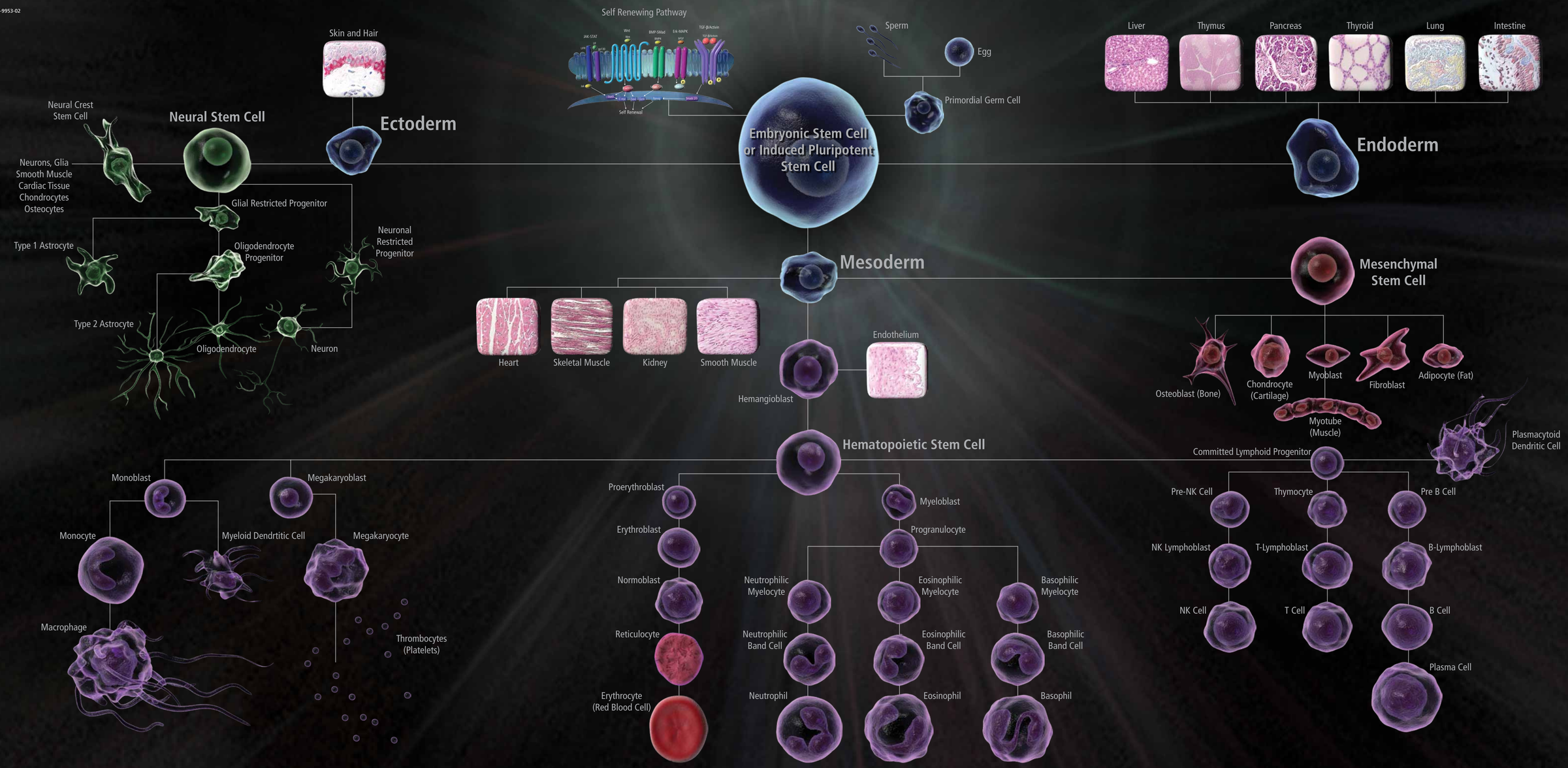
# BD Stem Cell Resource

## Markers of Self-Renewal and Differentiation

23-9953-02




*White colored markers are available from BD Biosciences*

## Ectoderm Markers

### Astrocytes

| | |
|---|---|
| A2B5 | GFAP |
| CD44 | Ran-2 |
| FGFR3 | S100B |

### Early Ectoderm Markers

| | |
|---|---|
| Nestin | TP63 |
| Notch1 | |

### Neural Crest Cell Markers

| | |
|---|---|
| CD49d (Integrin α4) | MASH1 |
| CD57 (HNK-1) | Neurogenin 3 |
| CD271 (p75, NGFR/NTR) | Notch1 |

