
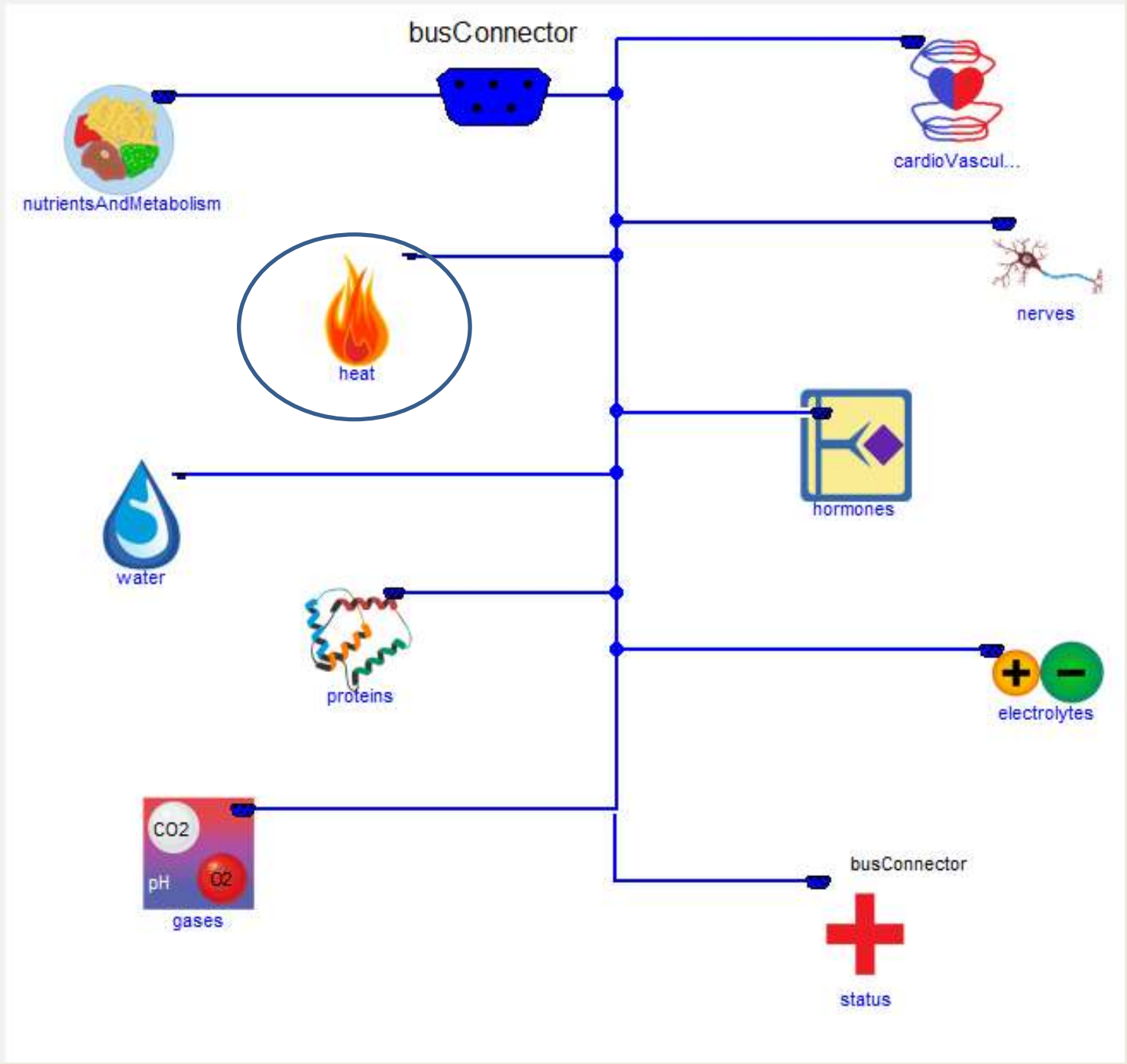
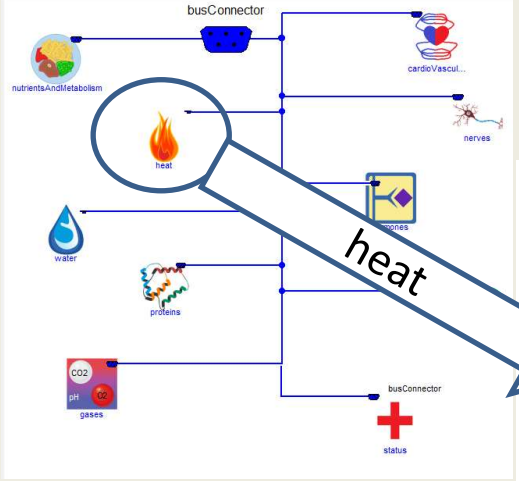
leptin
liverMetabolism
Lipids
KetoAcids
Glucose
Lactate
aminoAcids
Glucose_Totalbm
GILumen


busConnector
Leptin
eptinPool
ECFV_VoK
gain
k=0....
Leptin
FatFunctionEffect
secretion
LipidDepositsFA


busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status



busConnector

brain_FunctionEffect

HypothalamusShivering_NerveActivity

sweatGland

coreHeat

CD_H2O_Outflow

urine...

k=1000

toUrir

Const

BloodFlow

WindEffect

WindSpeed

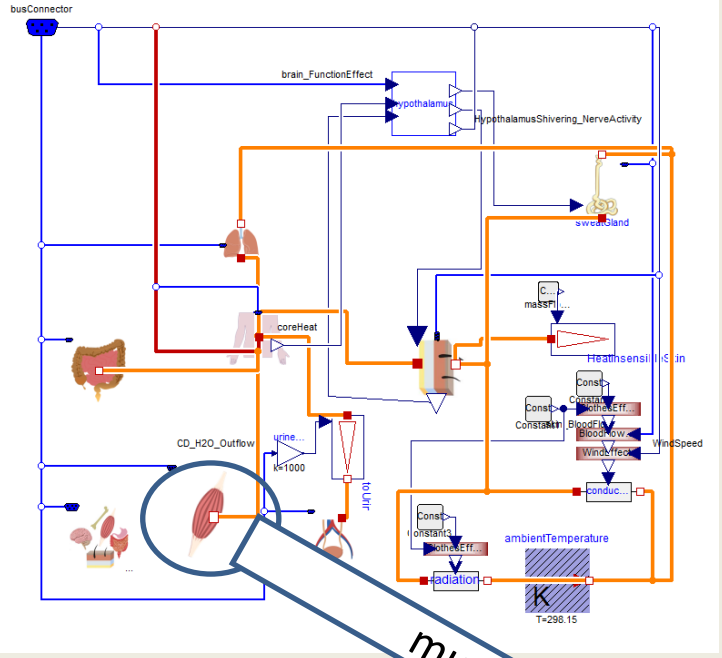
conduc...

ambientTemperature

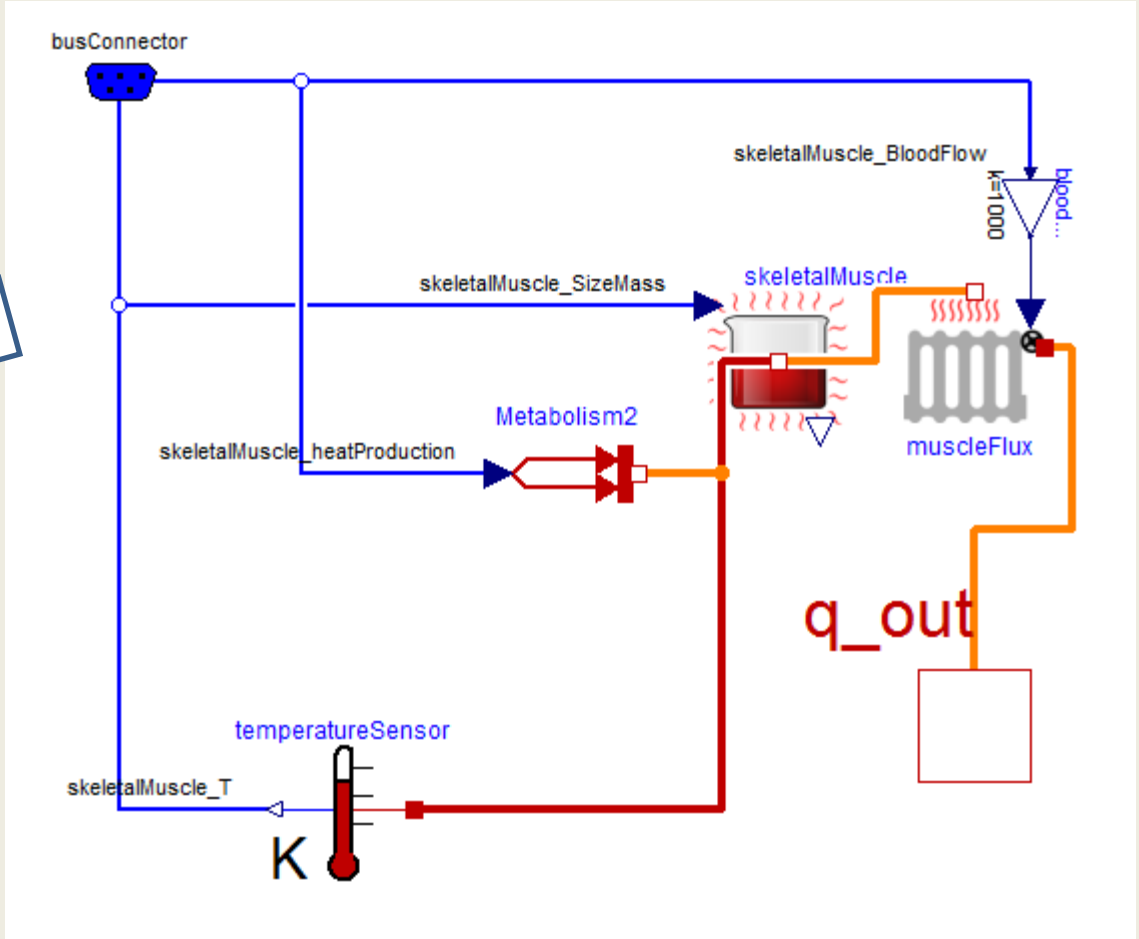
radiation

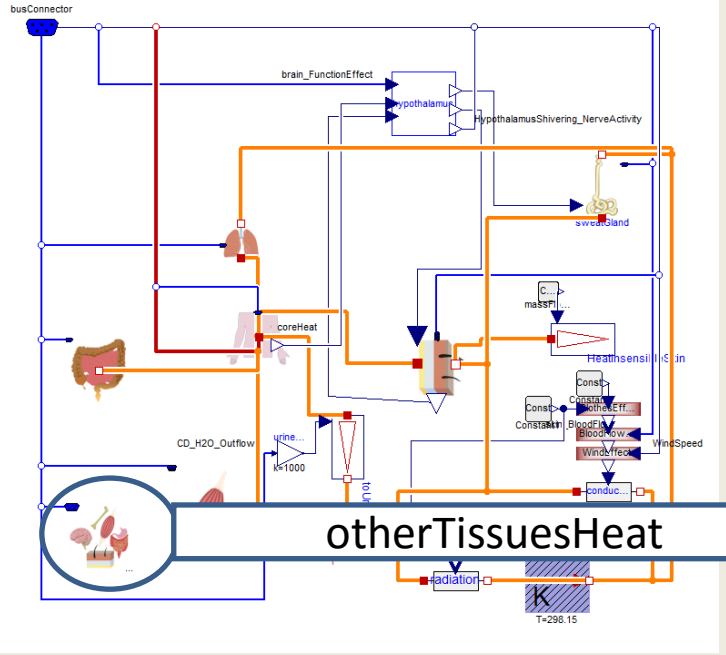
K

T=298.15

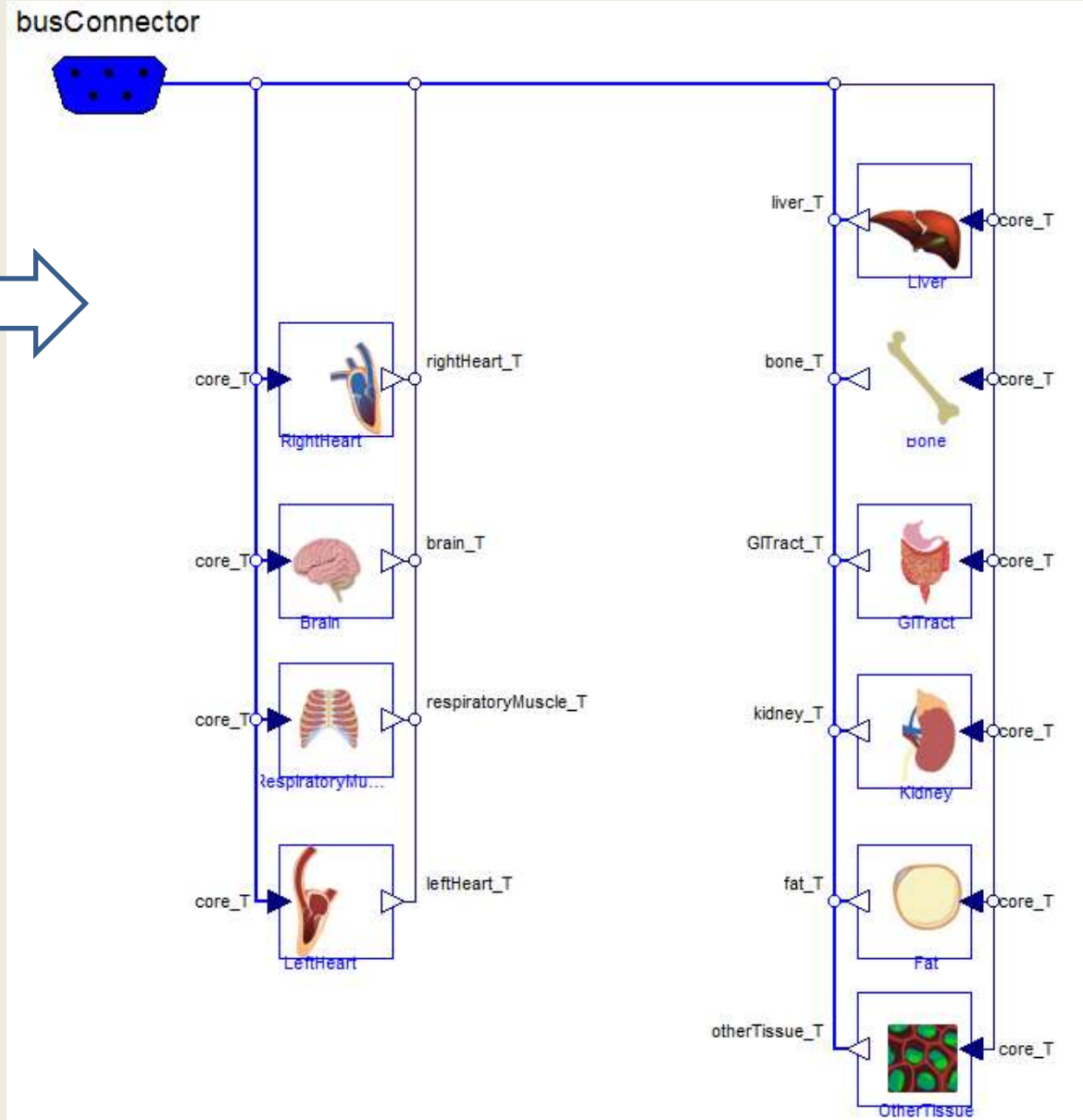

busConnector
brain_FunctionEffect
hypothalamus
HypothalamusShivering_NerveActivity
sweatGland
coreHeat
CD_H2O_Outflow
urine...
k=1000
toUrir
WindSpeed
conduc...
Const
radiation
ambientTemperature
K
T=298.15

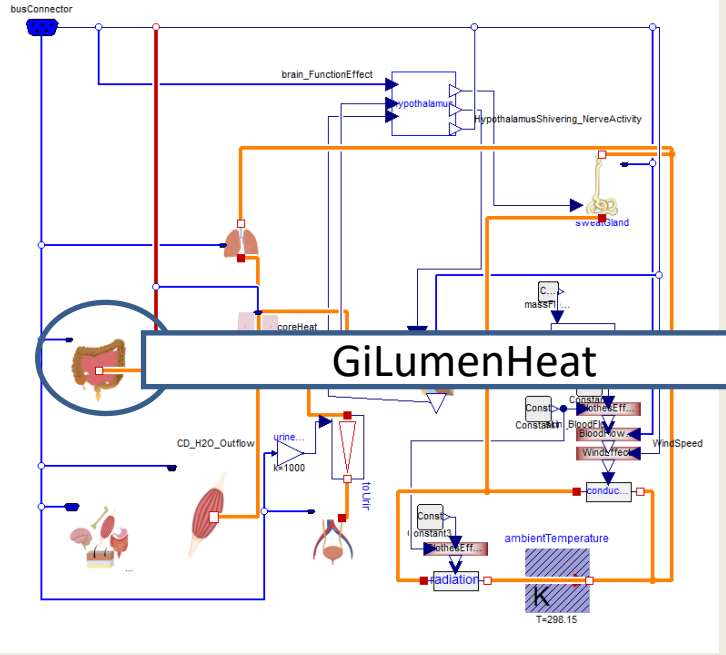
muscleheat


busConnector
skeletalMuscle_BloodFlow
k=1000
blood...
skeletalMuscle_SizeMass
skeletalMuscle
Metabolism2
skeletalMuscle_heatProduction
muscleFlux
q_out
temperatureSensor
skeletalMuscle_T
K

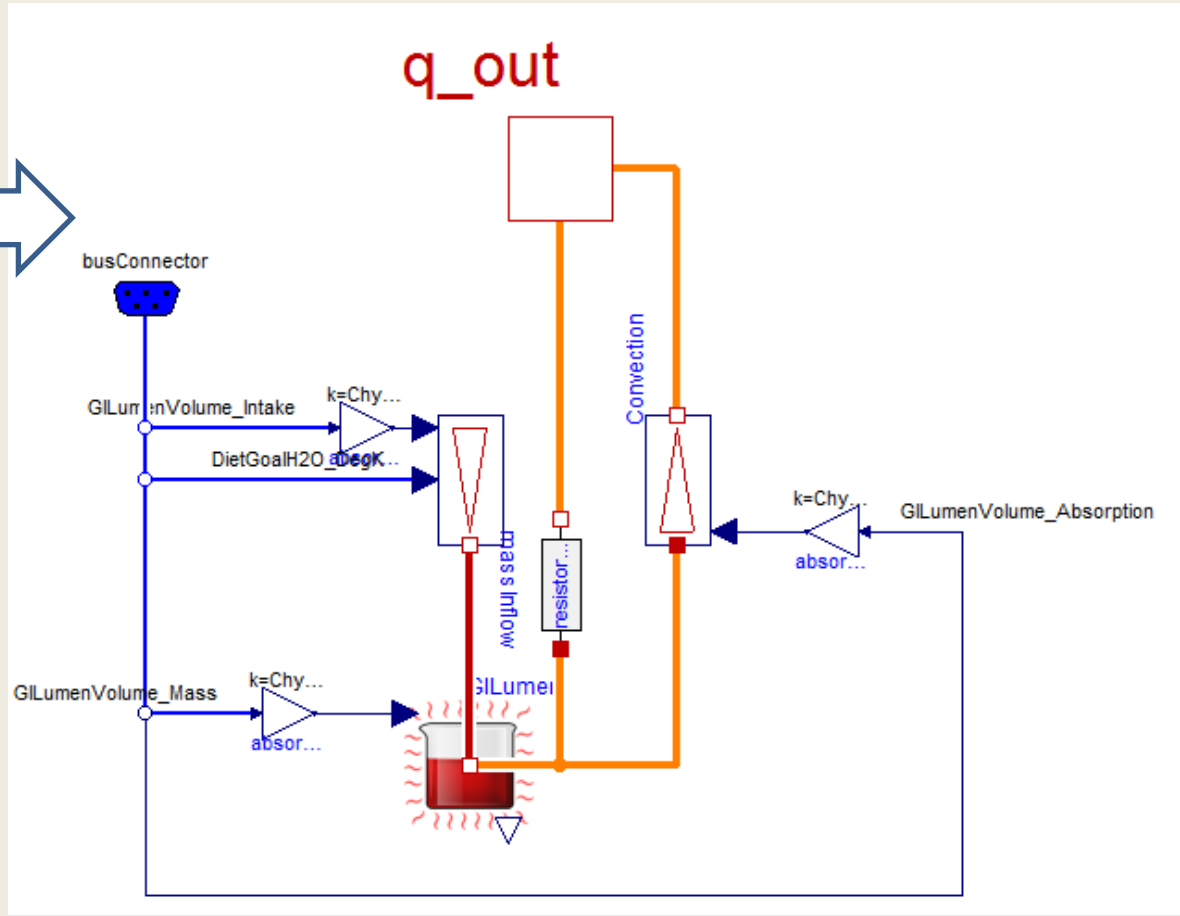


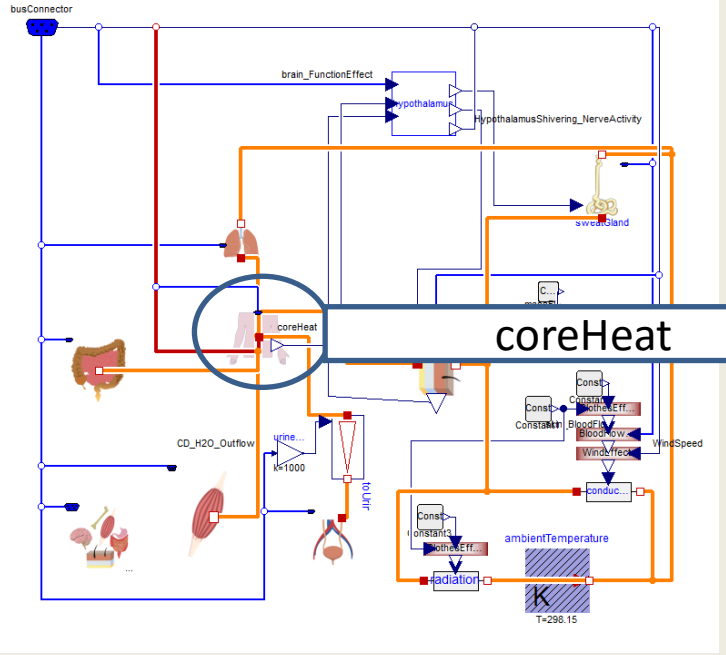
otherTissuesHeat



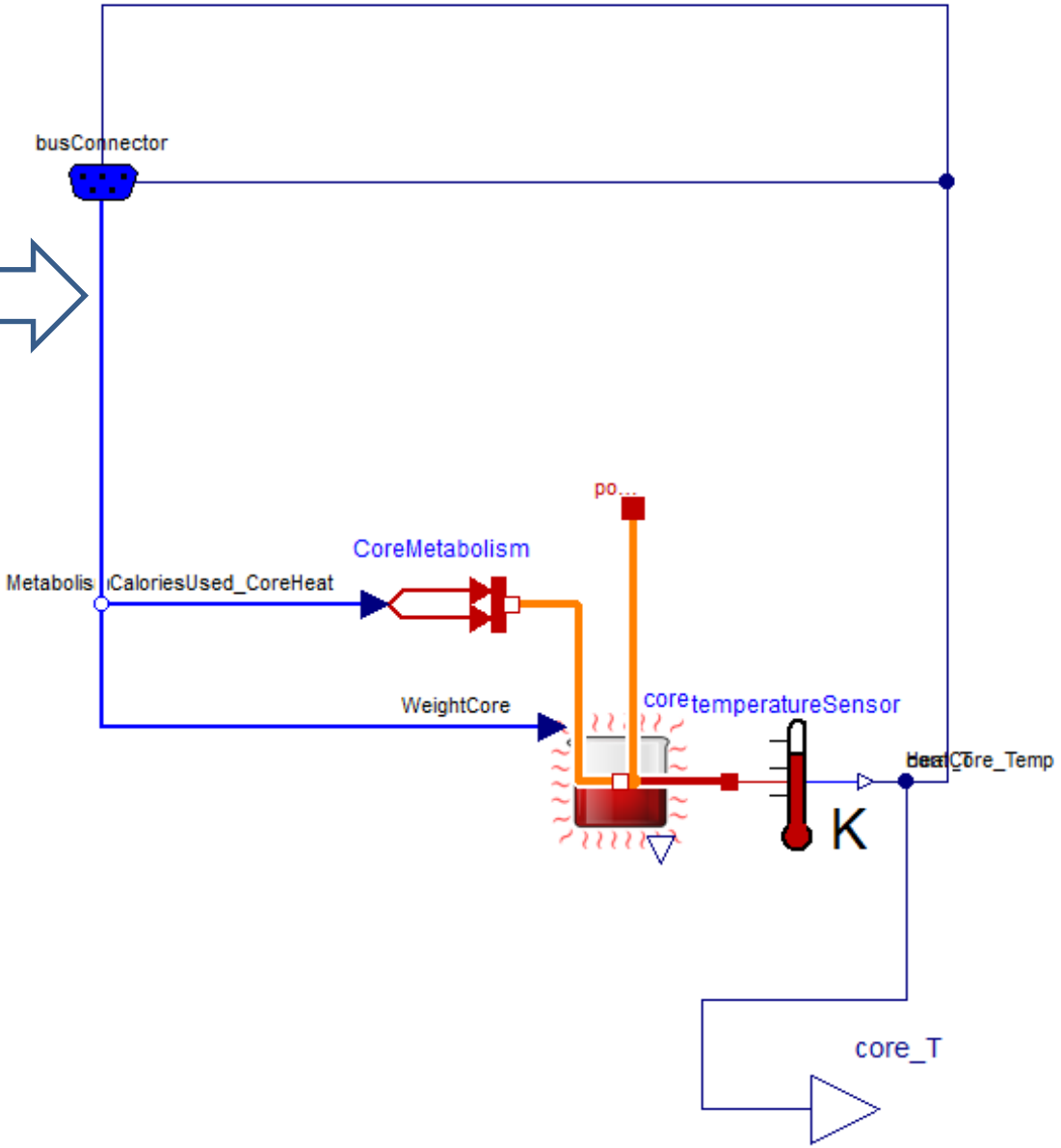


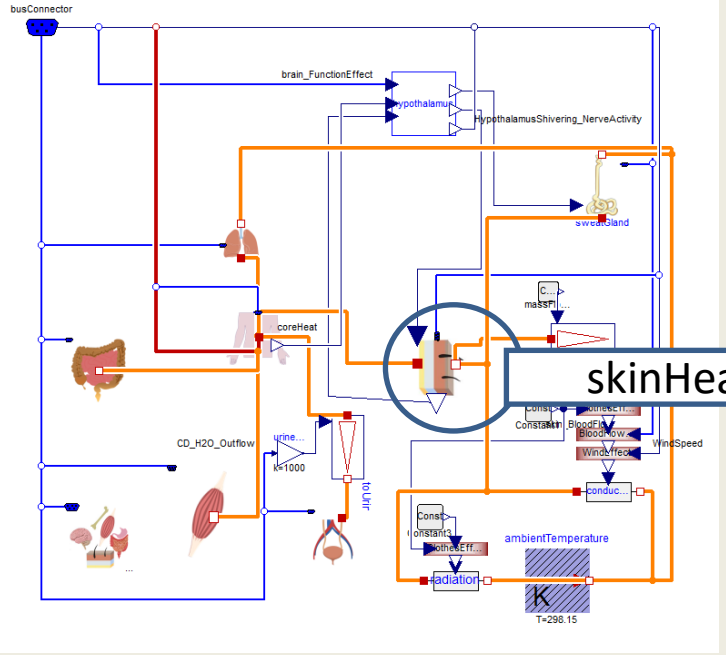
GiLumenHeat



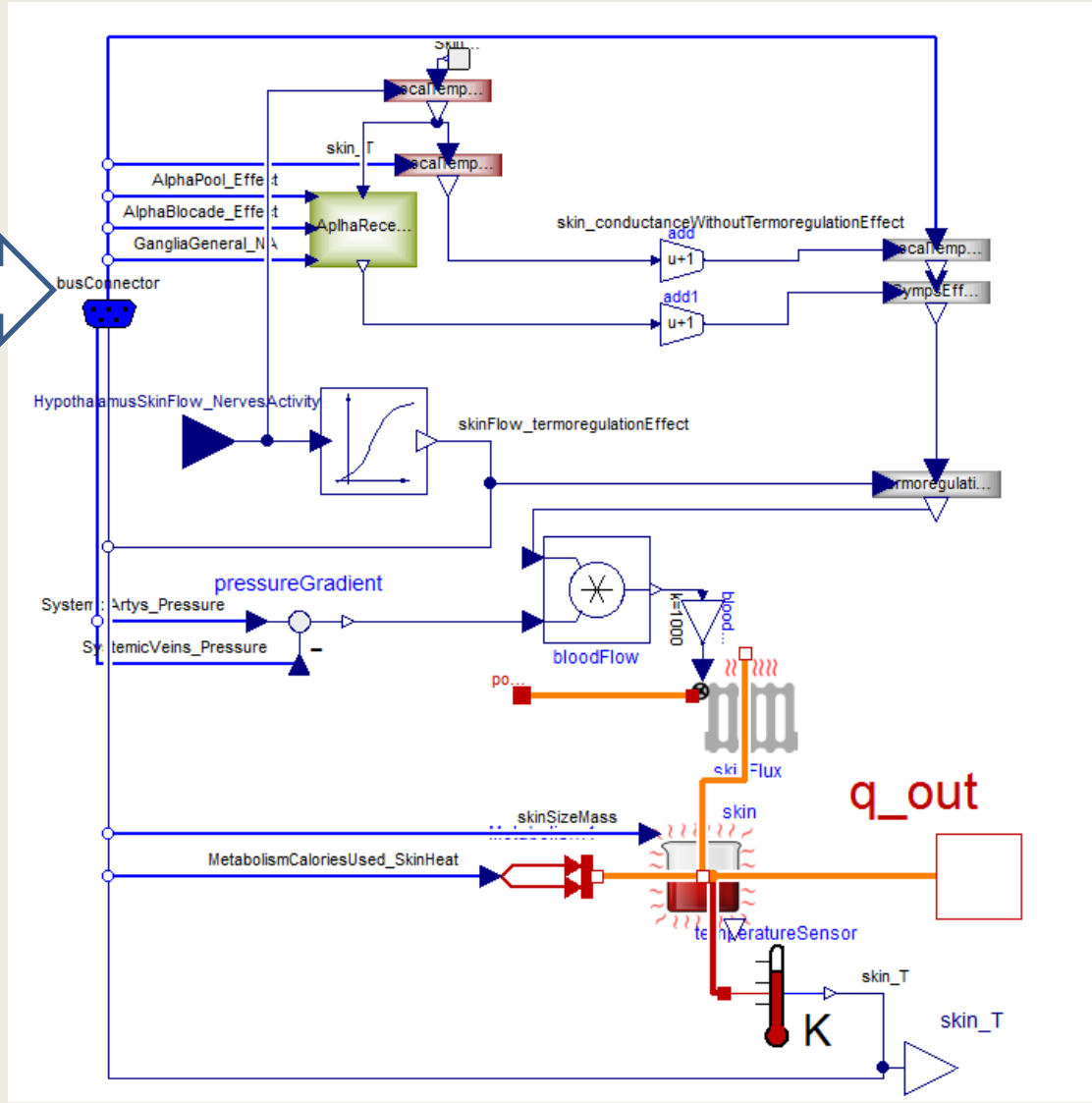

busConnector
brain_FunctionEffect
hypothalamus
HypothalamusShivering_NerveActivity
sweatGland
coreHeat
CD_H2O_Outflow
urine...
k=1000
toUrin
WindSpeed
conduc...
ambientTemperature
radiation
K
T=298.15

coreHeat


busConnector
po...
CoreMetabolism
Metabolis
CaloriesUsed_CoreHeat
WeightCore
core
temperatureSensor
K
core_T


busConnector
brain_FunctionEffect
hypothalamus
HypothalamusShivering_NerveActivity
sweatGland
coreHeat
massFl...
CD_H2O_Outflow
urine...
k=1000
toUrine
Const...
BloodFlow...
WindEffect
WindSpeed
conduc...
Const...
constant1
bothEff...
radiation
ambientTemperature
K
T=298.15

skinHeat


Skin...
calTemp...
skin_T
calTemp...
AlphaPool_Effect
AlphaBlocade_Effect
GangliaGeneral_NA
AlphaRece...
skin_conductanceWithoutTermoregulationEffect
add
u+1
add1
u+1
calTemp...
SympsEff...
busConnector
HypothalamusSkinFlow_NervesActivity
skinFlow_termoregulationEffect
termoregulati...
pressureGradient
System: Artys_Pressure
SystemicVeins_Pressure
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po...
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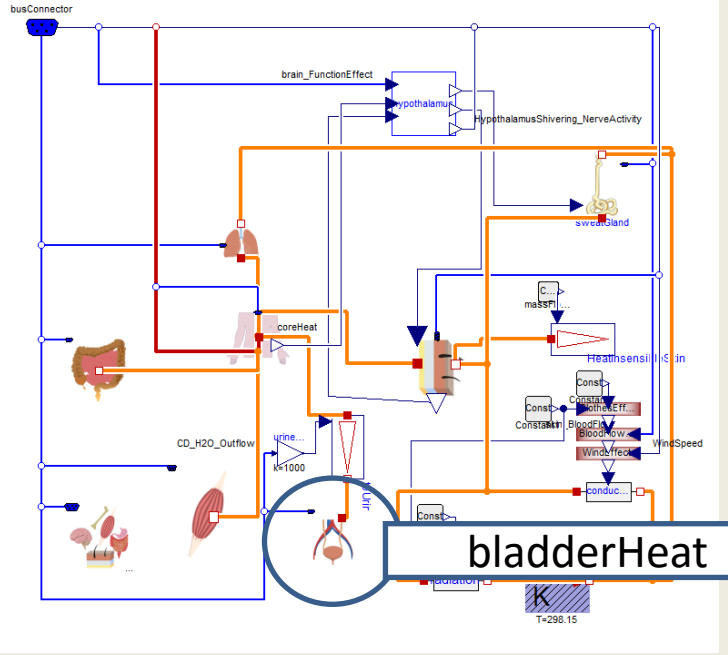
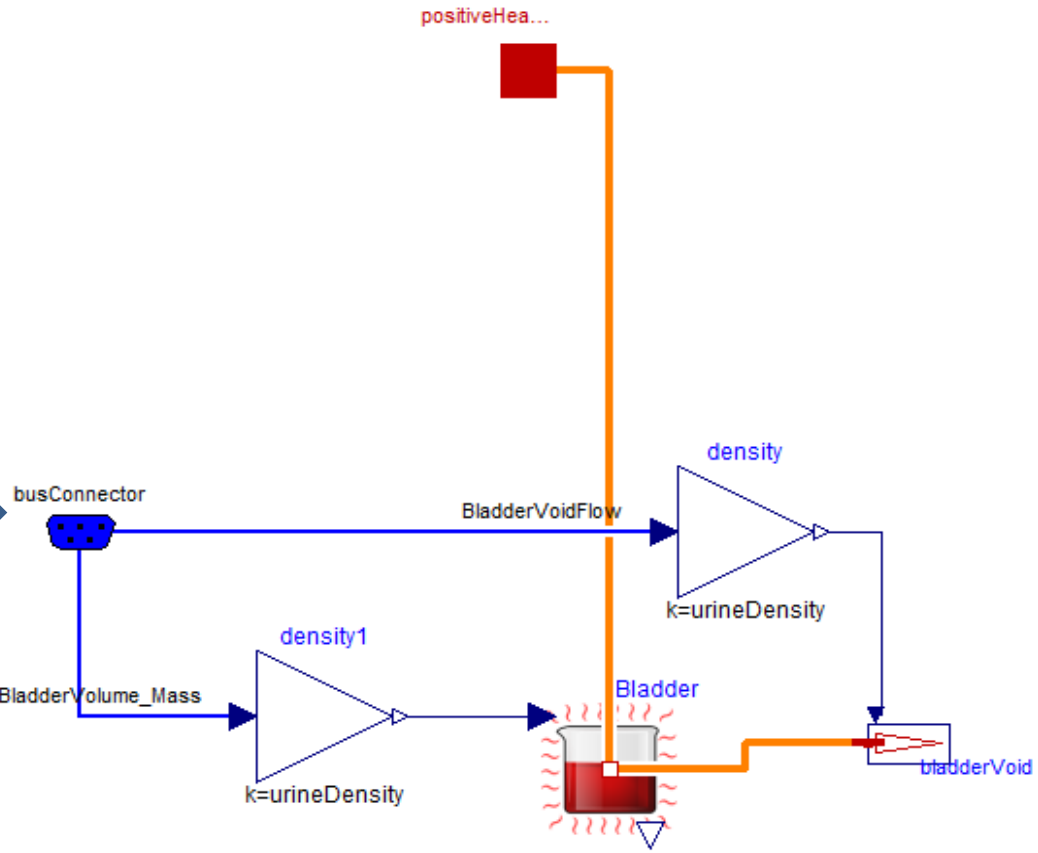
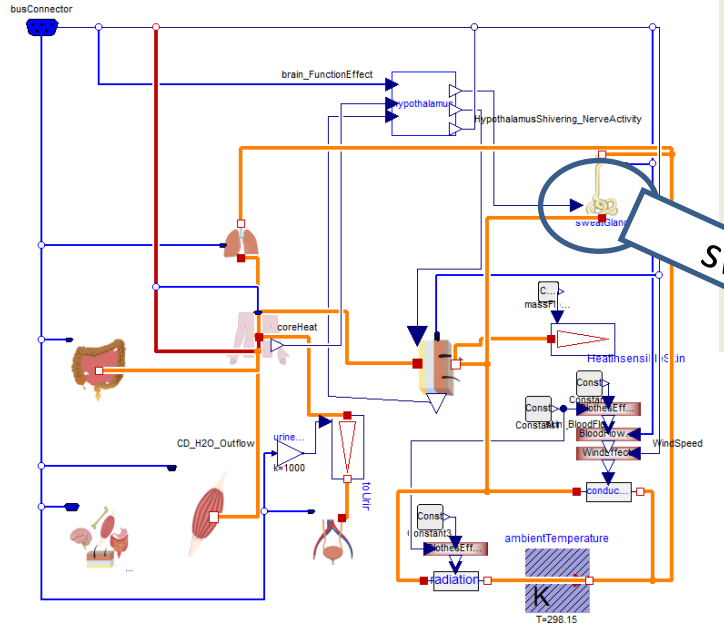
MetabolismCaloriesUsed_SkinHeat
skin
q_out
temperatureSensor
skin_T
K
skin_T

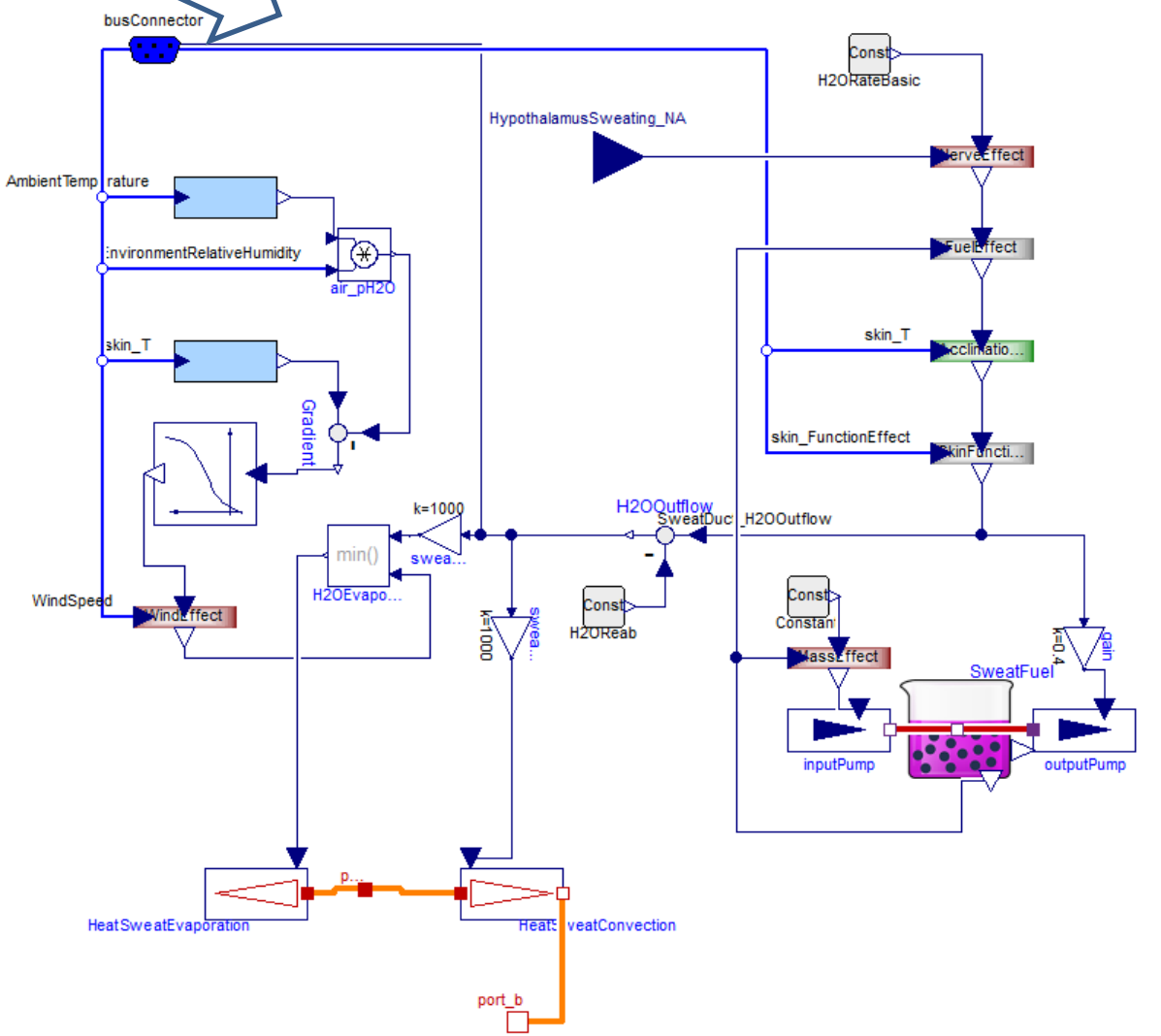


bladderHeat




busConnector
brain_FunctionEffect
hypothalamus
HypothalamusShivering_NerveActivity
sweatGland
coreHeat
massFl...
HeatSensibleSkin
Const
Constant
BloodFlow...
WindEffect
WindSpeed
conduc...
CD_H2O_Outflow
urine...
k=1000
toUrin
ambientTemperature
radiation
K
T=298.15

sweatGland


busConnector
Const
H2ORateBasic
HypothalamusSweating_NA
NerveEffect
AmbientTemp_rature
:nvironmentRelativeHumidity
air_pH2O
FuelEffect
skin_T
skin_T
kclimatio...
Gradient
skin_FunctionEffect
SkinFuncti...
k=1000
H2OOutflow
SweatDuc_H2OOutflow
min()
swea...
H2OEvapo...
WindSpeed
WindEffect
k=1000
swea...
Const
H2OReab
Const
Constan
MassEffect
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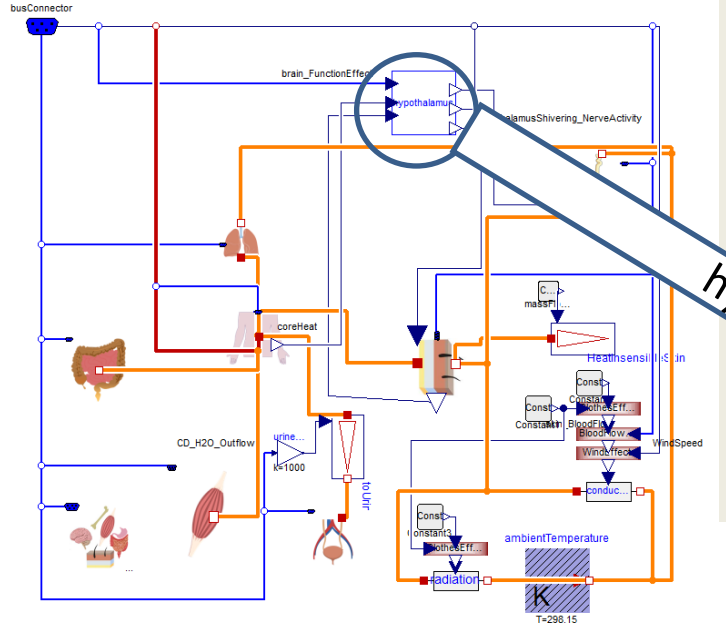
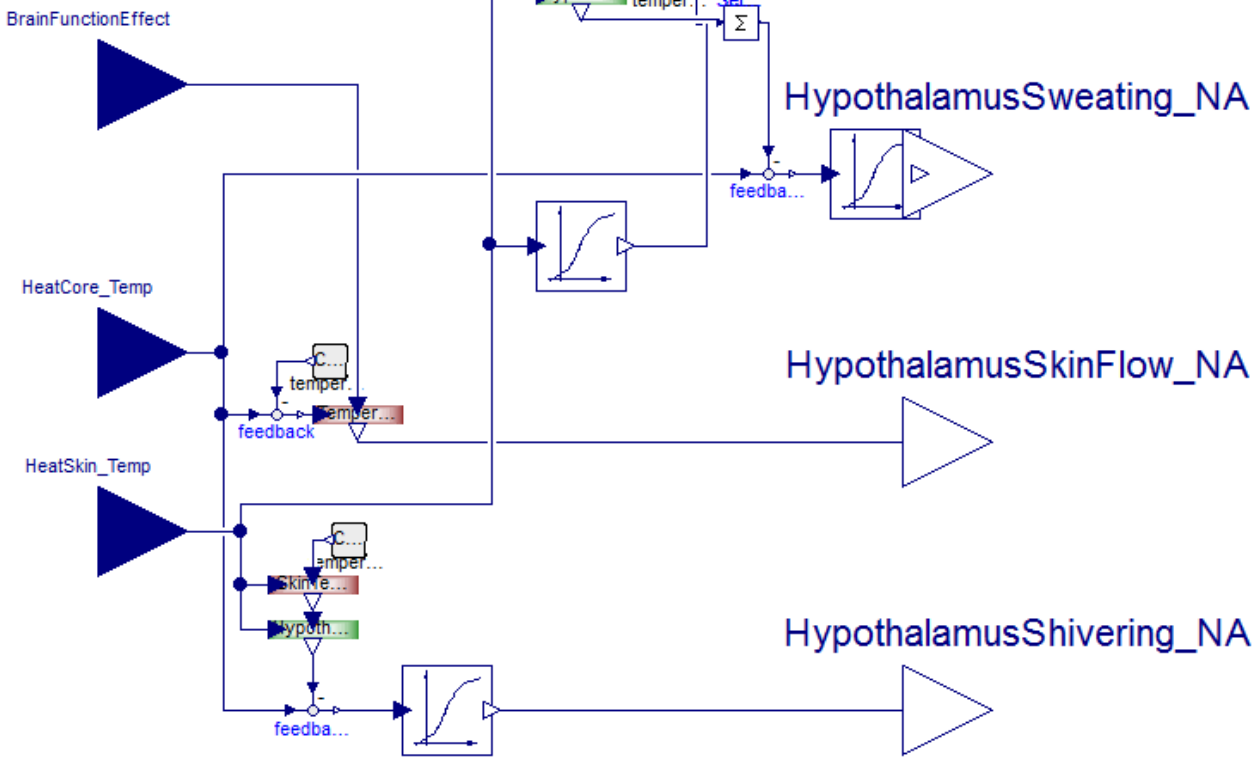
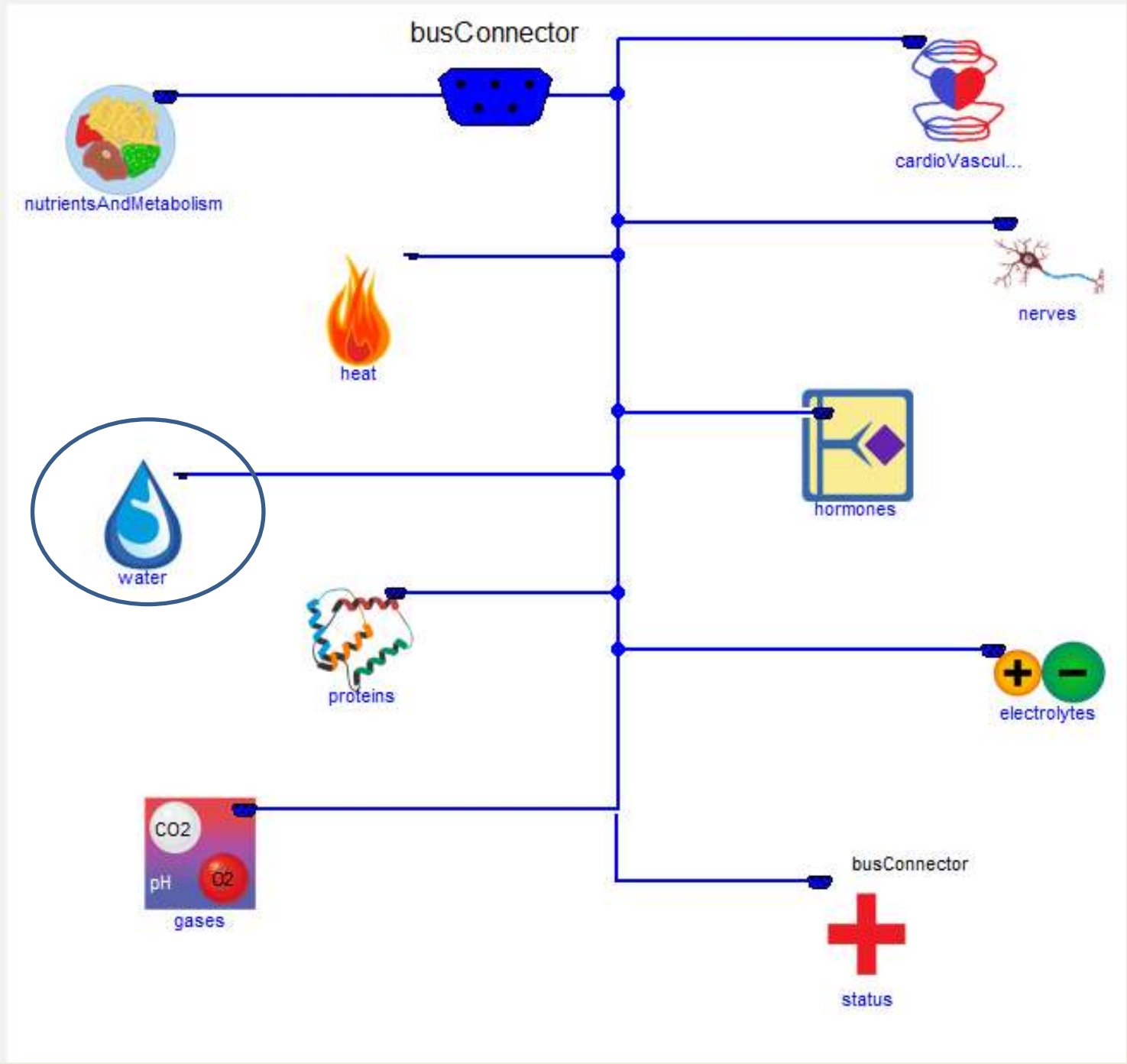
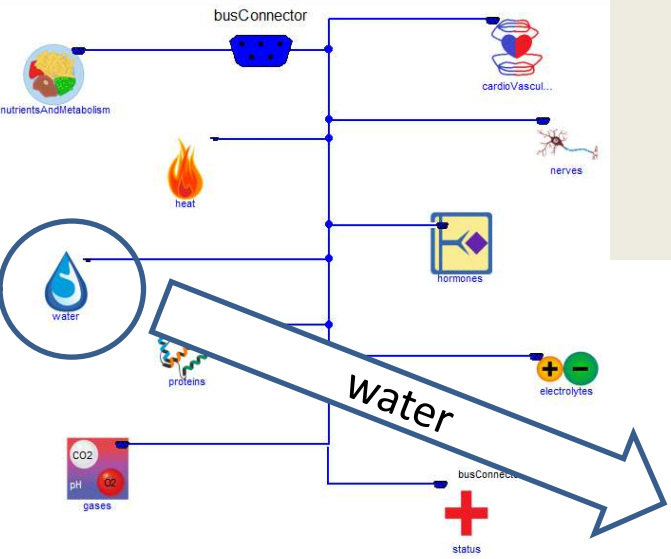
SweatFuel
inputPump
outputPump
HeatSweatEvaporation
p...
HeatSweatConvection
port_b

