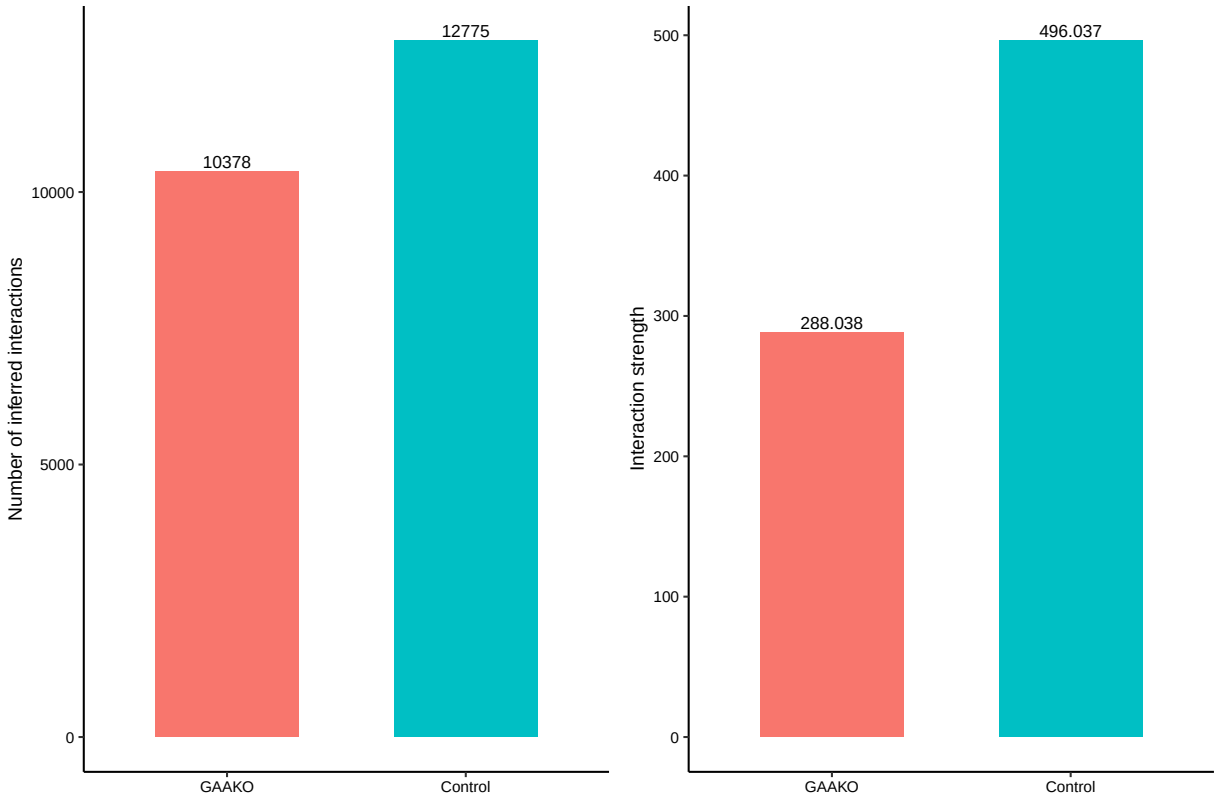
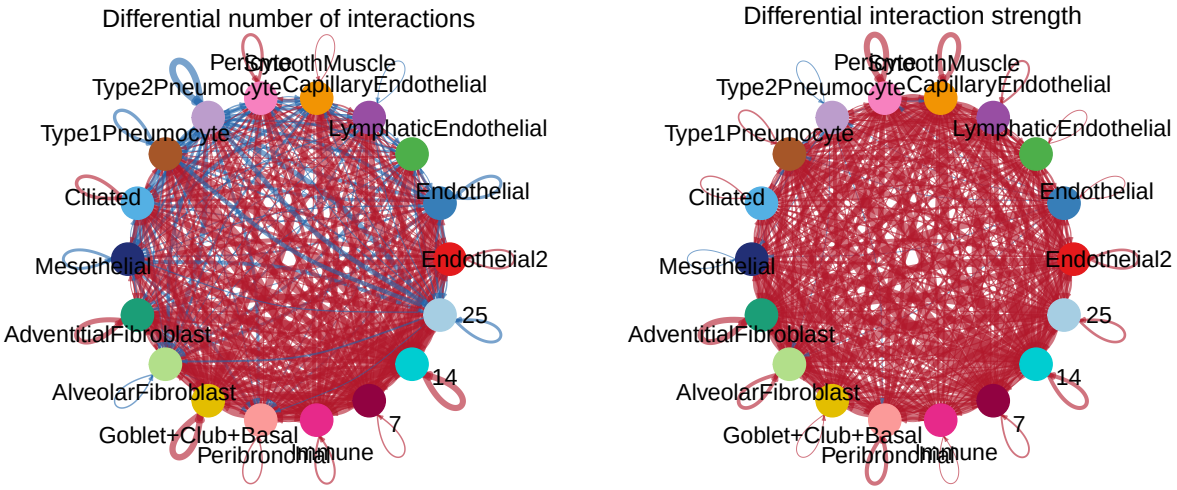
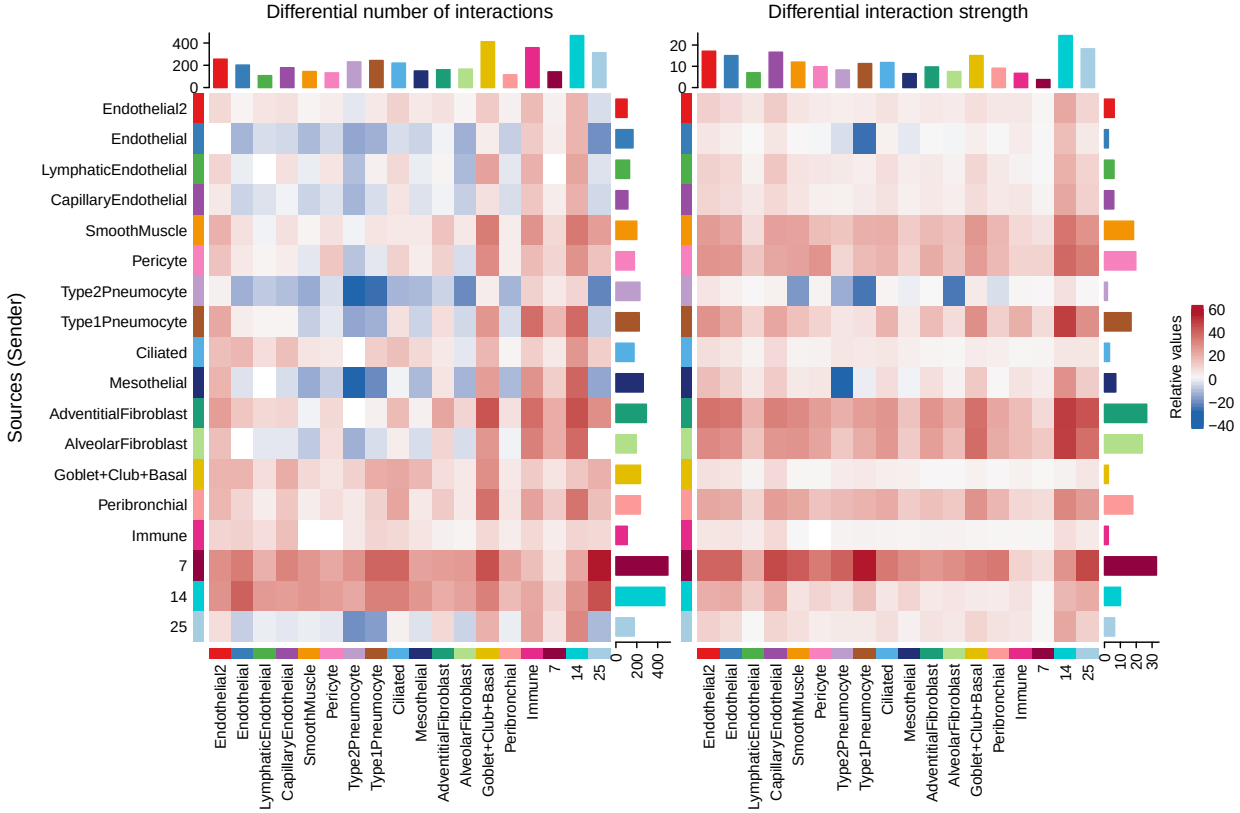
Interactions