### Neural Stem Cell Markers

| | |
|---|---|
| A2B5 | CD349 (Frizzled-9) |
| BMI-1 | Ki-67 |
| CD15 (SSEA-1, Lewis X) | MSI1 (Musashi-1) |
| CD15s (Sialyl Lewis x) | MSI2 (Musashi-2) |
| CD24 | Nanog (Mouse) |
| CD29 (Integrin β1) | Nestin |
| CD49f (Integrin α6) | Noggin |
| CD54 (ICAM-1) | Notch1 |
| CD81 (TAPA-1) | Pax-6 |
| CD95 (Fas/APO-1) | Prominin-2 |
| CD133 (AC133, Prominin-1) | PSA-NCAM |
| CD146 (MCAM, MUC18) | Sox1 |
| CD184 (CXCR4) | Sox2 |
| CD271 (p75, NGFR/NTR) | Vimentin |
| CD338 (ABCG2) | |

### Neuronal Markers

| | |
|---|---|
| α-Synuclein | MAP2B |
| α-Synuclein (pY125) | MASH1 |
| β-Tubulin (Tuj1) | mGluR1 |
| CD24 | mGluR1α |
| CD56 (NCAM) | Nestin |
| CD81 (TAPA-1) | NeuroD1 |
| CD90 (Thy-1) | Neurofilament NF-M |
| CD90.1 (Thy-1.1) | Neuron-restricted progenitors |
| CD90.2 (Thy-1.2) | Neuropilin-2 |
| CD112 | Nicastrin |
| CD271 (p75, NGFR/NTR) | p150 Glued |
| CD325 (N-Cadherin) | Pax-5 |
| ChAT | P-glycoprotein |
| Contactin | PSD-95 |
| Doublecortin | Serotonin Receptor 5-HT 2AR |
| GABA B Receptor | Serotonin Receptor 5-HT 2BR |
| Gad65 | SMN |
| GAP-43 (Neuromodulin) | Synapsin I |
| GluR α 2 | Synaptophysin |
| GluR2 | Synaptotagmin |
| GluR5/6/7 | Syntaxin |
| Glutamine Synthetase | Tau |
| HNF-3β (FoxA2) | TrkB |
| Islet-1 | Tubby |
| Jagged1 | Tyrosine Hydroxylase |
| MAP2 (a+b) | Vimentin |

### Oligodendrocyte Markers

| | |
|---|---|
| CD44 | O1 |
| CD44H (Pgp-1, H-CAM) | O4 |
| CD140a (PDGFR α) | Olig1 |
| Galactocerebroside C | Olig2 |
| MBP | RIP |

### Skin Precursor Cell Markers

| | |
|---|---|
| CRABP2 | Sca-1 (Ly6A/E) |
| Fibronectin | Vimentin |
| Nestin | |