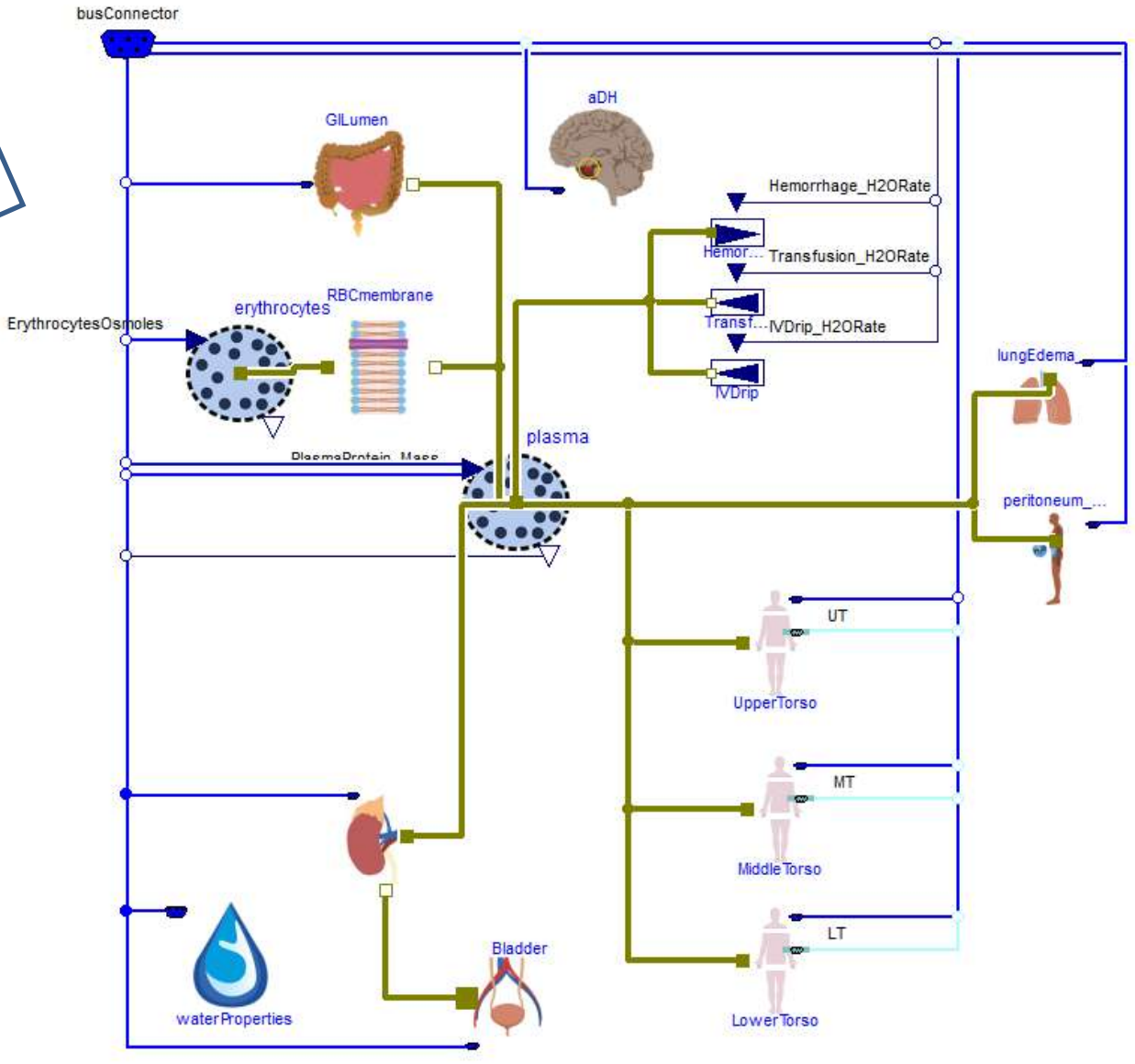


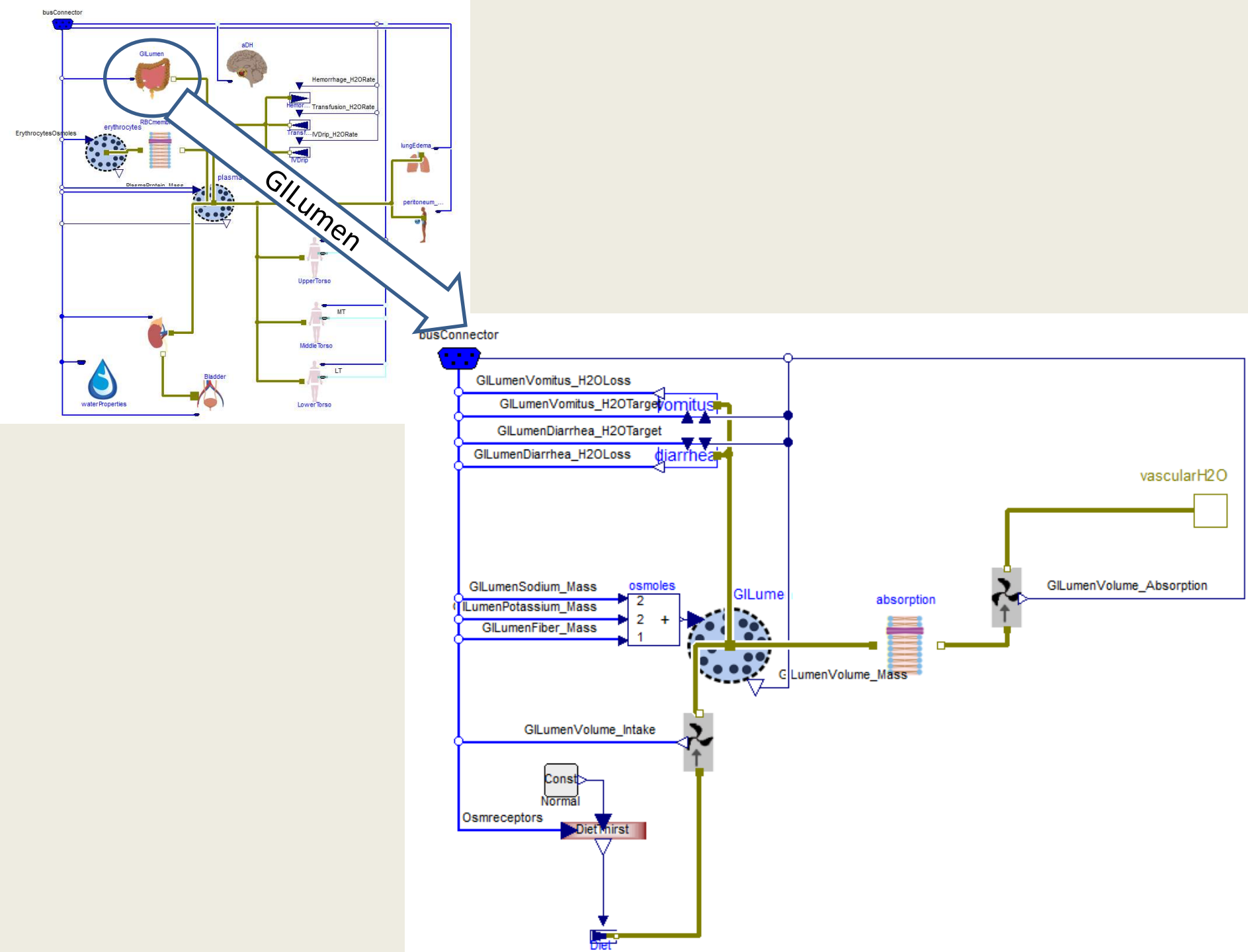
hypothalamus

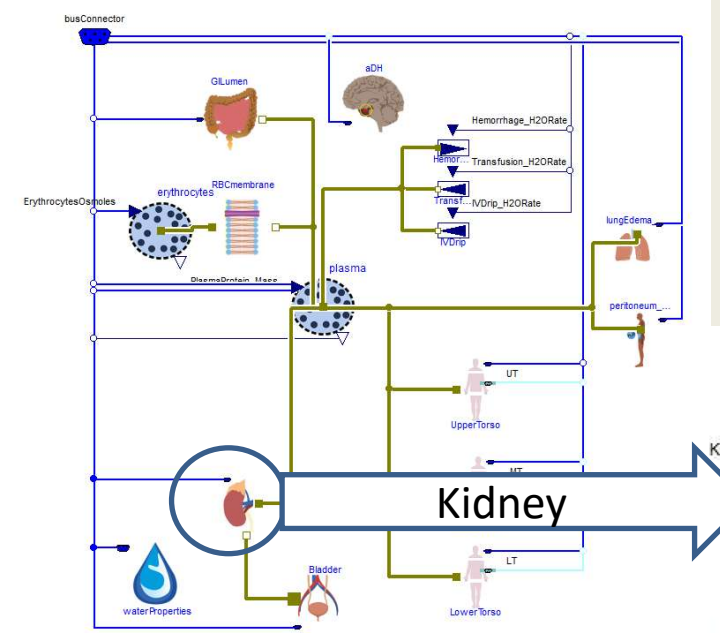



busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status

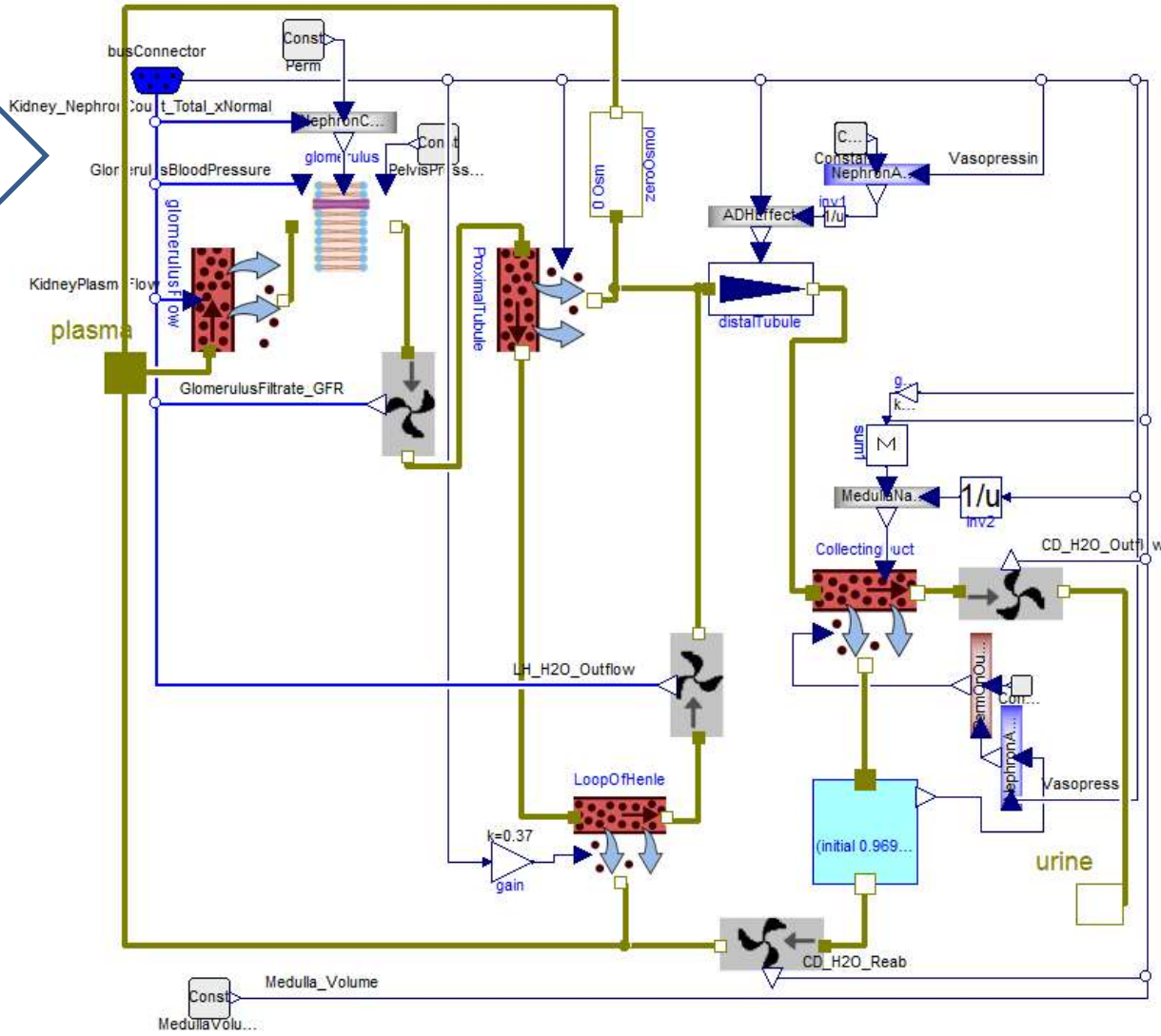

busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status
water

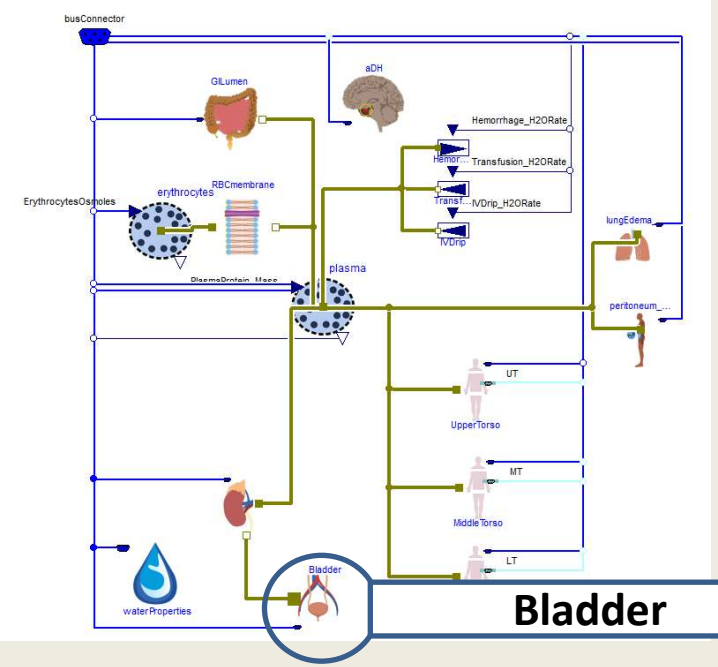

busConnector
GILumen
aDH
Hemorrhage_H2ORate
Hemor...
Transfusion_H2ORate
Transf...
IVDrip_H2ORate
IVDrip
lungEdema
RBCmembrane
erythrocytes
ErythrocytesOsmoles
plasma
peritoneum_...
UT
UpperTorso
MT
MiddleTorso
LT
LowerTorso
Bladder
waterProperties


busConnector
GILumen
aDH
Hemorrhage_H2ORate
Transfusion_H2ORate
IVDrip_H2ORate
IVDrip
RBCmembr
erythrocytes
ErythrocytesOsmoles
plasma
lungEdema
peritoneum_...
UpperTorso
MT
MiddleTorso
LT
LowerTorso
Bladder
waterProperties
GILumen
busConnector
GILumenVomitus_H2OLoss
GILumenVomitus_H2OTarget
GILumenDiarrhea_H2OTarget
GILumenDiarrhea_H2OLoss
vomitus
diarrhea
vascularH2O
GILumenSodium_Mass
GILumenPotassium_Mass
GILumenFiber_Mass
osmoles
2
2
1
+
GILume
absorption
GILumenVolume_Absorption
GILumenVolume_Mass
GILumenVolume_Intake
Const
Normal
Osmreceptors
Diet Thirst
Diet

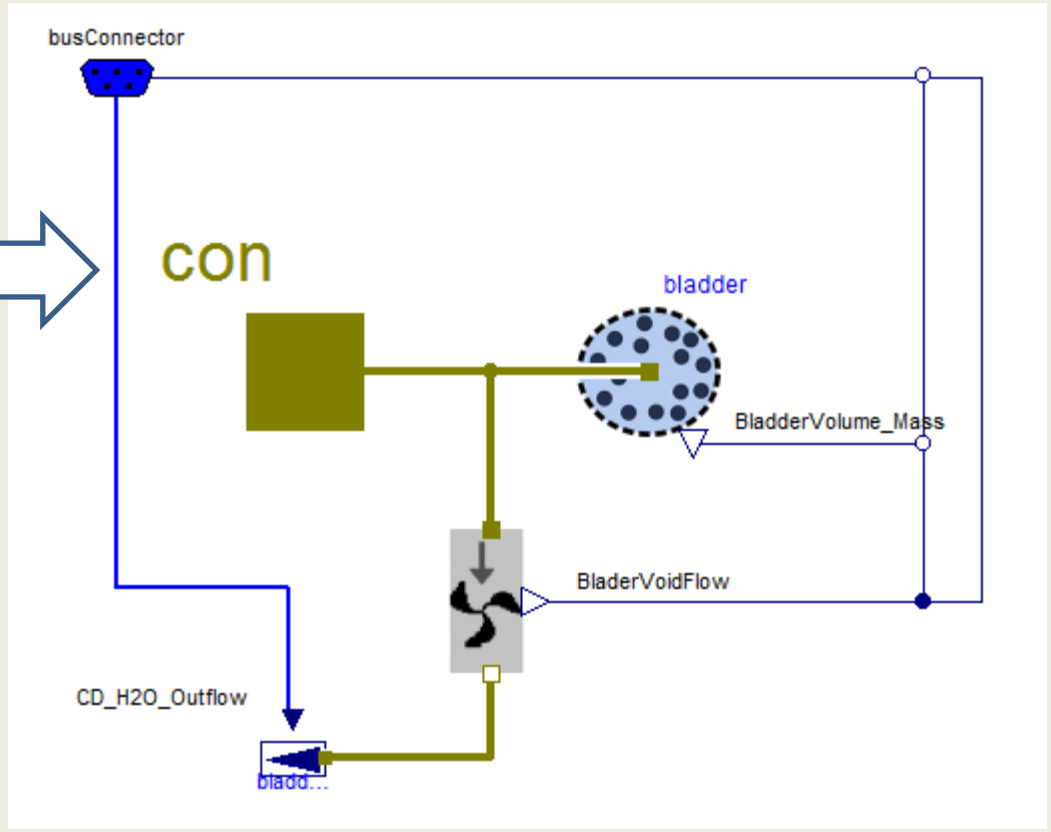

busConnector
GILumen
aDH
Hemorrhage_H2ORate
Transfusion_H2ORate
IVDrip_H2ORate
IVDrip
erythrocytes
RBCmembrane
ErythrocytesOsmoles
lungEdema
plasma
peritoneum_...
UT
UpperTorso
LT
LowerTorso
Bladder
waterProperties

Kidney


busConnector
Const
Perm
NephronC...
glomerulus
PelvisPr...
0 Osm
zeroOsmol
Vasopressin
NephronA...
ADHEffect
distalTubule
ProximalTubule
glomerulusFlow
plasma
GlomerulusFiltrate_GFR
sum1
MedullaNa...
1/u
inv2
Collecting Duct
CD_H2O_Outfl...
LH_H2O_Outflow
LoopOfHenle
k=0.37
gain
(initial 0.969...
urine
CD_H2O_Reab
Medulla_Volume
MedullaVolu...


busConnector
GILumen
aDH
Hemorrhage_H2ORate
Transfusion_H2ORate
IVDrip_H2ORate
IVDrip
erythrocytes
RBCmembrane
ErythrocytesOsmoles
plasma
lungEdema
peritoneum_...
UT
UpperTorso
MT
MiddleTorso
LT
Bladder
waterProperties

Bladder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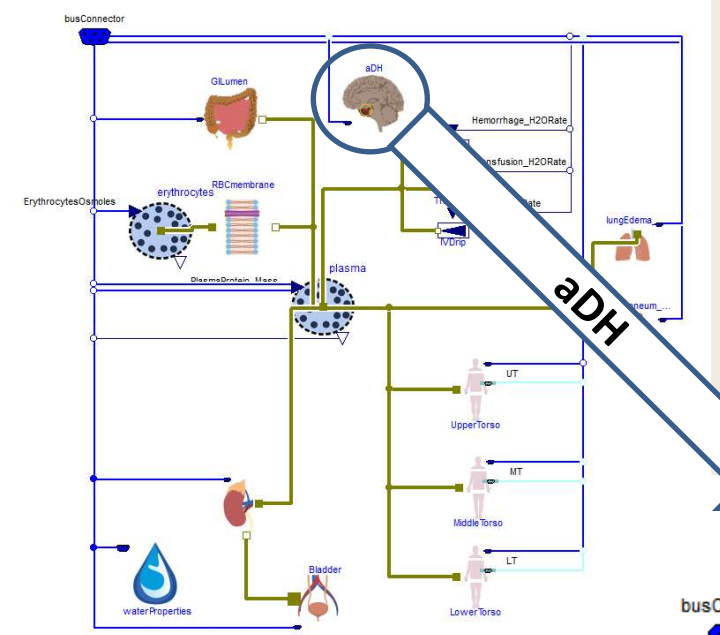
bladder
BladderVolume_Mass
BladerVoidFlow
CD_H2O_Outflow
bladd...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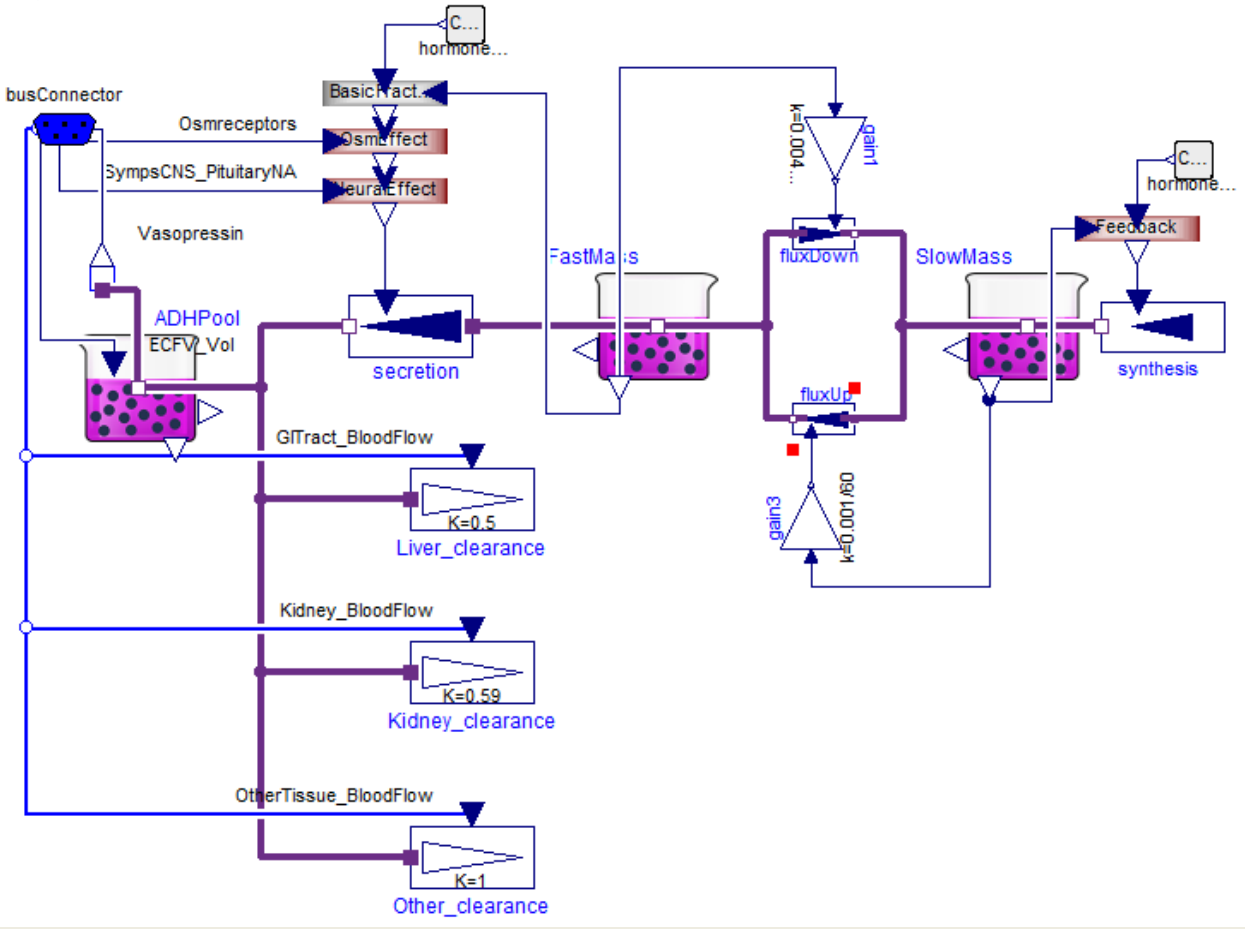
aDH
Hemorrhage_H2ORate
erythrocytes
RBCmembrane
ErythrocytesOsmoles
IVDrip
lungEdema
plasma
UT
UpperTorso
MT
MiddleTorso
LT
LowerTorso
Bladder
waterProperties

aDH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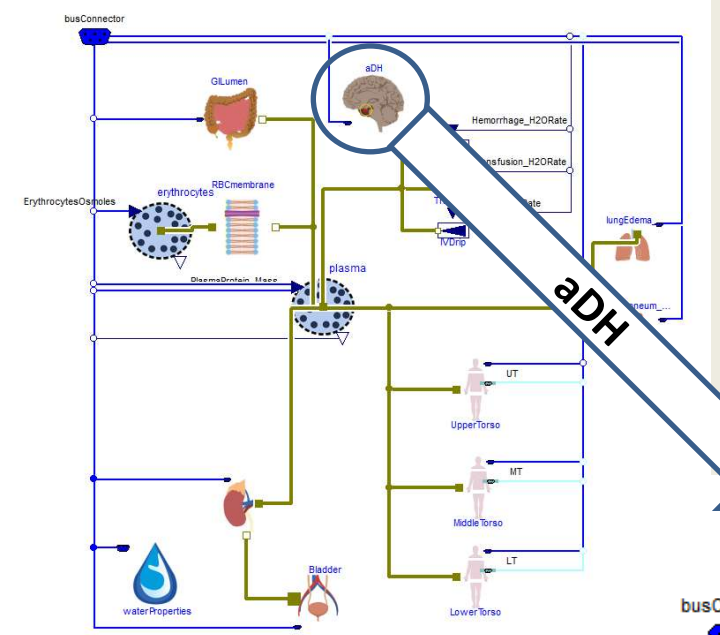
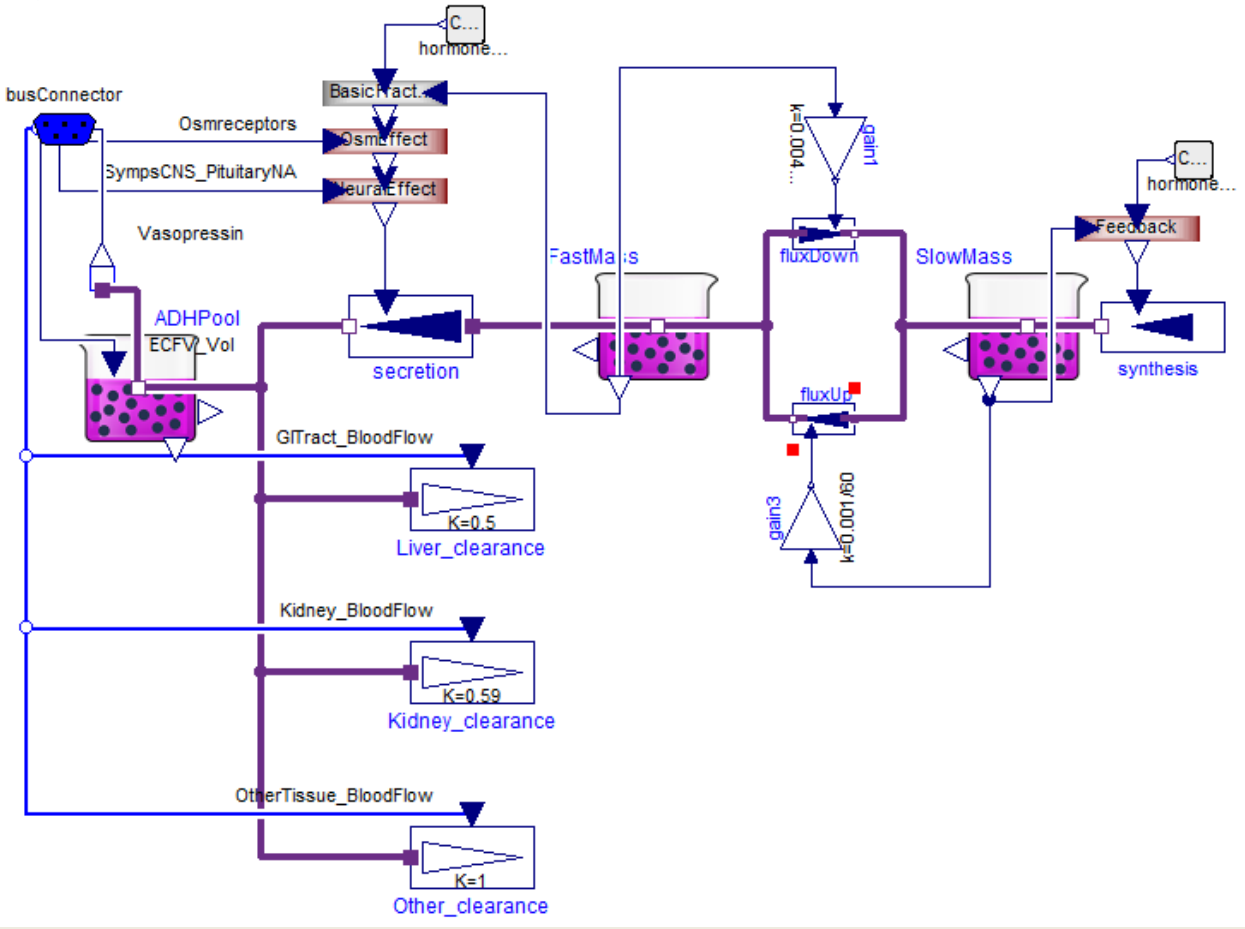
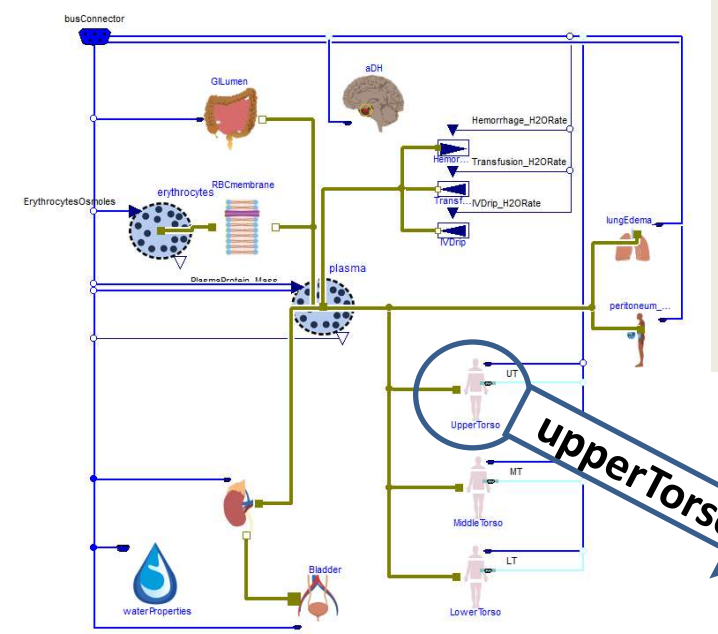
Vasopressin
BasicFract...
OsmEffect
NeuralEffect
ADHPool
ECFV_Vol
secretion
FastMass
fluxDown
gain1
k=0.004...
SlowMass
Feedback
synthesis
fluxUp
gain3
k=0.001/60
GITract_BloodFlow
K=0.5
Liver_clearance
Kidney_BloodFlow
K=0.59
Kidney_clearance
OtherTissue_BloodFlow
K=1
Other_clearance

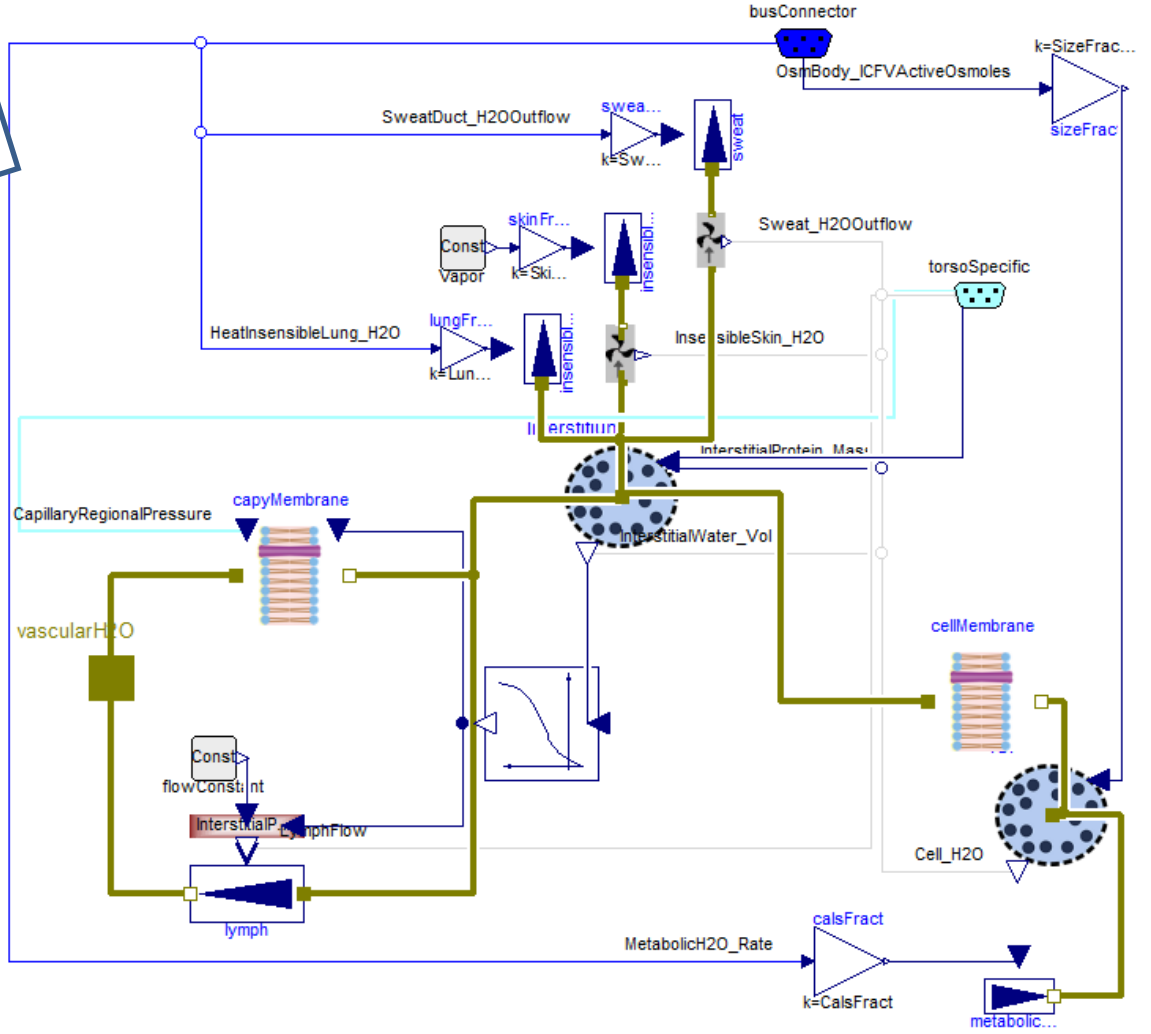

busConnector
GILumen
aDH
Hemorrhage_H2ORate
erythrocytes
RBCmembrane
ErythrocytesOsmoles
IVDrip
lungEdema
plasma
UT
UpperTorso
MT
MiddleTorso
LT
LowerTorso
Bladder
waterProperties

aDH


busConnector
Osmreceptors
SympsCNS_PituitaryNA
Vasopressin
BasicFract...
OsmEffect
NeuralEffect
ADHPool
ECFV_Vol
secretion
FastMass
fluxDown
gain1
k=0.004...
SlowMass
Feedback
synthesis
fluxUp
gain3
k=0.001/60
GITract_BloodFlow
K=0.5
Liver_clearance
Kidney_BloodFlow
K=0.59
Kidney_clearance
OtherTissue_BloodFlow
K=1
Other_clearance


busConnector
GILumen
aDH
Hemorrhage_H2ORate
Transfusion_H2ORate
IVDrip_H2ORate
IVDrip
RBCmembrane
erythrocytes
ErythrocytesOsmoles
plasma
lungEdema
peritoneum_...
UT
UpperTorso
MT
MiddleTorso
LT
LowerTorso
Bladder
waterProperties

upperTorso


busConnector
OsmBody_ICFVActiveOsmoles
k=SizeFrac...
sizeFrac
SweatDuct_H2OOutflow
swea...
k=Sw...
sweat
Sweat_H2OOutflow
Const
Vapor
skinFr...
k=Ski...
insensibl...
torsoSpecific
HeatInsensibleLung_H2O
lungFr...
k=Lun...
InsensibleSkin_H2O
InterstitialProtein_Mass
CapillaryRegionalPressure
capyMembrane
InterstitialWater_Vol
vascularH2O
cellMembrane
Const
flowConstant
lymphFlow
lymph
Cell_H2O
calsFract
MetabolicH2O_Rate
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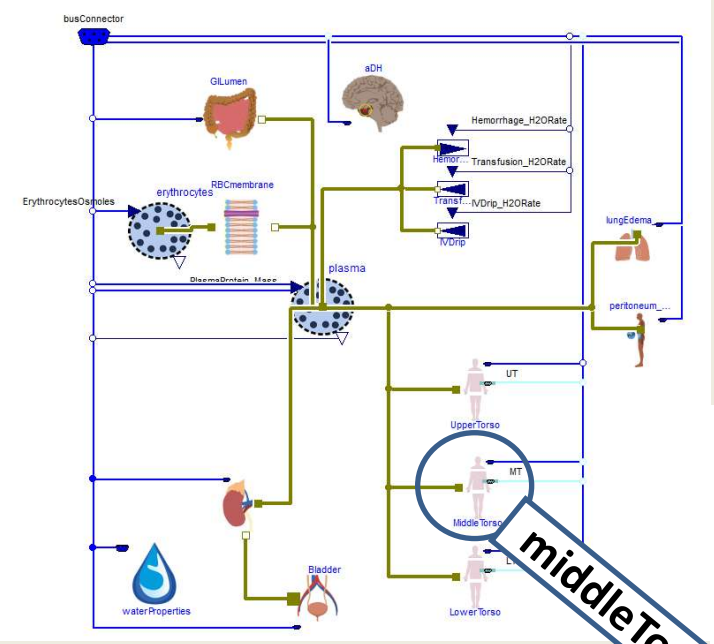
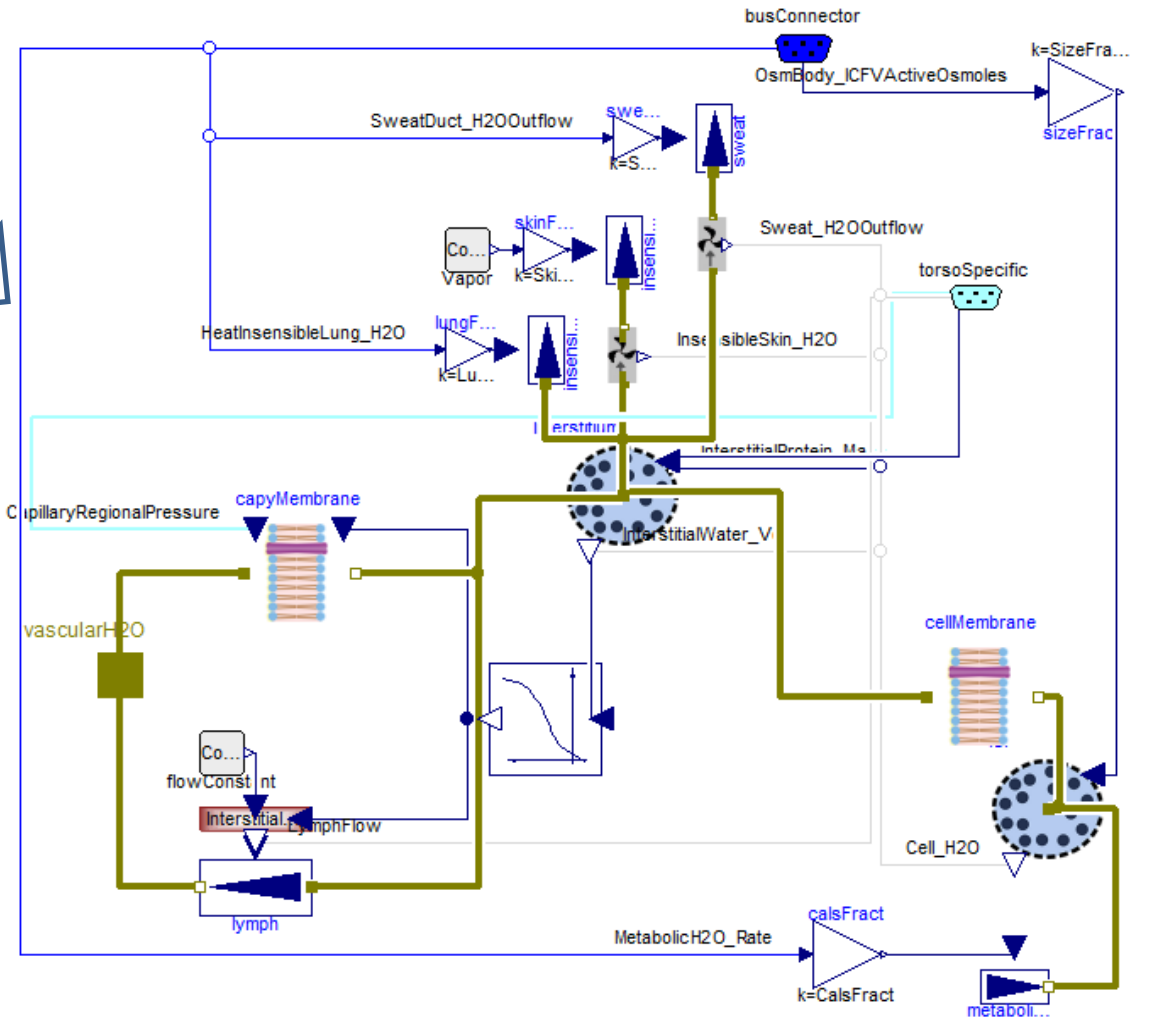
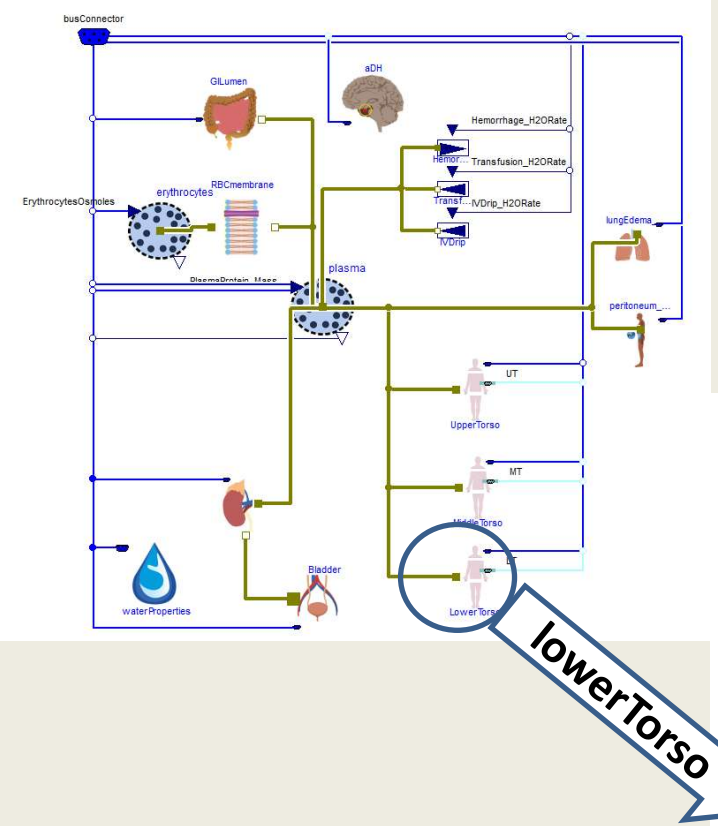
metabolic...