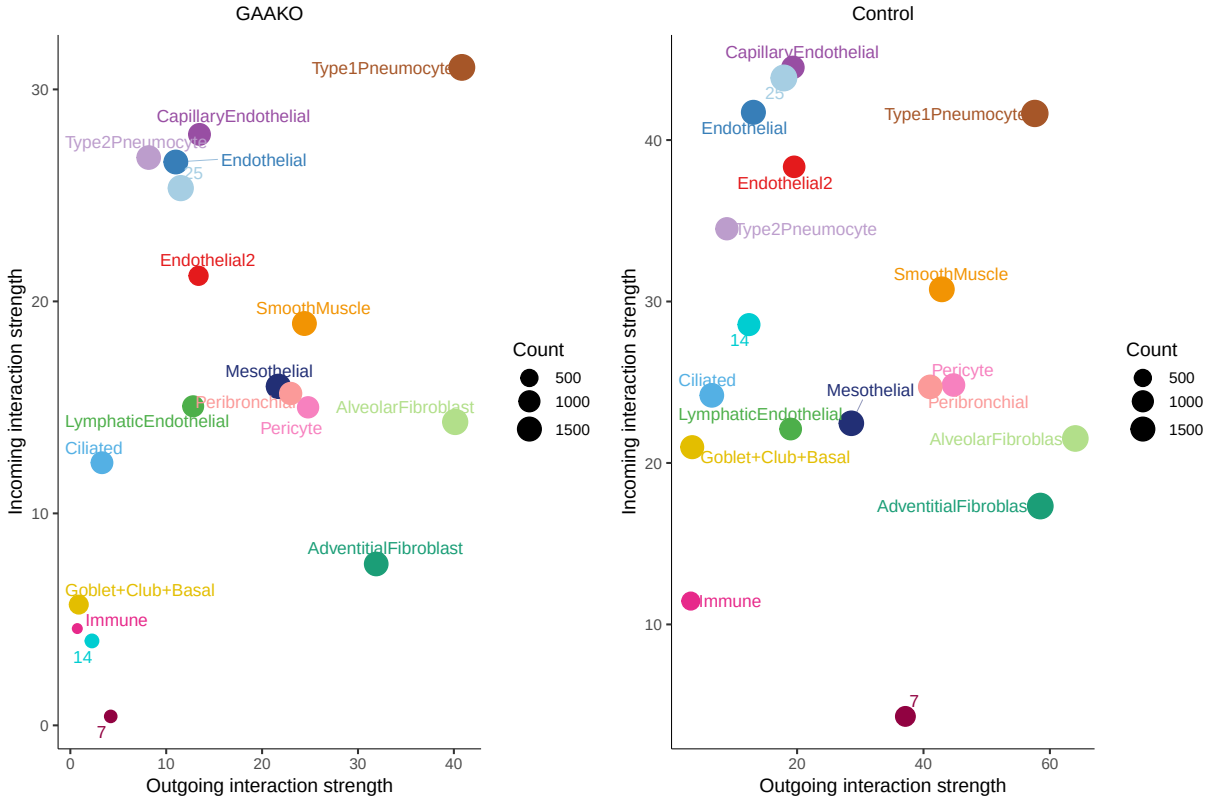
ElMallah Lab, Duke University

Elias Lai

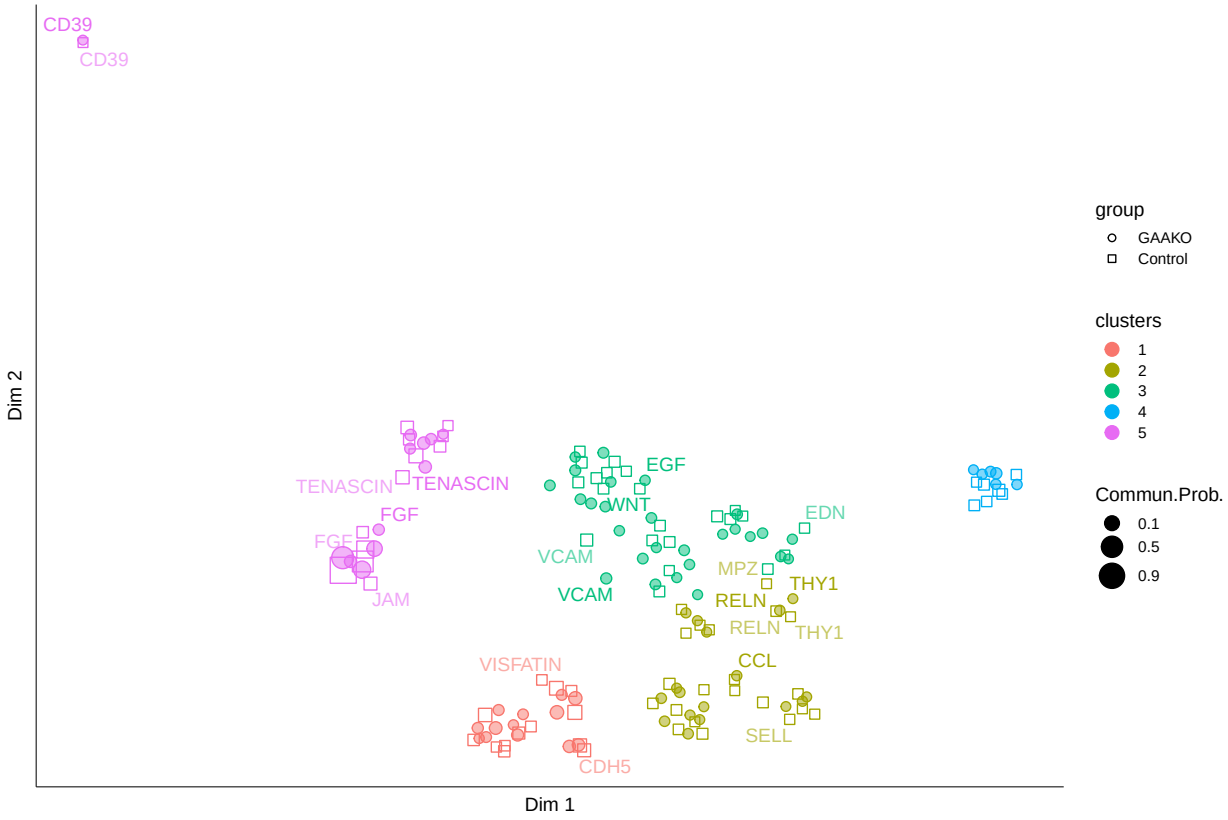



Differential number of interactions
Differential interaction strength
Pericyte
SmoothMuscle
Type2Pneumocyte
CapillaryEndothelial
Type1Pneumocyte
LymphaticEndothelial
Ciliated
Endothelial
Mesothelial
Endothelial2
AdventitialFibroblast
25
AlveolarFibroblast
14
Goblet+Club+Basal
7
Peribronchial
Immune

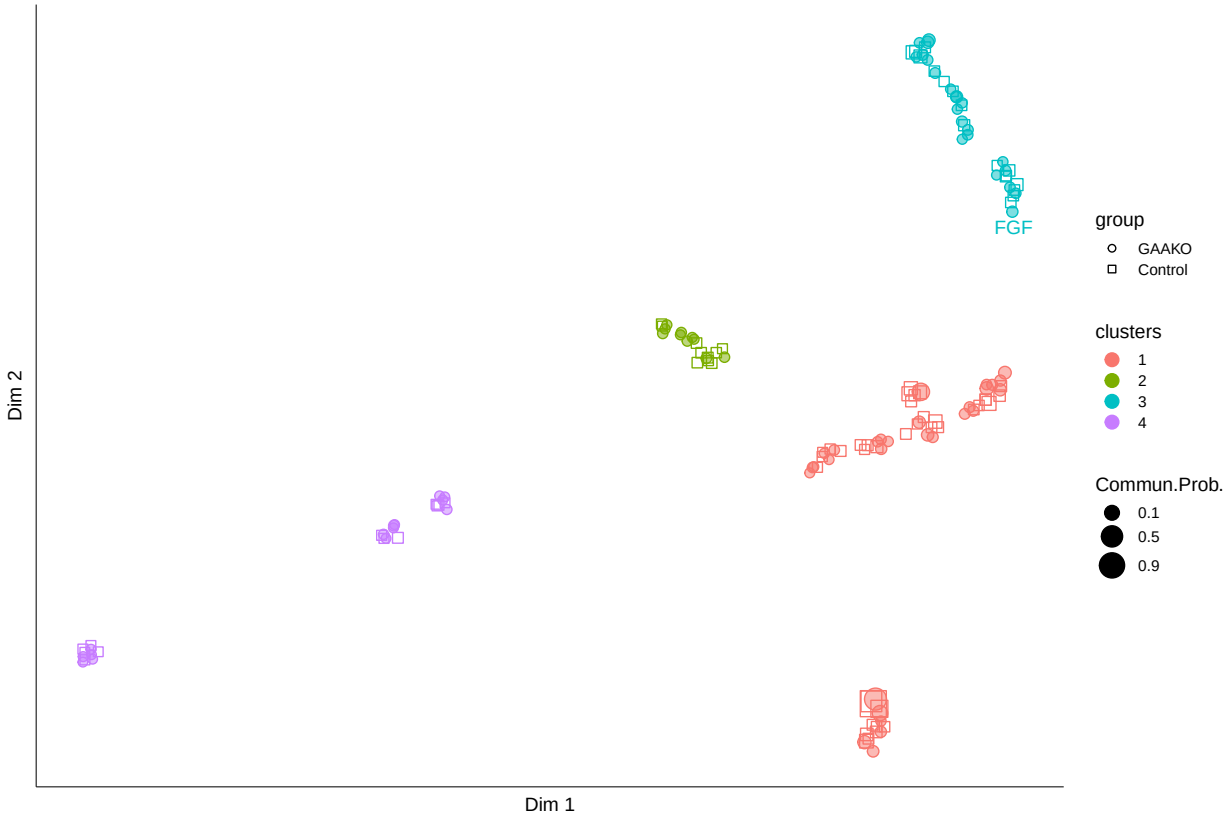

Differential number of interactions
Differential interaction strength
Sources (Sender)
Relative values
Endothelial2
Endothelial
LymphaticEndothelial
CapillaryEndothelial
SmoothMuscle
Pericyte
Type2Pneumocyte
Type1Pneumocyte
Ciliated
Mesothelial
AdventitialFibroblast
AlveolarFibroblast
Goblet+Club+Basal
Peribronchial
Immune
7
14
25