### Visual System

| | |
|---|---|
| CD68 | Pax-6 |
| CD325 (N-Cadherin) | Recoverin |

## Embryonic Stem Cells

### Embryonic Stem Cell Markers

| | |
|---|---|
| Alkaline Phosphatase | Nanog (Human) |
| CD9 | Nanog (Mouse) |
| CD15 (SSEA-1, Lewis X) | Nucleostemin |
| CD24 | Oct3/4 |
| CD29 (Integrin β1) | Oct3/4A |
| CD30 | Podocalyxin |
| CD49f (Integrin α6) | Podocalyxin Associated Keratin Sulfate |
| CD133 (AC133, Prominin-1) | PRC2 (Suz12) |
| CD194 (CCR4) | Rex-1 |
| CD324 (E-Cadherin) | Ronin |
| CD326 (EpCAM) | SFRP2 |
| CD338 (ABCG2) | Smad2/3 |
| c-Myc | Sox2 |
| Cripto | SSEA-3 |
| DPPA4 | SSEA-4 |
| DPPA5 (ESG1) | SSEA-5 |
| FGF-4 | STAT3 |
| FoxD3 | STAT3 (pS727) |
| Frizzled-5 | STAT3 (pY705) |
| GCNF (NR6A1) | STAT3-interacting protein 1 |
| GCTM-2 | TRA-1-60 Antigen |
| GDF-3 | TRA-1-81 Antigen |
| Hspd7 | UTF-1 |
| Lefty-A | Zic3 |
| Lin-28 | |

### Induced Pluripotency Markers

| | |
|---|---|
| c-Myc | Nanog |
| KLF4 | Oct3/4 |
| Lin-28 | Sox2 |

### Primordial Germ Cell Markers

| | |
|---|---|
| Blimp-1 | Nanos |
| CD15 (SSEA-1, Lewis X) | Oct3/4 |
| CD117 (SCF R, c-kit) | Piwi/Hiwi |
| DAZL | Steel |
| FABP9 | Stella (Dppa3) |
| Fragilis | VASA (DDX4) |

### Trophoblast Markers

| | |
|---|---|
| CDX2 | Sox7 |
| Cytokeratin 7 | Trop-2 |

## Mesoderm Markers

### Early Mesoderm Markers

| | |
|---|---|
| BMP2 | Cryptic |
| BMP4 | MIXL1 |
| Brachury | NF-YA |
| CD31 (PECAM1) | Foxf1 |
| CD34 (Mucosialin, gp 105-120) | Sca-1 (Ly6A/E) |
| CD325 (N-Cadherin) | Snail |

### Endothelial Cell Markers

| | |
|---|---|
| CD14 | CD151 |
| CD15 (SSEA-1, Lewis X) | CD152 (CTLA-4) |
| CD18 (Integrin β2 chain, CR3/CR4) | CD157 |
| CD29 (Integrin β1) | CD166 (ALCAM) |
| CD31 (PECAM1) | CD184 (CXCR4) |
| CD34 (Mucosialin, gp 105-120) | CD192 (CCR2) |
| CD36 | CD201 (EPCR) |
| CD45 (Leukocyte Common Antigen, Ly-5) | CD202b (TIE2) |
| CD45R (B220) | CD202b (TIE2) (pY992) |
| CD49d (Integrin α4) | CD202b (TIE2) (pY1102) |
| CD49e (Integrin α5) | CD209 |
| CD49f (Integrin α6) | CD209a (CIRE, DC-SIGN) |
| CD54 (ICAM-1) | CD213a1 |
| CD56 (NCAM) | CD213a2 |
| CD62E (E-Selectin) | CD249 |
| CD62L (L-Selectin) | CD252 (OX-40 Ligand) |
| CD62P (P-Selectin) | CD253 (TRAIL) |
| CD102 | CD262 (TRAIL-R2, DR5) |
| CD105 (Endoglin) | CD323 |
| CD106 (VCAM-1) | CD325 (N-Cadherin) |
| CD109 | CDw93 (C1qRp) |
| CD112 | Cdw145 |
| CD116 (GM-CSF Receptor) | Flk-1 (KDR, VEGF-R2, Ly-73) |
| CD117 (SCF R, c-kit) | HIF-1α |
| CD120a (TNF Receptor Type I) | IP-10 |
| CD120b (TNF Receptor Type II) | Ly-6A/E (Sca-1) |
| CD121a (IL-1 Receptor, Type Ip80) | Nestin |
| CD124 (IL-4 Receptor α) | STAT3 |
| CD141 (Thrombomodulin) | STAT3 (pS727) |
| CD144 (VE-cadherin) | STAT3 (pY705) |
| CD146 (MCAM, MUC18) | STAT3-interacting protein 1 |
| CD147 (Neurothelin) | Vimentin |