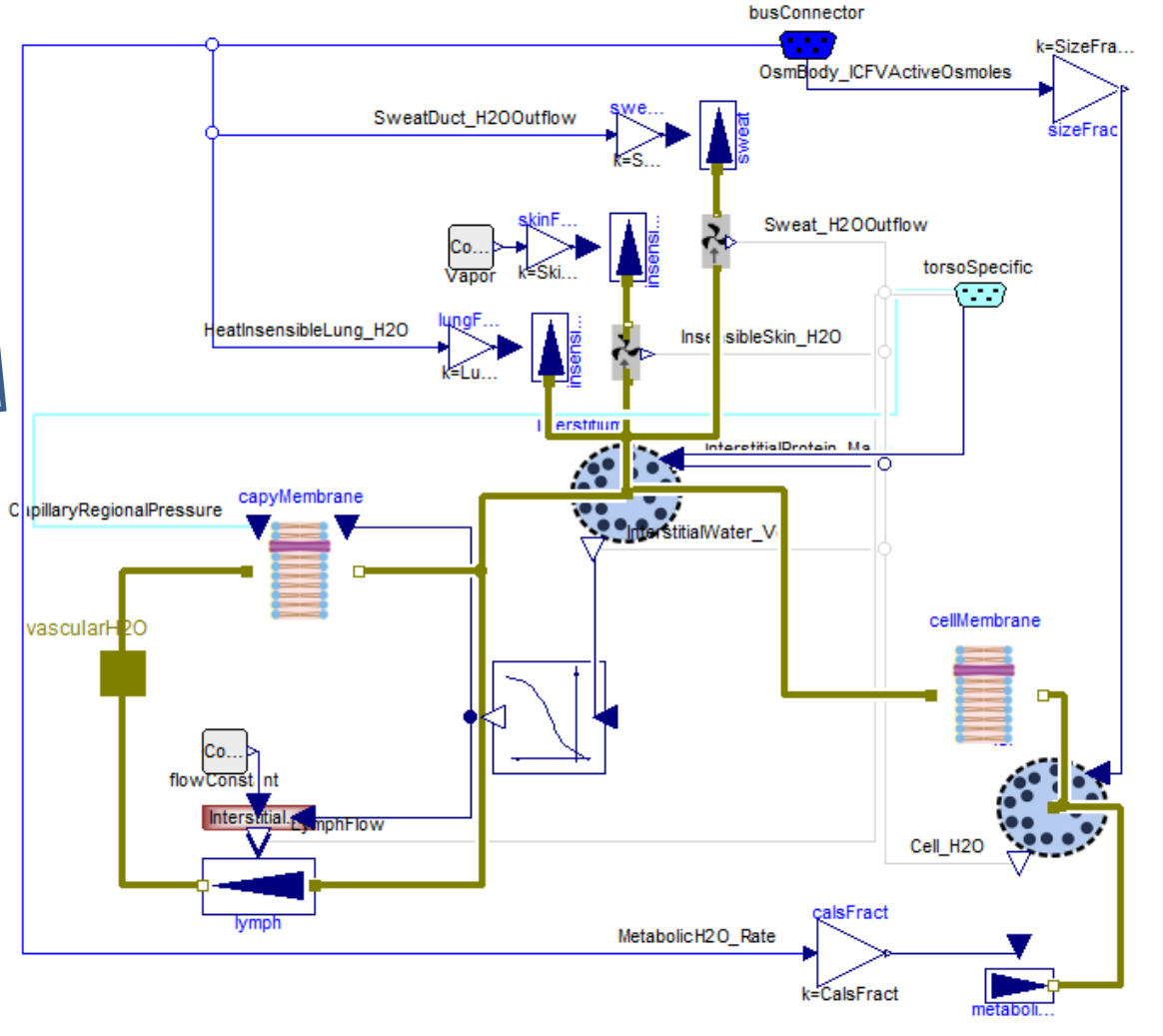


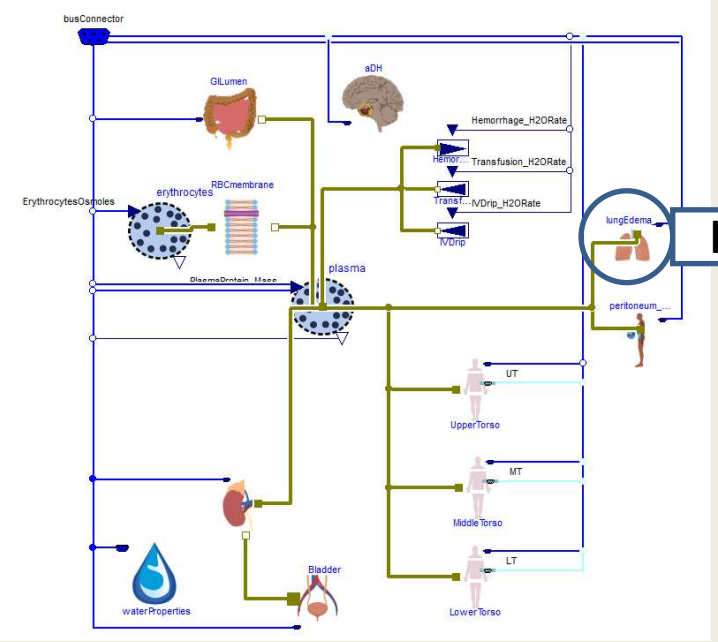
middleTorso



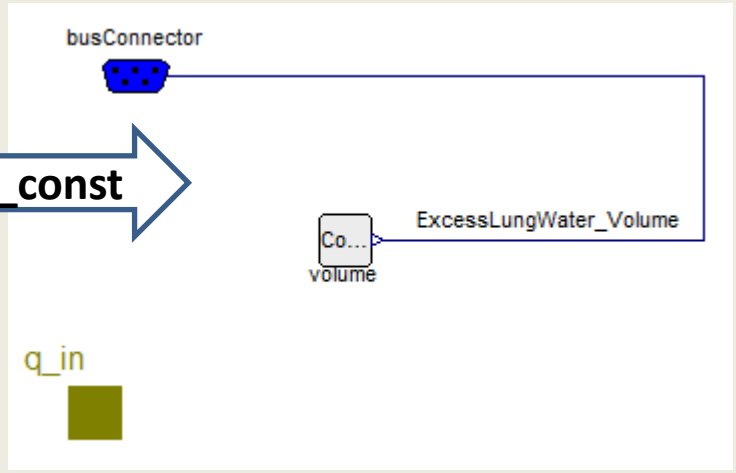

busConnector
GILumen
aDH
Hemorrhage_H2ORate
Transfusion_H2ORate
IVDrip_H2ORate
IVDrip
erythrocytes
RBCmembrane
ErythrocytesOsmoles
plasma
lungEdema
peritoneum_...
UT
UpperTorso
MT
MiddleTorso
LowerTorso
Bladder
waterProperties

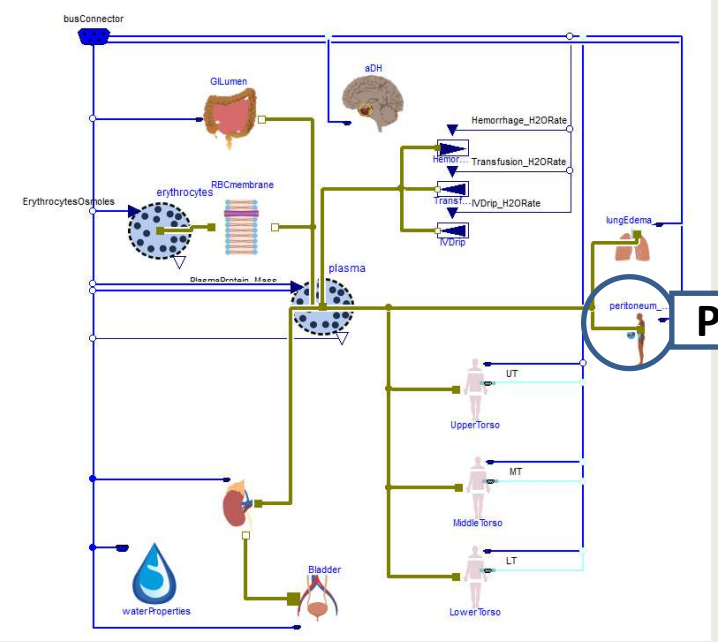
lowerTorso


busConnector
OsmBody_ICFVActiveOsmoles
k=SizeFra...
sizeFrac
SweatDuct_H2OOutflow
swe...
k=S...
sweat
skinF...
k=Ski...
insensi...
Sweat_H2OOutflow
Co...
Vapor
torsoSpecific
HeatInsensibleLung_H2O
lungF...
k=Lu...
InsensibleSkin_H2O
CapillaryRegionalPressure
capyMembrane
vascularH2O
cellMembrane
flowConst_nt
lymph
Cell_H2O
MetabolicH2O_Rate
calsFract
k=CalsFract

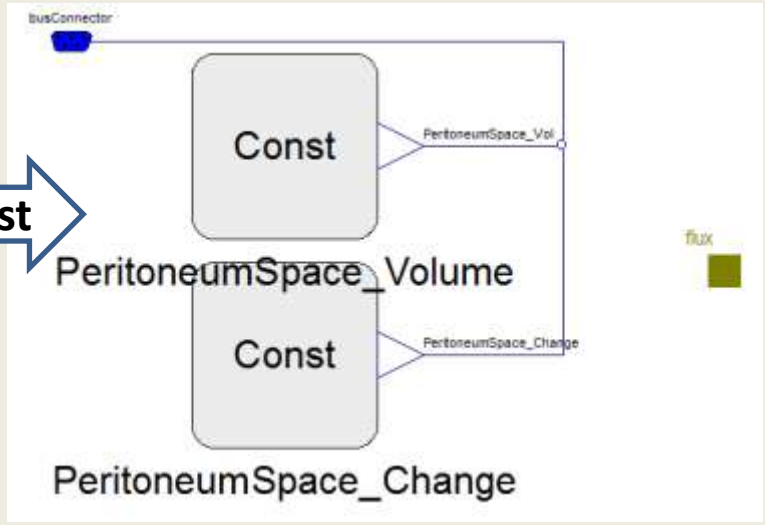


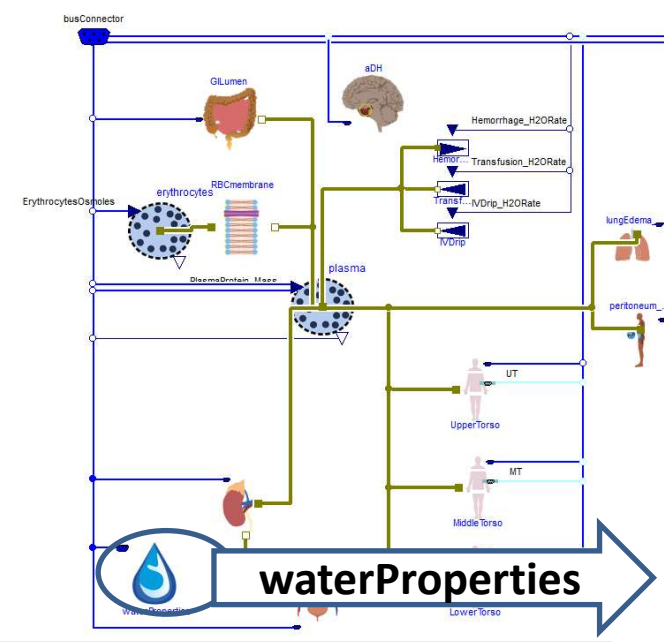
lungEdema_const

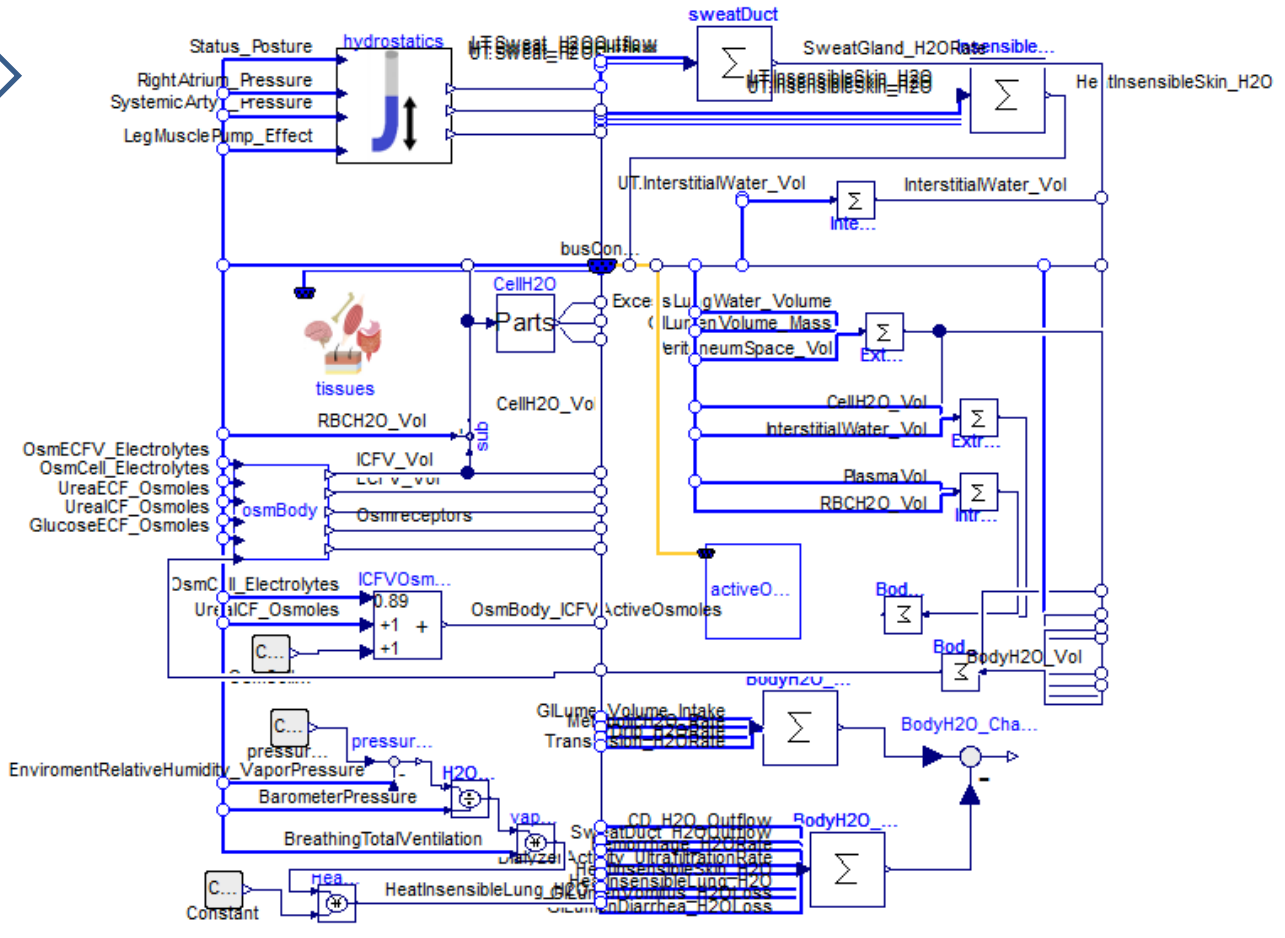


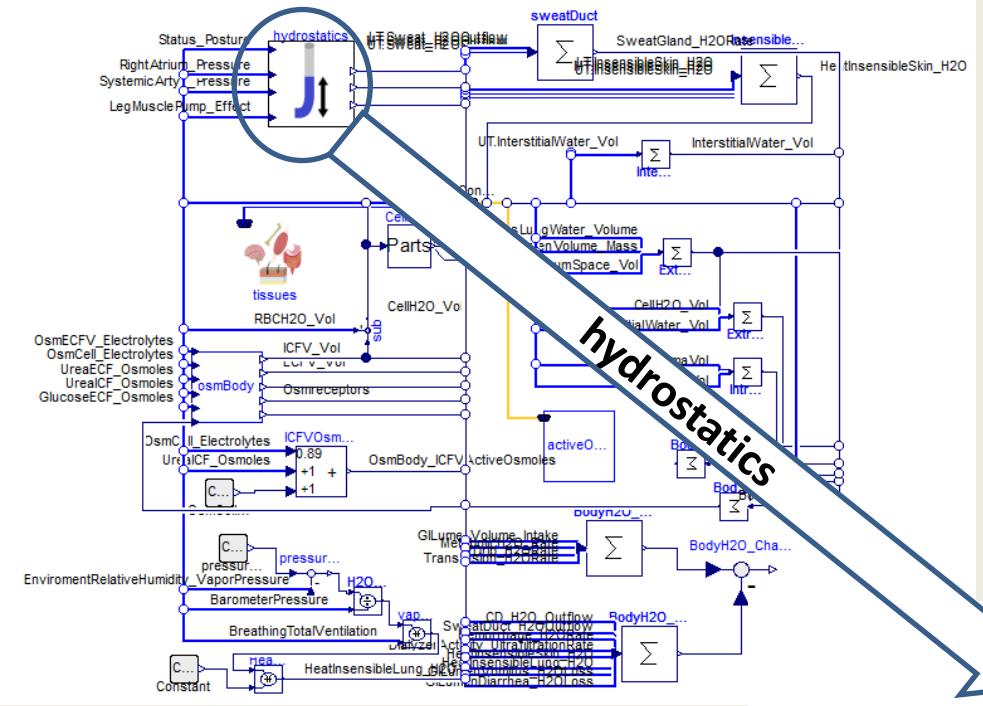


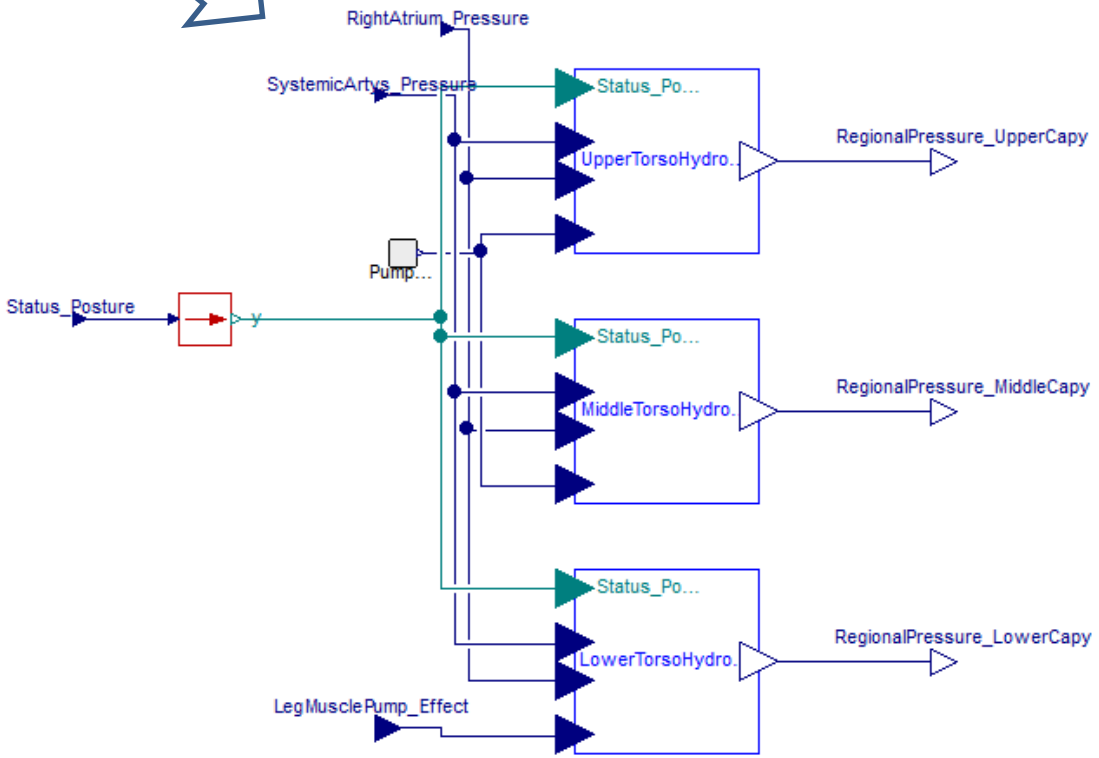
Peritoneum_const




busConnector
GILumen
aDH
Hemorrhage_H2ORate
Transfusion_H2ORate
IVDrip_H2ORate
IVDrip
erythrocytes
RBCmembrane
ErythrocytesOsmoles
plasma
lungEdema
peritoneum_...
UT
UpperTorso
MT
MiddleTorso
LowerTorso
waterProperties


sweatDuct
Status_Posture
hydrostatics
RightAtrium_Pressure
SystemicArty_Pressure
LegMusclePump_Effect
SweatGland_H2ORate
UT.InterstitialWater_Vol
InterstitialWater_Vol
busCon...
CellH2O
Parts
tissues
RBCH2O_Vol
CellH2O_Vo
sub
OsmECFV_Electrolytes
OsmCell_Electrolytes
UreaECF_Osmoles
UrealCF_Osmoles
GlucoseECF_Osmoles
ICFV_Vol
OsmBody
OsmReceptors
ICFVOsm...
0.89
+1
+1
OsmBody_ICFV_ActiveOsmoles
activeO...
CellH2O_Vol
InterstitialWater_Vol
PlasmaVol
RBCH2O_Vol
BodyH2O_Vol
BodyH2O_Cha...
pressur...
EnviromentRelativeHumidity
_VaporPressure
BarometerPressure
H2O...
BreathingTotalVentilation
HeatInsensibleLung_H2O
Constant
CD_H2O_Outflow
BodyH2O_...


hydrostatics
Status_Posture
RightAtrium_Pressure
SystemicArtys_Pressure
LegMusclePump_Effect
sweatDuct
SweatGland_H2ORate
InsensibleSkin_H2O
UT.InterstitialWater_Vol
InterstitialWater_Vol
Parts
tissues
RBCH2O_Vol
ICFV_Vol
OsmECFV_Electrolytes
OsmCell_Electrolytes
UreaECF_Osmoles
UrealCF_Osmoles
GlucoseECF_Osmoles
OsmBody
OsmReceptors
ICFVOsm...
OsmBody_ICFV_ActiveOsmoles
activeO...
GILumen_Volume_Intake
BodyH2O_Cha...
EnviromentRelativeHumidity
VaporPressure
BarometerPressure
BreathingTotalVentilation
HeatInsensibleLung_H2O
Constant


RightAtrium_Pressure
SystemicArtys_Pressure
Status_Po...
UpperTorsoHydro...
RegionalPressure_UpperCapy
Pump...
Status_Posture
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MiddleTorsoHydro...
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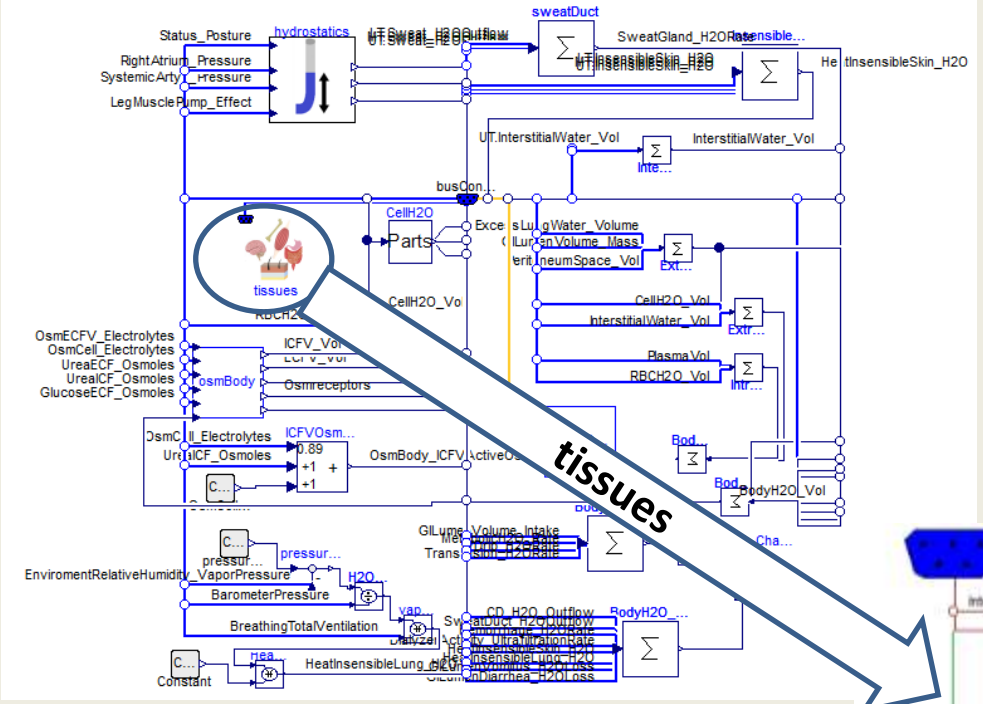
Status_Po...
LowerTorsoHydro...
RegionalPressure_LowerCapy
LegMusclePump_Effect


sweatDuct
Status_Posture
hydrostatics
RightAtrium_Pressure
SystemicArty_Pressure
LegMusclePump_Effect
SweatGland_H2ORate
InsensibleSkin_H2O
UT.InterstitialWater_Vol
InterstitialWater_Vol
busCon...
CellH2O
Parts
tissues
CellH2O_Vol
InterstitialWater_Vol
PlasmaVol
RBCH2O_Vol
OsmECFV_Electrolytes
OsmCell_Electrolytes
UreaECF_Osmoles
UreaICF_Osmoles
GlucoseECF_Osmoles
osmBody
OsmReceptors
ICFVOsm...
0.89
OsmBody_ICFV_ActiveOs...
BodyH2O_Vol
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VaporPressure
BarometerPressure
H2O
BreathingTotalVentilation
HeatInsensibleLung_dt
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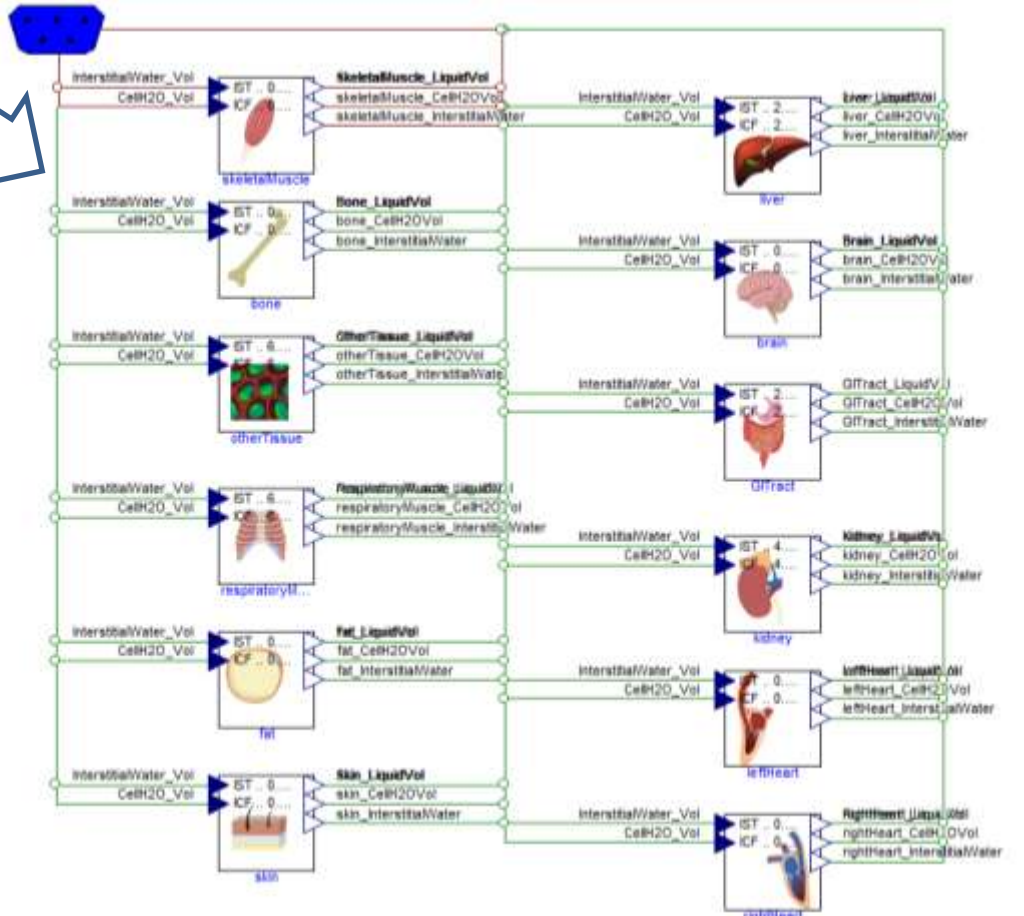
tissues


InterstitialWater_Vol
CellH2O_Vol
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otherTissue
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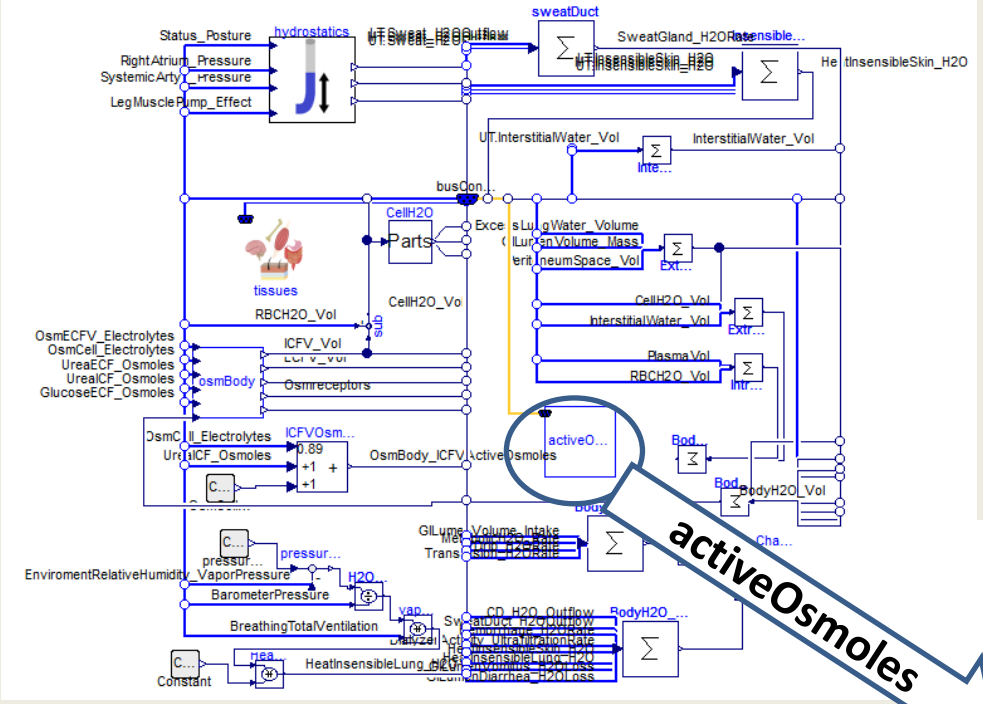
skin
liver
brain
GITract
kidney
leftHeart



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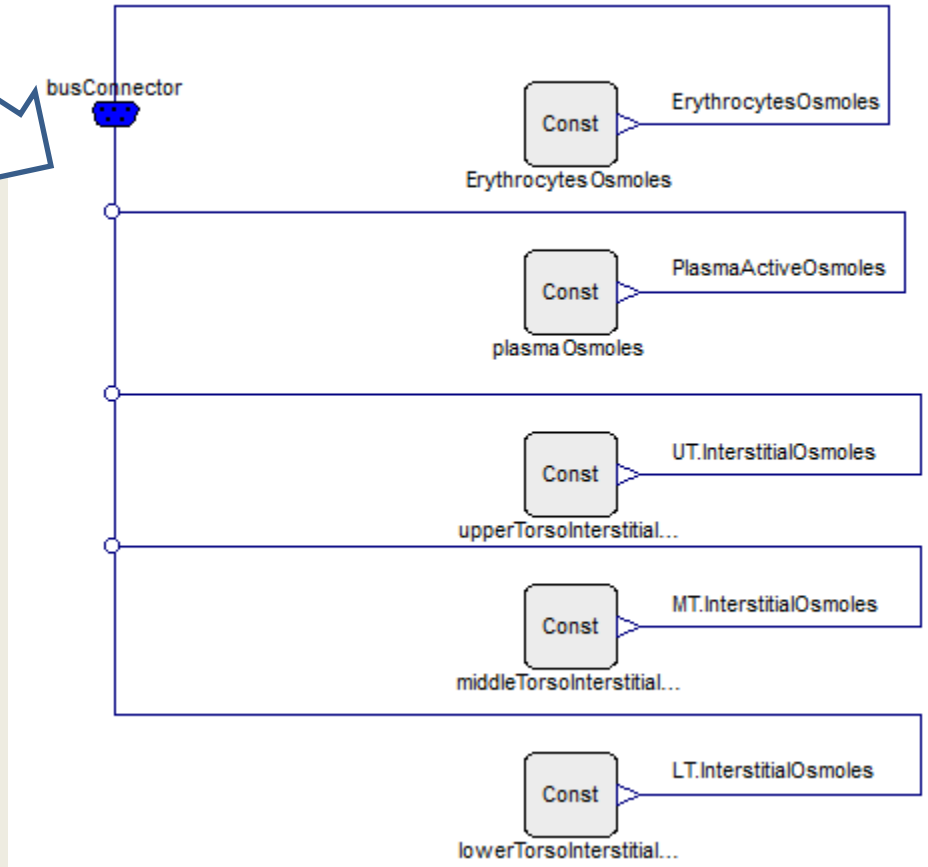

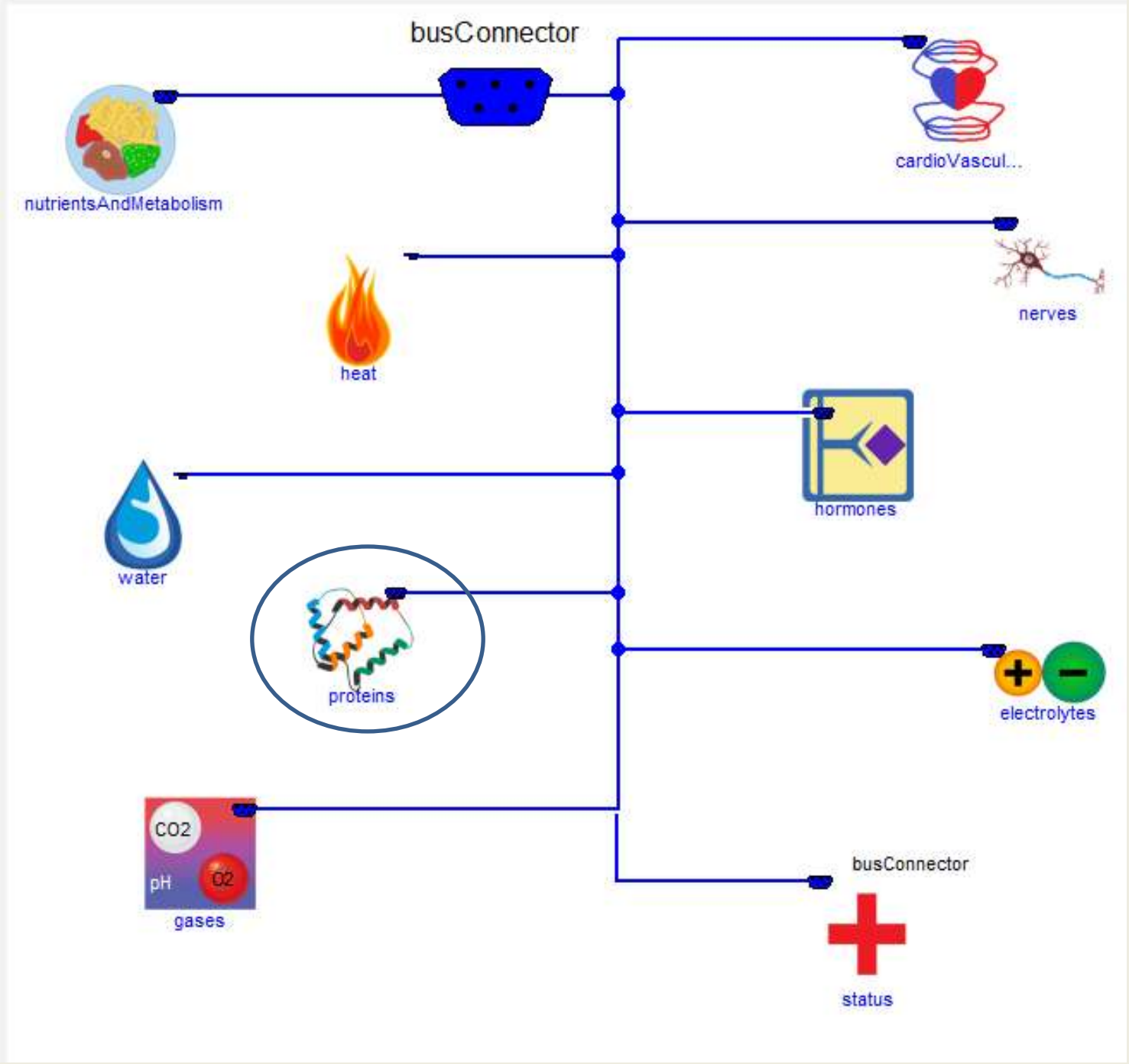
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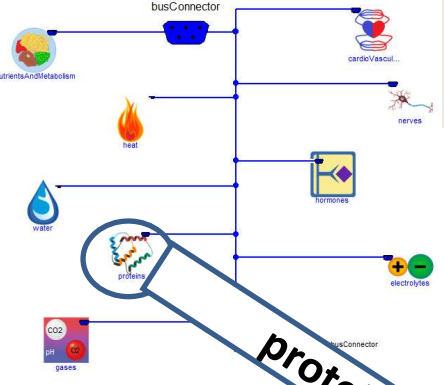
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status



proteins

synthesis

plasma
PlasmaVol
PlasmaProtein_Mass
PlasmaProteinConc
prot...
ctAlb
ctGlb

UT_Lymph
UT.LymphFlow
UpperTorso
UT.InterstitialWater_Vol
UT.InterstitialProtein_Mass

MT_Lymph
MT.LymphFlow
MiddleTorso
MT.InterstitialWater_Vol
MT.InterstitialProtein_Mass

busConnector

LT_Lymph
LT.LymphFlow
LowerTorso
LT.Interstiti lWater_Vol
LT.Inters itialProtein_Mass

peritoneum
PeritoneumSpace_Vol
Change

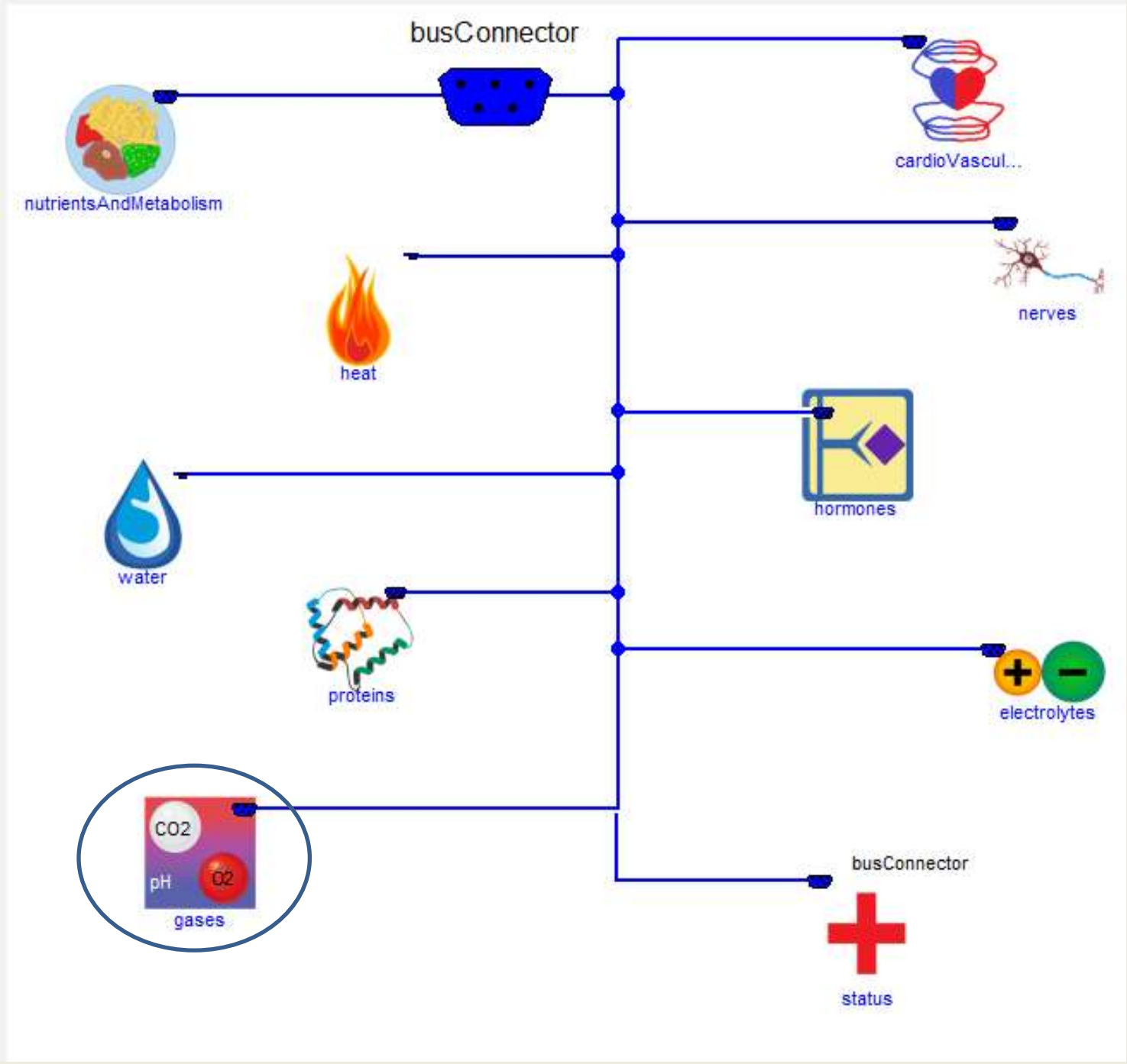
degradation

Bladder
BladderVolume_Mass

IVDripProteinRate
IVDrip

Transfusion_ProteinRate
Transfusion

Hemorrhage_ProteinRate
Hemorrhage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heat
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water
proteins
electrolytes
CO2
pH
O2
gases
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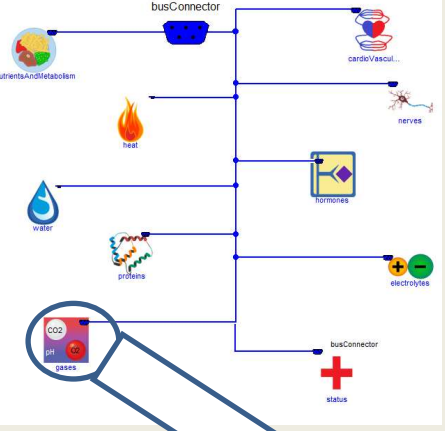
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nerves
heat
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proteins
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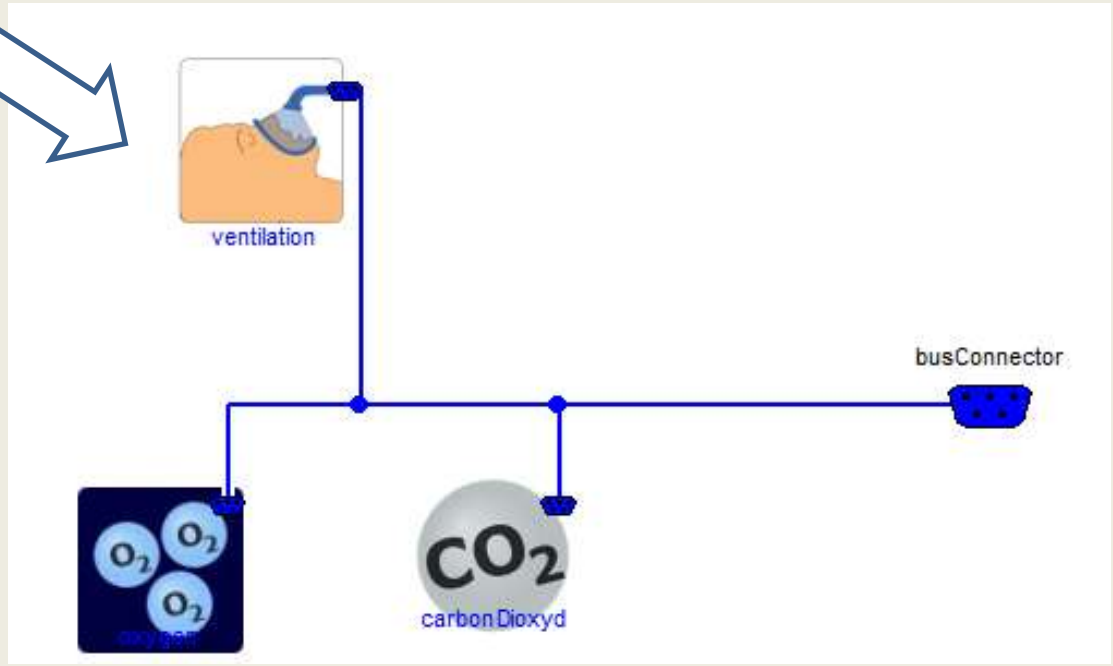
CO2
pH
gases
busConnector
status

gases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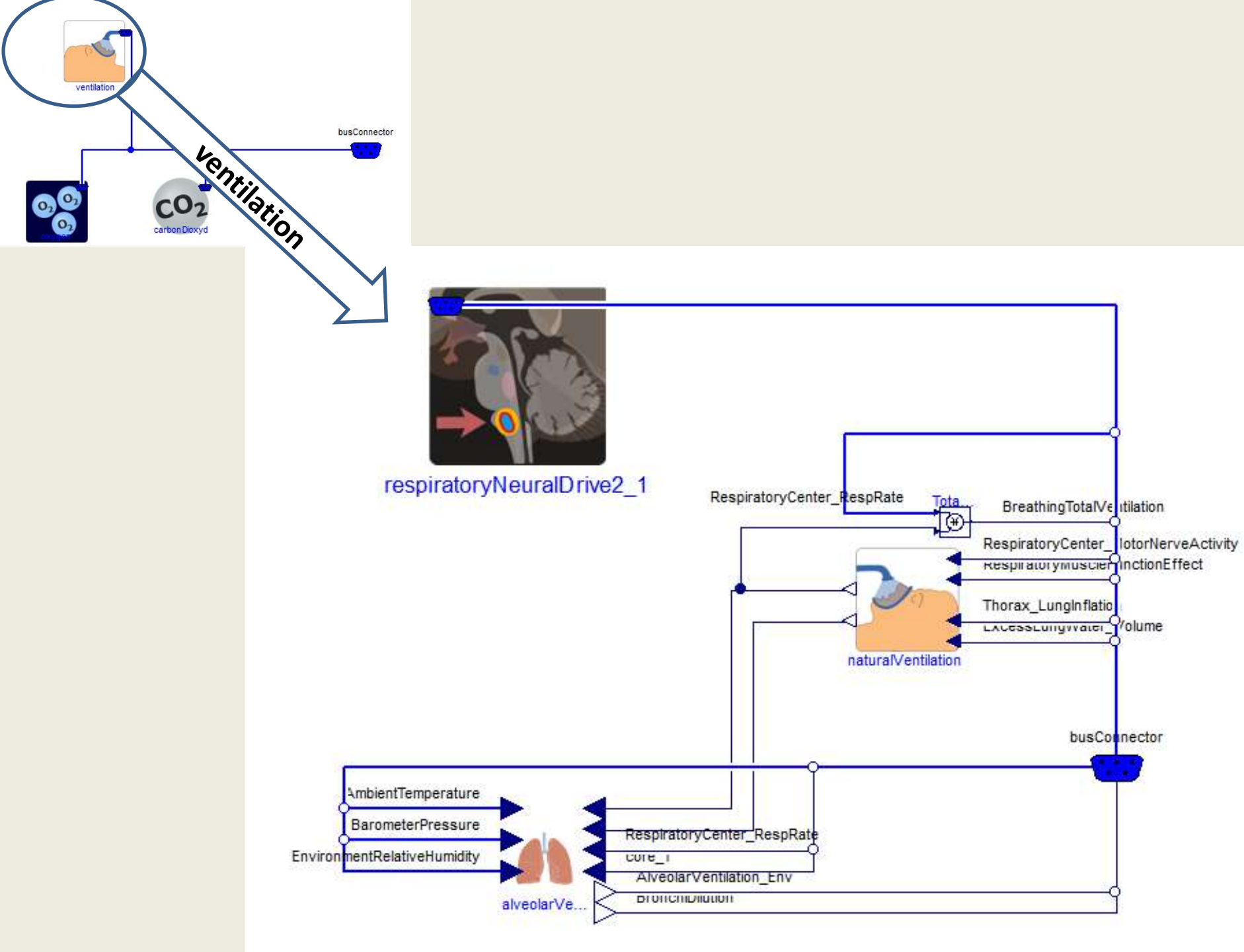
busConnector
O2
O2
O2
CO2
carbonDioxyd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busConnector
ventilation
carbonDioxyd
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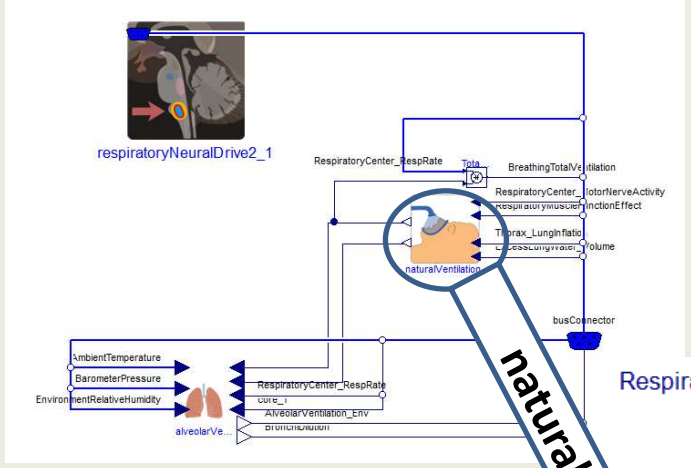
RespiratoryCenter_RespRate
Tota
BreathingTotalVe tilation
RespiratoryCenter_ lotorNerveActivity
Respiratorymuscler InctionEffect
Thorax_LungInflatio
Volume
naturalVentilation
busConnector
AmbientTemperature
BarometerPressure
EnvironmentRelativeHumidity
RespiratoryCenter_RespRate
core_T
AlveolarVentilation_Env
Bronchidilation
alveolarVe...