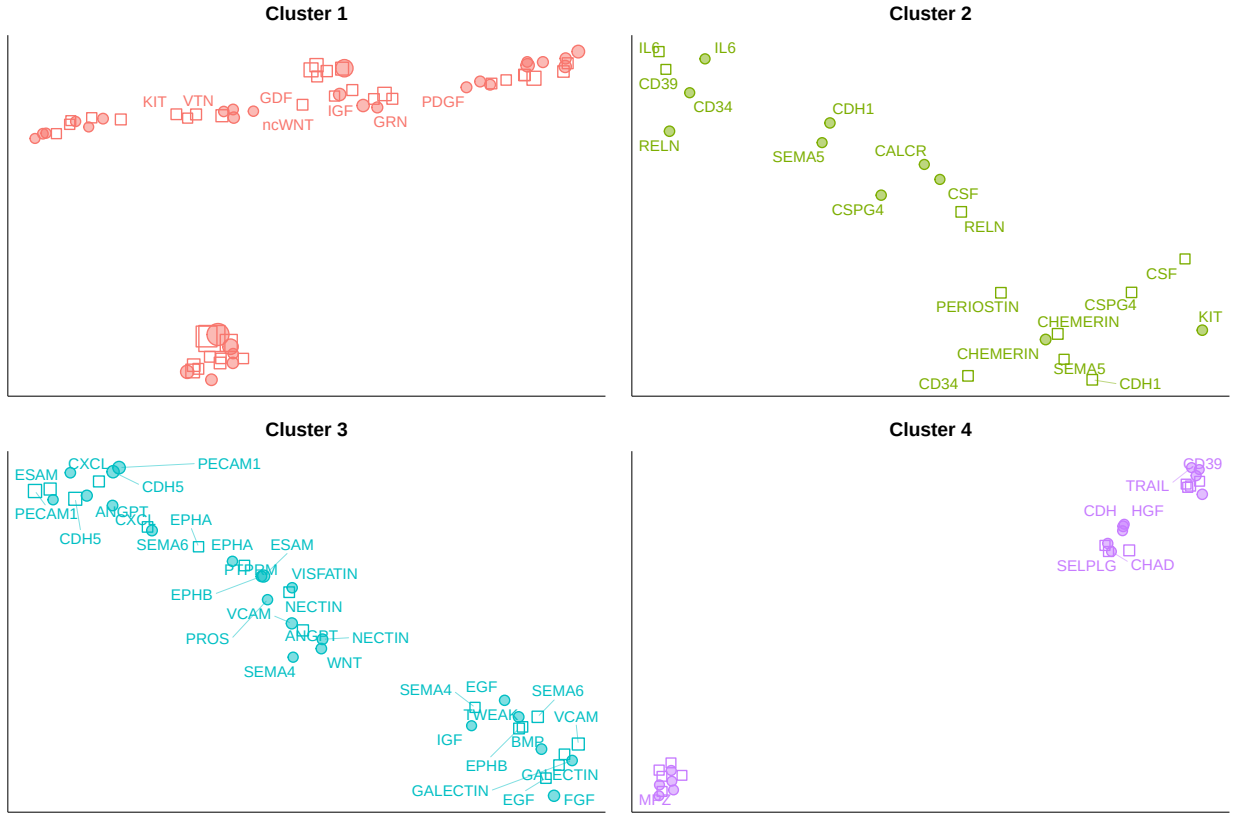
2D visualization of signaling networks from datasets 1 2