### Heart - Cardiogenesis Markers

| | |
|---|---|
| α-Actinin | CD309 (VEGFR2, KDR) |
| Annexin VI | CD325 (N-Cadherin) |
| Cardiac specific myosin | Connexin-43 |
| Cardiac Troponin I | Desmin |
| Cardiac Troponin T | Flk-1 (KDR, VEGF-R2, Ly-73) |
| Caveolin-2 | GATA4 |
| Caveolin-3 | GATA6 |
| CD13 | HAND1 |
| CD31 (PECAM1) | HAND2 |
| CD34 (Mucosialin, gp 105-120) | Islet 1 |
| CD66 | M-Cadherin |
| CD66c | MLC2a |
| CD106 (VCAM-1) | MLC2v |
| CD117 (SCF R, c-kit) | Myogenin |
| CD140a (PDGFRα) | Myosin Heavy Chain |
| CD144 (VE-cadherin) | NF-YA |
| CD166 (ALCAM) | Nkx2.5 |
| CD172a (SIRPA) | P-glycoprotein (MDR) |
| CD202b (TIE2) | SSEA-1 |
| CD202b (TIE2) (pY992) | Vimentin |
| CD202b (TIE2) (pY1102) | |

### Hemangioblast Markers

| | |
|---|---|
| ACE | CD324 (E-Cadherin) |
| Brachury | EphB4 |
| CD31 (PECAM1) | Flk-1 (KDR, VEGF-R2, Ly-73) |
| CD34 (Mucosialin, gp 105-120) | GATA1 |
| CD133 (AC133, Prominin-1) | LMO-2 |
| CD144 (VE-cadherin) | Podocalyxin |
| CD202b (TIE2) | Runx1 (CBFA2) |
| CD202b (TIE2) (pY992) | Tal (SCL) |
| CD202b (TIE2) (pY1102) | |

### Hematopoietic Stem Cell Markers

*Negative Markers*

| | |
|---|---|
| CD2 | CD24 |
| CD3 | CD33 |
| CD4 | CD36 |
| CD7 | CD38 |
| CD8 | CD45 (Leukocyte Common Antigen, Ly-5) |
| CD10 | CD45R (B220) |
| CD11b | CD48 |
| CD13 | CD56 (NCAM) |
| CD14 | CD97 |
| CD15 (SSEA-1, Lewis X) | CD114 (G-CSF Receptor) |
| CD15s (Sialyl Lewis x) | CD138 (Syndecan-1) |
| CD16 | CD235a |
| CD19 | GATA3 |
| CD20 | |

*Positive Markers*

| | |
|---|---|
| BMI-1 | CDw93 (C1qRp) |
| CaM Kinase IV | Duo338 (ABCG2) |
| CD31 (PECAM1) | DAZL |
| CD34 (Mucosialin, gp 105-120) | Flk-1 (KDR, VEGF-R2, Ly-73) |
| CD49f (Integrin α6 chain) | FOXO1 |
| CD44 | G-CSF |
| CD59 | GJB-1 |
| CD90 (Thy-1) | HOXB4 |
| CD90.1 (Thy-1.1) | Jak2 |
| CD105 (Endoglin) | Lmo2 |
| CD106 (VCAM-1) | Ly-6A/E (Sca-1) |
| CD117 (SCF R, c-kit) | MBP1 |
| CD133 (AC133, Prominin-1) | NF-YA |
| CD164 | Notch1 |
| CD184 (CXCR4) | P-glycoprotein |
| CD201 (EPCR) | Runx1 (CBFA2) |
| CD202b (TIE2) | Sox7 |
| CD202b (TIE2) (pY992) | Tal (SCL) |
| CD202b (TIE2) (pY1102) | WASP (Wiskott-Aldrich Syndrome Protein) |
| CD325 (N-Cadherin) | |