naturalVentilation

RespiratoryCenterOutput_MotorNerveActivity

RespiratoryMuscleFunctionEffect

Thorax_LungInflation

ExcessLungWater_Volume

tidalVol0

TidalVolume

max

Const

Breathing_TidalVolumeMin

product

DeadSpace

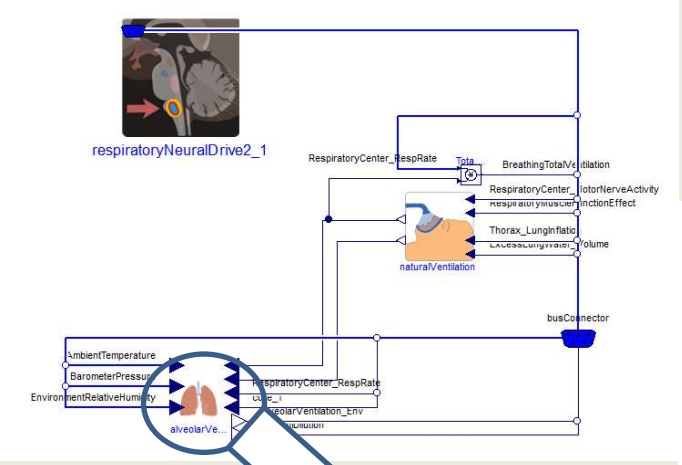
add

+1

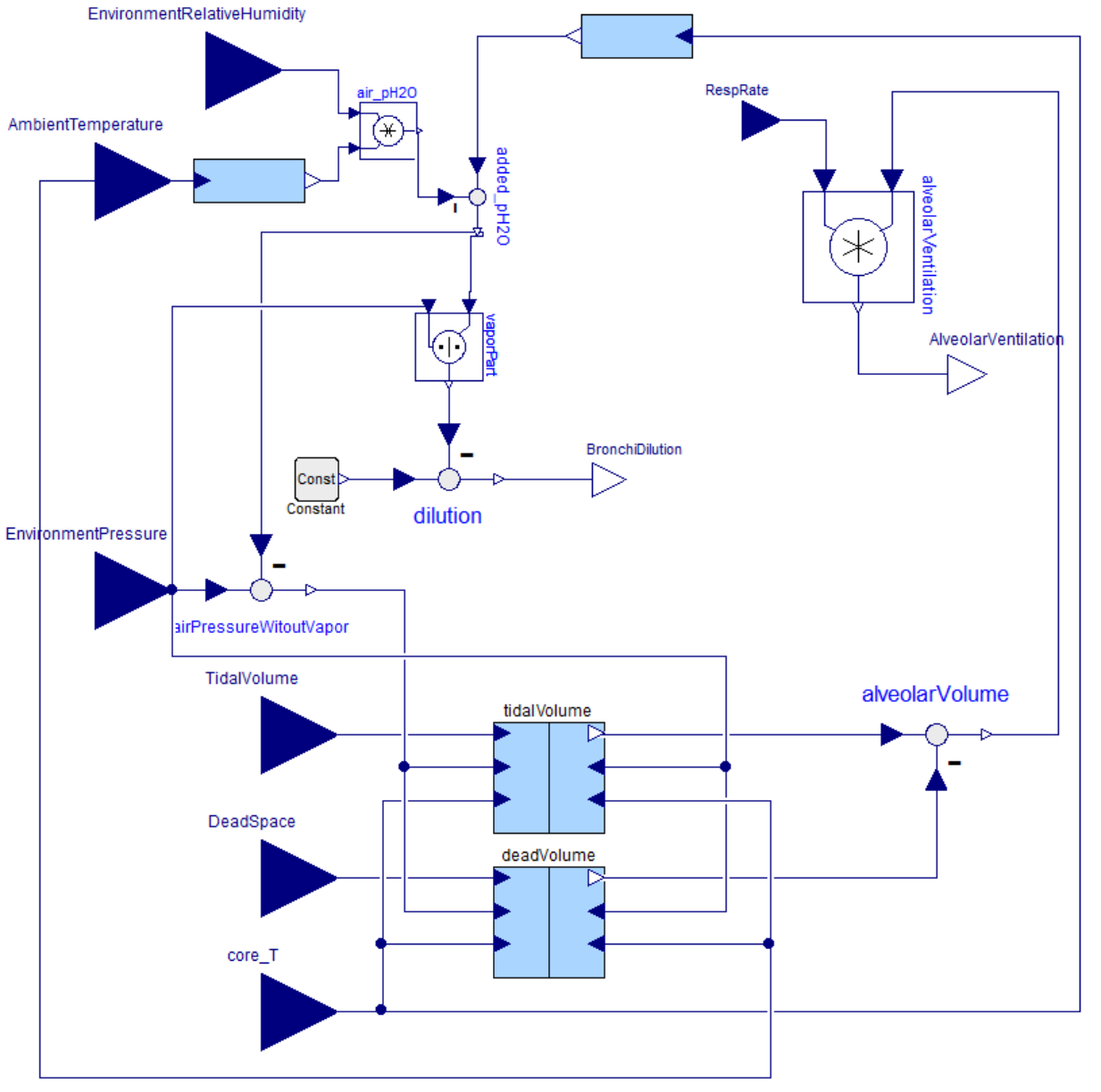
+1

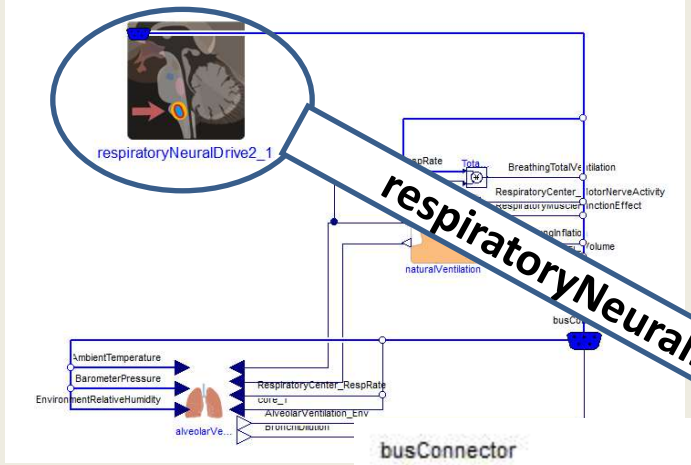
Const

Const



alveolarVentilation





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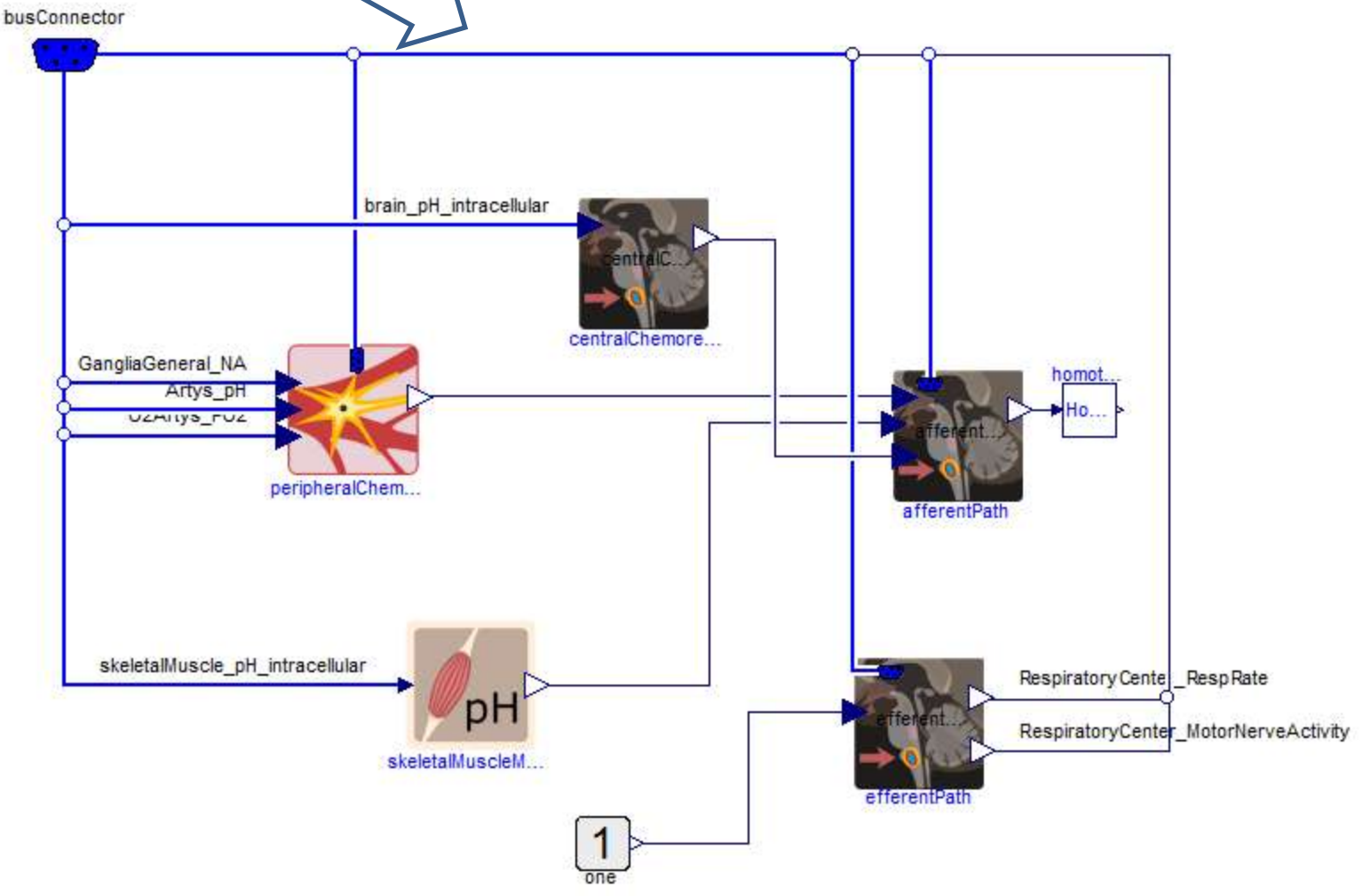
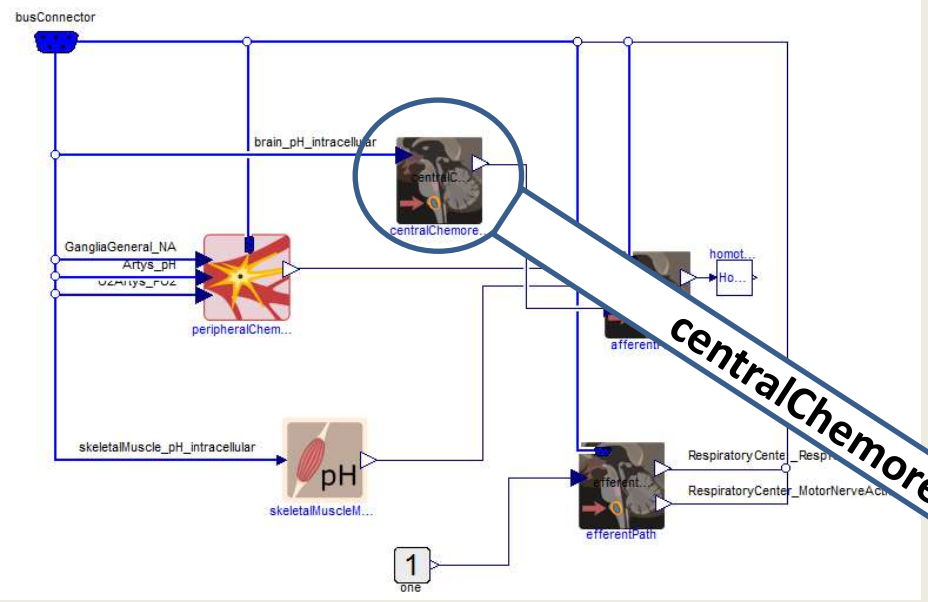
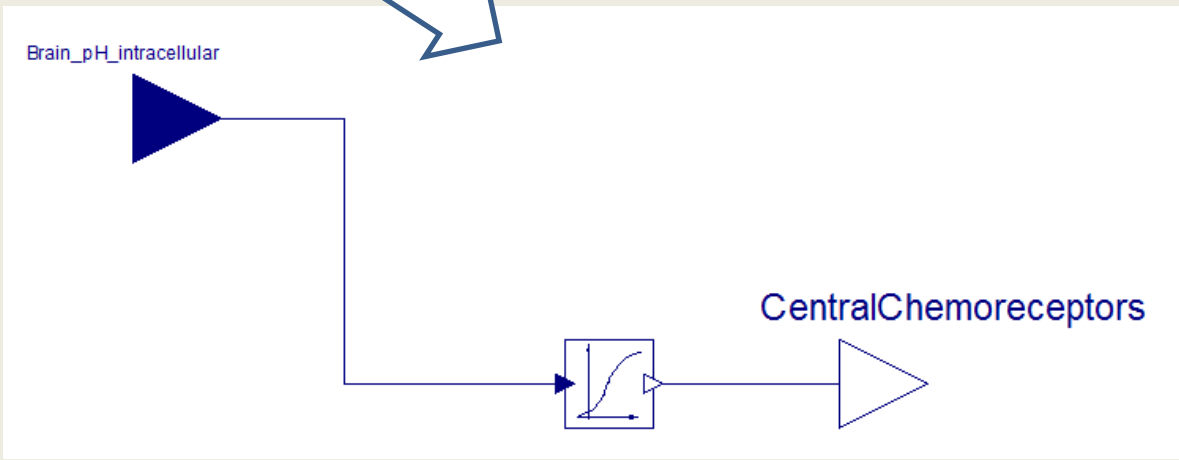
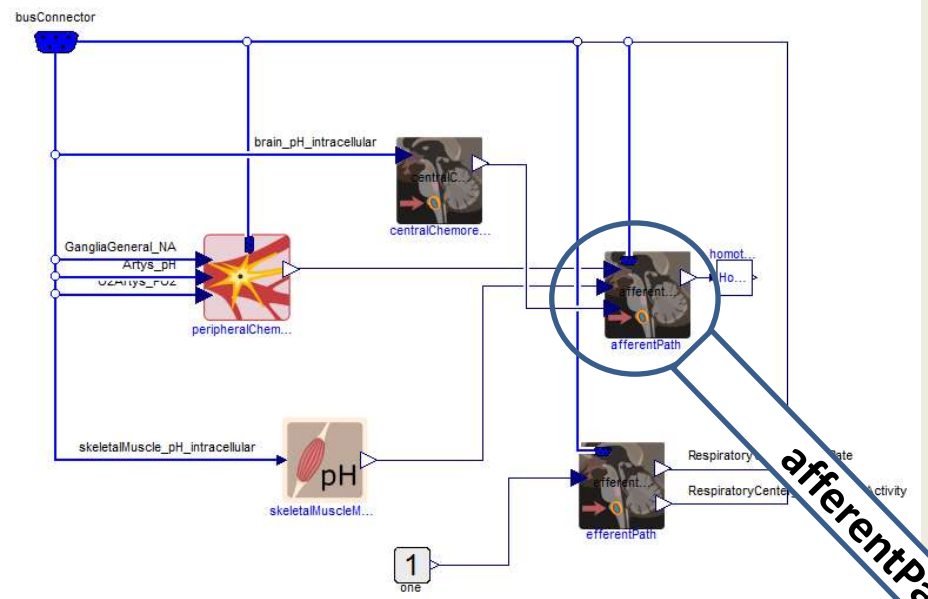




centralChemoreceptor





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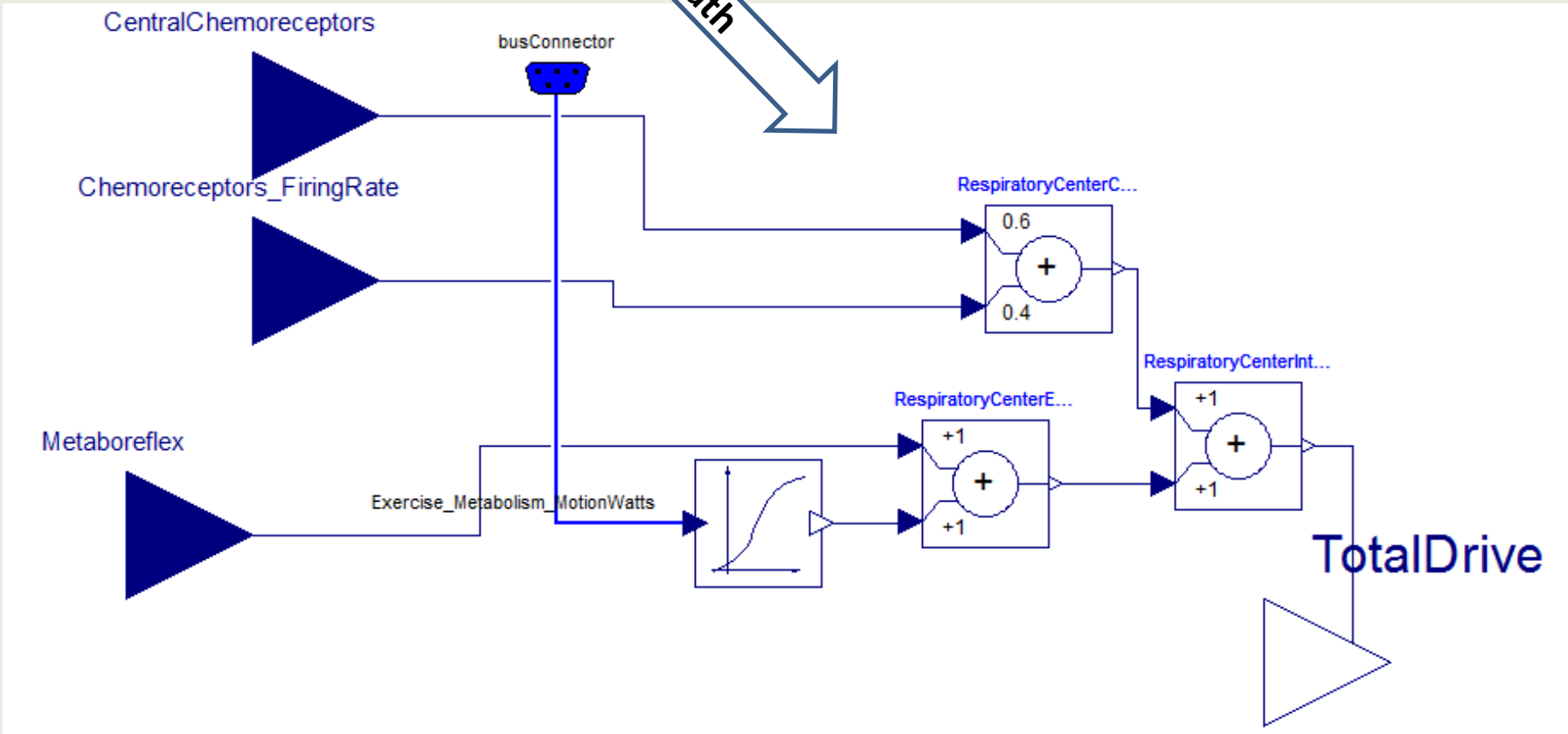

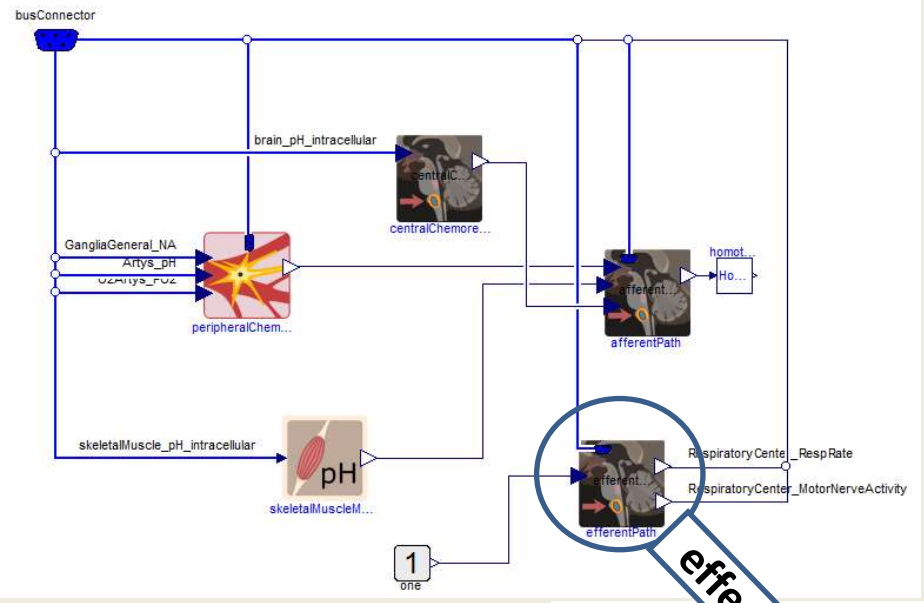

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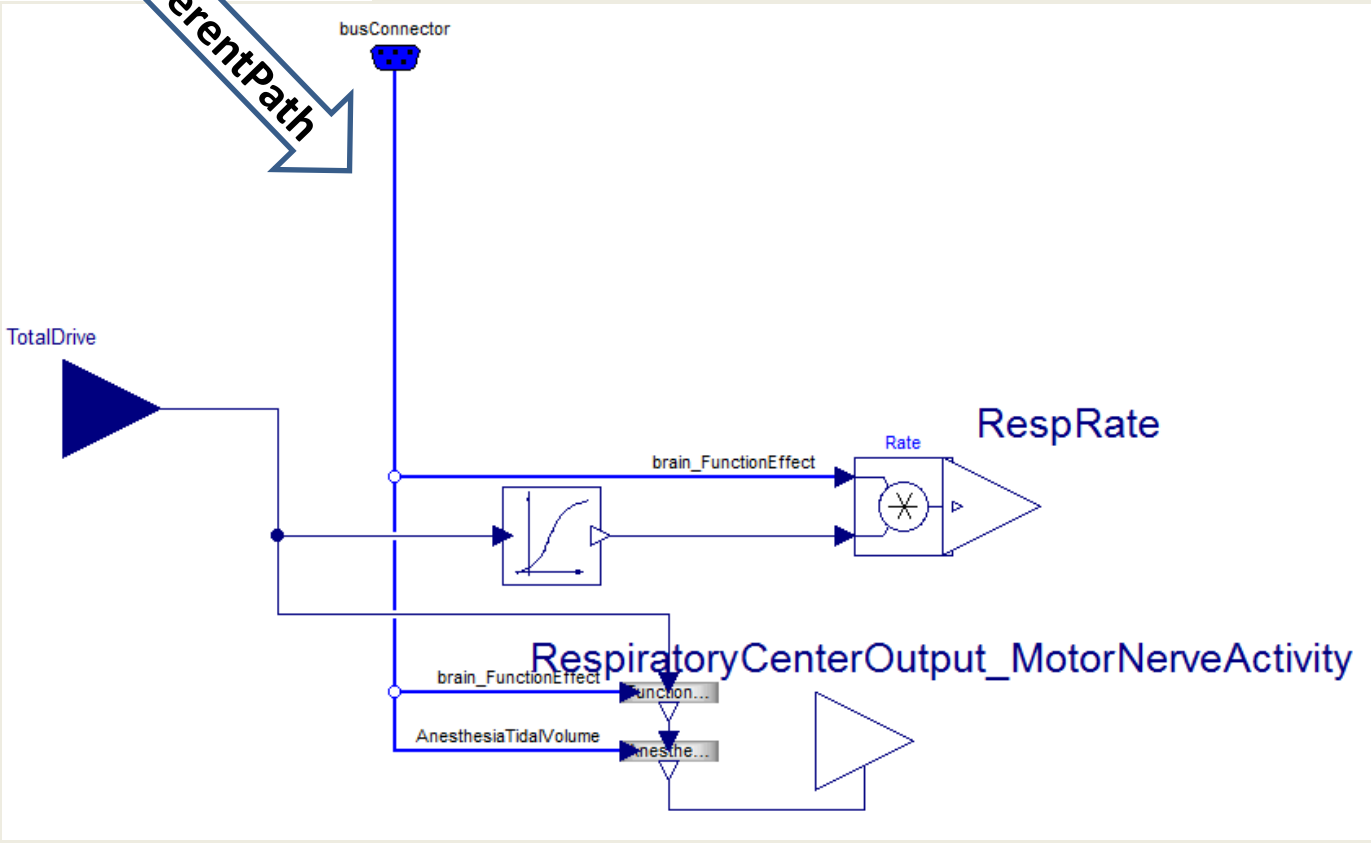
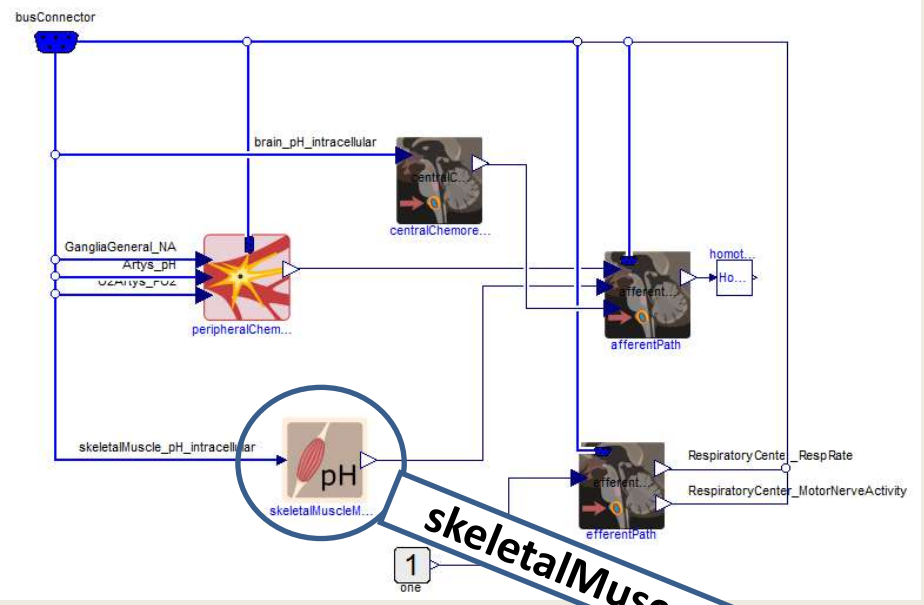
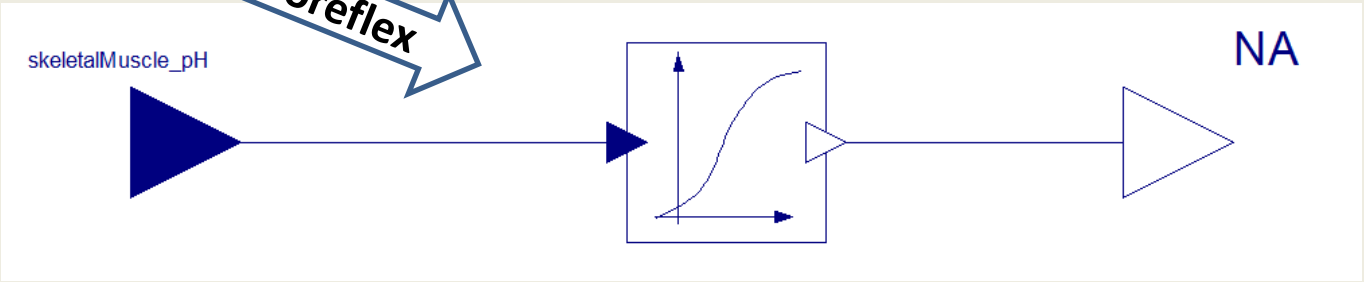
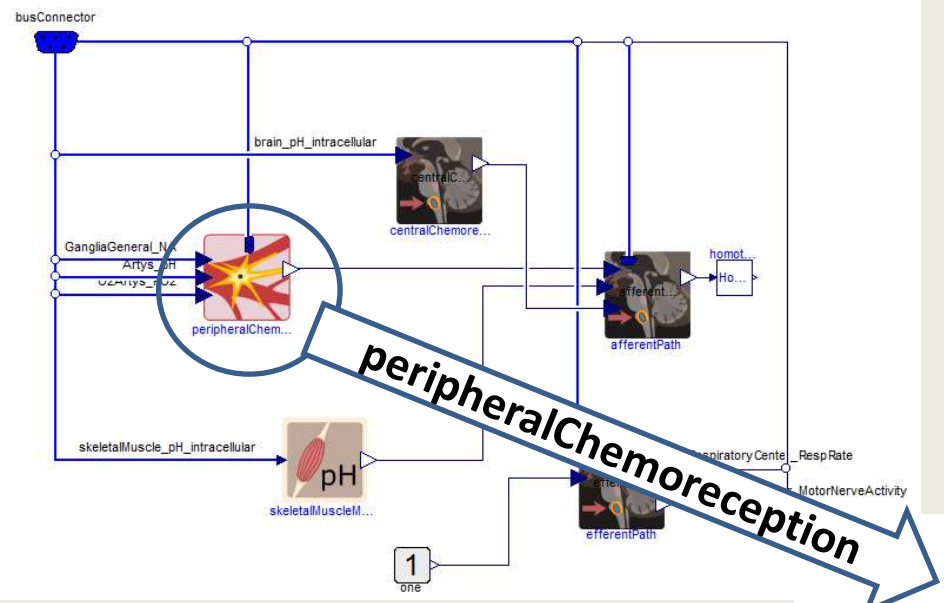


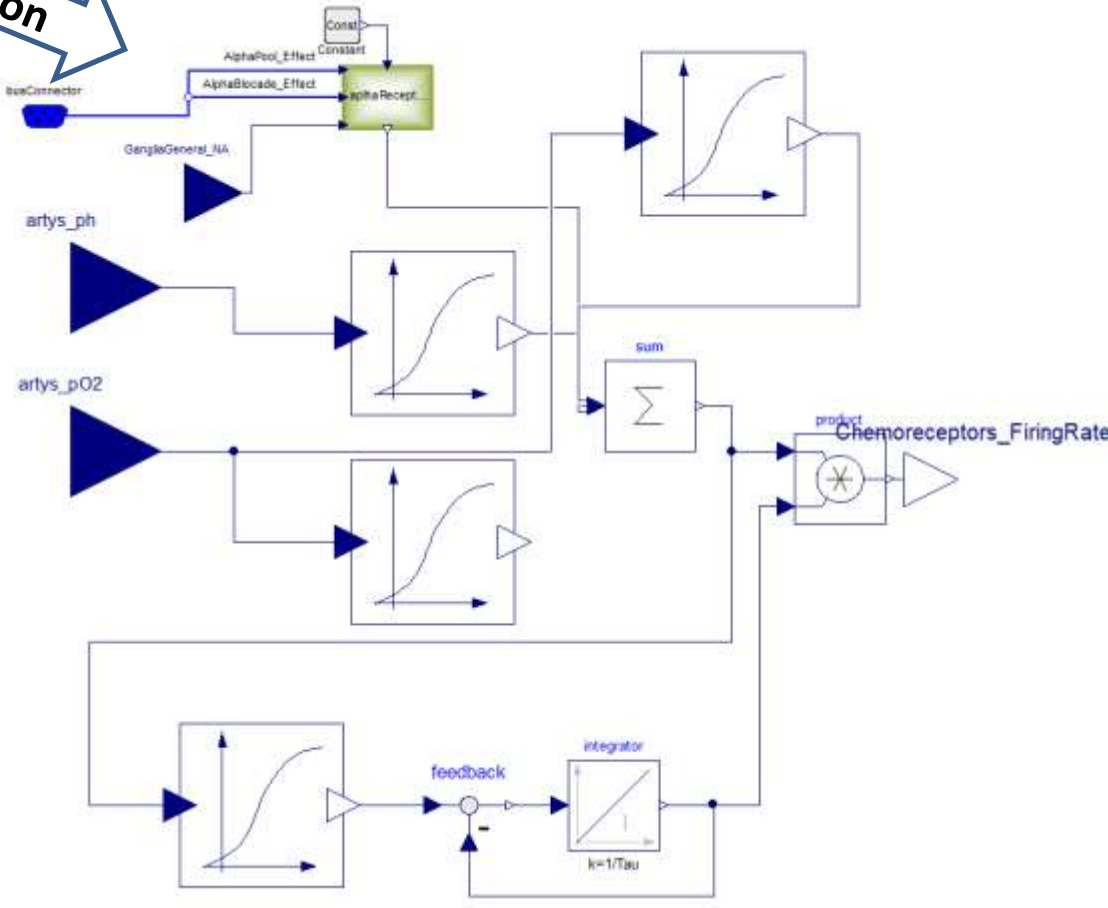


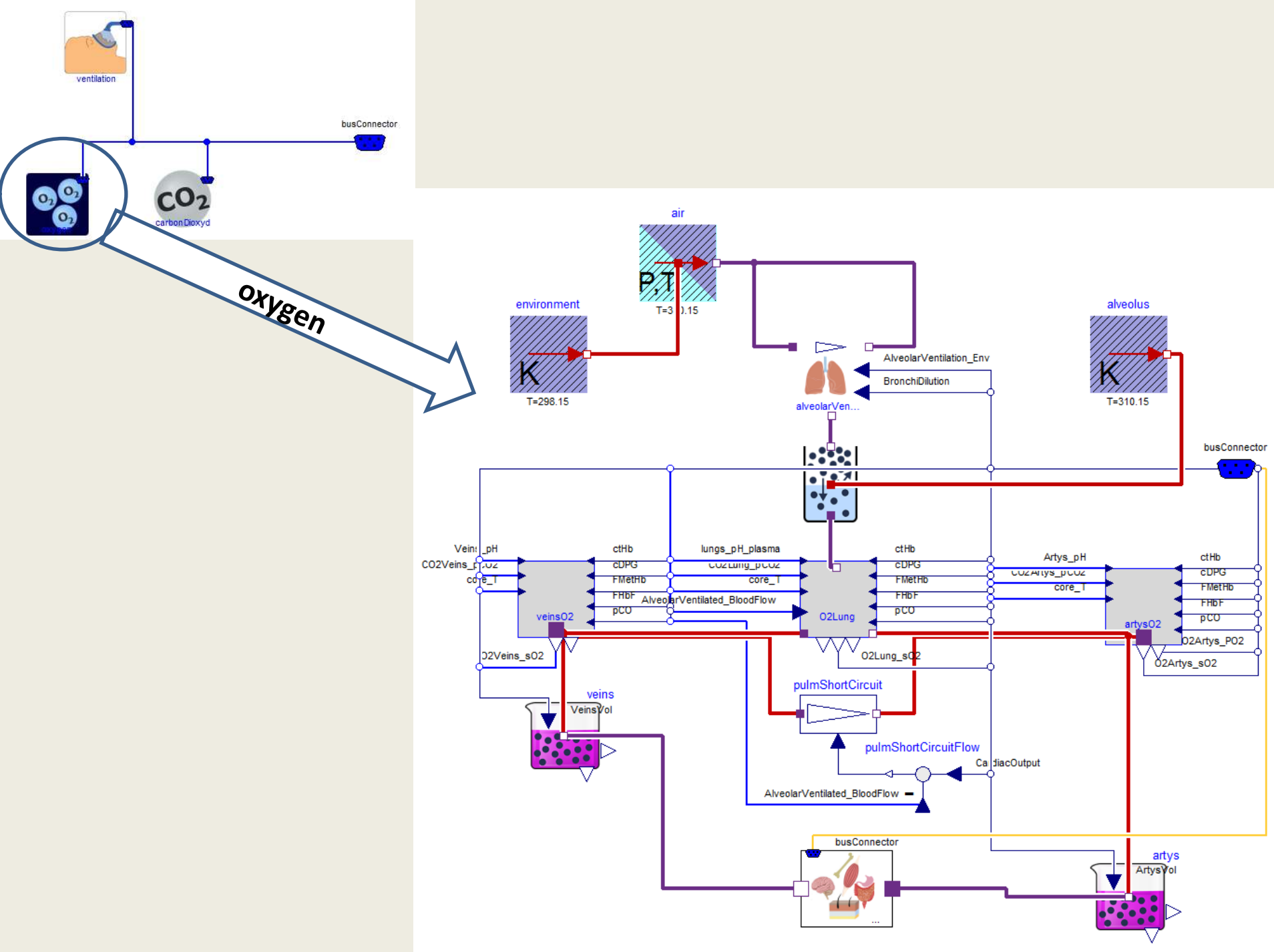
skeletalMuscelMetaboreflex

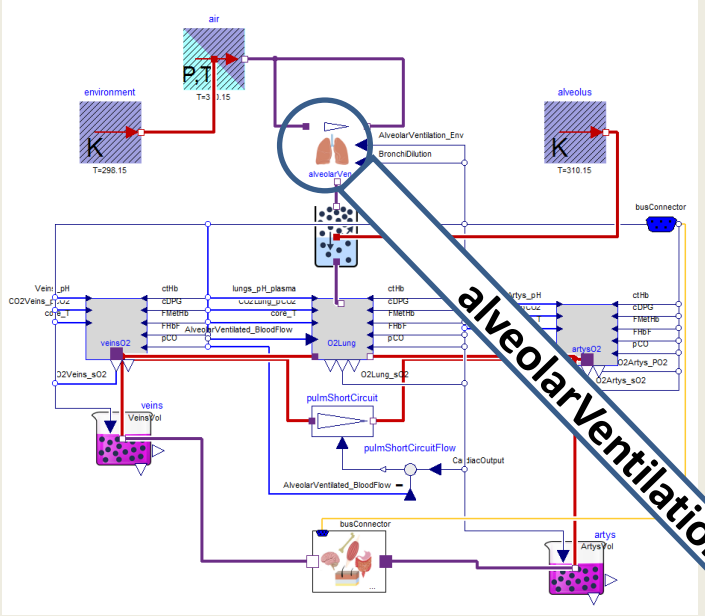




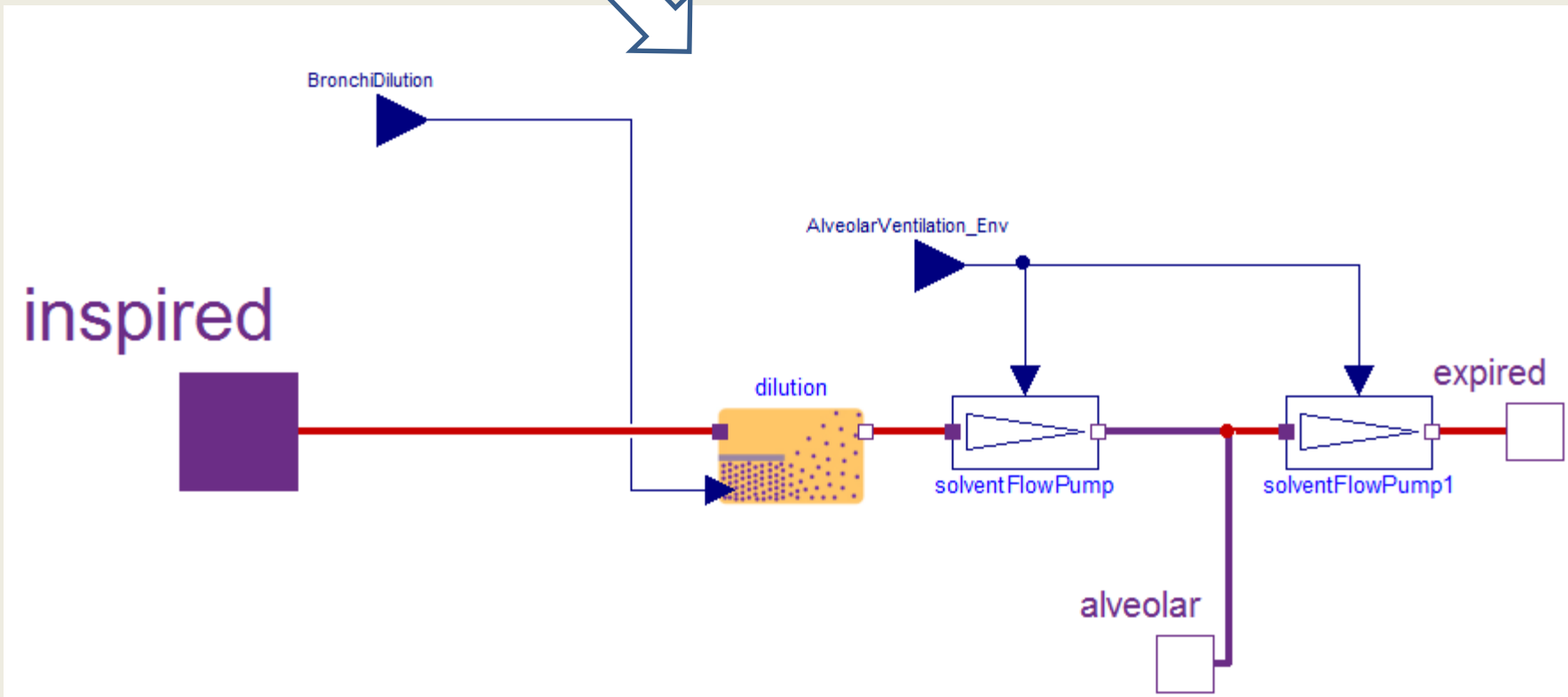
peripheralChemoreception

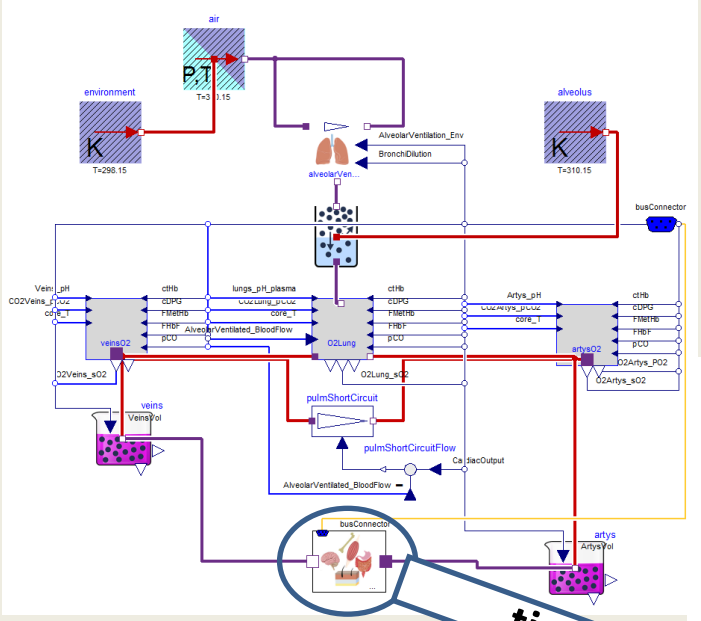


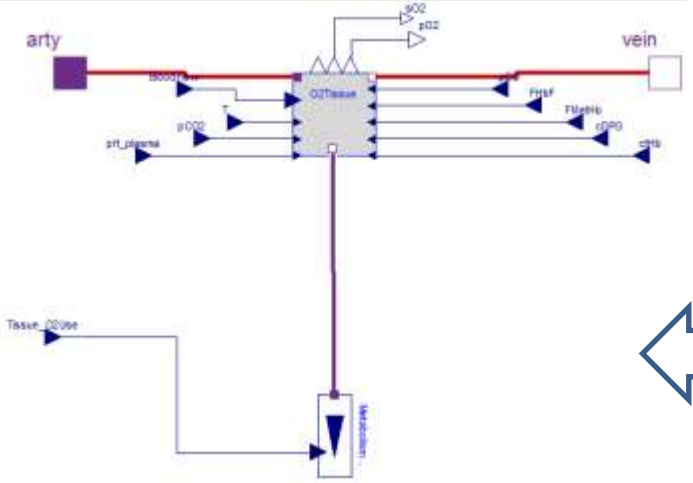

ventilation
busConnector
carbonDioxyd
oxygen
air
P,T
environment
K
T=298.15
alveolus
T=310.15
AlveolarVentilation_Env
BronchiDilution
alveolarVen...
busConnector
ctHb
cDPG
FMetHb
FHbF
pCO
lungs_pH_plasma
core_T
AlveolarVentilated_BloodFlow
veinsO2
O2Lung
artysO2
Artys_pH
O2Veins_sO2
O2Lung_sO2
O2Artys_PO2
O2Artys_sO2
veins
VeinsVol
pulmShortCircuit
pulmShortCircuitFlow
CardiacOutput
AlveolarVentilated_BloodFlow
busConnector
artys
ArtysVol