2D visualization of signaling networks from datasets 1 2



2D visualization of signaling networks from datasets 1 2

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Compute the distance of signaling networks between datasets 1 2
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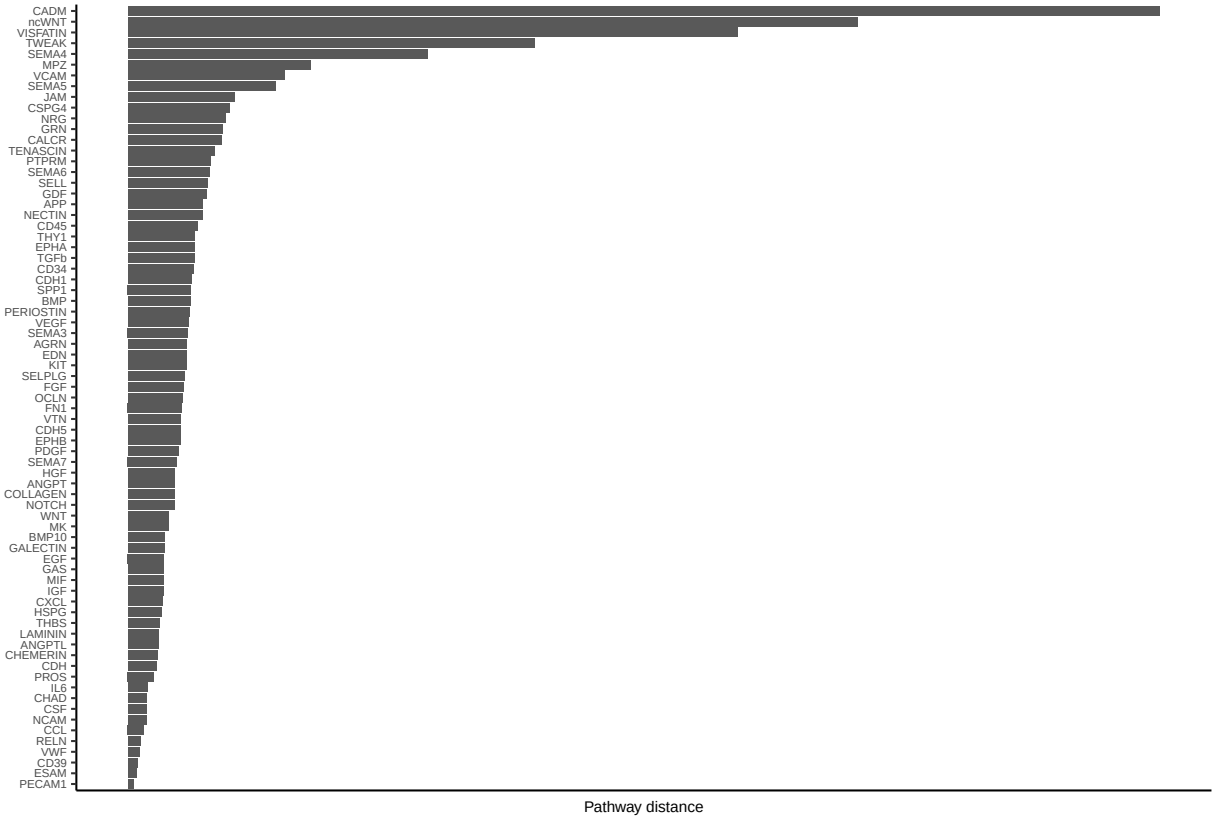
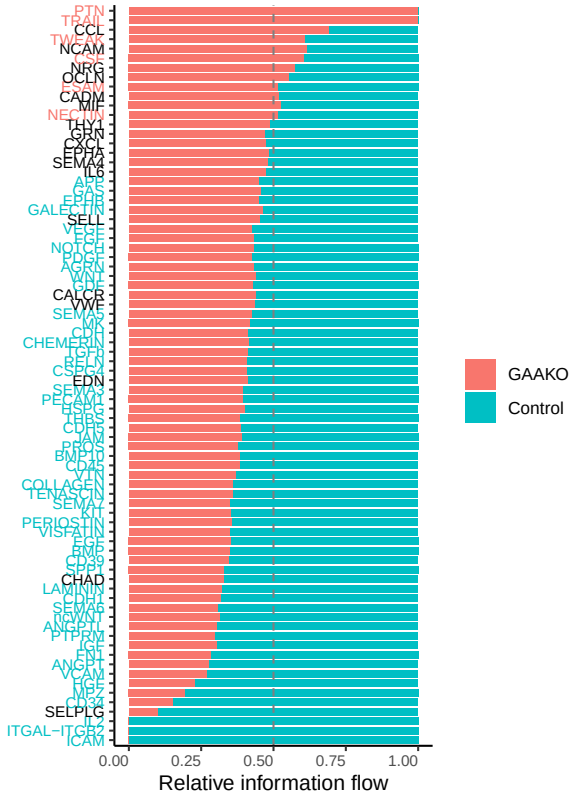
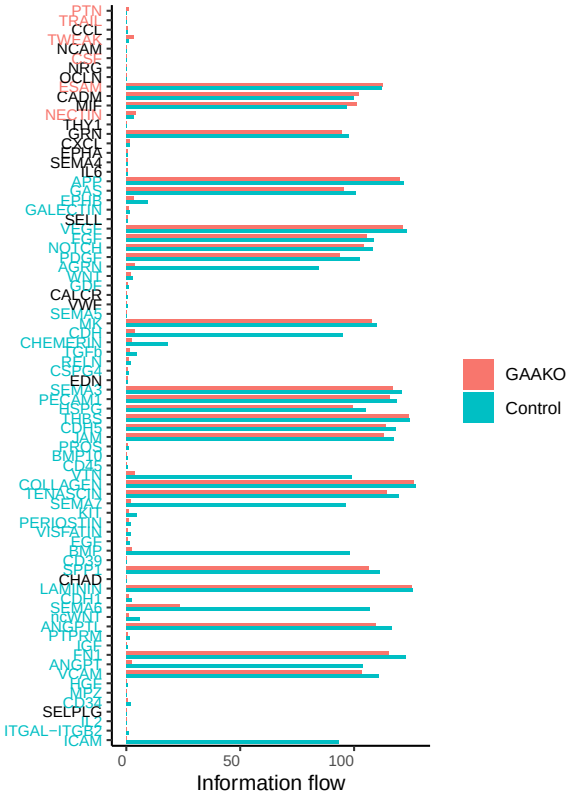
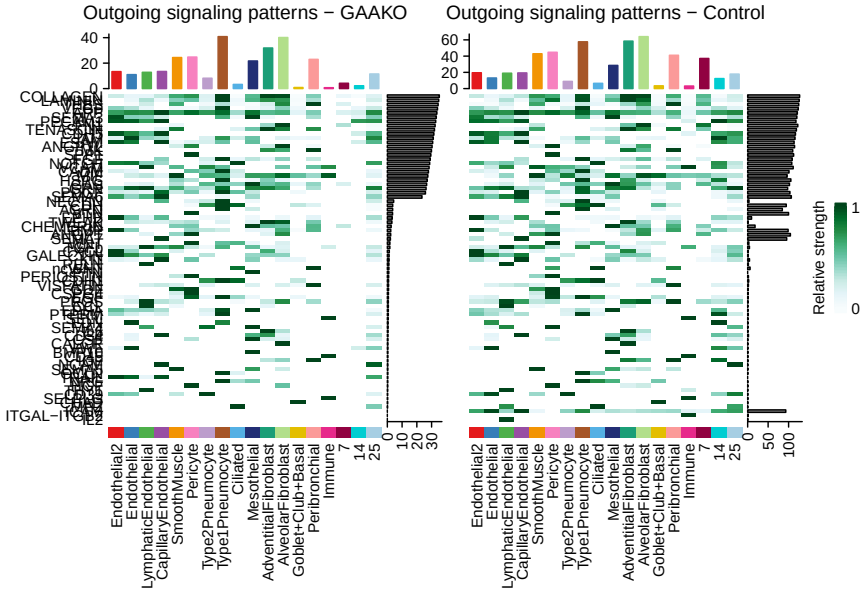
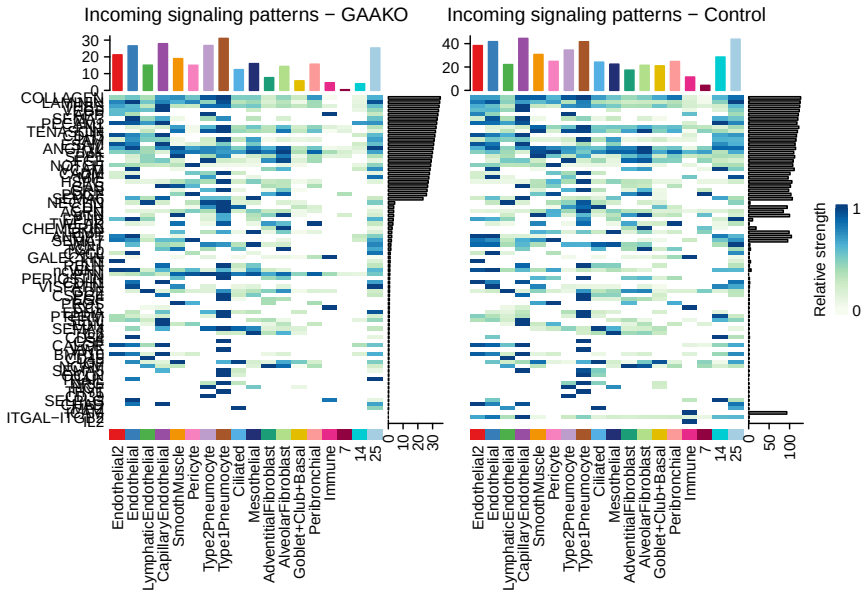
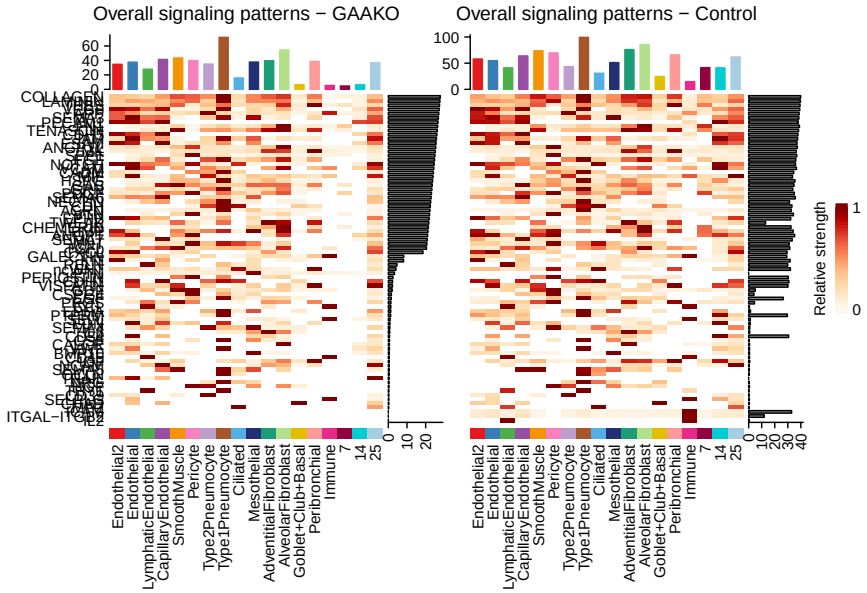

CADM
ncWNT
VISFATIN
TWEAK
SEMA4
MPZ
VCAM
SEMA5
JAM
CSPG4
NRG
GRN
CALCR
TENASCIN
PTPRM
SEMA6
SELL
GDF
APP
NECTIN
CD45
THY1
EPHA
TGFb
CD34
CDH1
SPP1
BMP
PERIOSTIN
VEGF
SEMA3
AGRN
EDN
KIT
SELPLG
FGF
OCLN
FN1
VTN
CDH5
EPHB
PDGF
SEMA7
HGF
ANGPT
COLLAGEN
NOTCH
WNT
MK
BMP10
GALECTIN
EGF
GAS
MIF
IGF
CXCL
HSPG
THBS
LAMININ
ANGPTL
CHEMERIN
CDH
PROS
IL6
CHAD
CSF
NCAM
CCL
RELN
VWF
CD39
ESAM
PECAM1
Pathway distance

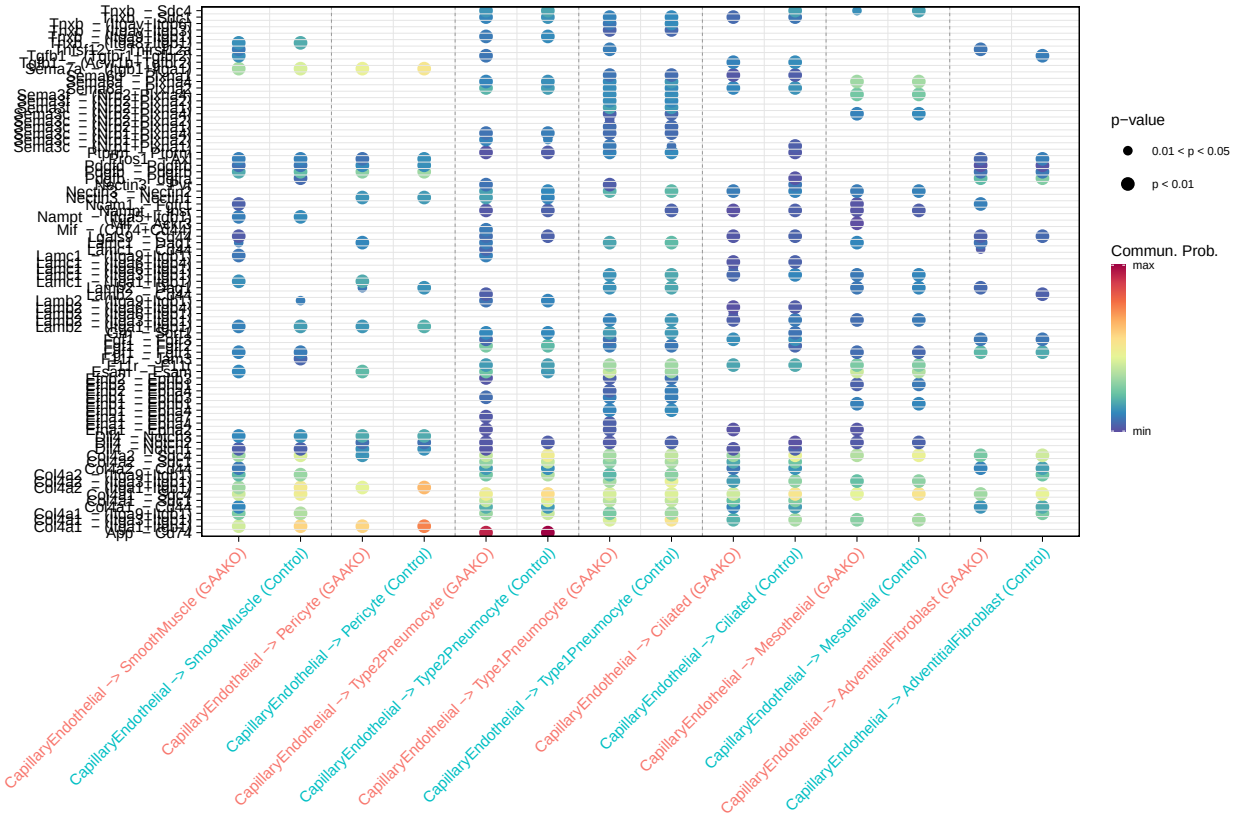

PTN
TRAIL
CCL
TWEAK
NCAM
NRG
OCLN
CADM
MIF
NECTIN
THY1
GRN
CXCL
EPHA
SEMA4
IL6
APP
GAS
EPHB
GALECTIN
SELL
VEGF
FGF
NOTCH
PDGF
AGRN
WNT
CDH
CALCR
VWF
SEMA5
MK
CDH1
CHEMERIN
EGF
RELN
CSPG4
EDN
SEMA3
PECAM1
HSPG
THBS
CDH5
JAM
PROS
BMP10
CD45
VTN
COLLAGEN
TENASCIN
SEMA7
KIT
PERIOSTIN
VISFATIN
EGF
BMP
CD39
SPP1
CHAD
LAMININ
EPHB
SEMA6
ncWNT
ANGPTL
PTPRM
IGF
FGF
ANGPT
VCAM
EGF
MPZ
CD34
SELPLG
IL2
ITGAL−ITGB2
ICAM
0.00
0.25
0.50
0.75
1.00
Relative information flow
GAAKO
Control

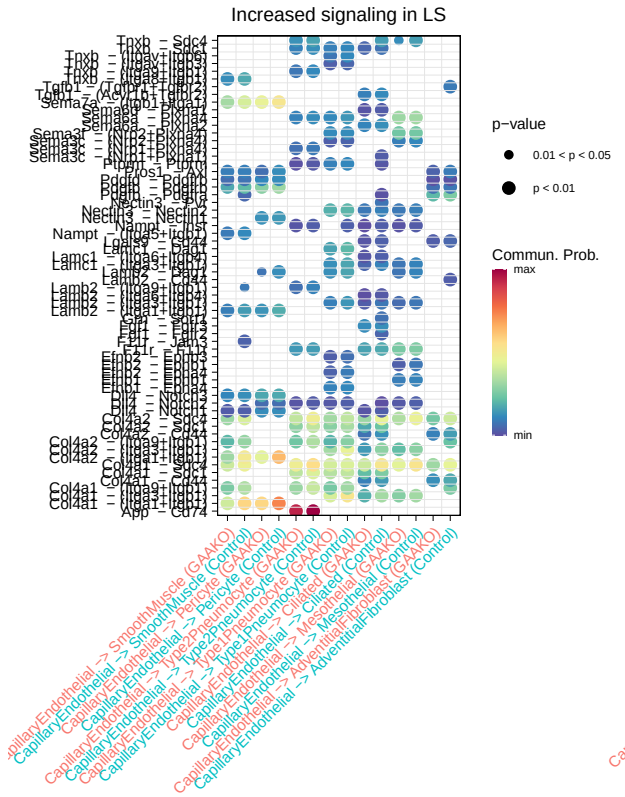

PTN
TRAIL
CCL
TWEAK
NCAM
NRG
OCLN
CADM
MIF
NECTIN
THY1
GRN
CXCL
EPHA
SEMA4
IL6
APP
GAS
EPHB
GALECTIN
SELL
VEGF
FGF
NOTCH
PDGF
AGRN
WNT
CDH
CALCR
VWF
SEMA5
MK
CDH1
CHEMERIN
EGF
RELN
CSPG4
EDN
SEMA3
PECAM1
HSPG
THBS
CDH5
JAM
PROS
BMP10
CD45
VTN
COLLAGEN
TENASCIN
SEMA7
KIT
PERIOSTIN
VISFATIN
EGF
BMP
CD39
SPP1
CHAD
LAMININ
EPHB
SEMA6
ncWNT
ANGPTL
PTPRM
IGF
FGF
ANGPT
VCAM
EGF
MPZ
CD34
SELPLG
IL2
ITGAL−ITGB2
ICAM
0
50
100
Information flow
GAAKO
Control

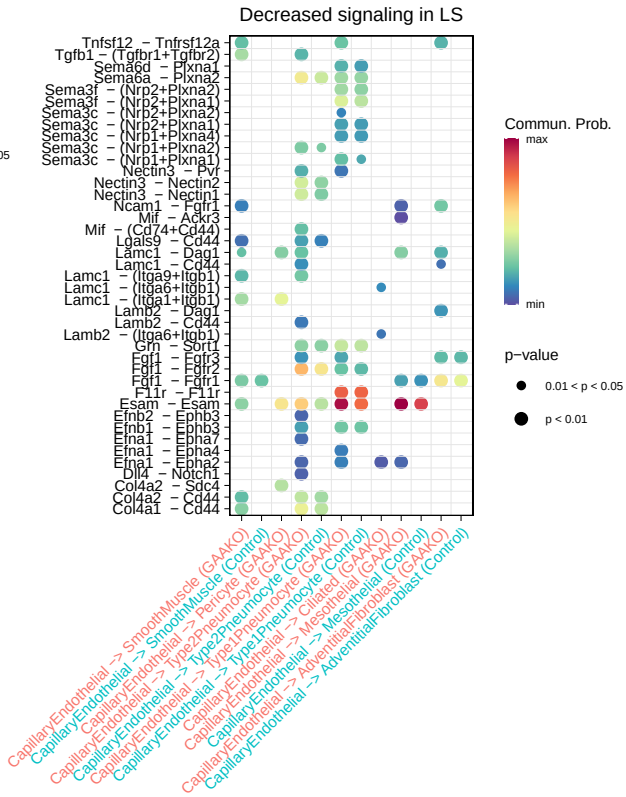

Outgoing signaling patterns − GAAKO
Outgoing signaling patterns − Control
Relative strength
1
0
Endothelial2
Endothelial
LymphaticEndothelial
CapillaryEndothelial
SmoothMuscle
Pericyte
Type2Pneumocyte
Type1Pneumocyte
Ciliated
Mesothelial
AdventitialFibroblast
AlveolarFibroblast
Goblet+Club+Basal
Peribronchial
Immune