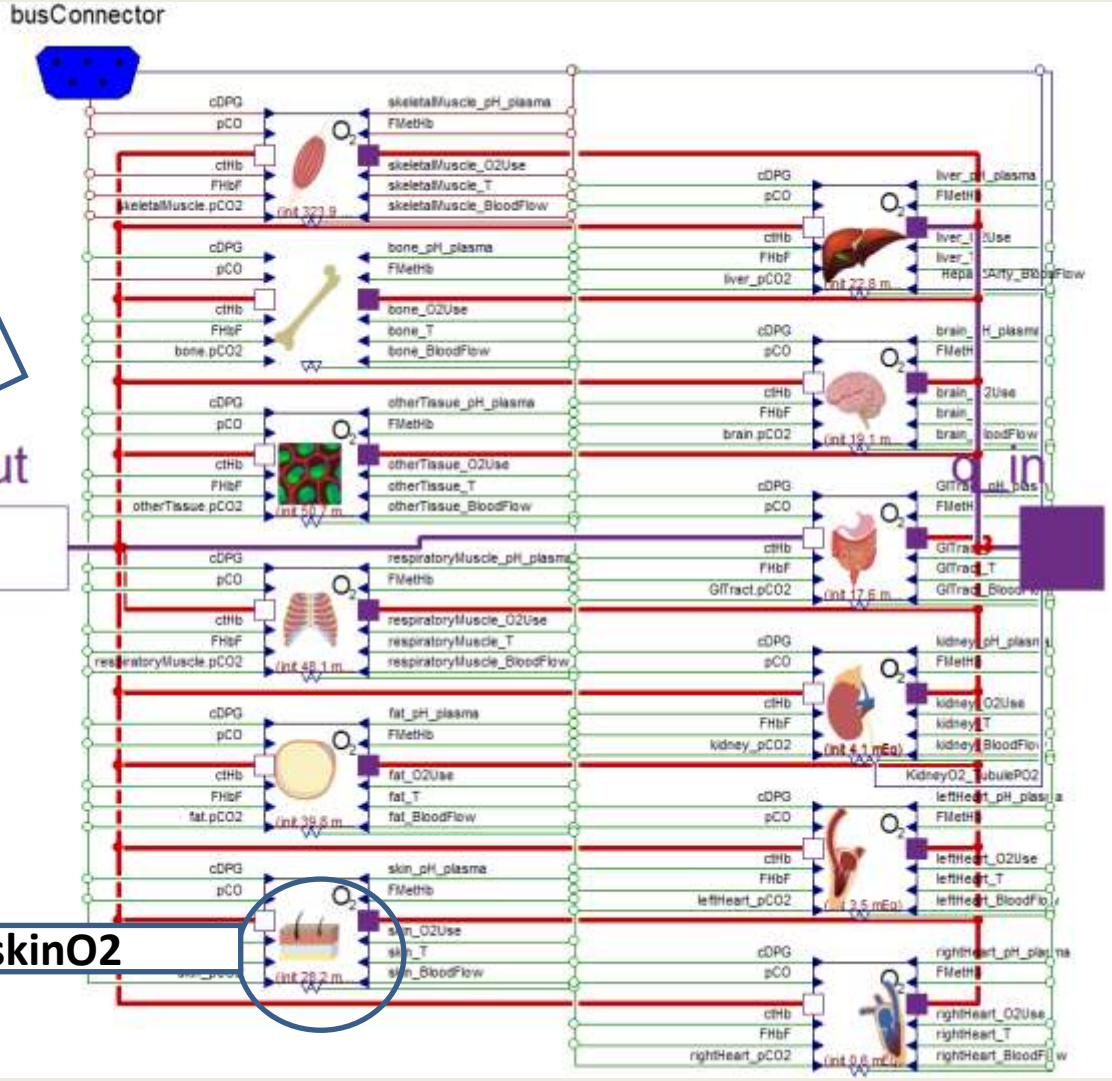


alveolarVentilation







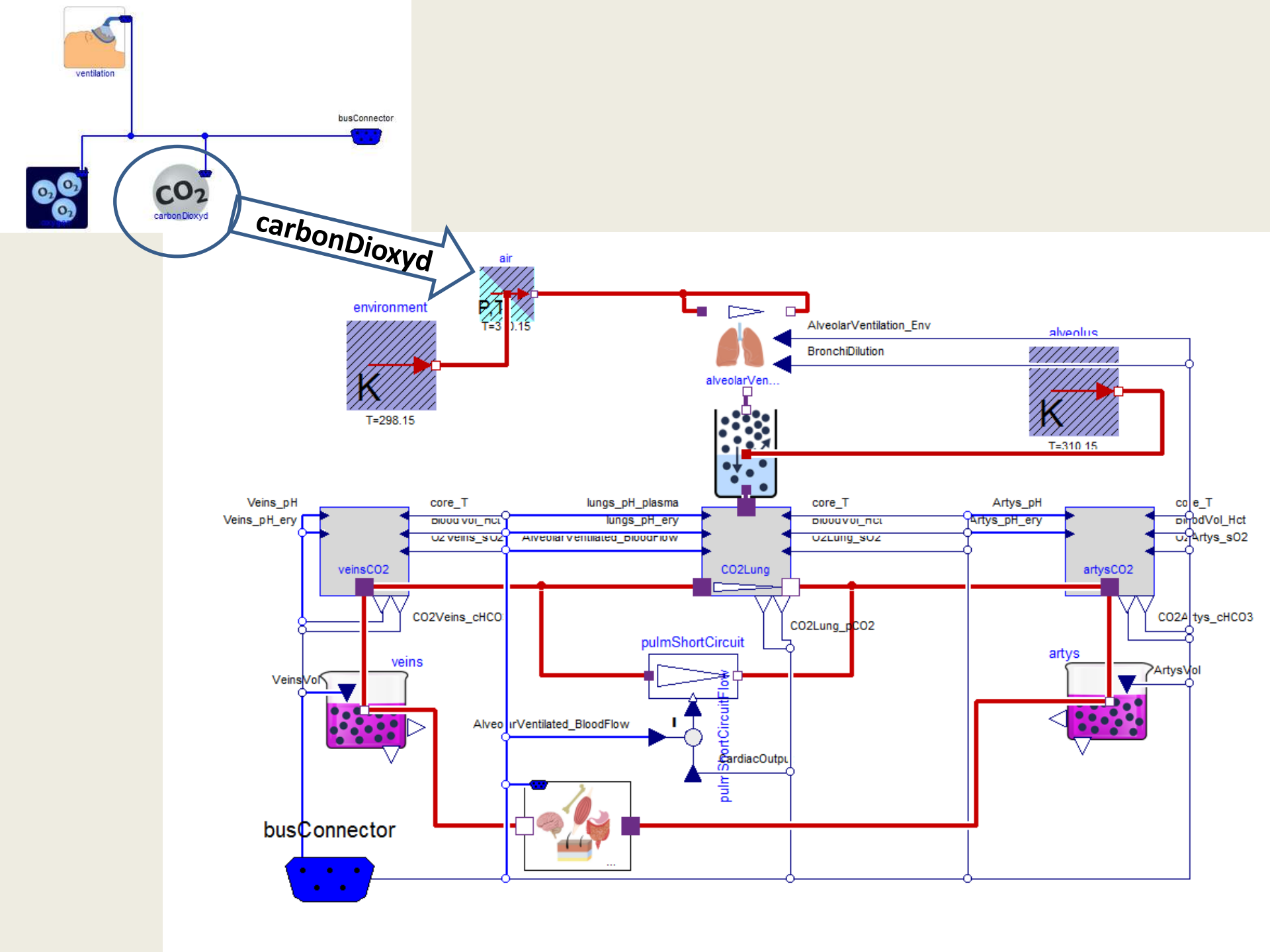


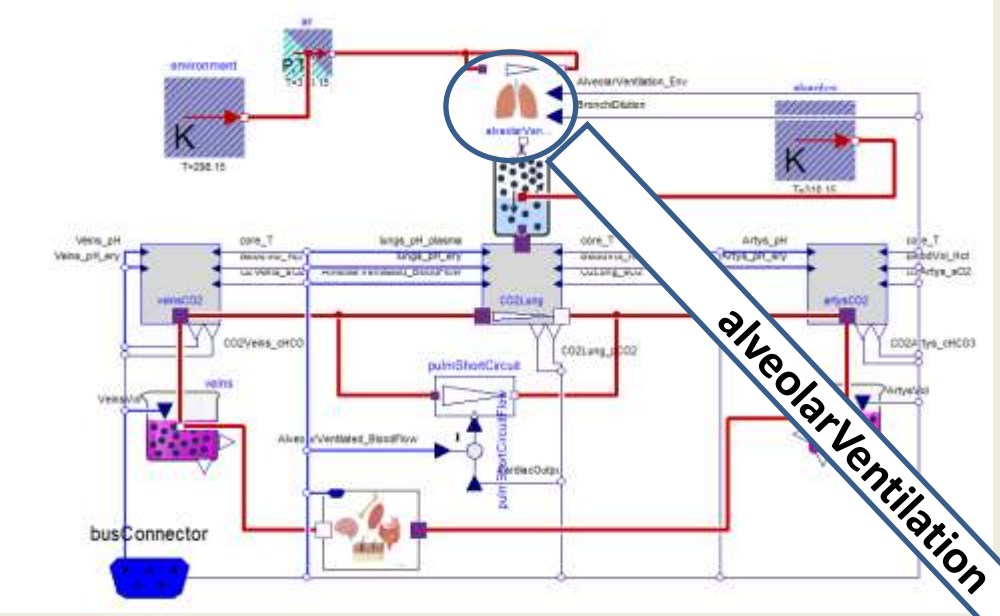
tissuesO2

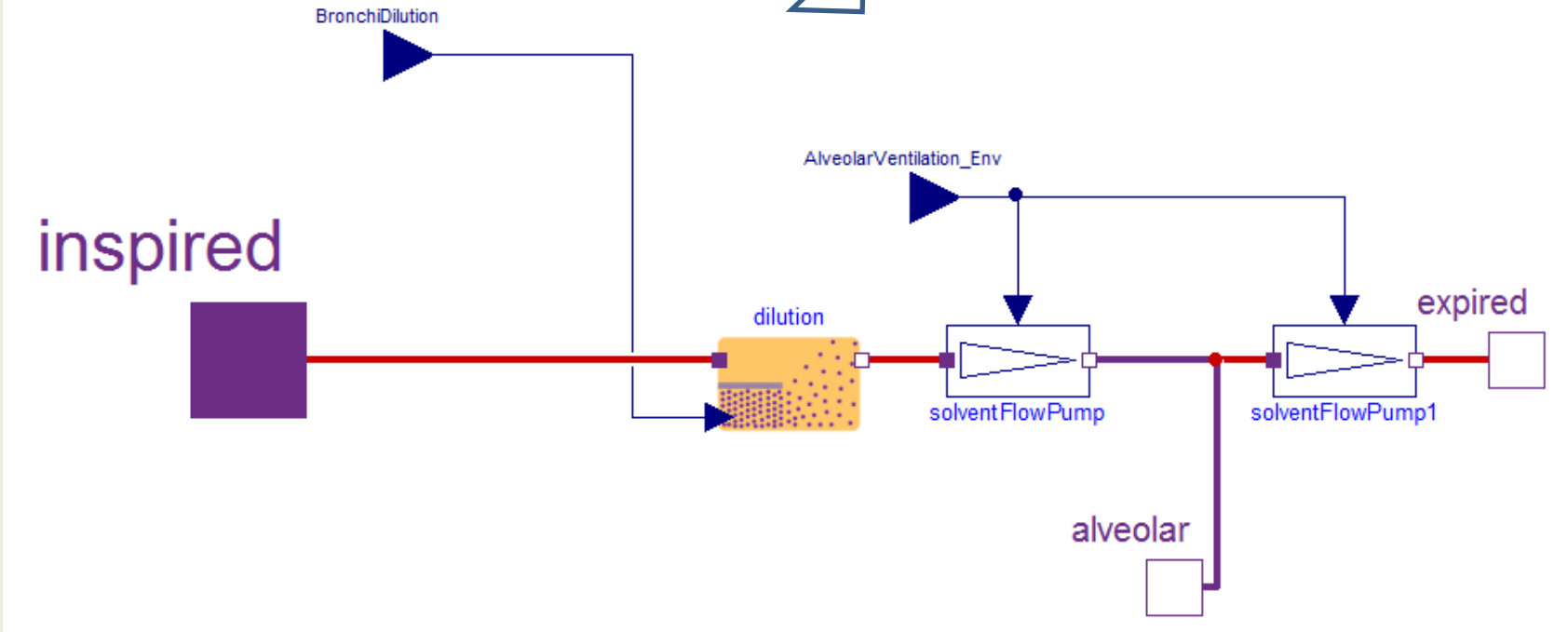
q_out

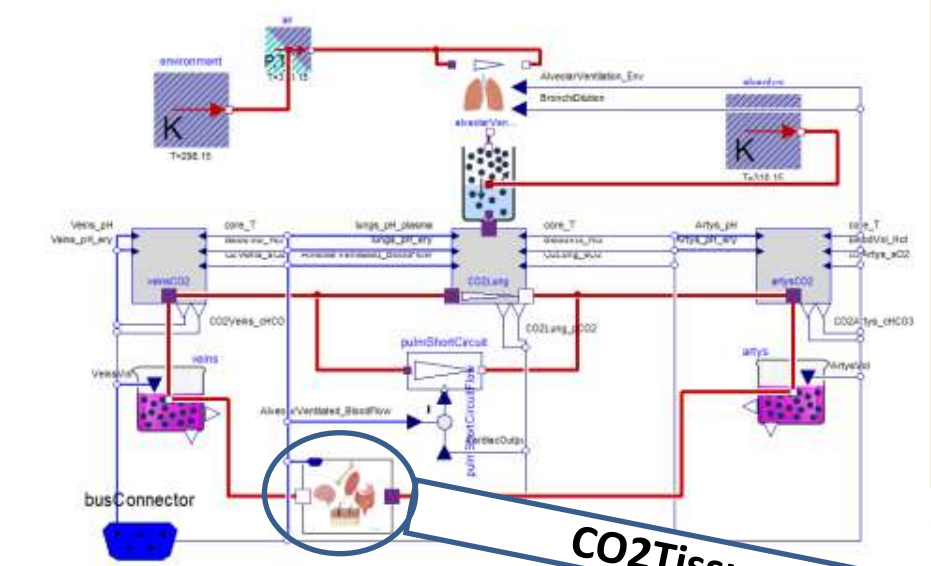
q_in

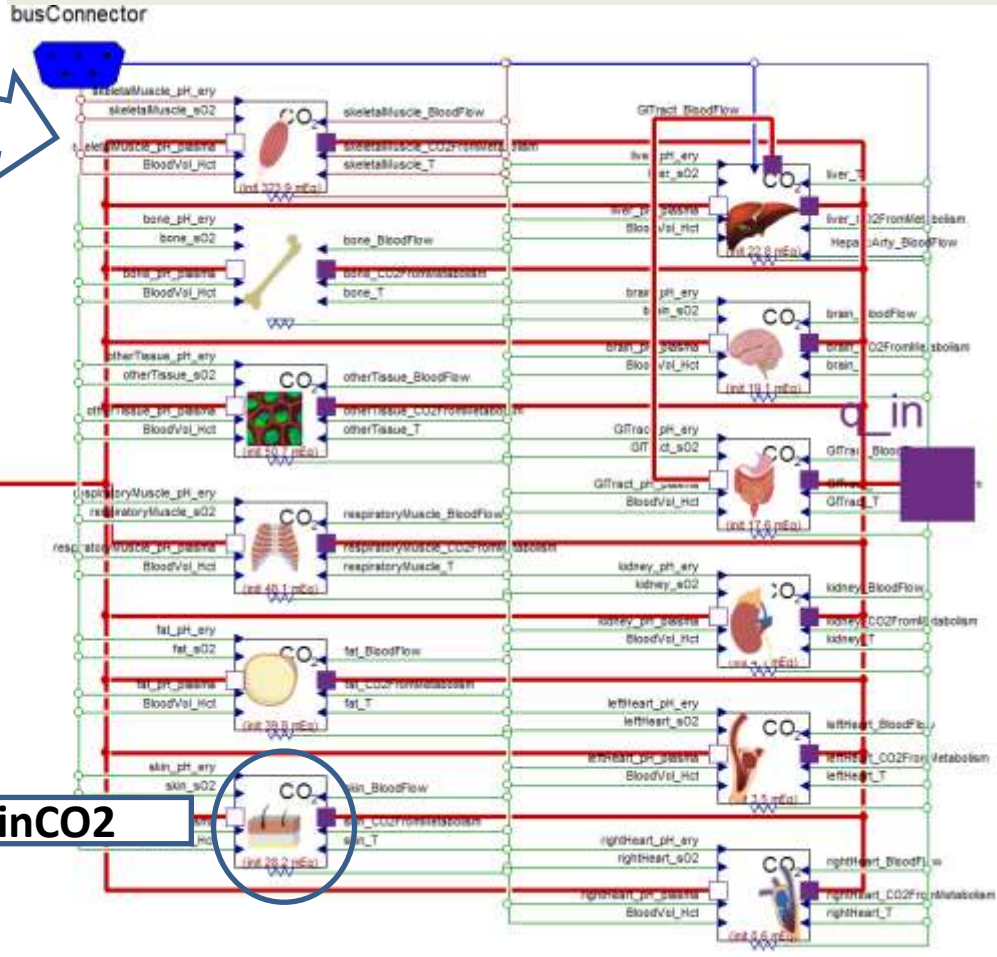
skinO2

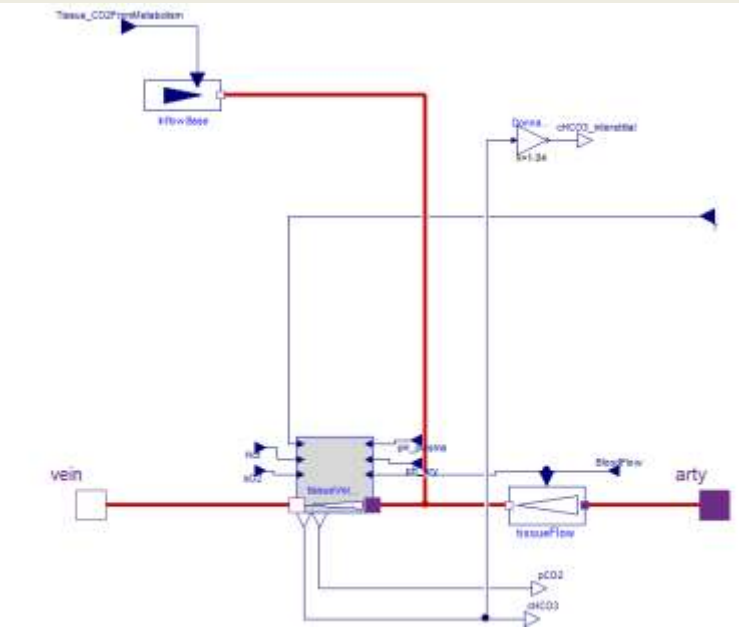

ventilation
busConnector
carbonDioxyd
carbonDioxyd
air
environment
T=298.15
AlveolarVentilation_Env
BronchiDilution
alveolus
T=310.15
Veins_pH
Veins_pH_ery
core_T
lungs_pH_plasma
lungs_pH_ery
core_T
Artys_pH
Artys_pH_ery
veinsCO2
CO2Lung
artysCO2
CO2Veins_cHCO
CO2Lung_pCO2
pulmShortCircuit
veins
artys
VeinsVol
ArtysVol
busConnector

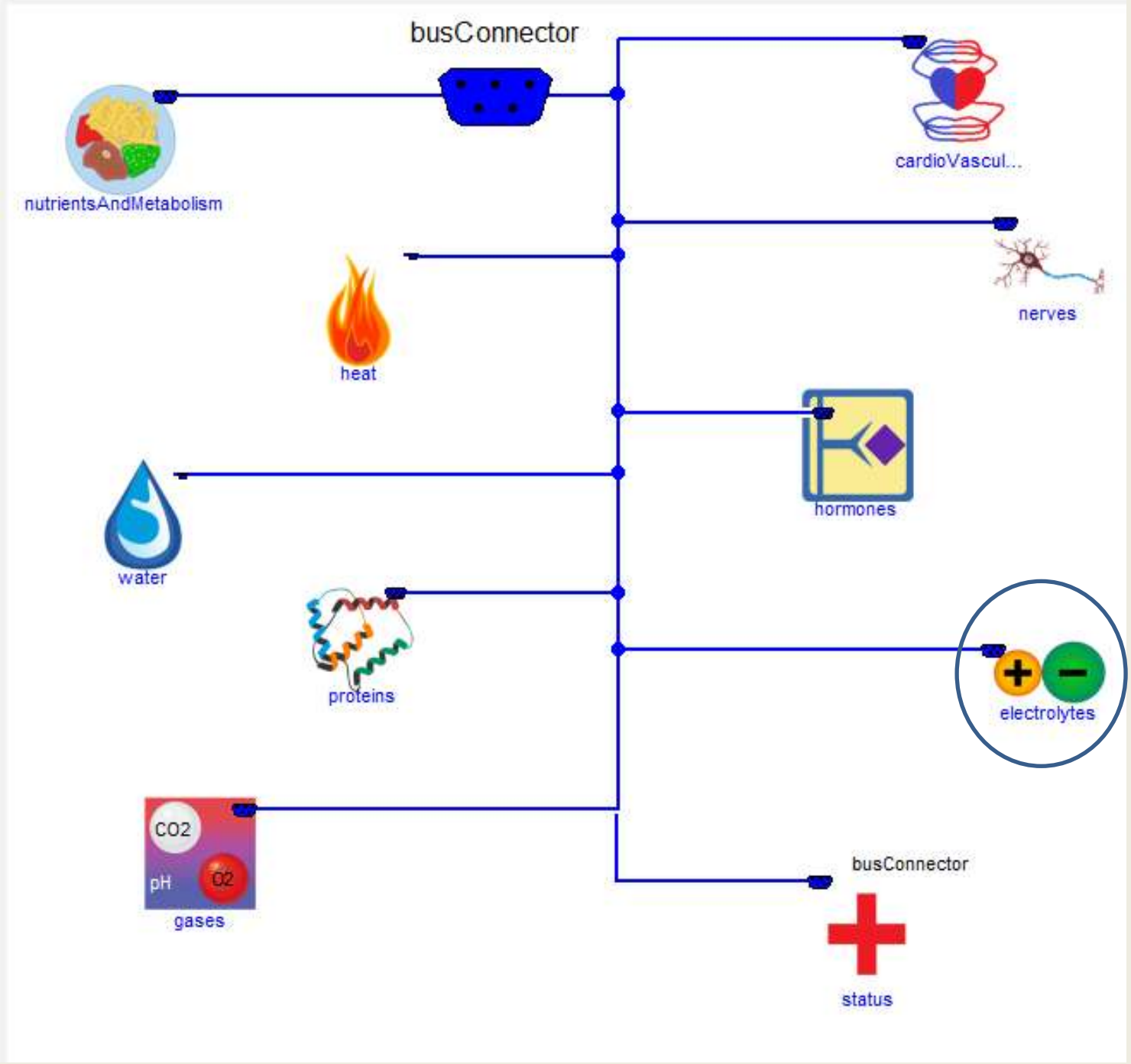

environment
busConnector
alveolarVentilation

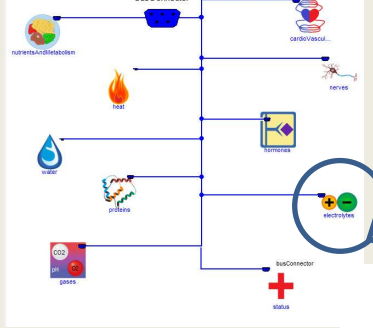

BronchiDilution
AlveolarVentilation_Env
inspired
dilution
solventFlowPump
solventFlowPump1
expired
alveolar


environment
busConnector
CO2Tissues


busConnector
q_out
q_in
skinCO2


vein
arty


busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status



electrolytes

sodium

potassium

chloride

acidBase

busConnector

ammonium

phosphate

sulphate

electrolytes Prope...

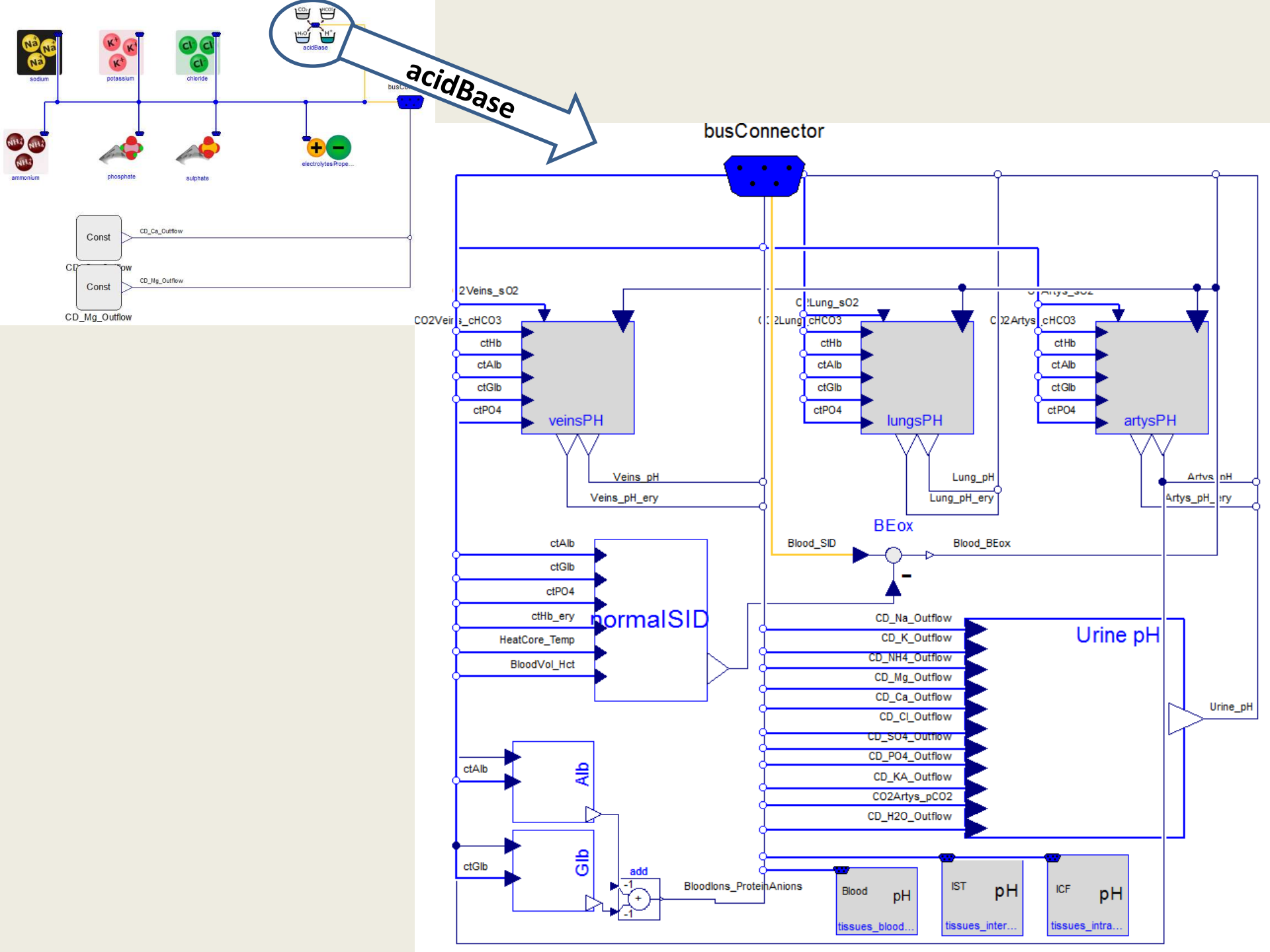
Const

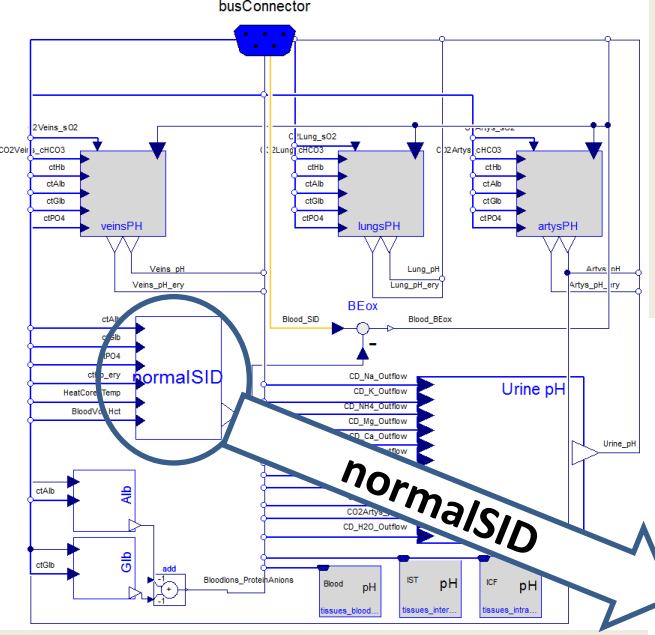
CD_Ca_Outflow

CD_Mg_Outflow

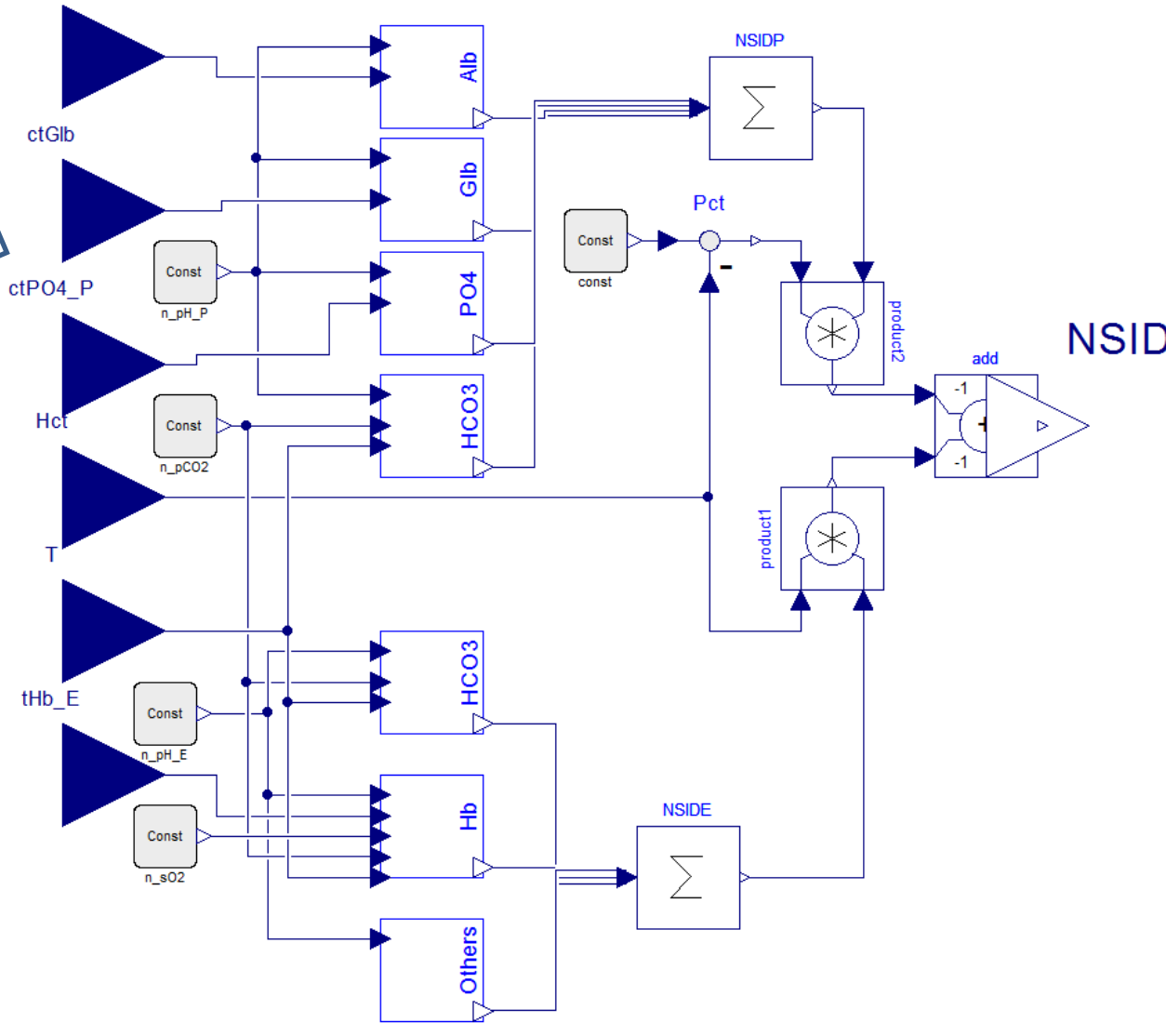
Const

CD_Mg_Outflow


acidBase
busConnector
sodium
potassium
chloride
ammonium
phosphate
sulphate
electrolytesPrope...
Const
CD_Ca_Outflow
Const
CD_Mg_Outflow
CD_Mg_Outflow
ctHb
ctAlb
ctGlb
ctPO4
veinsPH
lungsPH
artysPH
Veins_pH
Veins_pH_ery
Lung_pH
Lung_pH_ery
BEox
Blood_SID
Blood_BEox
ctHb_ery
HeatCore_Temp
BloodVol_Hct
normalSID
CD_Na_Outflow
CD_K_Outflow
CD_NH4_Outflow
CD_Mg_Outflow
CD_Ca_Outflow
CD_Cl_Outflow
CD_SO4_Outflow
CD_PO4_Outflow
CD_KA_Outflow
CO2Artys_pCO2
CD_H2O_Outflow
Urine pH
Urine_pH
Alb
Glb
add
BloodIons_ProteinAnions
Blood pH
tissues_blood...
IST pH
tissues_inter...
ICF pH
tissues_intra...


busConnector
veinsPH
lungsPH
artysPH
BEox
normalSID
Urine pH
Alb
Glb
add
Bloodions_ProteinAnions
Blood pH
IST pH
ICF pH

normalSID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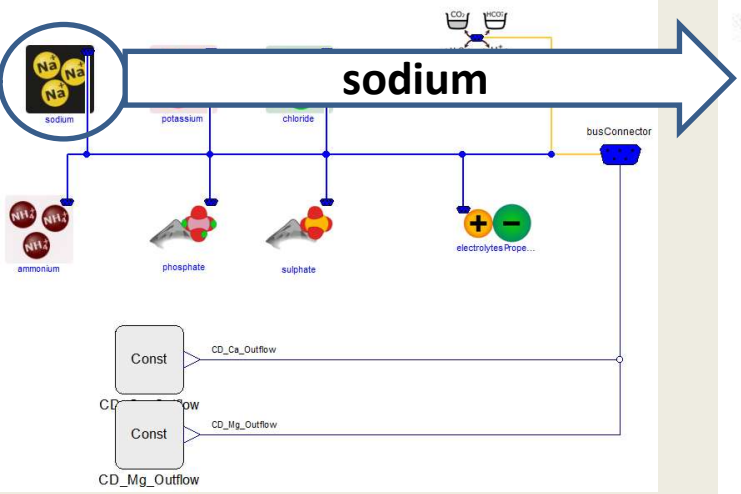
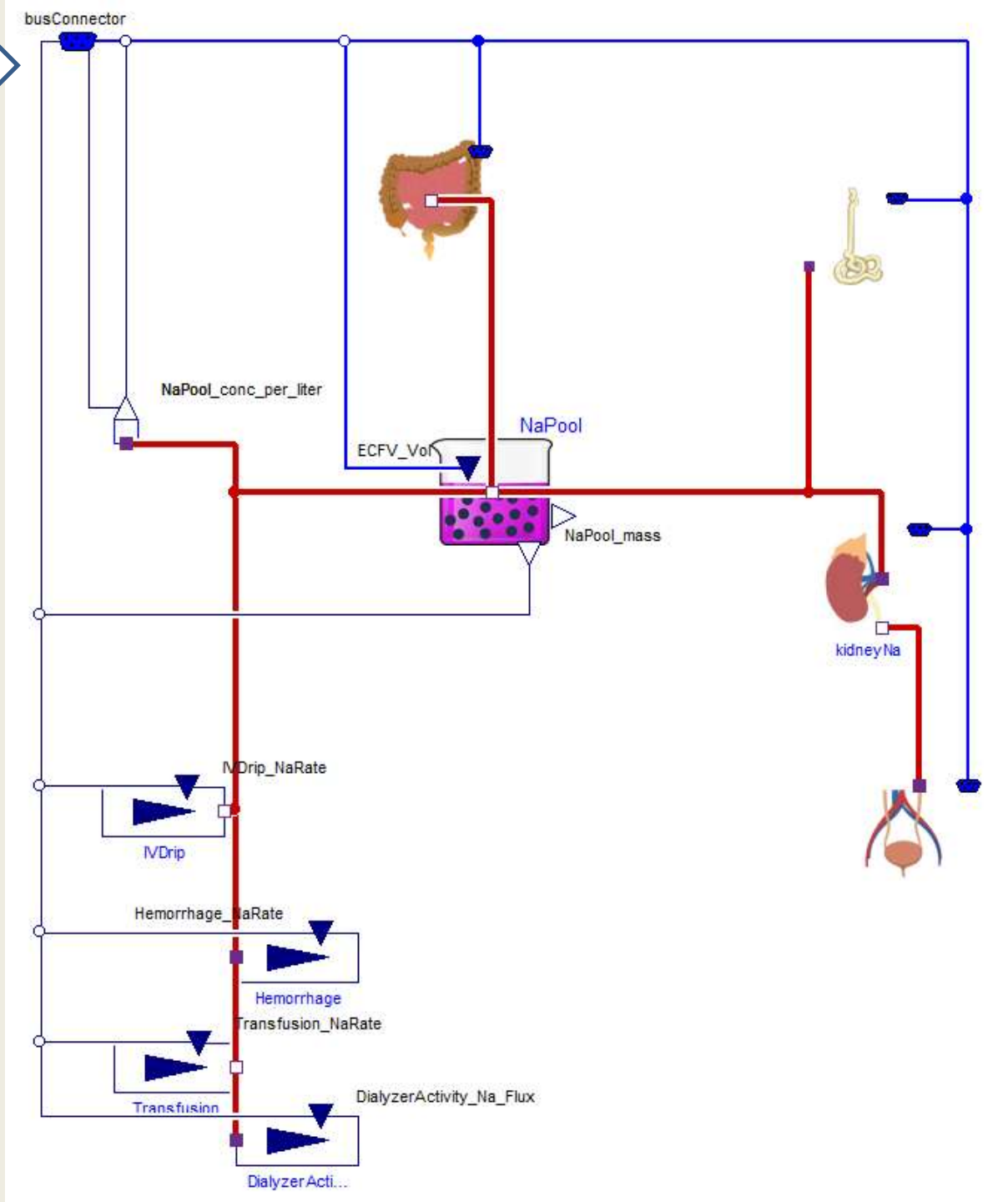
ctPO4_P
Hct
T
tHb_E
Const
n_pH_P
n_pCO2
n_pH_E
n_sO2
Alb
Glb
PO4
HCO3
HCO3
Hb
Others
NSIDP
Pct
const
product2
add
product1
NSIDE
NSID


sodium
potassium
chloride
busConnector
ammonium
phosphate
sulphate
electrolytesPrope...
Const
CD_Ca_Outflow
Const
CD_Mg_Outflow
CD_Mg_Outflow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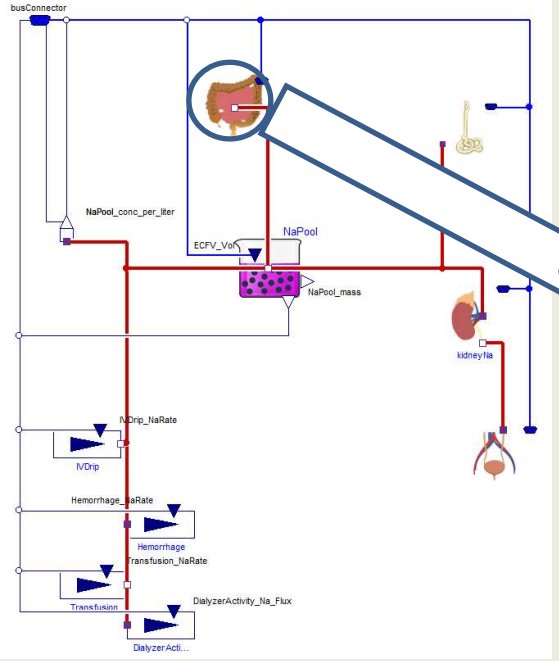
NaPool_conc_per_liter
NaPool
ECFV_Vol
NaPool_mass
kidneyNa
IVDrip_NaRate
IVDrip
Hemorrhage_NaRate
Hemorrhage
Transfusion_NaRate
DialyzerActivity_Na_Flux
DialyzerActi...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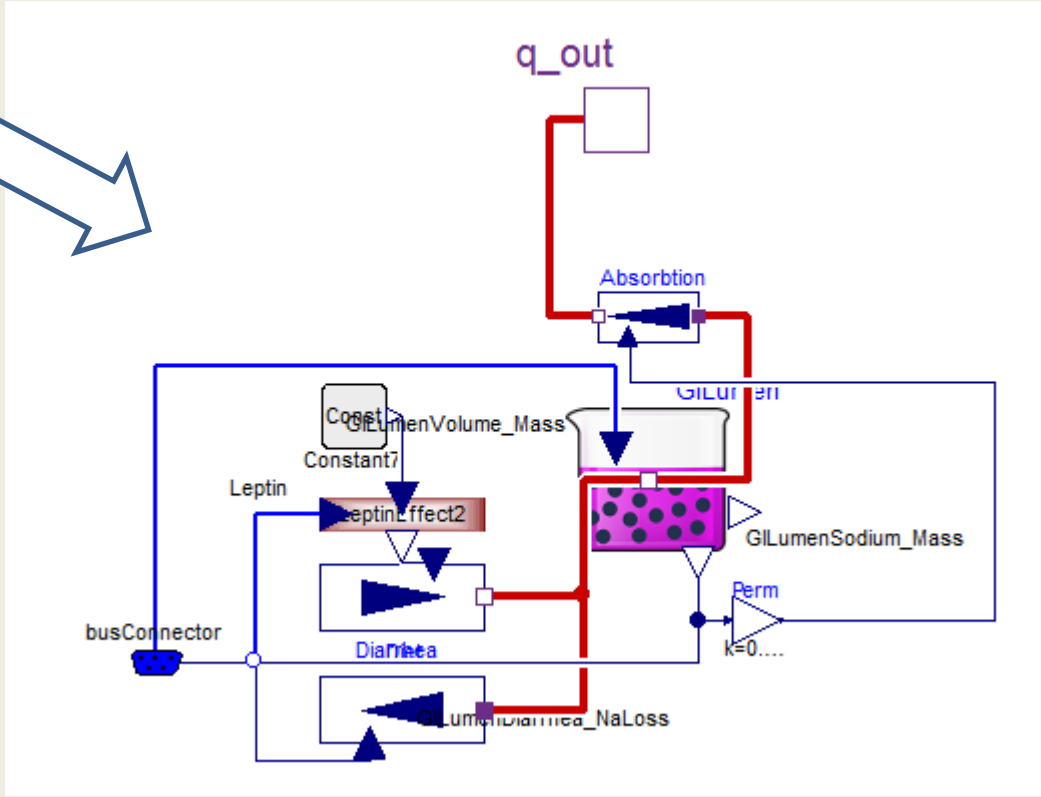
NaPool_conc_per_liter
ECFV_Vol
NaPool
NaPool_mass
kidneyNa
IVDrip_NaRate
IVDrip
Hemorrhage_NaRate
Hemorrhage
Transfusion_NaRate
Transfusion
DialyzerActivity_Na_Flux
DialyzerActi...