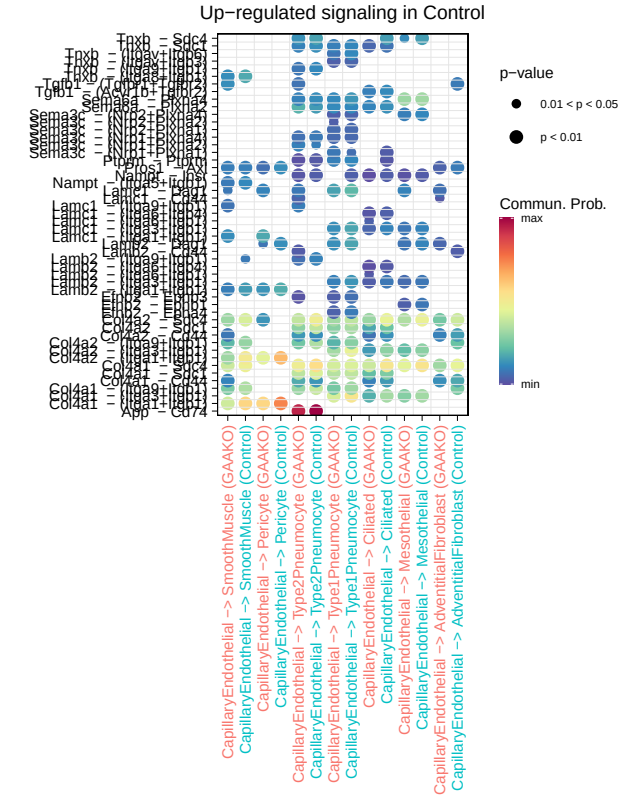

Incoming signaling patterns − GAAKO
Incoming signaling patterns − Control
Relative strength
Endothelial2
Endothelial
LymphaticEndothelial
CapillaryEndothelial
SmoothMuscle
Pericyte
Type2Pneumocyte
Type1Pneumocyte
Ciliated
Mesothelial
AdventitialFibroblast
AlveolarFibroblast
Goblet+Club+Basal
Peribronchial
Immune

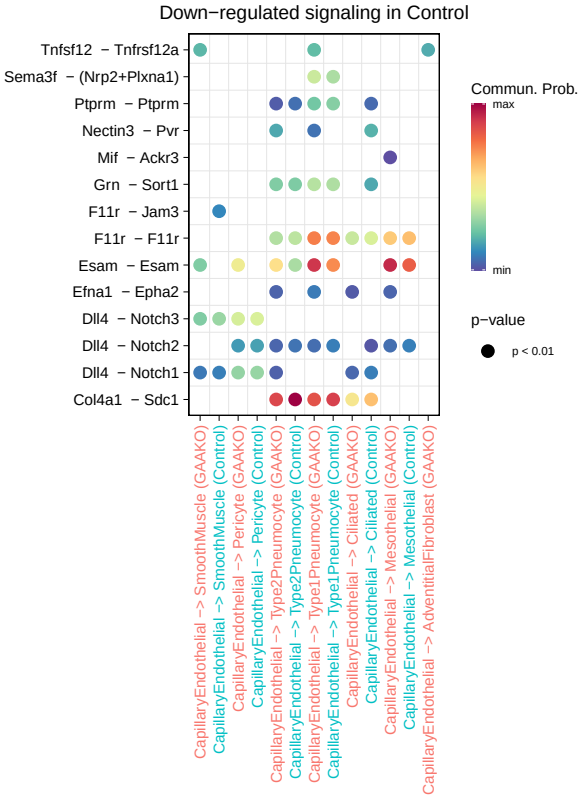

Overall signaling patterns − GAAKO
Overall signaling patterns − Control
Relative strength
Endothelial2
Endothelial
LymphaticEndothelial
CapillaryEndothelial
SmoothMuscle
Pericyte
Type2Pneumocyte
Type1Pneumocyte
Ciliated
Mesothelial
AdventitialFibroblast
AlveolarFibroblast
Goblet+Club+Basal
Peribronchial
Immune


p−value
0.01 < p < 0.05
p < 0.01
Commun. Prob.
max
min
CapillaryEndothelial –> SmoothMuscle (GAAKO)
CapillaryEndothelial –> SmoothMuscle (Control)
CapillaryEndothelial –> Pericyte (GAAKO)
CapillaryEndothelial –> Pericyte (Control)
CapillaryEndothelial –> Type2Pneumocyte (GAAKO)
CapillaryEndothelial –> Type2Pneumocyte (Control)
CapillaryEndothelial –> Type1Pneumocyte (GAAKO)
CapillaryEndothelial –> Type1Pneumocyte (Control)
CapillaryEndothelial –> Ciliated (GAAKO)
CapillaryEndothelial –> Ciliated (Control)
CapillaryEndothelial –> Mesothelial (GAAKO)
CapillaryEndothelial –> Mesothelial (Control)
CapillaryEndothelial –> AdventitialFibroblast (GAAKO)
CapillaryEndothelial –> AdventitialFibroblast (Control)

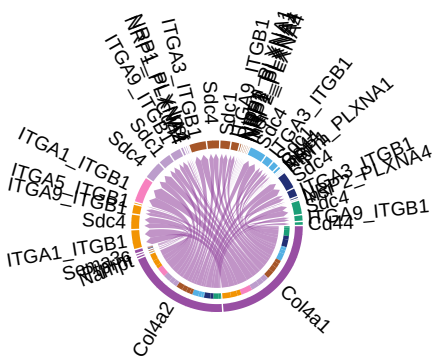

Increased signaling in LS
p−value
0.01 < p < 0.05
p < 0.01
Commun. Prob.
max
min
CapillaryEndothelial −> SmoothMuscle (GAAKO)
CapillaryEndothelial −> SmoothMuscle (Control)
CapillaryEndothelial −> Pericyte (GAAKO)
CapillaryEndothelial −> Pericyte (Control)
CapillaryEndothelial −> Type2Pneumocyte (GAAKO)
CapillaryEndothelial −> Type2Pneumocyte (Control)
CapillaryEndothelial −> Type1Pneumocyte (GAAKO)
CapillaryEndothelial −> Type1Pneumocyte (Control)
CapillaryEndothelial −> Ciliated (GAAKO)
CapillaryEndothelial −> Ciliated (Control)
CapillaryEndothelial −> Mesothelial (GAAKO)
CapillaryEndothelial −> Mesothelial (Control)
CapillaryEndothelial −> AdventitialFibroblast (GAAKO)
CapillaryEndothelial −> AdventitialFibroblast (Control)


Decreased signaling in LS
Tnfsf12 − Tnfrsf12a
Tgfb1 − (Tgfbr1+Tgfbr2)
Sema6d − Plxna1
Sema6a − Plxna2
Sema3f − (Nrp2+Plxna2)
Sema3f − (Nrp2+Plxna1)
Sema3c − (Nrp2+Plxna2)
Sema3c − (Nrp2+Plxna1)
Sema3c − (Nrp1+Plxna4)
Sema3c − (Nrp1+Plxna2)
Sema3c − (Nrp1+Plxna1)
Nectin3 − Pvr
Nectin3 − Nectin2
Nectin3 − Nectin1
Ncam1 − Fgfr1
Mif − Ackr3
Mif − (Cd74+Cd44)
Lgals9 − Cd44
Lamc1 − Dag1
Lamc1 − Cd44
Lamc1 − (Itga9+Itgb1)
Lamc1 − (Itga6+Itgb1)
Lamc1 − (Itga1+Itgb1)
Lamb2 − Dag1
Lamb2 − Cd44
Lamb2 − (Itga6+Itgb1)
Grn − Sort1
Fgf1 − Fgfr3
Fgf1 − Fgfr2
Fgf1 − Fgfr1
F11r − F11r
Esam − Esam
Efnb2 − Epbh3
Efnb1 − Epbh3
Efna1 − Epha7
Efna1 − Epha4
Efna1 − Epha2
Dll4 − Notch1
Col4a2 − Sdc4
Col4a2 − Cd44
Col4a1 − Cd44
Commun. Prob.
max
min
p−value
0.01 < p < 0.05
p < 0.01
CapillaryEndothelial −> SmoothMuscle (GAAKO)
CapillaryEndothelial −> SmoothMuscle (Control)
CapillaryEndothelial −> Pericyte (GAAKO)
CapillaryEndothelial −> Pericyte (Control)
CapillaryEndothelial −> Type2Pneumocyte (GAAKO)
CapillaryEndothelial −> Type2Pneumocyte (Control)
CapillaryEndothelial −> Type1Pneumocyte (GAAKO)
CapillaryEndothelial −> Type1Pneumocyte (Control)
CapillaryEndothelial −> Ciliated (GAAKO)
CapillaryEndothelial −> Ciliated (Control)
CapillaryEndothelial −> Mesothelial (GAAKO)
CapillaryEndothelial −> Mesothelial (Control)
CapillaryEndothelial −> AdventitialFibroblast (GAAKO)
CapillaryEndothelial −> AdventitialFibroblast (Control)