GILumen


q_out
Absorbtion
GILumen
GILumenVolume_Mass
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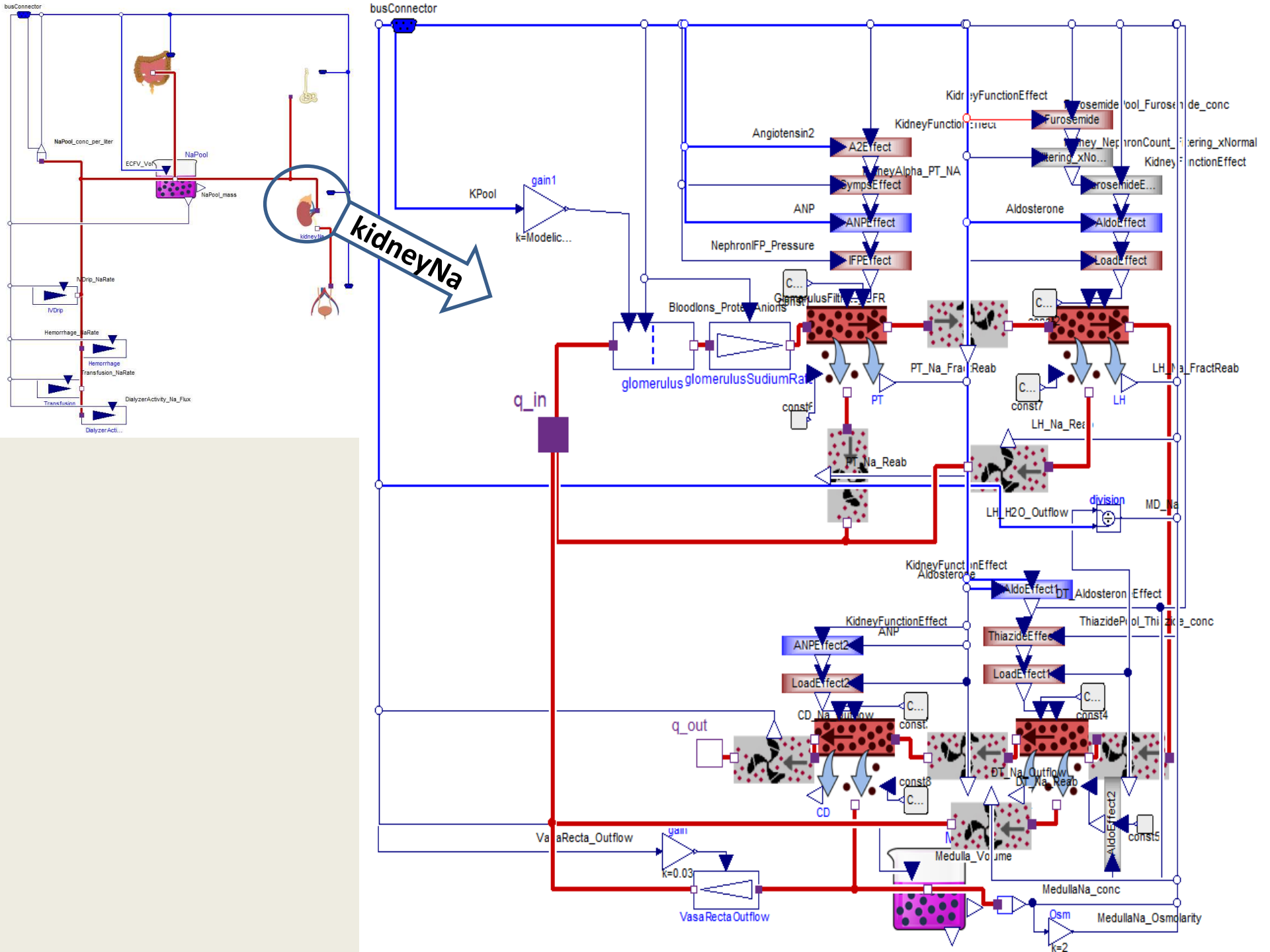
Constant7
Leptin
LeptinEffect2
GILumenSodium_Mass
Perm
k=0....
busConnector
Diarrhea
GILumenDiarrhea_NaLoss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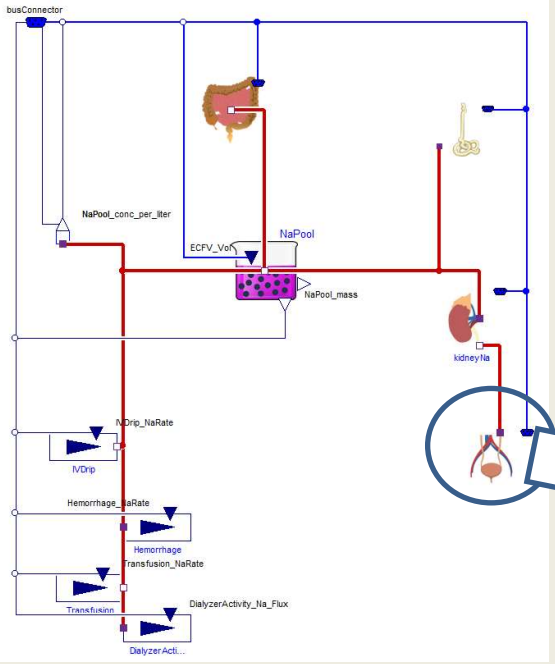
NaPool_conc_per_liter
ECFV_Vol
NaPool
NaPool_mass
kidneyNa
IVDrip_NaRate
IVDrip
Hemorrhage_NaRate
Hemorrhage
Transfusion_NaRate
Transfusion
DialyzerActivity_Na_Flux
DialyzerActi...
busConnector
KPool
gain1
k=Modelic...
kidneyNa
Angiotensin2
A2Effect
SympsEffect
ANP
ANPEffect
NephronIFP_Pressure
IFPEffect
KidneyFunctionEffect
Furosemide
Aldosterone
AldoEffect
LoadEffect
Bloodlons_Proteins_Anions
glomerulus
glomerulusSudiumRate
PT_Na_FractReab
PT
LH
LH_Na_FractReab
q_in
const6
const7
PT_Na_Reab
LH_Na_Reab
LH_H2O_Outflow
division
KidneyFunctionEffect
Aldosterone
AldoEffect1
DT_Aldosteron_Effect
KidneyFunctionEffect
ANP
ANPEffect2
LoadEffect2
ThiazideEffect
LoadEffect1
CD_Na_Outflow
const
const4
q_out
DT_Na_Outflow
DT_Na_Reab
const8
CD
AldoEffect2
const5
VasaRecta_Outflow
gain
k=0.03
VasaRecta Outflow
Medulla_Volume
MedullaNa_conc
Osm
k=2
MedullaNa_Osmolarity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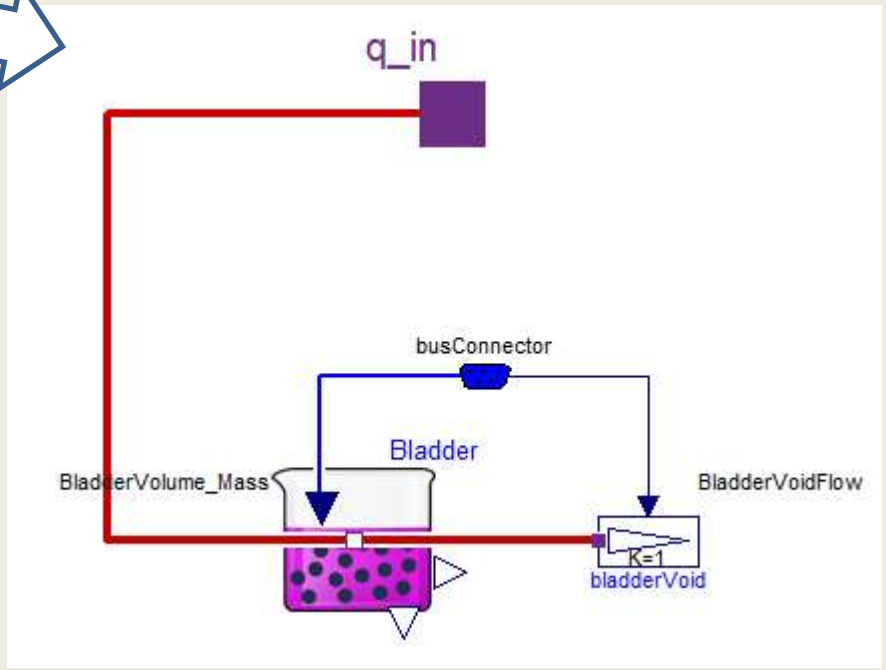
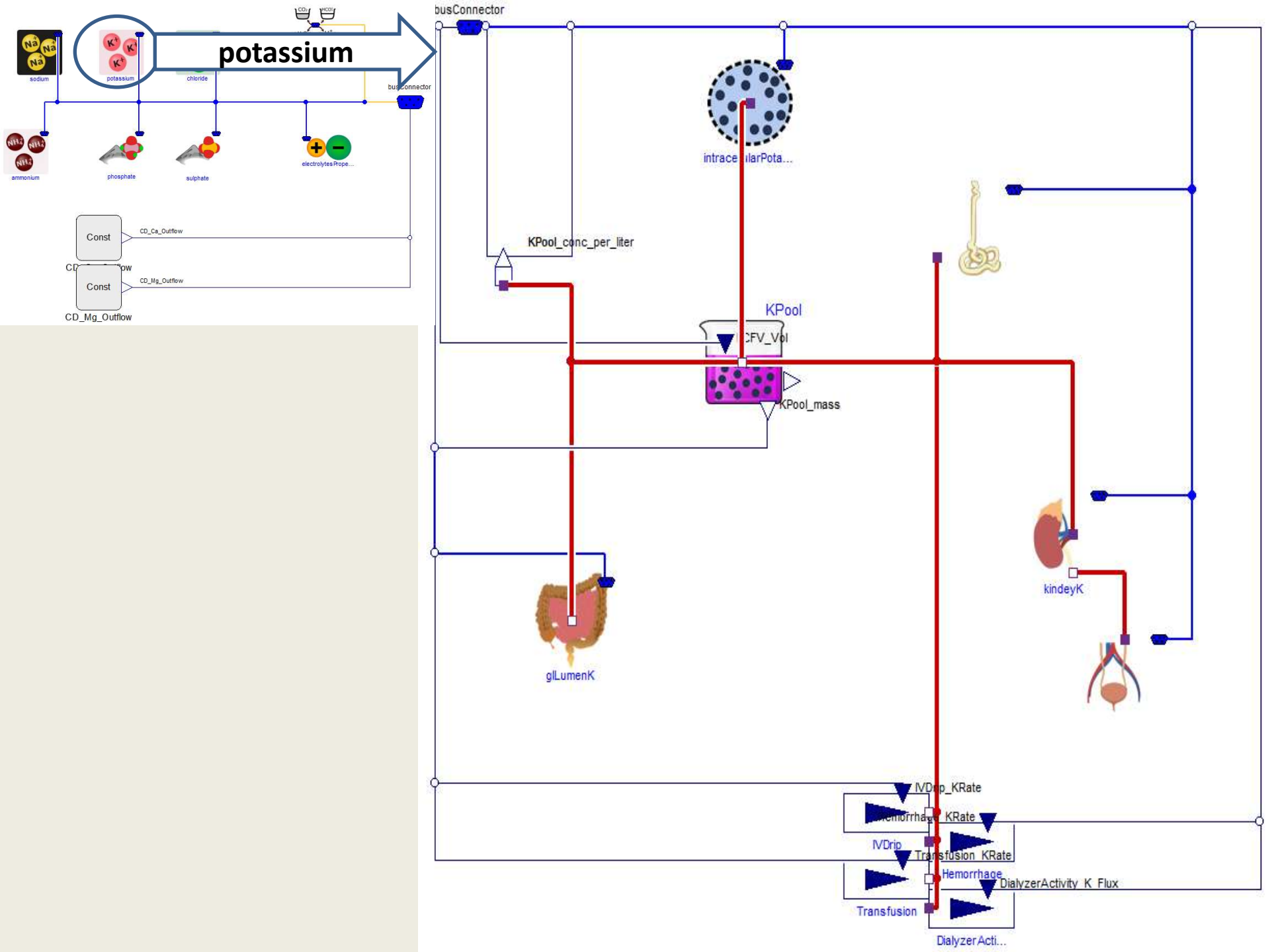
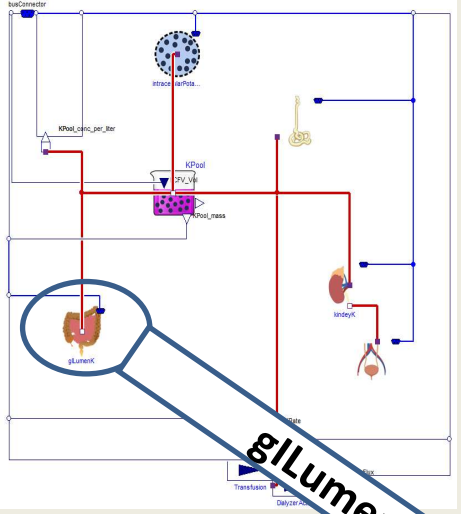
NaPool_conc_per_liter
ECFV_Vol
NaPool
NaPool_mass
kidneyNa
IVDrip_NaRate
IVDrip
Hemorrhage_NaRate
Hemorrhage
Transfusion_NaRate
DialyzerActivity_Na_Flux

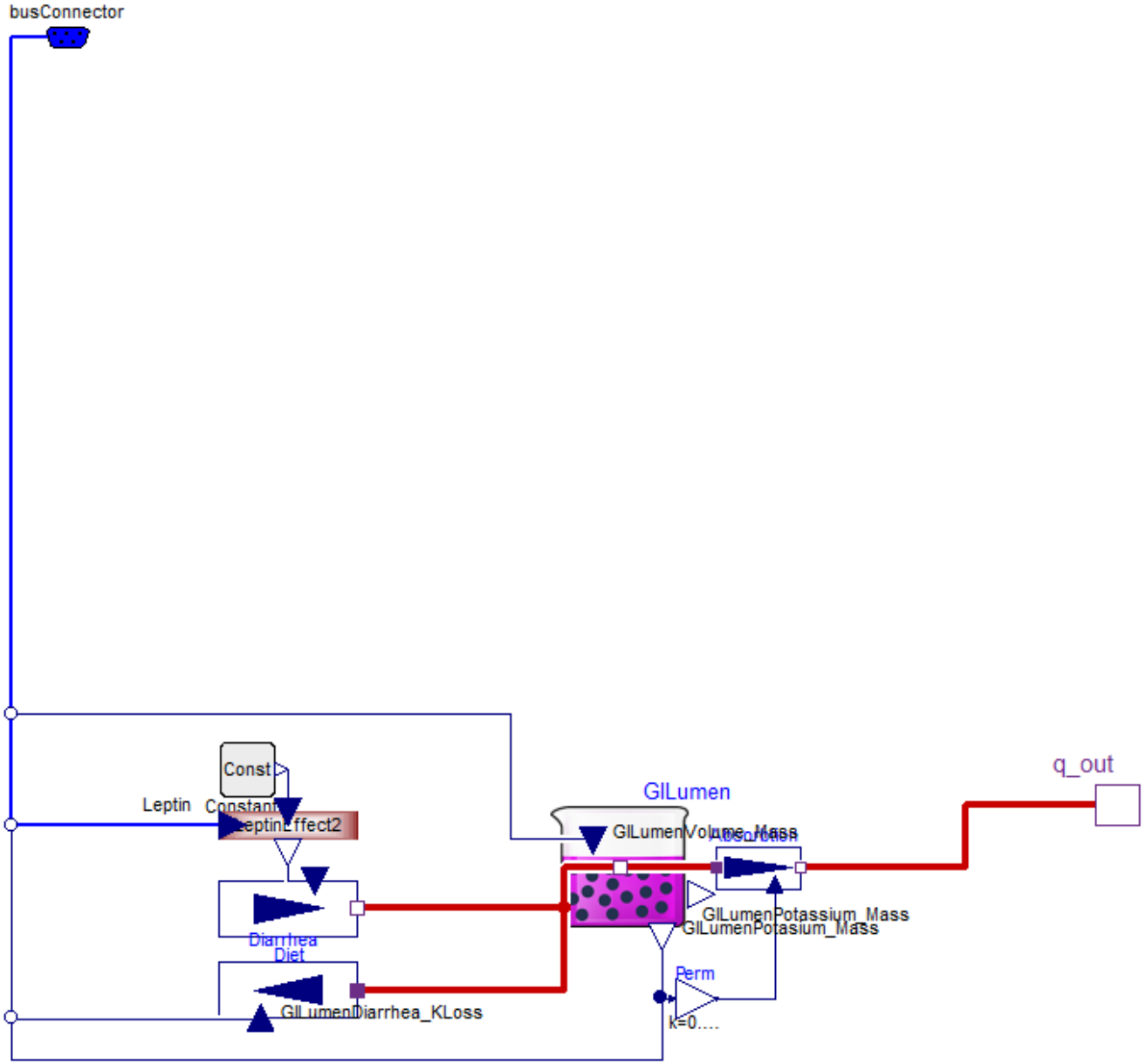
bladder

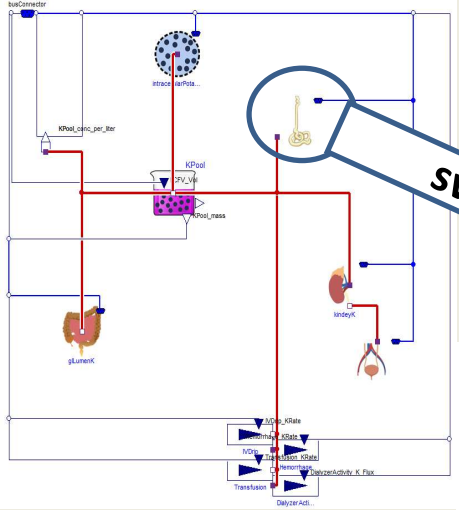

q_in
busConnector
Bladder
BladderVolume_Mass
BladderVoidFlow
K=1
bladderVoid


potassium
sodium
potassium
chloride
busConnector
ammonium
phosphate
sulphate
electrolytesPrope...
Const
CD_Ca_Outflow
Const
CD_Mg_Outflow
CD_Mg_Outflow
busConnector
intrace ularPota...
KPool_conc_per_liter
KPool
CFV_Vol
KPool_mass
kindeyK
glLumenK
IVDrip_KRate
IVDrip
Transfusion_KRate
Hemorrhage
DialyzerActivity_K_Flux
Transfusion
DialyzerActi...


busConnector
KPool_conc_per_liter
KPool
KPool_mass
kindeyK
gILumenK
Transfusion
Dialyzer

gILumen


busConnector
Const
Leptin
Constant
LeptinEffect2
Diarrhea
Diet
GILumen
GILumenVolume_Mass
GILumenPotassium_Mass
GILumenPotasium_Mass
GILumenDiarrhea_KLoss
Perm
k=0....
q_out



sweatGlandSalt

busConnector

Const
Constant

Aldosterone

AldoEffect

division

FractReab

exp

Reab

product

SweatGland_H2ORate

Const
Constant1

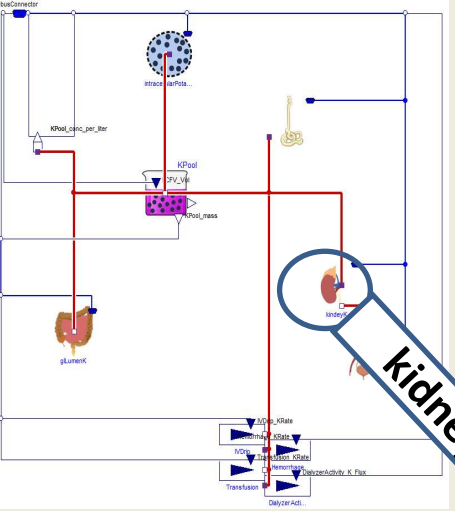
SaltInflow

SweatGland_H2ORate

Outflow

salt

outputPump



busConnector

Const

electrolytesFlowConstant

KidneyFunctionEffect

ThiazidePool_Thiazide_conc

Aldosterone

DT_Na_Outflow

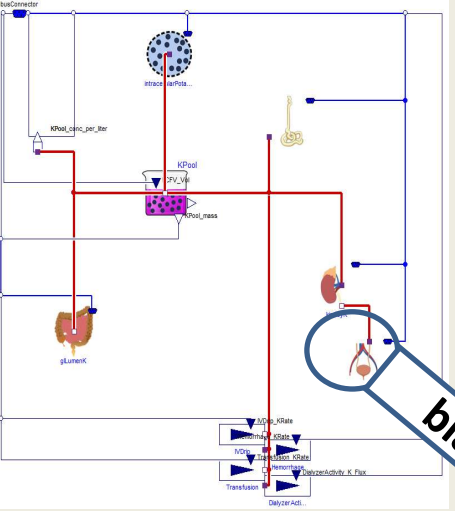
KPool_conc_per_liter

CD_K_Outflow

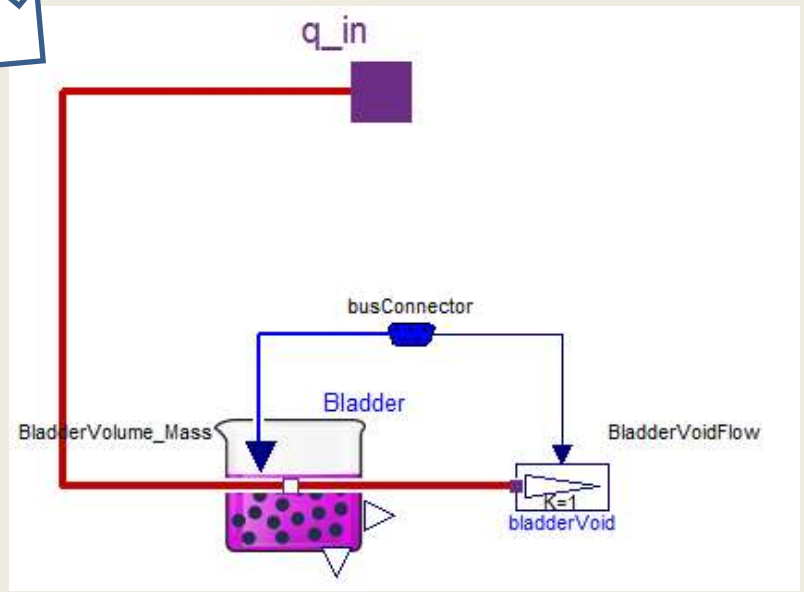
q_in

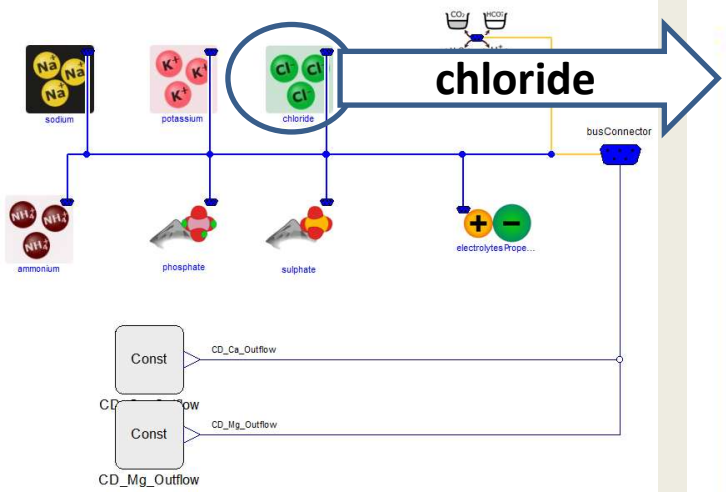
DT_K

q_out

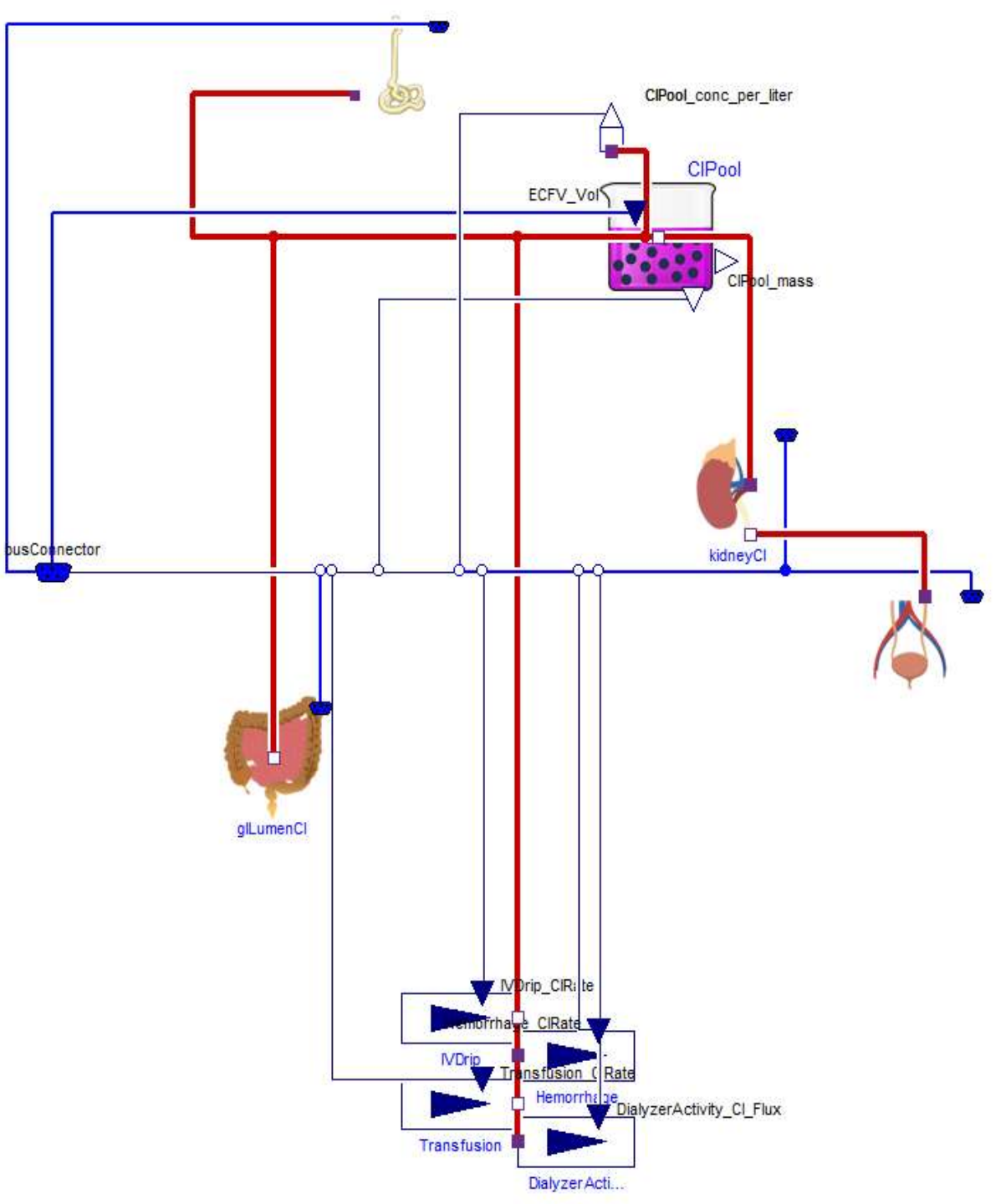

busConnector
KPool_conc_per_liter
KPool
KPool_mass
gLumenK
Transfusion
DialyzerActi...

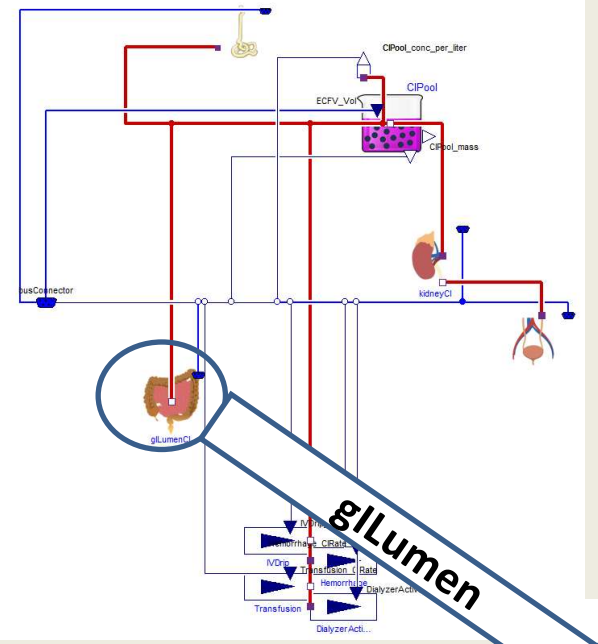
bladder


q_in
busConnector
Bladder
BladderVolume_Mass
BladderVoidFlow
K=1
bladderVoid

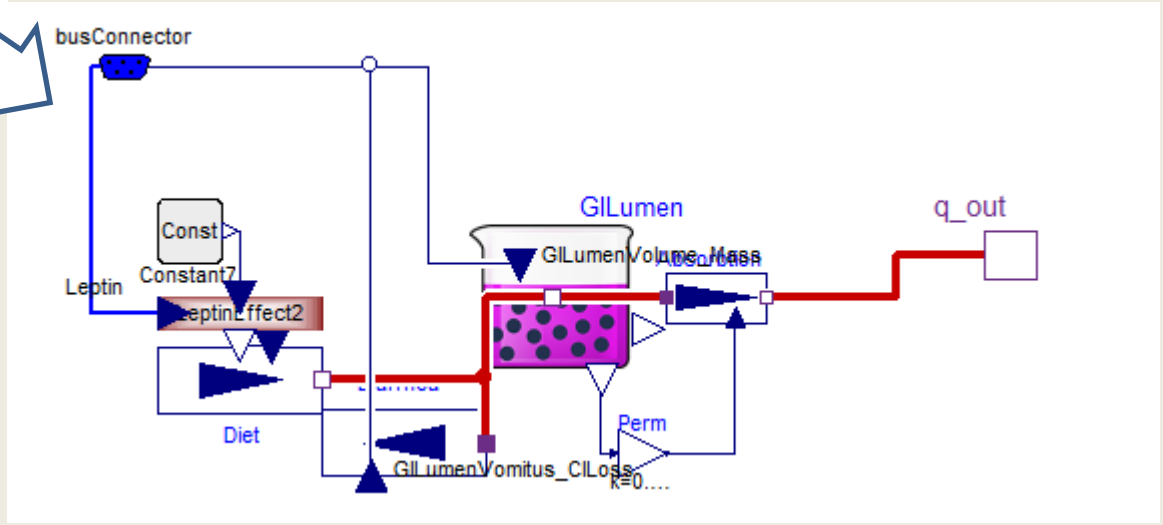

sodium
potassium
chloride
busConnector
ammonium
phosphate
sulphate
electrolytesPrope...
Const
CD_Ca_Outflow
Const
CD_Mg_Outflow
CD_Mg_Outflow

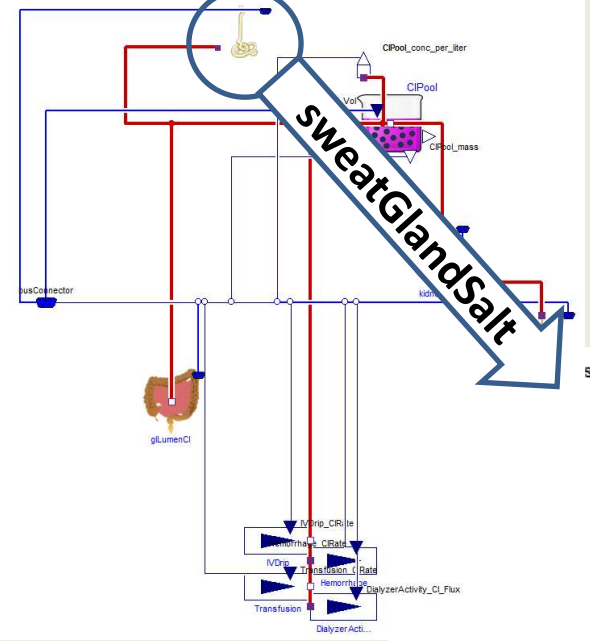
chloride

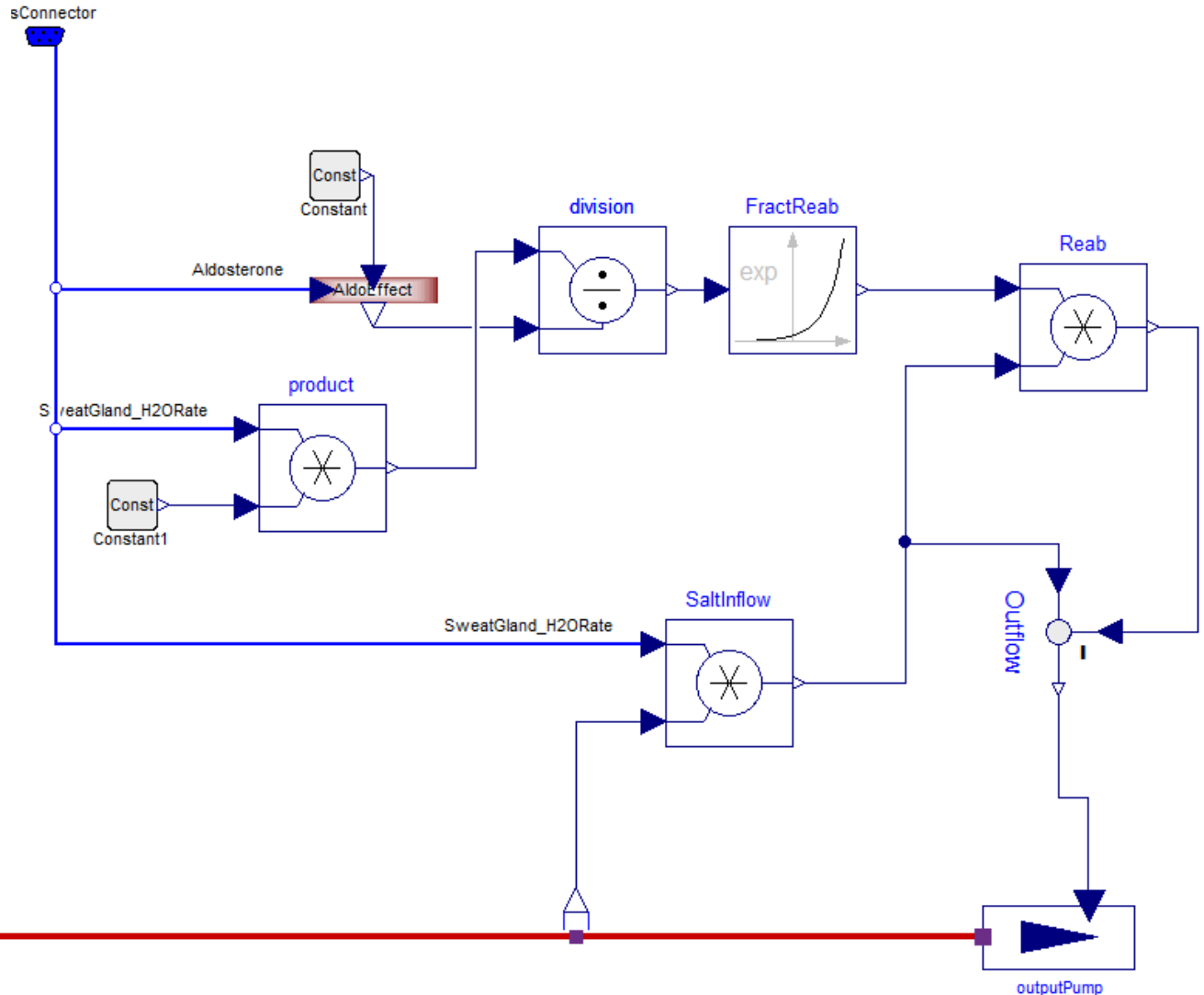

ClPool_conc_per_liter
ClPool
ECFV_Vol
ClPool_mass
busConnector
kidneyCl
glLumenCl
IVDrip_ClRate
IVDrip
Transfusion
DialyzerActivity_Cl_Flux
DialyzerActi...

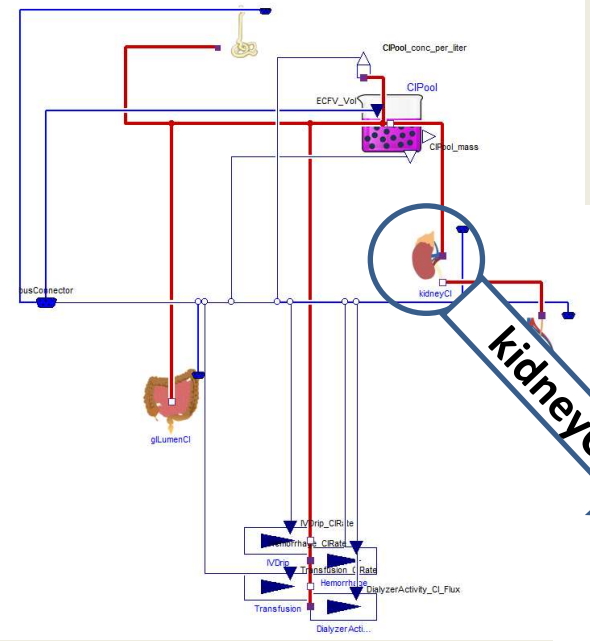

ClPool_conc_per_liter
ClPool
ECFV_Vol
ClPool_mass
kidneyCl
busConnector
glLumenCl
IVDrip
Hemorrhage
Transfusion
DialyzerActi...

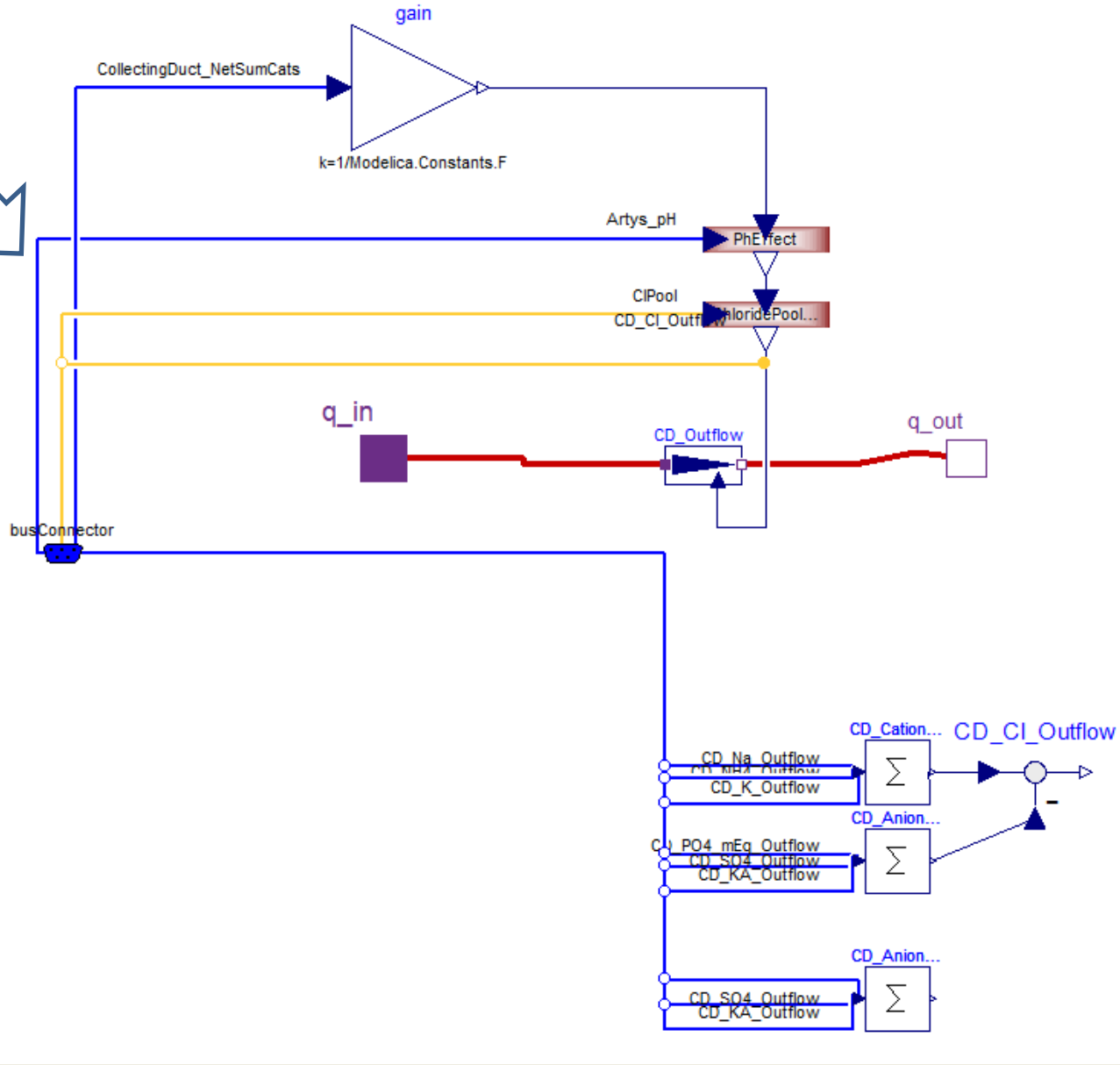
glLumen

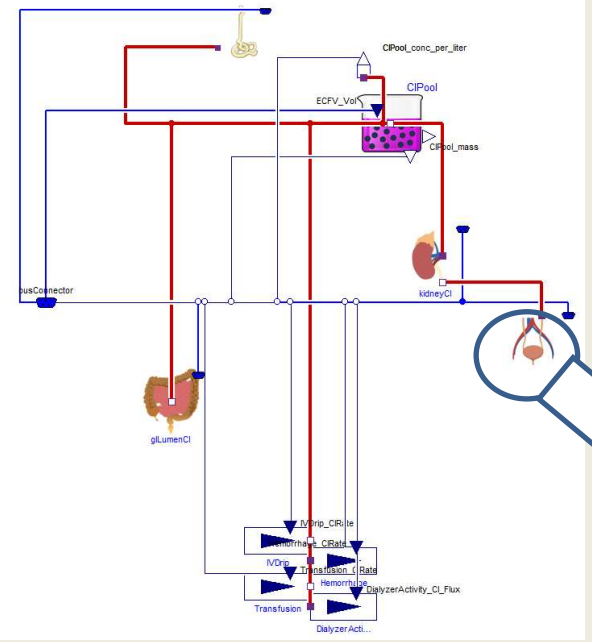

busConnector
Const
Constant7
Leptin
Diet
GILumen
GILumenVolume_Mass
q_out
Perm
k=0....


ClPool_conc_per_liter
ClPool
Vol
ClPool_mass
sweatGlandSalt
glLumenCl
IVDrip_ClRate
Hemorrhage_ClRate
IVDrip
Transfusion_ClRate
Hemorrhage
DialyzerActivity_Cl_Flux
Transfusion
DialyzerActi...

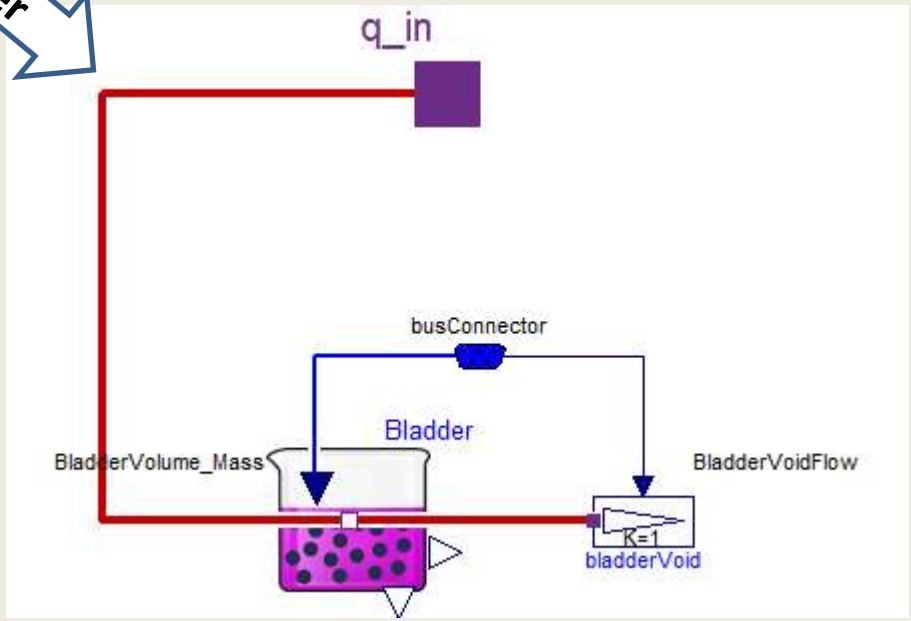

sConnector
Const
Constant
division
FractReab
exp
Reab
Aldosterone
AldoEffect
product
SweatGland_H2ORate
Const
Constant1
SaltInflow
SweatGland_H2ORate
Outflow
salt
outputPump

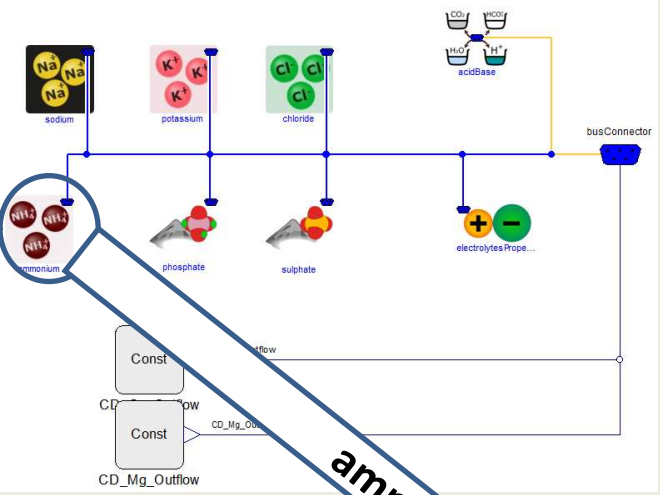

ClPool_conc_per_liter
ClPool
ECFV_Vol
ClPool_mass
kidneyCl
busConnector
glLumenCl
IVDrip_ClRate
IVDrip
Transfusion
Hemorrhage
DialyzerActivity_Cl_Flux
kidneyCl


gain
CollectingDuct_NetSumCats
k=1/Modelica.Constants.F
Artys_pH
PhEffect
ClPool
CD_Cl_Outflow
ChloridePool...
q_in
CD_Outflow
q_out
busConnector
CD_Cation...
CD_Cl_Outflow
CD_Na_Outflow
CD_K_Outflow
CD_Anion...
CD_PO4_mEq_Outflow
CD_SO4_Outflow
CD_KA_Outflow
CD_Anion...
CD_SO4_Outflow
CD_KA_Outflow

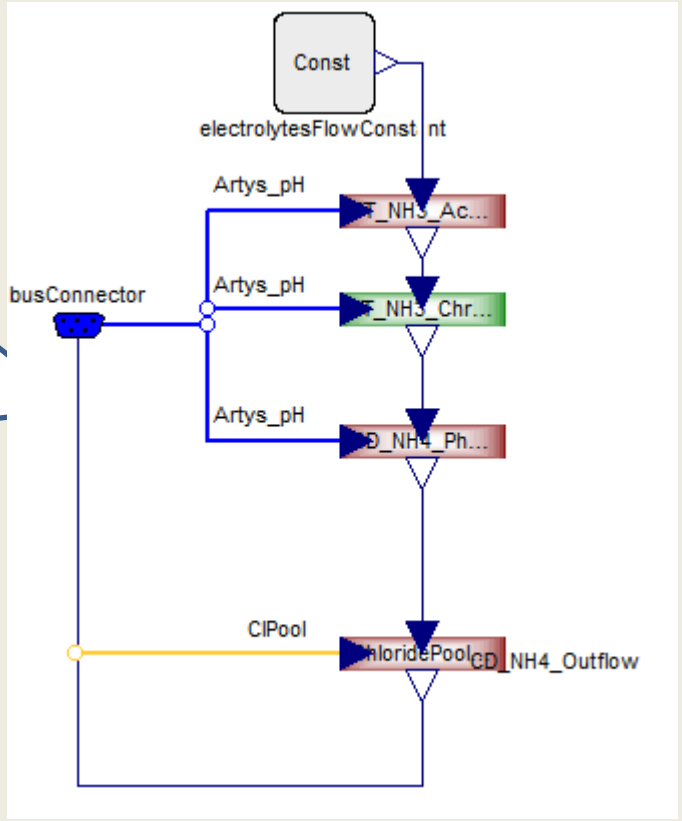

ClPool_conc_per_liter
ClPool
ECFV_Vol
ClPool_mass
busConnector
kidneyCl
glLumenCl
IVDrip_ClRate
IVDrip
Transfusion
Hemorrhage
DialyzerActivity_Cl_Flux
DialyzerActi...