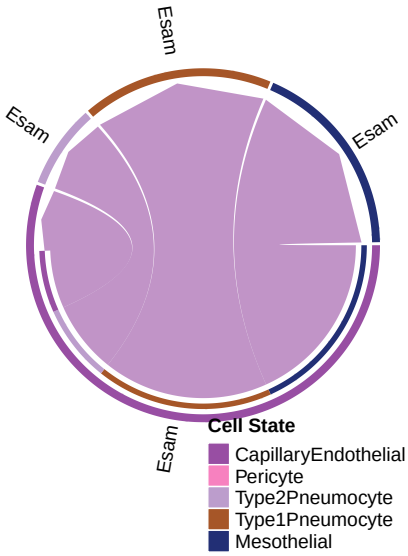

Up−regulated signaling in Control
p−value
0.01 < p < 0.05
p < 0.01
Commun. Prob.
max
min
CapillaryEndothelial −> SmoothMuscle (GAAKO)
CapillaryEndothelial −> SmoothMuscle (Control)
CapillaryEndothelial −> Pericyte (GAAKO)
CapillaryEndothelial −> Pericyte (Control)
CapillaryEndothelial −> Type2Pneumocyte (GAAKO)
CapillaryEndothelial −> Type2Pneumocyte (Control)
CapillaryEndothelial −> Type1Pneumocyte (GAAKO)
CapillaryEndothelial −> Type1Pneumocyte (Control)
CapillaryEndothelial −> Ciliated (GAAKO)
CapillaryEndothelial −> Ciliated (Control)
CapillaryEndothelial −> Mesothelial (GAAKO)
CapillaryEndothelial −> Mesothelial (Control)
CapillaryEndothelial −> AdventitialFibroblast (GAAKO)
CapillaryEndothelial −> AdventitialFibroblast (Control)

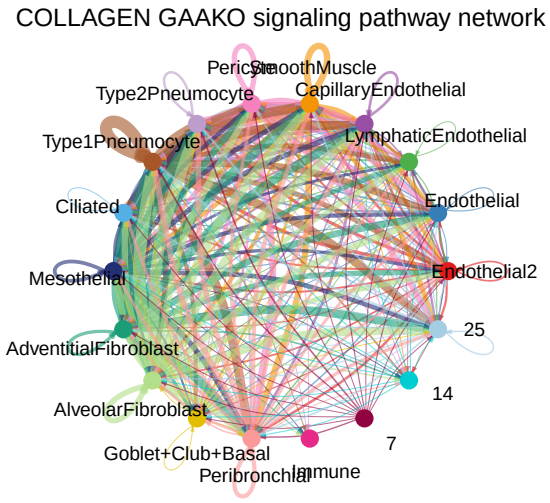

Down−regulated signaling in Control
Tnfsf12 − Tnfrsf12a
Sema3f − (Nrp2+Plxna1)
Ptprm − Ptprm
Nectin3 − Pvr
Mif − Ackr3
Grn − Sort1
F11r − Jam3
F11r − F11r
Esam − Esam
Efna1 − Epha2
Dll4 − Notch3
Dll4 − Notch2
Dll4 − Notch1
Col4a1 − Sdc1
Commun. Prob.
max
min
p−value
p < 0.01
CapillaryEndothelial −> SmoothMuscle (GAAKO)
CapillaryEndothelial −> SmoothMuscle (Control)
CapillaryEndothelial −> Pericyte (GAAKO)
CapillaryEndothelial −> Pericyte (Control)
CapillaryEndothelial −> Type2Pneumocyte (GAAKO)
CapillaryEndothelial −> Type2Pneumocyte (Control)
CapillaryEndothelial −> Type1Pneumocyte (GAAKO)
CapillaryEndothelial −> Type1Pneumocyte (Control)
CapillaryEndothelial −> Ciliated (GAAKO)
CapillaryEndothelial −> Ciliated (Control)
CapillaryEndothelial −> Mesothelial (GAAKO)
CapillaryEndothelial −> Mesothelial (Control)
CapillaryEndothelial −> AdventitialFibroblast (GAAKO)
CapillaryEndothelial −> AdventitialFibroblast (Control)

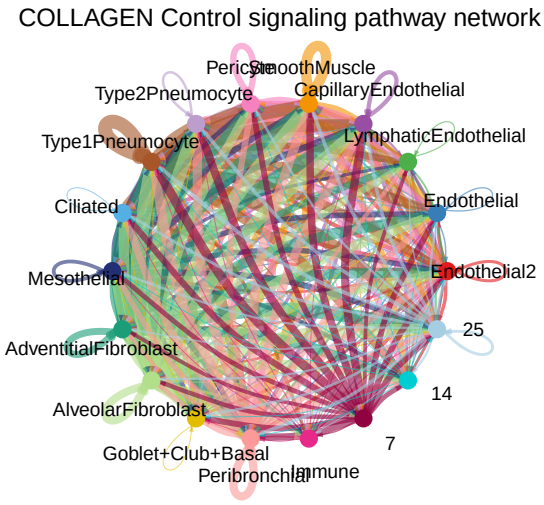
Up−regulated signaling in Control

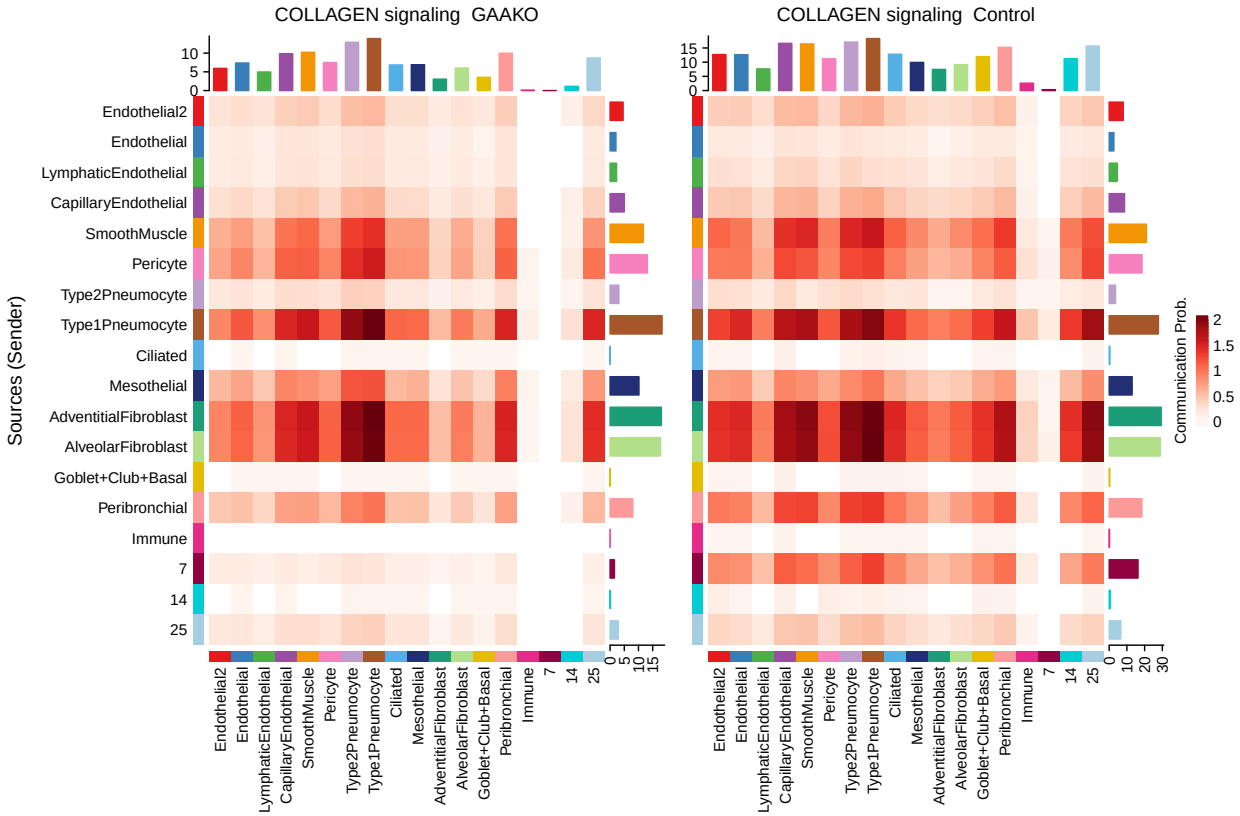


Down−regulated signaling in Control

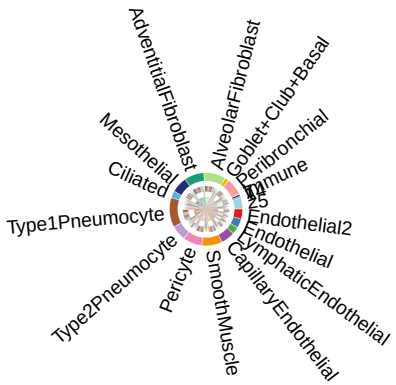



COLLAGEN GAAKO signaling pathway network
Pericyte
SmoothMuscle
Type2Pneumocyte
CapillaryEndothelial
Type1Pneumocyte
LymphaticEndothelial
Ciliated
Endothelial
Mesothelial
Endothelial2
25
AdventitialFibroblast
14
AlveolarFibroblast
7
Goblet+Club+Basal
Peribronchial
Immune