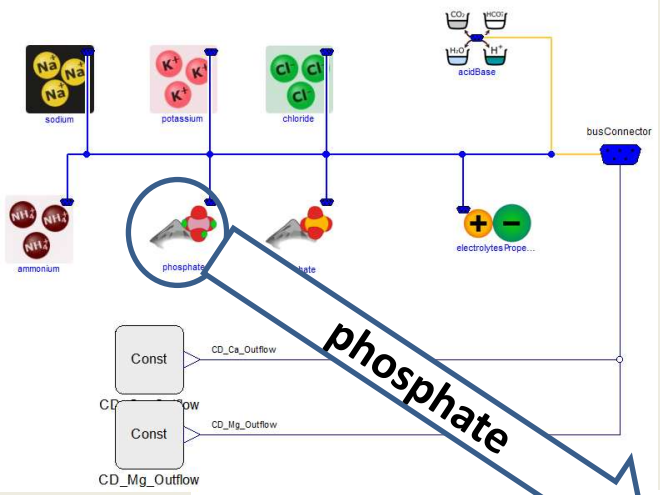
bladder


q_in
busConnector
Bladder
BladderVolume_Mass
BladderVoidFlow
K=1
bladderVoid

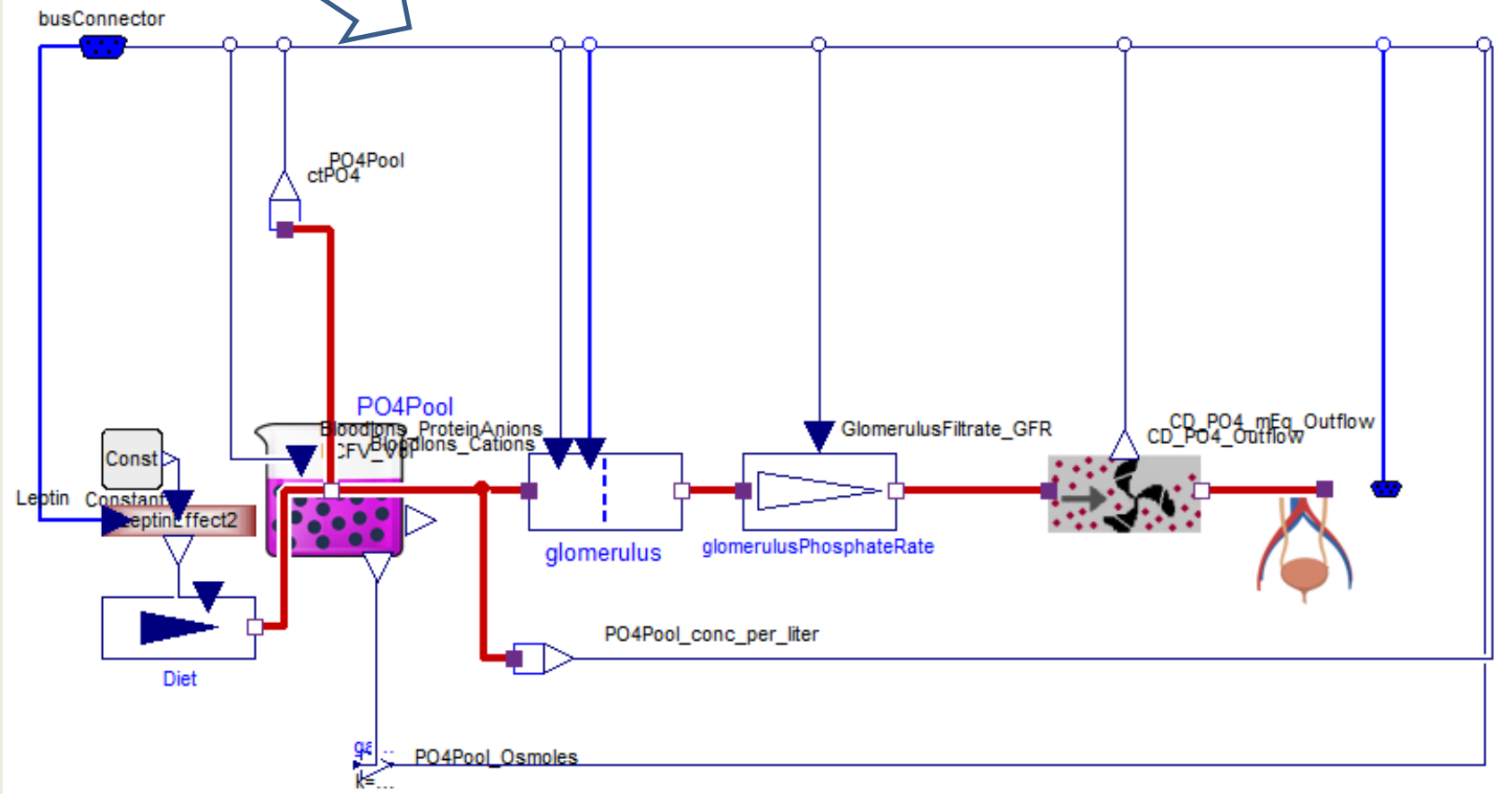

sodium
potassium
chloride
acidBase
busConnector
ammonium
phosphate
sulphate
electrolytesPrope...
Const
Const
CD_Mg_Outflow

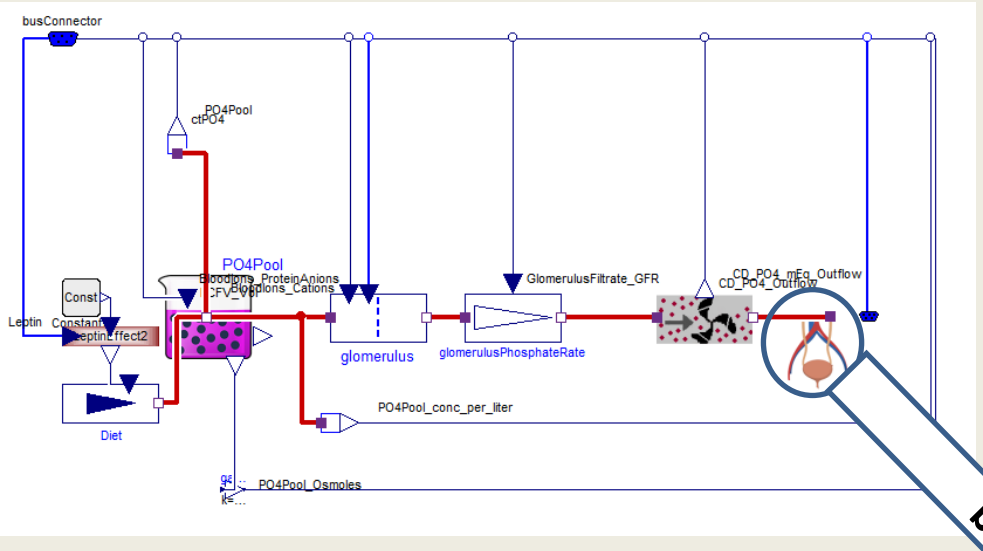
ammonium


Const
electrolytesFlowConst nt
Artys_pH
F_NH3_Ac...
busConnector
Artys_pH
F_NH3_Chr...
Artys_pH
D_NH4_Ph...
ClPool
hloridePool
CD_NH4_Outflow

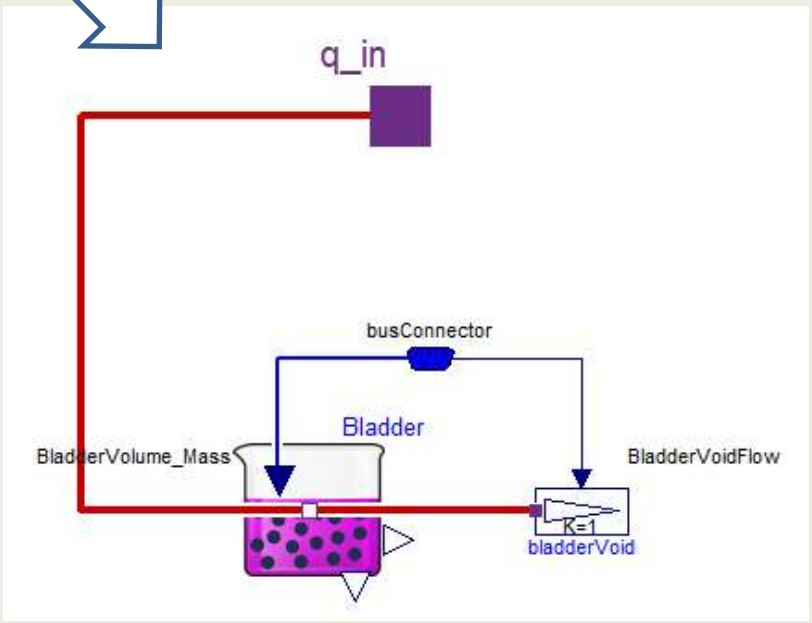

sodium
potassium
chloride
acidBase
busConnector
ammonium
phosphate
electrolytesPrope...
Const
CD_Ca_Outflow
Const
CD_Mg_Outflow
CD_Mg_Outflow

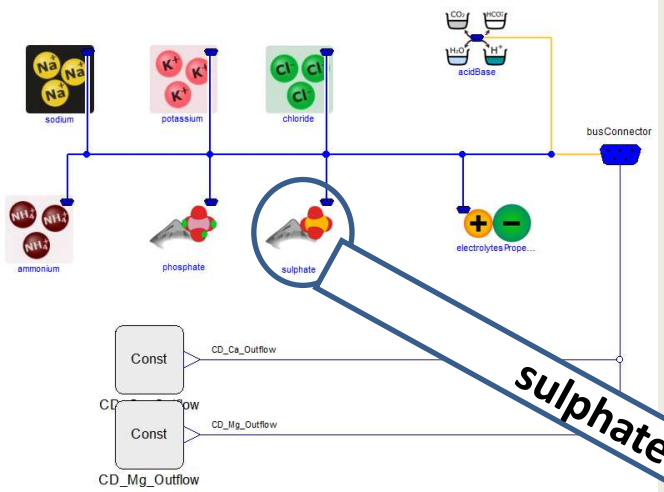
phosphate


busConnector
PO4Pool
ctPO4
PO4Pool
BloodIons_ProteinAnions
BloodIons_Cations
GlomerulusFiltrate_GFR
CD_PO4_mEq_Outflow
CD_PO4_Outflow
Const
Leptin
Constant
LeptinEffect2
glomerulus
glomerulusPhosphateRate
Diet
PO4Pool_conc_per_liter
PO4Pool_Osmoles


busConnector
PO4Pool
ctPO4
PO4Pool
BloodIons_ProteinAnions
BloodIons_Cations
GlomerulusFiltrate_GFR
CD_PO4_mEq_Outflow
CD_PO4_Outflow
Const
Leptin
Constant
LeptinEffect2
glomerulus
glomerulusPhosphateRate
Diet
PO4Pool_conc_per_liter
PO4Pool_Osmoles

bladder


q_in
busConnector
Bladder
BladderVolume_Mass
BladderVoidFlow
K=1
bladderVoid



sulphate

busConnector

PO4Pool
ctPO4

PO4Pool
BloodIons_ProteinAnions
BloodIons_Cations

Const
Leptin
Constant
LeptinEffect2

Diet

glomerulus

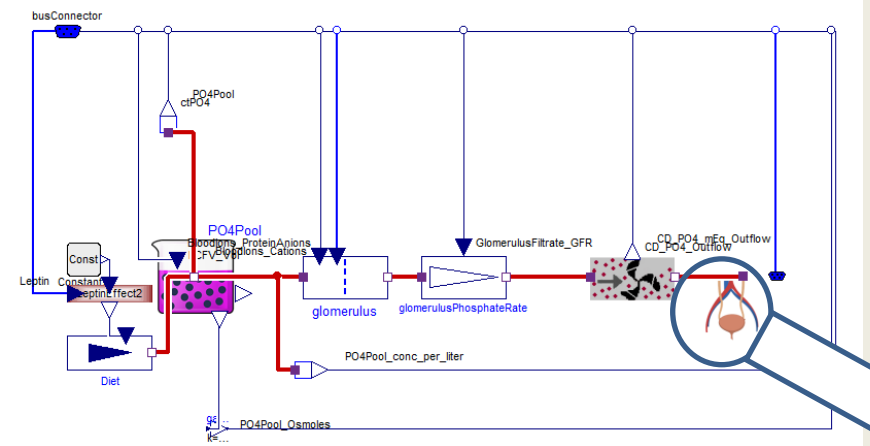
GlomerulusFiltrate_GFR

glomerulusPhosphateRate

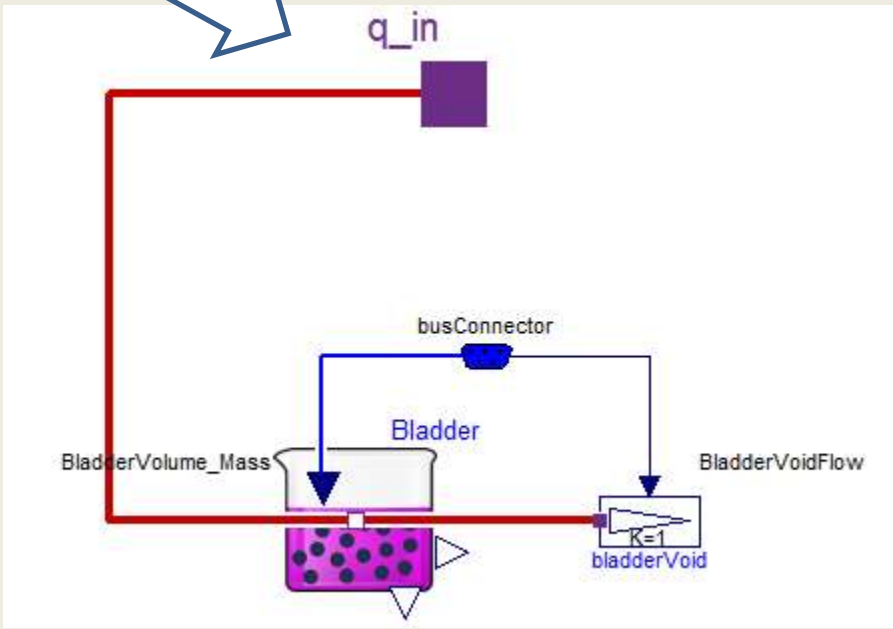
CD_PO4_mEq_Outflow
CD_PO4_Outflow

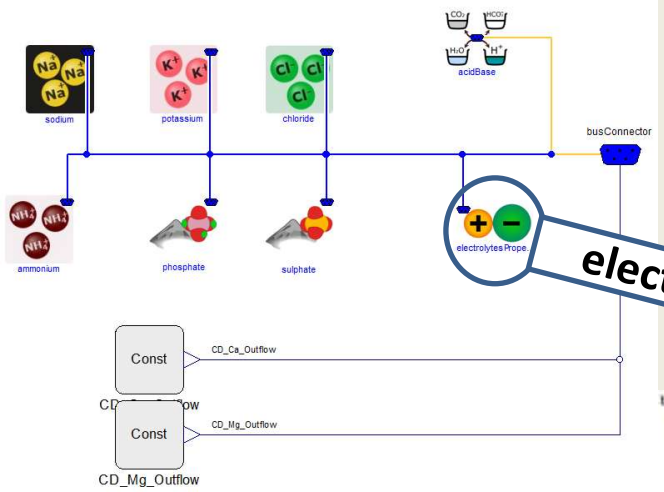
PO4Pool_conc_per_liter

PO4Pool_Osmoles

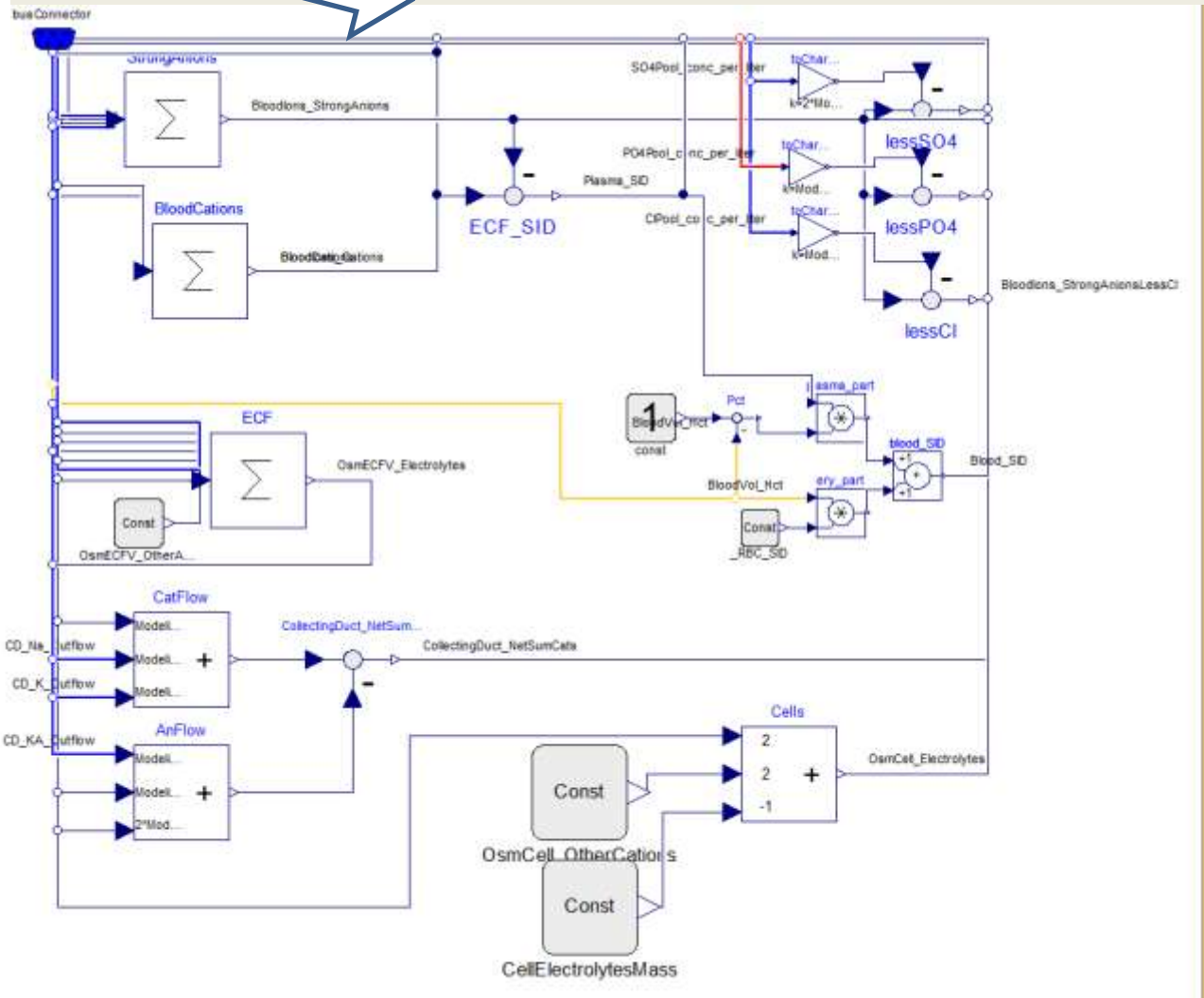

busConnector
PO4Pool
ctPO4
PO4Pool
Const
Leptin
Constant
LeptinEffect2
Diet
glomerulus
GlomerulusFiltrate_GFR
glomerulusPhosphateRate
CD_PO4_mEq_Outflow
CD_PO4_Outflow
PO4Pool_conc_per_liter
PO4Pool_Osmoles

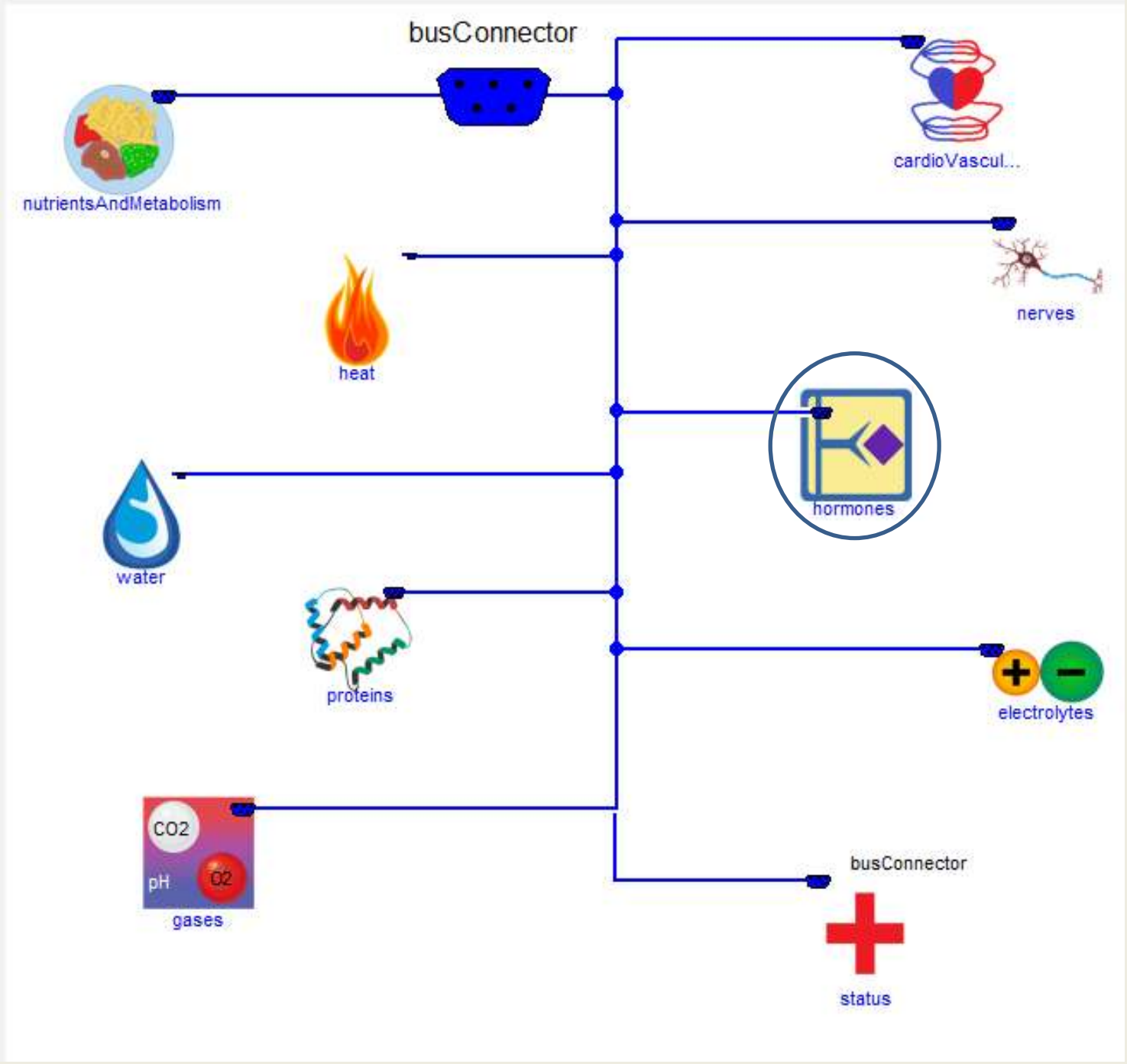
bladder

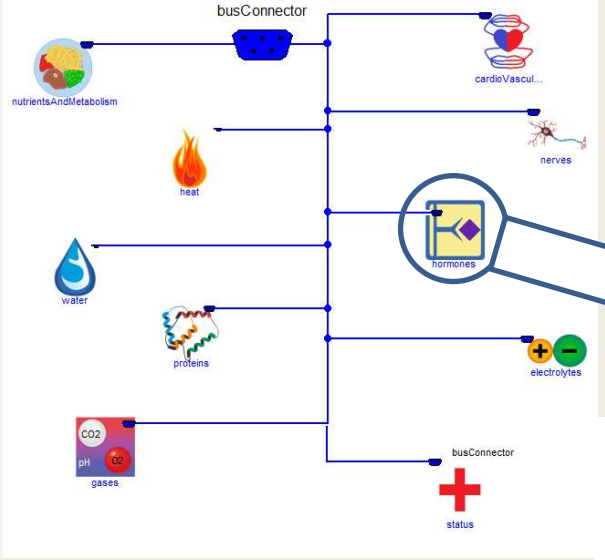

q_in
busConnector
Bladder
BladderVolume_Mass
BladderVoidFlow
K=1
bladderVoid



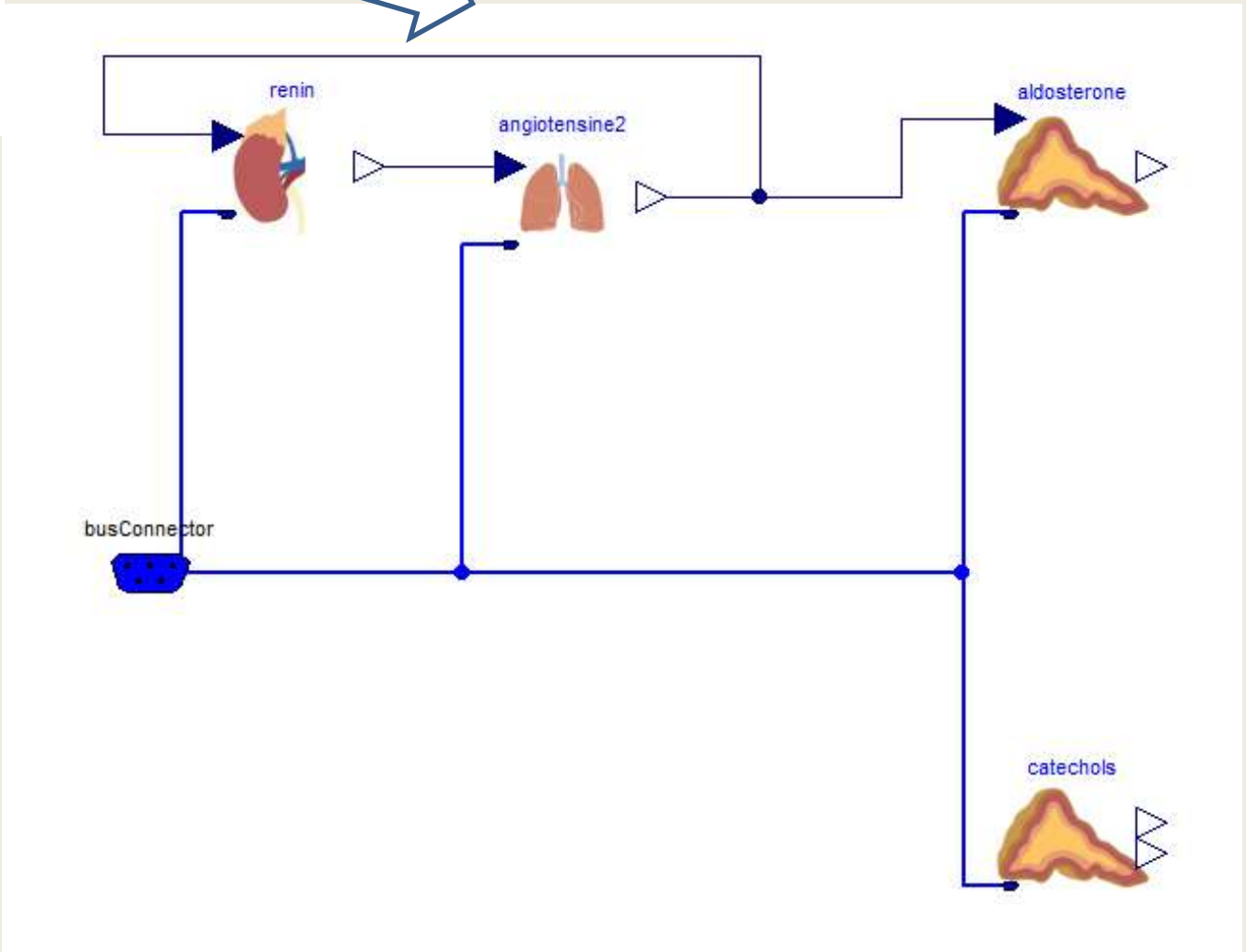
electrolytesProperties

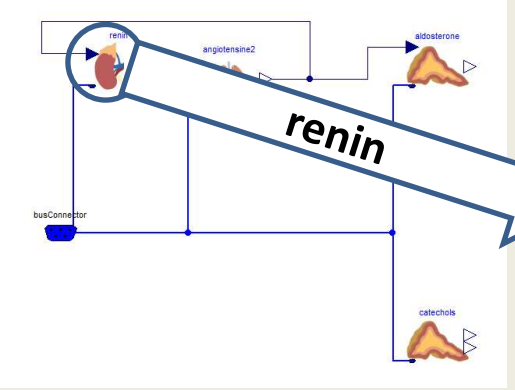



busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status

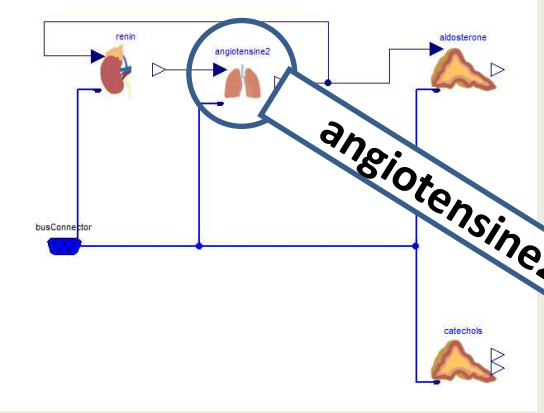

busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status

hormones

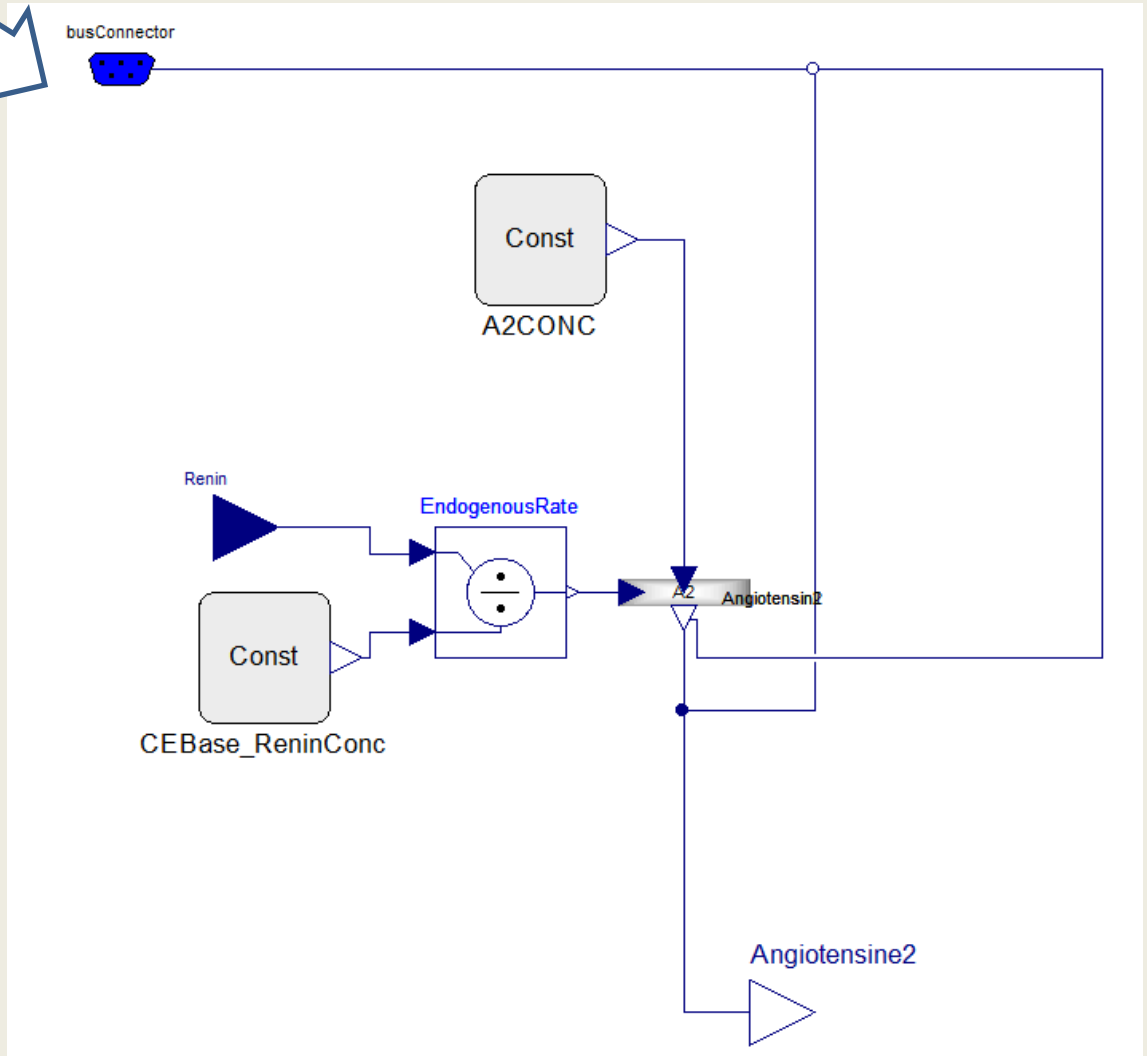

renin
angiotensine2
aldosterone
busConnector
catechols

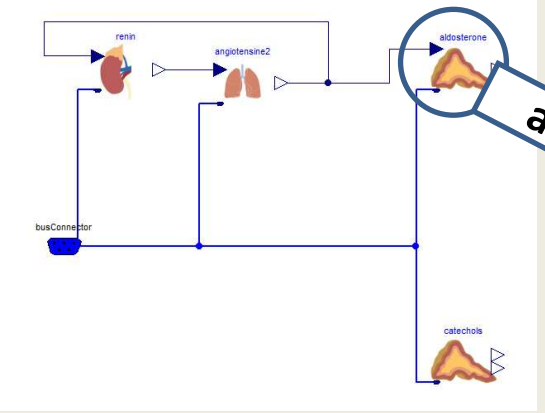


busConnector
Const
Angiotensin2
Kidney_NephronCount_Total_xNormal
KidneyFunctionEffect
Constant2
MD_Na
ANP
SympsEffect1
TGFEffect1
feedback
Constant3
BetaPool_Effect
BetaBlocade_Effect
GangliaKidney_NA
betaReceptor...
integrator
k=(1/60)/60
VODIST
ECFV_Vol
k=0.6
Const
TGFEffect
SympsEffect
Renin
Renin
synthesis
ReninFree
ReninGranules
gain1
secretion
K
k=0....
Clearance
gain3
k=0.001/60
fluxRenin...
fluxReninF...



angiotensine2





aldosterone

busConnector

Aldo

AngiotensinII

Const

hormoneFlow...

KPool

Aldosterone

AldoPool

BodyH2O_Vol

adrenalCortex

Liver_BloodFlow

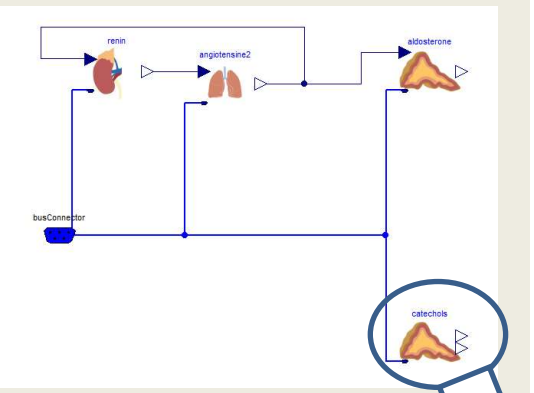
K=0.78

Clearance

Degr...

k=0....

Degradation



catechols

busConnector

ECFV_Vol
OtherTissueFunctionEffect
AdrenalNerve_NA

Epinephrine

EpinephrineConc

ECFV_Vol
AdrenalNerve_NA
GangliaGeneral_NA
OtherTissueFunctionEffect

Norepinephrine

NorepinephrineConc

BetaTotal
0.02...
0.12...

log10_2
max(log1...

BetaPool_Effect

Const
Constant1

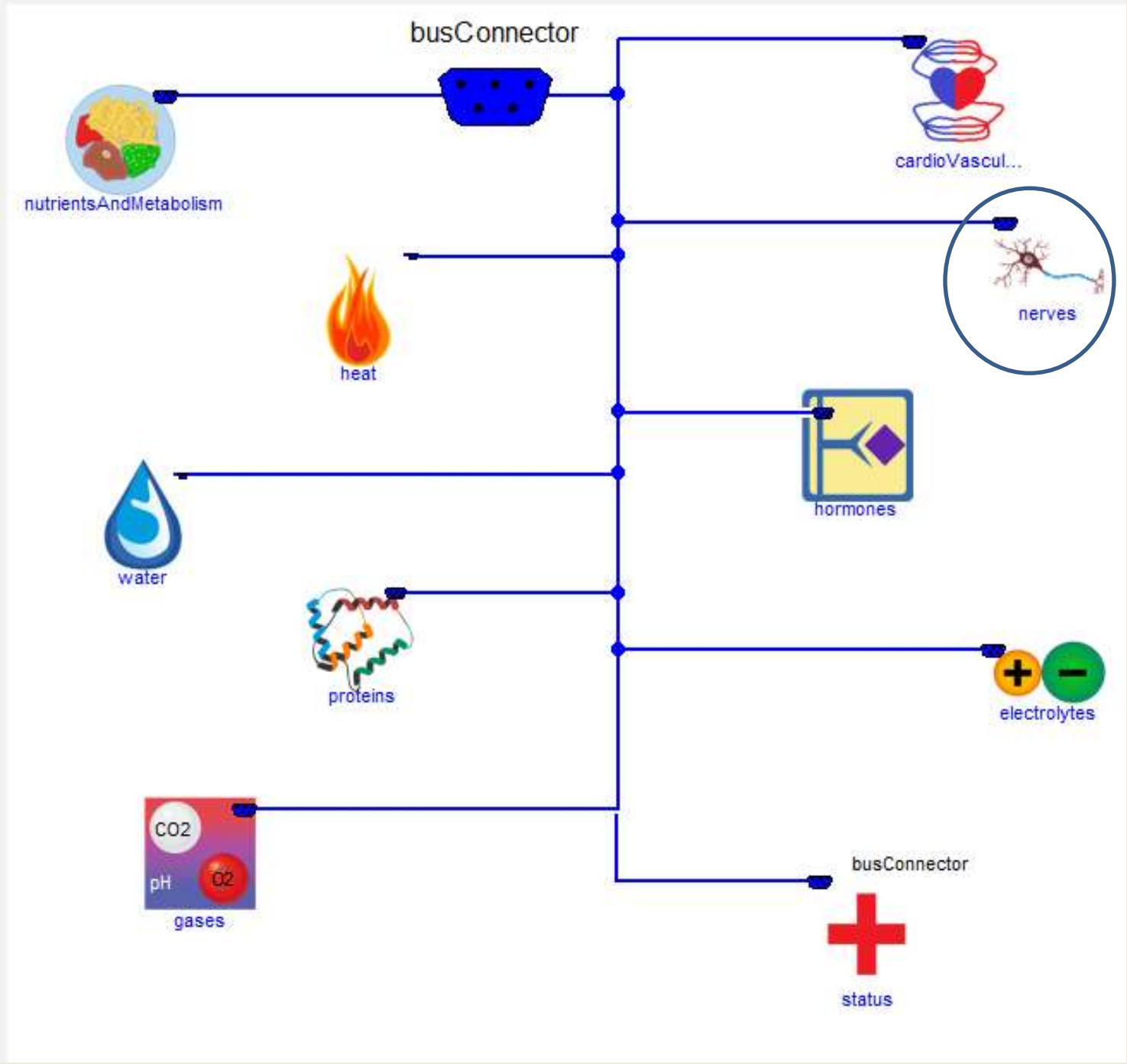
AlphaTotal
0.021*...
0.125*...
5

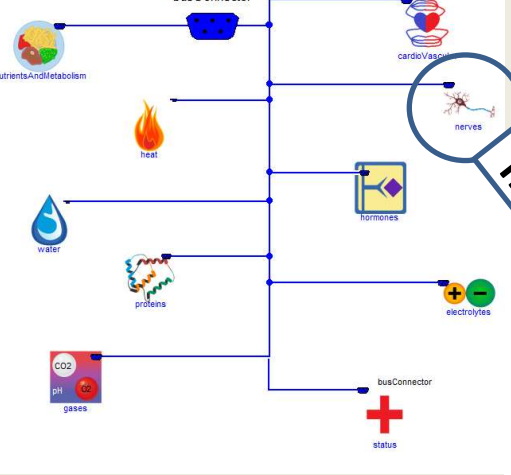
log10_1
max(log1...

AlphaPool_Effect

Const
Constant

Const
Desglymidodrine


busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status



nerves

busConnector

Baroreflex

carotidSinusArteryPressure

pituitary

SympsCNS_PituitaryNA

brain_Fuel_FractUseDelay

AtrialLowPressureReceptors_NA

gangliaKidney

Const

GangliaKidney_NA

KidneyAlpha_PT_N...