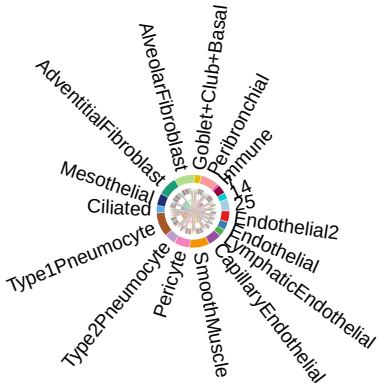

COLLAGEN Control signaling pathway network
Pericyte
SmoothMuscle
Type2Pneumocyte
CapillaryEndothelial
Type1Pneumocyte
LymphaticEndothelial
Ciliated
Endothelial
Mesothelial
Endothelial2
25
AdventitialFibroblast
14
AlveolarFibroblast
7
Goblet+Club+Basal
Peribronchial
Immune


COLLAGEN signaling GAAKO
COLLAGEN signaling Control
Sources (Sender)
Endothelial2
Endothelial
LymphaticEndothelial
CapillaryEndothelial
SmoothMuscle
Pericyte
Type2Pneumocyte
Type1Pneumocyte
Ciliated
Mesothelial
AdventitialFibroblast
AlveolarFibroblast
Goblet+Club+Basal
Peribronchial
Immune
7
14
25
Communication Prob.
2
1.5
1
0.5
0

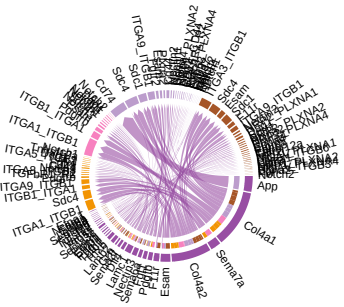
COLLAGEN GAAKO signaling pathway network



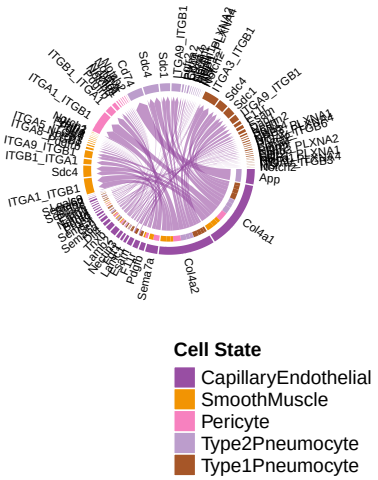
COLLAGEN Control signaling pathway network



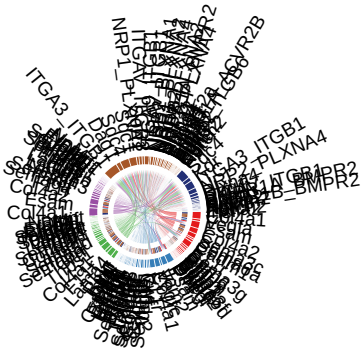
Signaling from Inflam.FIB − GAAKO



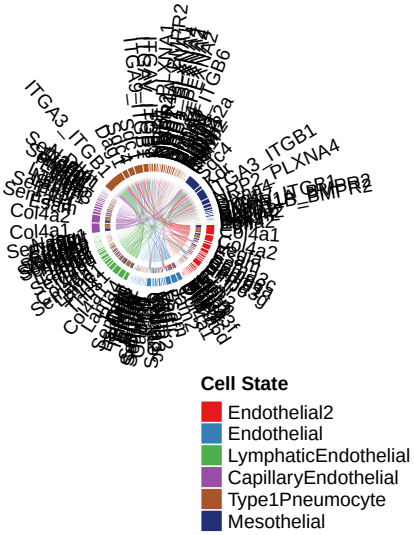
Signaling from Inflam.FIB − Control



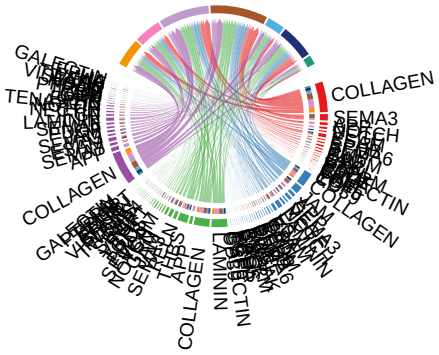
Signaling received by Inflam.DC and .TC − GAAKO



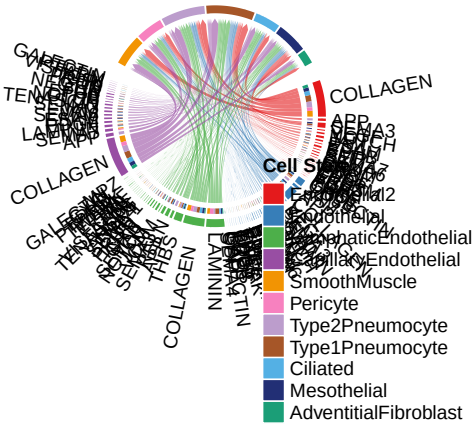
Signaling received by Inflam.DC and .TC − Control

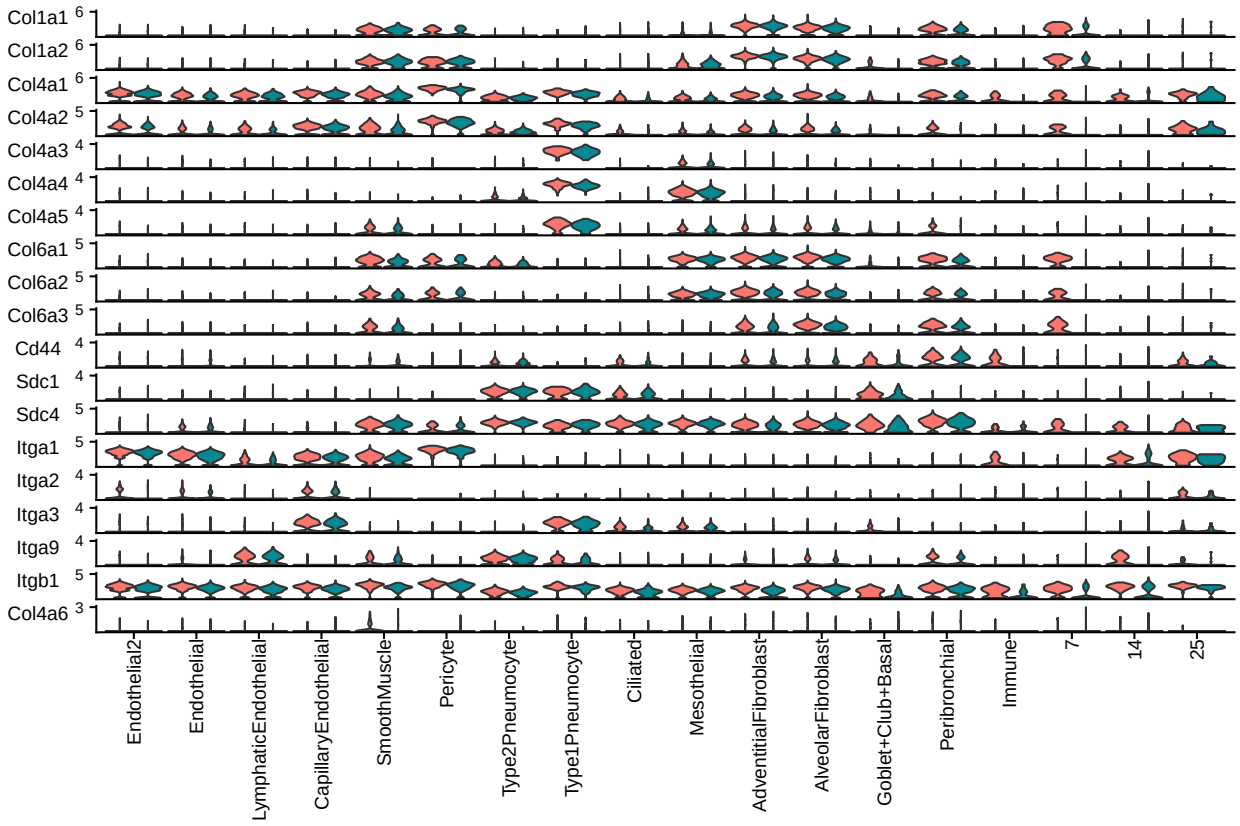


Signaling pathways sending from fibroblast − GAAKO



Signaling pathways sending from fibroblast − Control




Col1a1 6
Col1a2 6
Col4a1 6
Col4a2 5
Col4a3 4
Col4a4 4
Col4a5 4
Col6a1 5
Col6a2 5
Col6a3 5
Cd44 4
Sdc1 4
Sdc4 5
Itga1 5
Itga2 4
Itga3 4
Itga9 4
Itgb1 5
Col4a6 3
Endothelial2
Endothelial
LymphaticEndothelial
CapillaryEndothelial
SmoothMuscle
Pericyte
Type2Pneumocyte
Type1Pneumocyte
Ciliated
Mesothelial
AdventitialFibroblast
AlveolarFibroblast
Goblet+Club+Basal
Peribronchial
Immune
7
14
25