Const

Constant

Kidney_Alpha_NA

Adrena...

k=0.667

AdrenalNerve_NA

exercise

skeletalMuscl _pH_intracellular

ExerciseMeta olism_TotalWatts

sympatheticCNS

AtrialLowPressureReceptors_NA

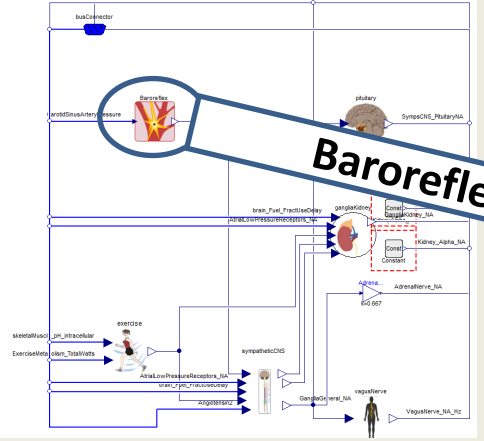
brain_Fuel_FractUseDelay

Angiotensin2

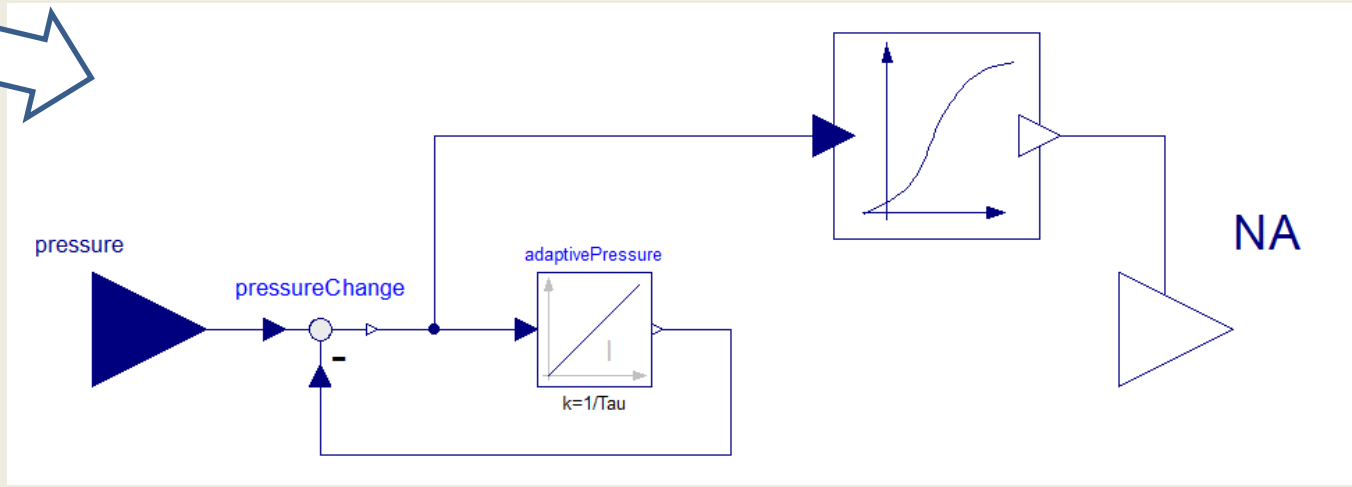
GangliaGeneral_NA

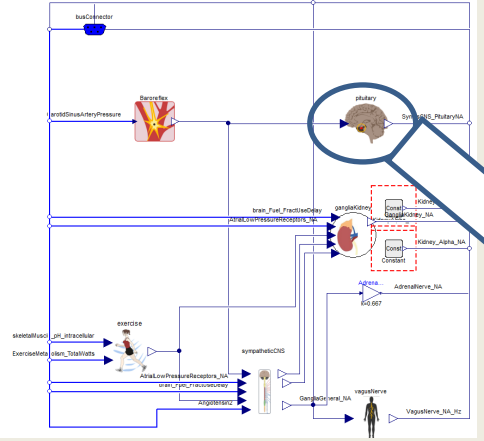
vagusNerve

VagusNerve_NA_Hz

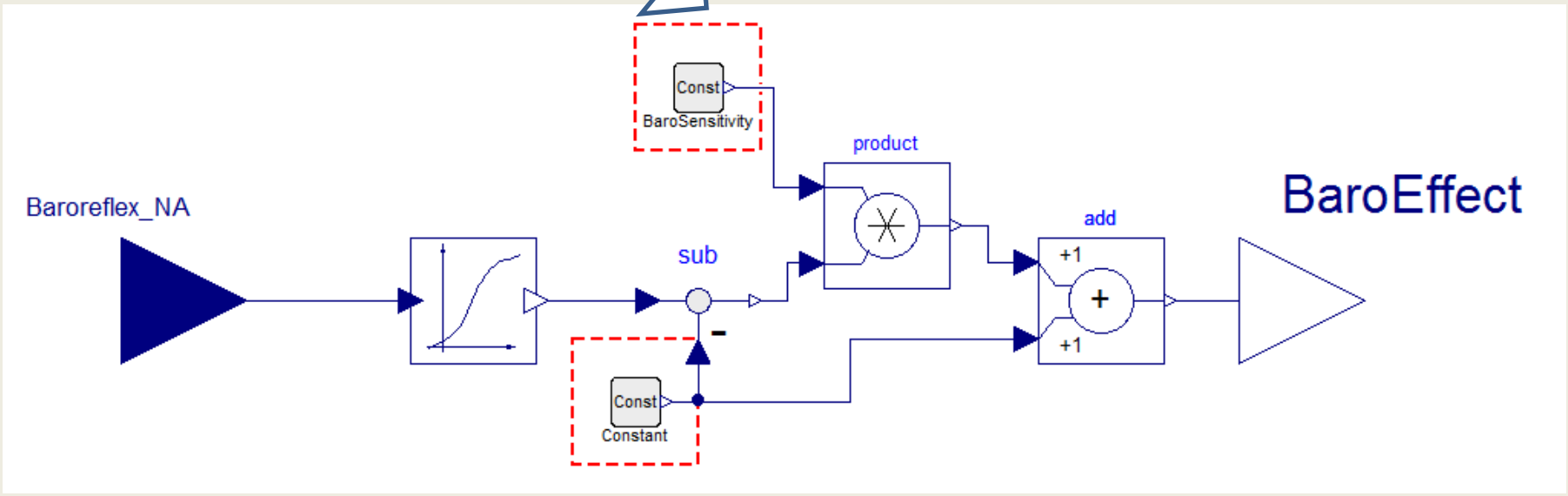

busConnector
Baroreflex
pituitary
SympsCNS_PituitaryNA
brain_Fuel_FractSiteDelay
gangliaKidney
Const
Const1
Constant
kKidney_Alpha_NA
Alpha
AdrenalNerve_NA
exercise
sympatheticCNS
vagusNerve
VagusNerve_NA_Hz

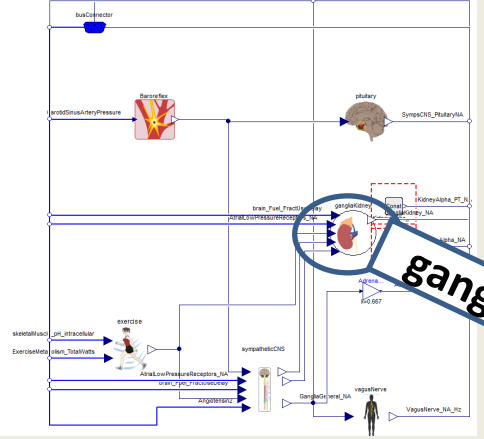
Baroreflex

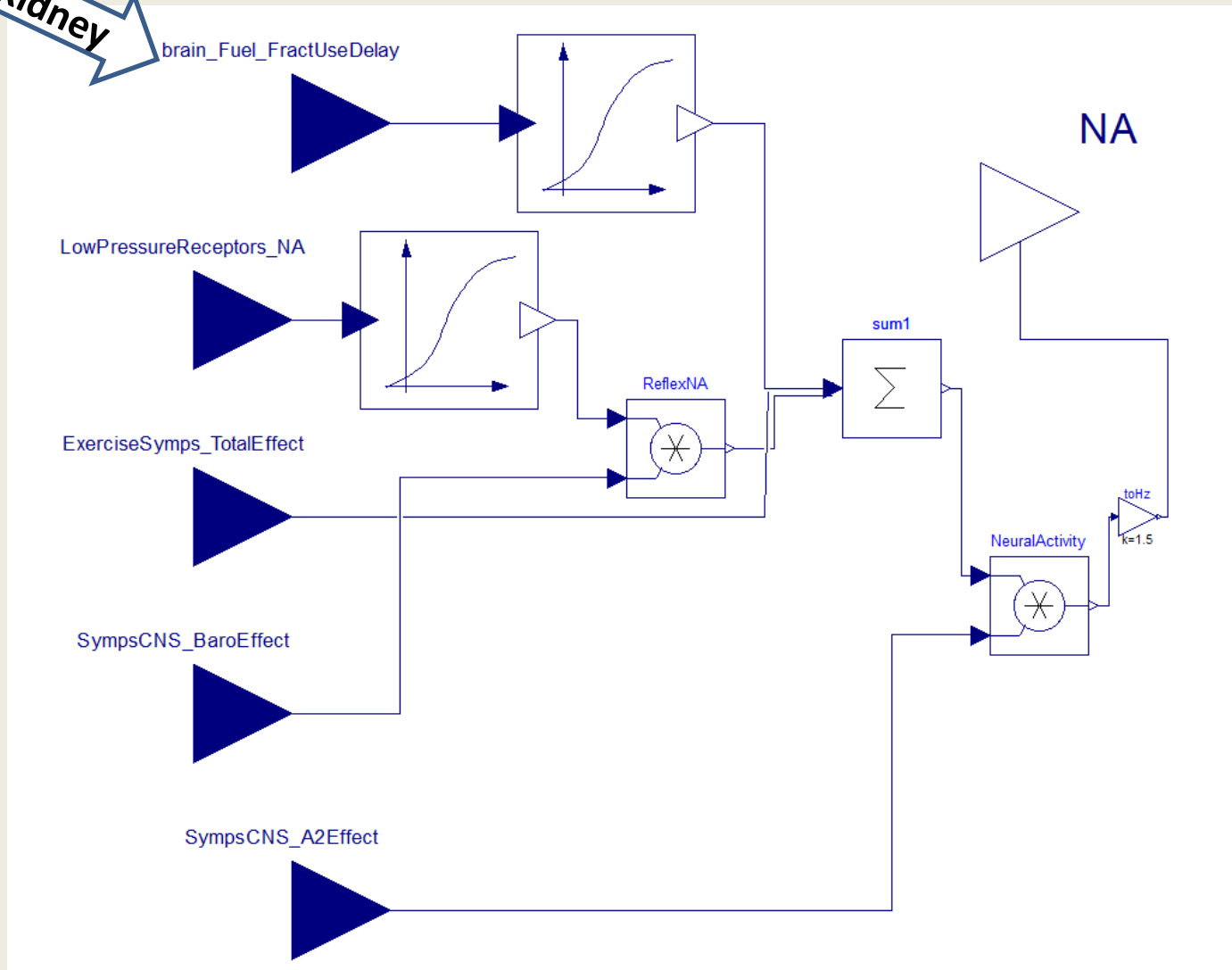

pressure
pressureChange
adaptivePressure
k=1/Tau
NA

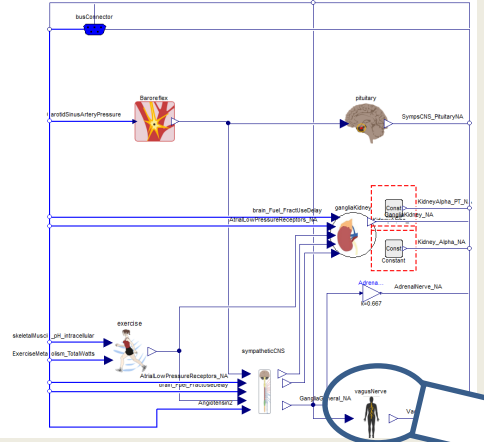

busConnector
Baroreflex
pituitary
carotidSinusArteryPressure
Sym_SNS_PituitaryNA
brain_Fuel_FractUseDelay
ganglaKidney
Const
Constant
Kidney_Alpha_NA
AdrenalNerve_NA
Alpha
exercise
sympatheticCNS
vagualNerve
VagusNerve_NA_Hz

pituitary

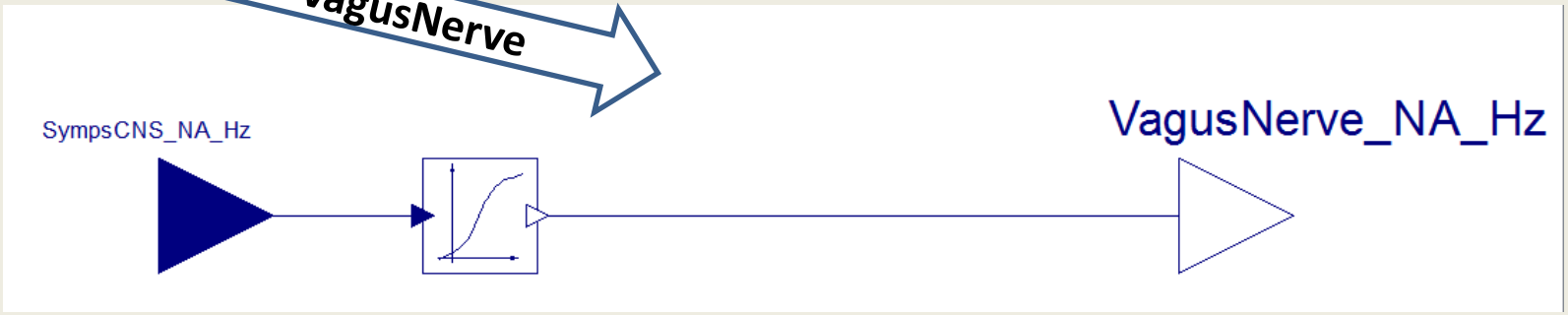

Const
BaroSensitivity
product
Baroreflex_NA
sub
add
+1
+1
BaroEffect
Const
Constant

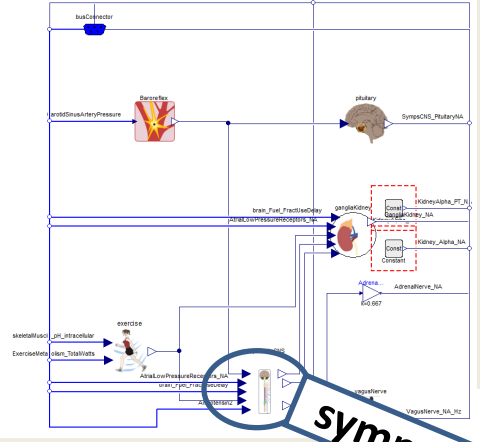

busConnector
Baroreflex
pituitary
SympsCNS_PituitaryNA
gangliaKidney
KidneyAlpha_PT_N
Alpha_NA
exercise
sympatheticCNS
vagusNerve
VagusNerve_NA_Hz
gangliaKidney


brain_Fuel_FractUseDelay
LowPressureReceptors_NA
ExerciseSymps_TotalEffect
SympsCNS_BaroEffect
SympsCNS_A2Effect
ReflexNA
sum1
NeuralActivity
toHz
k=1.5
NA

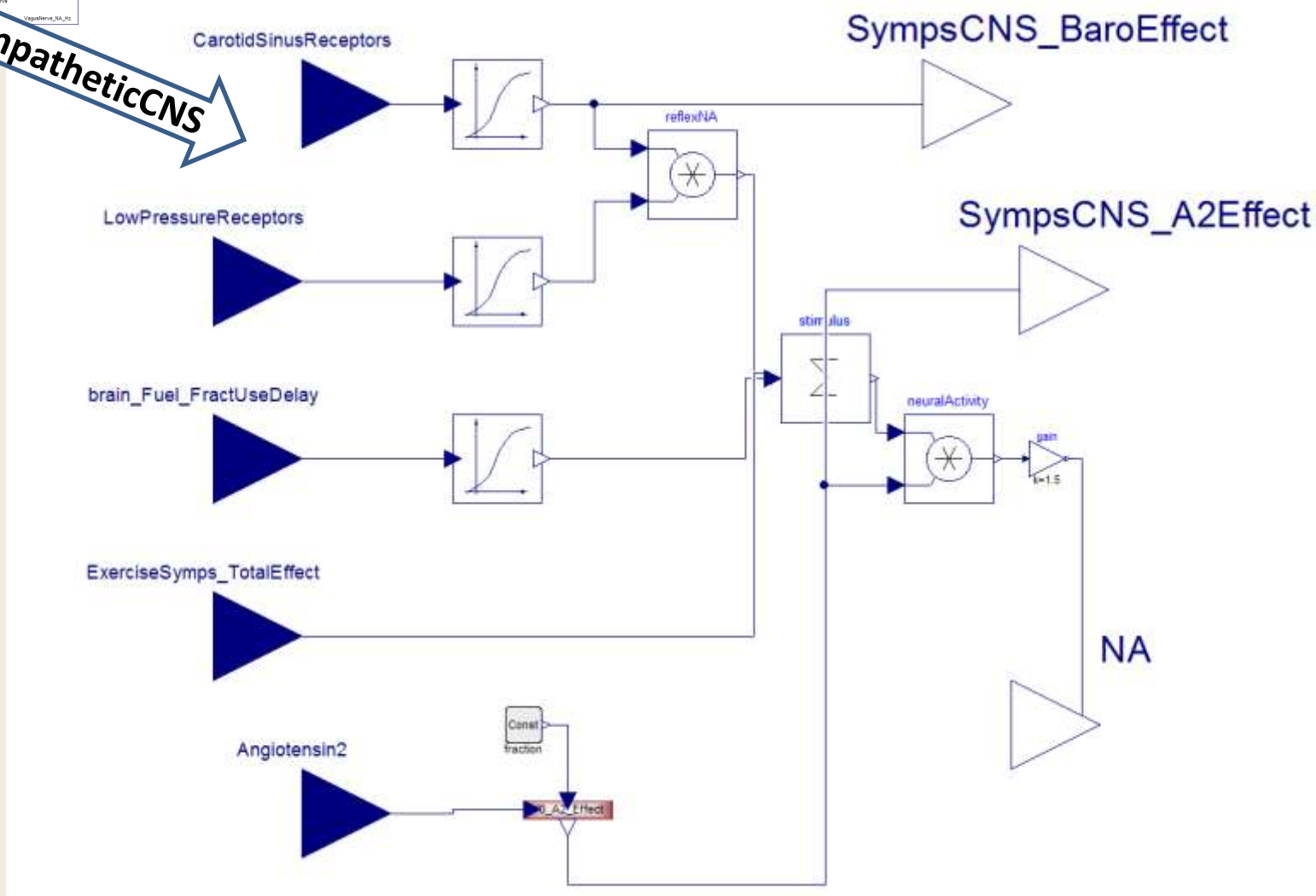

busConnector
Baroreflex
carotidSinusArteryPressure
pituitary
SympsCNS_PituitaryNA
brain_Fuel_FractUseDelay
ganglaKidney
Kidney_Alpha_NA
Constant
AdrenalNerve_NA
exercise
sympathoticCNS
vagusNerve

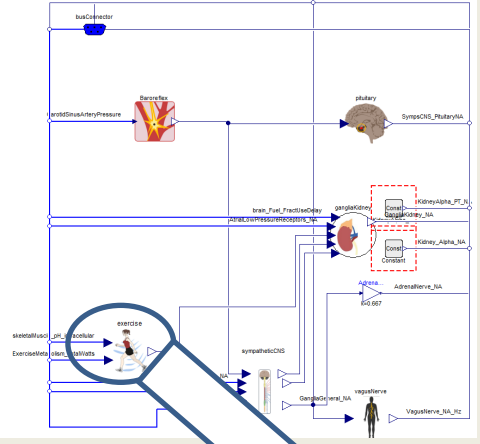
vagusNerve


SympsCNS_NA_Hz
VagusNerve_NA_Hz

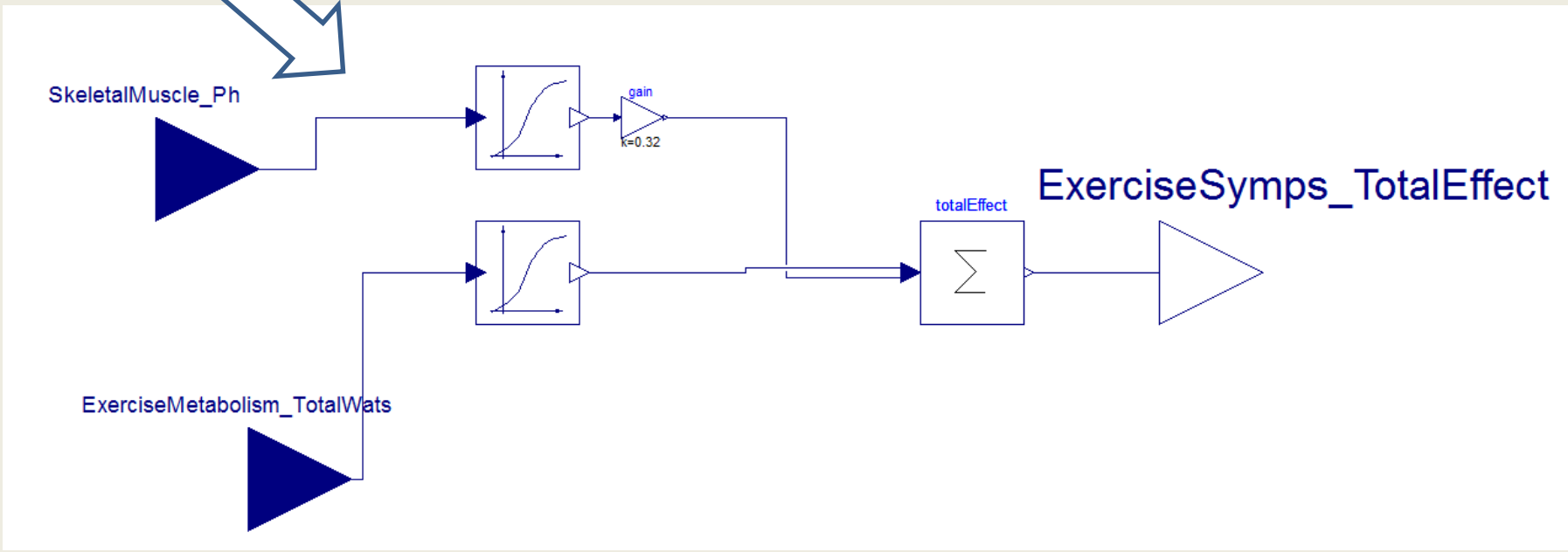


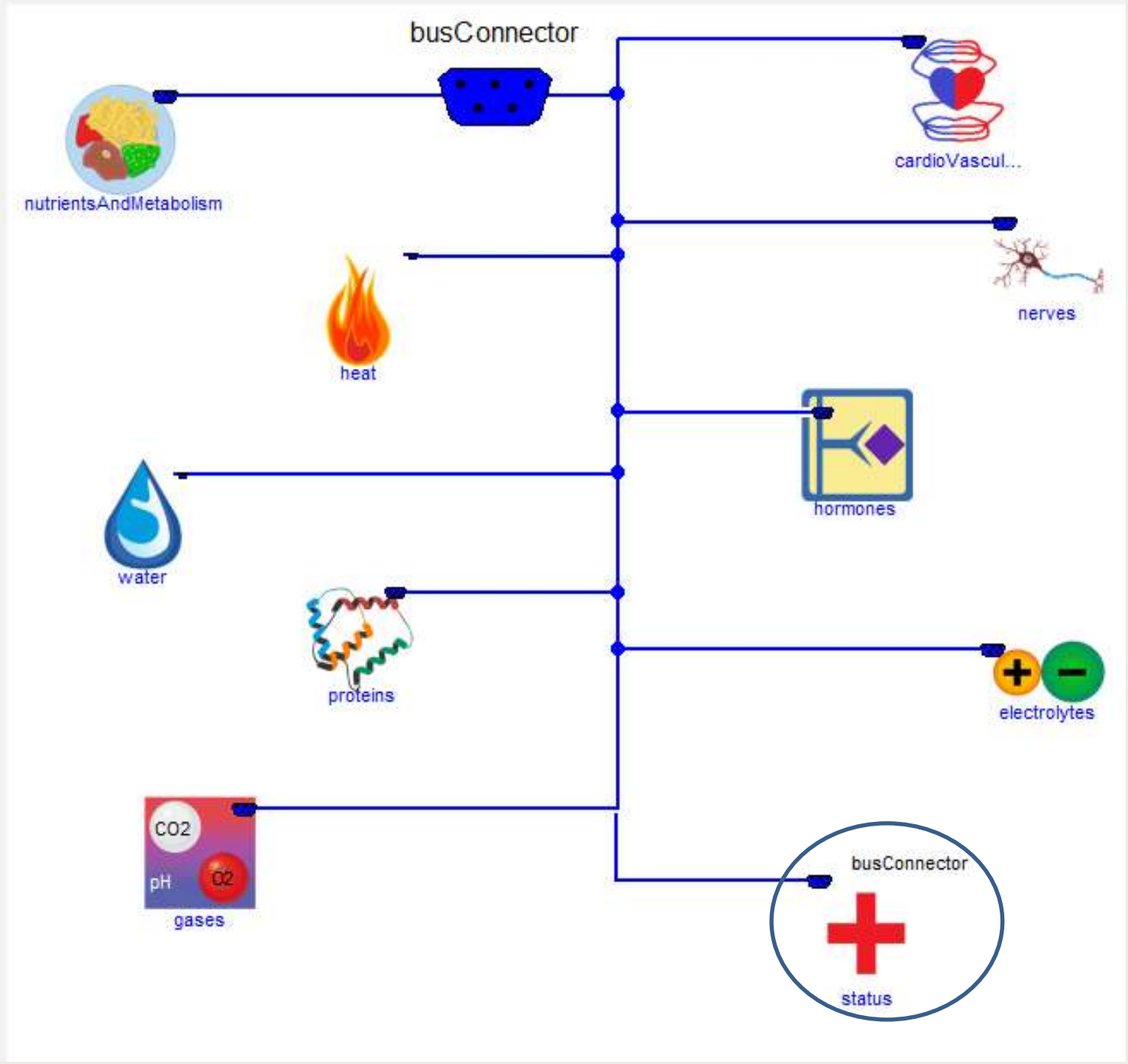
sympatheticCNS

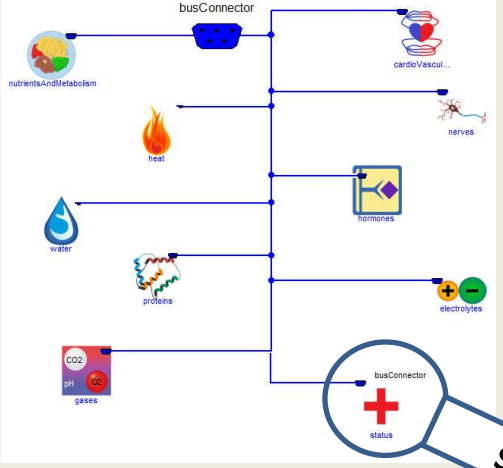



busConnector
Baroreflex
pituitary
carotidSinusArteryPressure
SympsCNS_PituitaryNA
brain_Fuel_FractUseDelay
gangliaKidney
Const
Constant
Const1
Constant1
kKidney_Alpha_NA
AdrenalNerve_NA
Alpha
exercise
sympatheticCNS
vagusNerve
VagusNerve_NA_Hz

exercise


SkeletalMuscle_Ph
gain
k=0.32
totalEffect
ExerciseSymps_TotalEffect
ExerciseMetabolism_TotalWats


busConnector
nutrientsAndMetabolism
cardioVascul...
nerves
heat
hormones
water
proteins
electrolytes
CO2
pH
O2
gases
busConnector
status



status

busConnector

skeletalMuscle_pH_intracellular
skeletalMuscle_T
skeletalMuscle_Fuel_FractUseDelay
CellProteinAA

liver_pH_intracellular
liver_T
liver_Fuel_FractUseDelay
CellProteinAA

bone_pH_intracellular
bone_T
bone_Fuel_FractUseDelay
CellProteinAA

brain_pH_intracellular
brain_T
brain_Fuel_FractUseDelay
CellProteinAA

otherTissue_pH_intracellular
otherTissue_T
otherTissue_Fuel_FractUseDelay
CellProteinAA

GITract_pH_intracellular
GITract_T
GITract_Fuel_FractUseDelay
CellProteinAA

respiratoryMuscle_pH_intracellular
respiratoryMuscle_T
respiratoryMuscle_Fuel_FractUseDelay
CellProteinAA

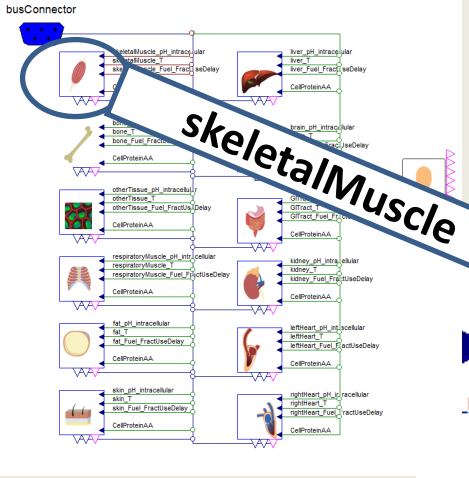
kidney_pH_intracellular
kidney_T
kidney_Fuel_FractUseDelay
CellProteinAA

fat_pH_intracellular
fat_T
fat_Fuel_FractUseDelay
CellProteinAA

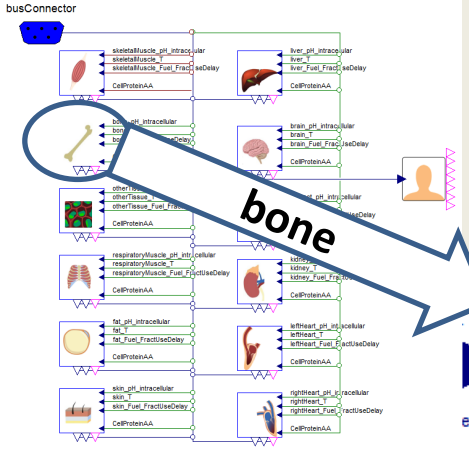
leftHeart_pH_intracellular
leftHeart_T
leftHeart_Fuel_FractUseDelay
CellProteinAA

skin_pH_intracellular
skin_T
skin_Fuel_FractUseDelay
CellProteinAA

rightHeart_pH_intracellular
rightHeart_T
rightHeart_Fuel_FractUseDelay
CellProteinAA



Const
Constant1
_FractUseDelay
pH_intracellular
Const
Constant
CellProteinAA
Const
Constant2
feedback
integrator
k=1
StructureEffect
FunctionEffect
failed
FunctionFailed



el_FractUseDelay

pH_intracellular

Const
Constant

Ph On Structure

uel On Structure

mperature On...

Const
Constant1

mperature On...

uel On unction

Ph On Function

CellProteinAA

teinOnFunction

Structure Eff

FunctionEffect

integrator

StructureEffect

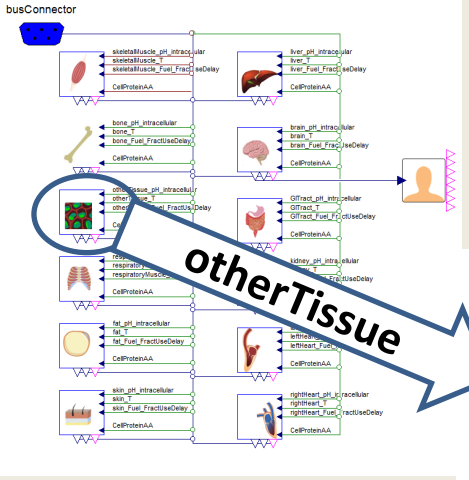
Const
Constant2

feedback

k=1

failed

FunctionFailed



T

Fuel_FractUseDelay

pH_intracellular

Const
Constant

Const
Constant1

CellProteinAA

integrator

StructureEffect

FunctionEffect

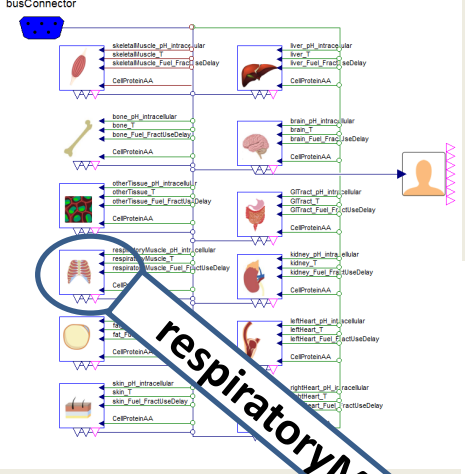
Const
Constant2

feedback

k=1

failed

FunctionFailed



T

Fuel_FractUseDelay

pH_intracellular

CellProteinAA

Const
Constant

Const
Constant1

Const
Constant2

feedback

integrator

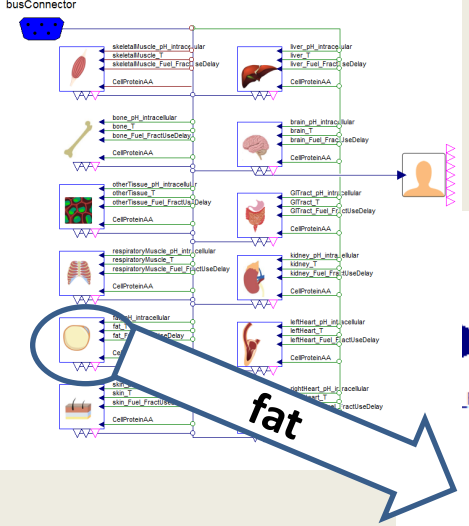
k=1

StructureEffect

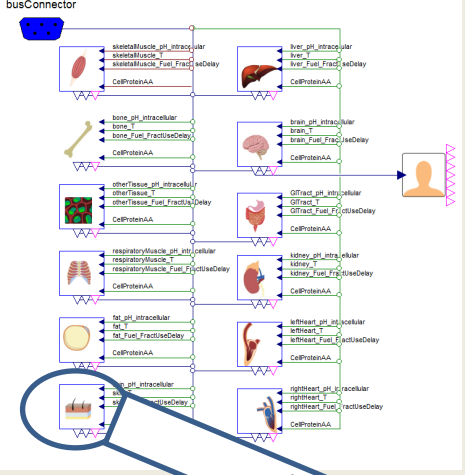
FunctionEffect

failed

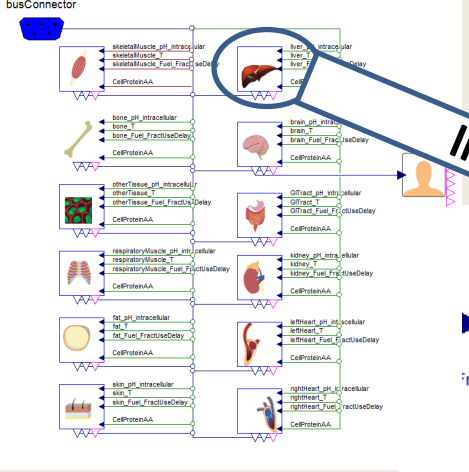
FunctionFailed

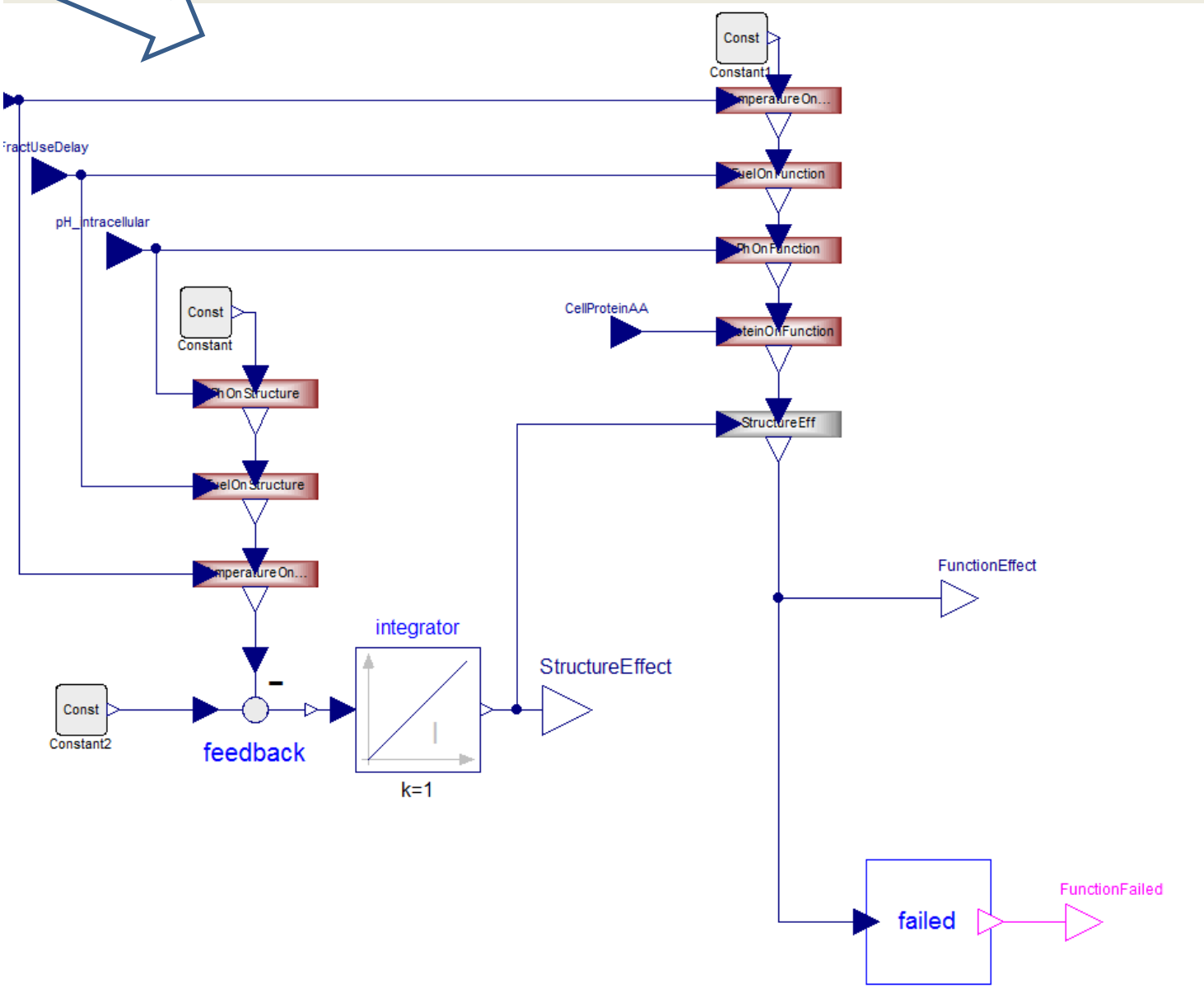


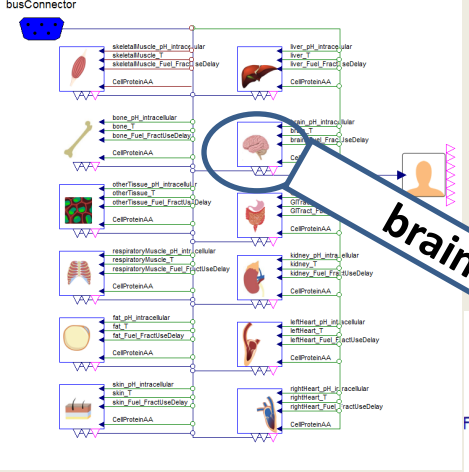
Const
Constant1
FuelOnFunction
pHOnFunction
CellProteinAA
StructureEff
FunctionEffect
pH_intracellular
Const
Constant
pHOnStructure
FuelOnStructure
Const
Constant2
integrator
StructureEffect
feedback
k=1
failed
FunctionFailed

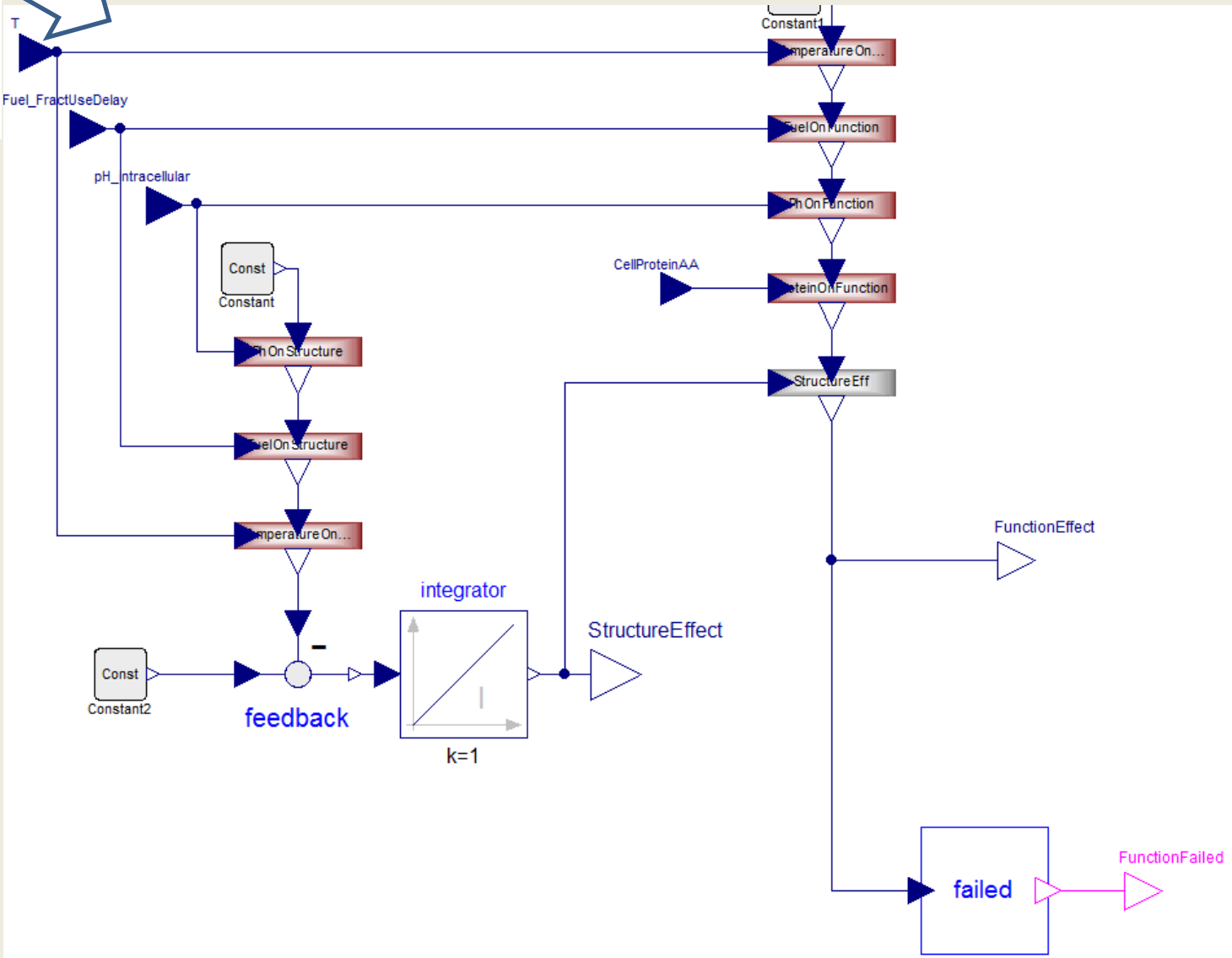


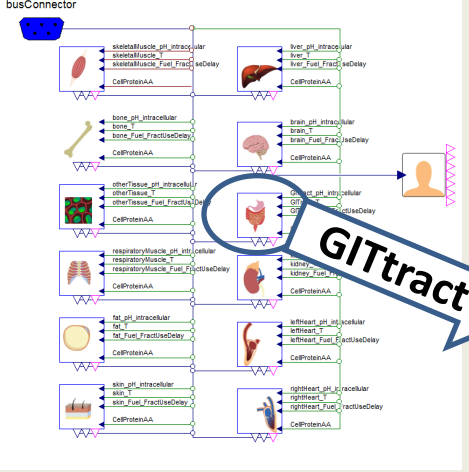
T
Fuel_FractUseDelay
pH_intracellular
CellProteinAA
Const
Constant
Const
Constant1
Const
Constant2
integrator
k=1
feedback
StructureEffect
FunctionEffect
failed
FunctionFailed


busConnector
liver


Const
Constant1
pH_intracellular
Const
Constant
CellProteinAA
integrator
StructureEffect
FunctionEffect
Const
Constant2
feedback
k=1
failed
FunctionFailed


busConnector
brain


T
Fuel_FractUseDelay
pH_intracellular
Const
Constant
CellProteinAA
Constant1
StructureEff
FunctionEffect
integrator
StructureEffect
Const
Constant2
feedback
k=1
failed
FunctionFailed



Fuel_FractUseDelay

pH_intracellular

CellProteinAA

Const
Constant

Const
Constant1

Const
Constant2

feedback

integrator

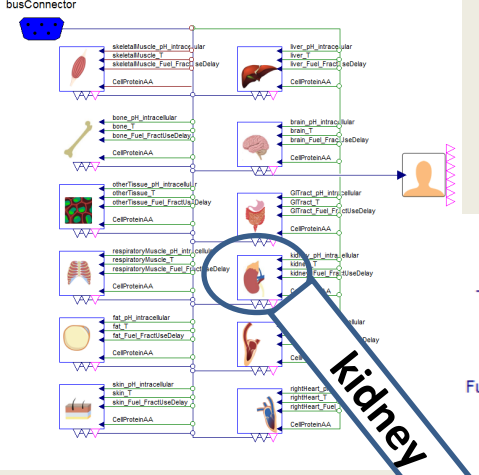
k=1

StructureEffect

FunctionEffect

failed

FunctionFailed



T

Fuel_FractUseDelay

pH_intracellular

CellProteinAA

Const
Constant

Ph On Structure

Fuel On Structure

Temperature On...

Const
Constant1

Temperature On...

Fuel On Function

Ph On Function

Protein On Function

Structure Eff

FunctionEffect

integrator

StructureEffect

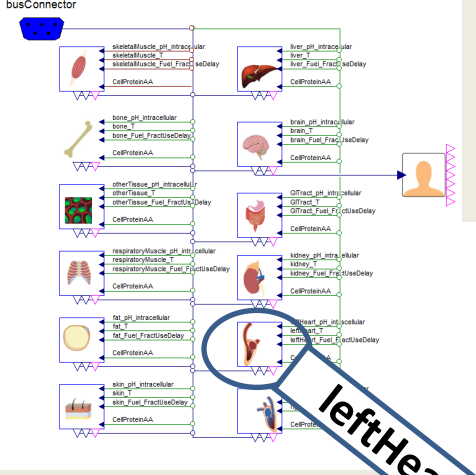
Const
Constant2

feedback

k=1

failed

FunctionFailed



T

Fuel_FractUseDelay

pH_intracellular

CellProteinAA

Const
Constant

Const
Constant1

Const
Constant2

PhOnStructure

FuelOnStructure

TemperatureOn...

PhOnFunction

FuelOnFunction

ProteinOnFunction

StructureEff

integrator

k=1

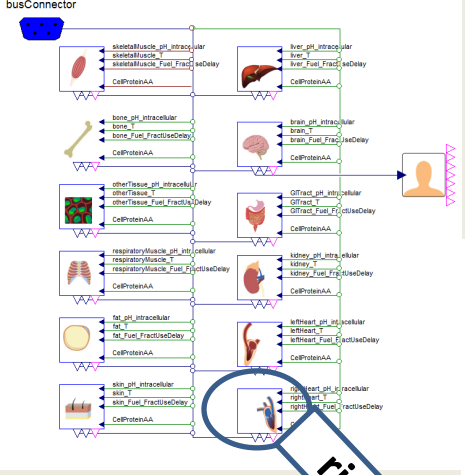
StructureEffect

feedback

FunctionEffect

failed

FunctionFailed



T

Fuel_FractUseDelay

pH_intracellular

CellProteinAA

Const
Constant

Const
Constant1

Const
Constant2

Ph On Structure

Fuel On Structure

Temperature On...

Temperature On...

Fuel On Function

Ph On Function

Protein On Function

Structure Eff

integrator

k=1

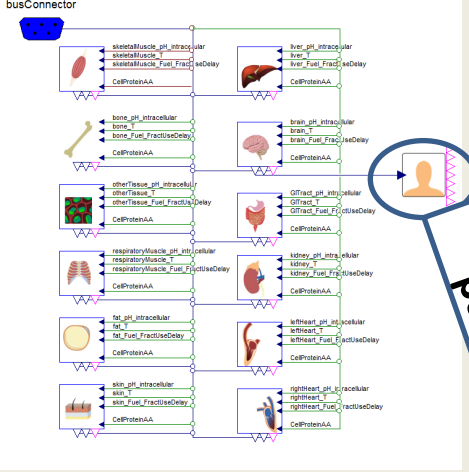
feedback

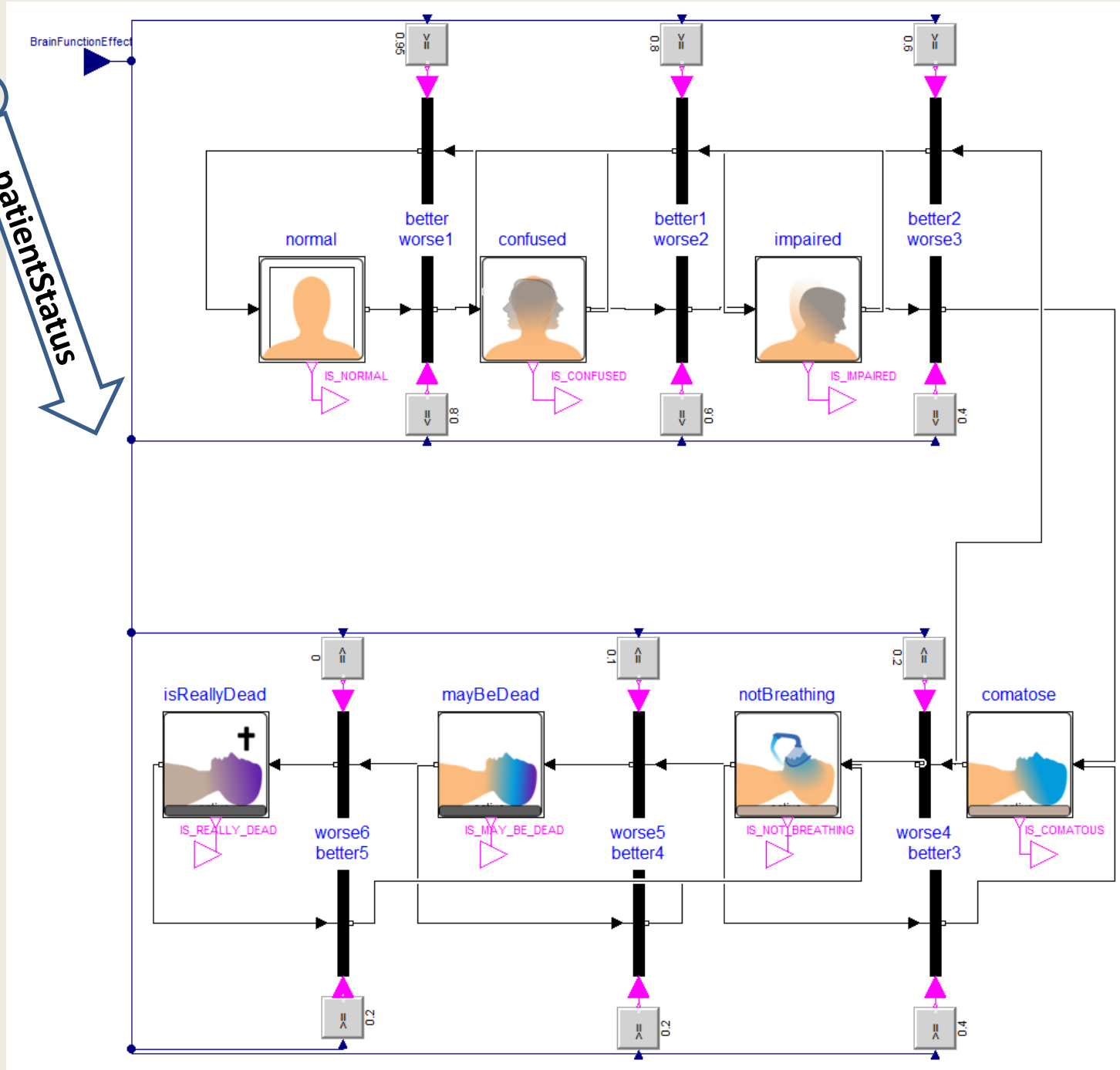
StructureEffect

FunctionEffect

failed

FunctionFailed


busConnector
patientStatus


BrainFunctionEffect
normal
better
worse1
confused
better1
worse2
impaired
better2
worse3
IS_NORMAL
IS_CONFUSED
IS_IMPAIRED
isReallyDead
mayBeDead
notBreathing
comatose
worse6
better5
worse5
better4
worse4
better3
IS_REALLY_DEAD
IS_MAY_BE_DEAD
IS_NOT_BREATHING
IS_COMATOUS