### Mesenchymal Stem Cell Differentiation Markers

*Chondrocyte (Cartilage) Markers*

| | |
|---|---|
| Aggrecan | Matrilin-4 |
| CD44 | Osteonectin |
| CD151 | Sox9 |
| Collagen II | |

*Osteoblast (Bone) Markers*

| | |
|---|---|
| Alkaline Phosphatase | IGFBP-3 |
| Collagen I | Osteocalcin |
| Fibronectin | RUNX2 |

*Myoblast (Muscle) Markers*

| | |
|---|---|
| Acetylcholinesterase | Lactate Dehydrogenase (LDH) |
| Actin | Myf-5 |
| B-Enolase (ENO-3) | MyoD |
| CD146 (MCAM, MUC18) | Pax3 |
| CD325 (N-Cadherin) | Pax7 |
| Desmin | PX-M |

### Mesenchymal Stem Cell Markers (Bone Marrow)

*Negative Markers*

| | |
|---|---|
| CD11a (Integrin αL chain) | CD34 (Mucosialin, gp 105-120) |
| CD11b (Integrin αM chain) | CD45 (Leukocyte Common Antigen, Ly-5) |
| CD14 | CD79a |
| CD19 | HLA-DR |
| CD31 (PECAM1) | |

*Positive Markers*

| | |
|---|---|
| CD10 | CD117 (SCF R, c-kit) |
| CD13 | CD120a (TNF Receptor Type I) |
| CD14 | CD120b (TNF Receptor Type II) |
| CD15 (SSEA-1, Lewis X) | CD146 |
| CD29 (Integrin β1) | CD166 |
| CD44 (Pgp-1, H-CAM) | CD166 (ALCAM) |
| CD49d (Integrin α4) | CD271 (p75, NGFR/NTR) |
| CD49e (Integrin α5) | Flk-1 (KDR, VEGF-R2, Ly-73) |
| CD51 (Integrin αV) | GD2 |
| CD54 (ICAM-1) | Ly-6A/E (Sca-1) |
| CD56 (NCAM) | Nucleostemin |
| CD71 (Transferrin Receptor) | SSEA-4 |
| CD73 (Ecto-5'-nucleotidase) | STRO-1 |
| CD90 (Thy-1) | TAZ |
| CD105 (Endoglin) | Vimentin |
| CD106 (VCAM-1) | |

### Mesenchymal Stem Cell Markers (Fat)

*Negative Markers*

| | |
|---|---|
| CD11b (Integrin αM chain) | CD79a |
| CD14 | CD117 (SCF R, c-kit) |
| CD19 | HLA-DR |
| CD45 (Leukocyte Common Antigen, Ly-5) | |

*Positive Markers*

| | |
|---|---|
| CD9 | CD73 (Ecto-5'-nucleotidase) |
| CD10 | CD90 (Thy-1) |
| CD13 | CD105 (Endoglin) |
| CD29 (Integrin β1) | CD106 (VCAM-1) |
| CD44 | CD146 (MCAM, MUC18) |
| CD49d (Integrin α4) | CD166 (ALCAM) |
| CD49e (Integrin α5) | Fibronectin |
| CD54 (ICAM-1) | HLA I |
| CD55 | Vimentin |
| CD59 | |

### Skeletal Muscle Markers

| | |
|---|---|
| α-Actinin | MyoD |
| Actin | Myogenin |
| B-Enolase (ENO-3) | Myosin heavy chain |
| CD146 (MCAM, MUC18) | Myosin light chain |
| CD325 (N-Cadherin) | Titin |
| Desmin | |
| M-Cadherin | |

### Smooth Muscle Markers

| | |
|---|---|
| Calmodulin | Smooth muscle myosin |
| Desmin | Vimentin |

## Endoderm Markers

### Definitive Endoderm Markers

| | |
|---|---|
| B-Catenin | HNF-1β (TCF-2) |
| CD184 (CXCR4) | HNF-3β (FoxA2) |
| CD325 (N-Cadherin) | Sox17 |
| GATA4 | |

### Hepatic Endoderm Markers

| | |
|---|---|
| α-Fetoprotein | CD90 (Thy-1) |
| Albumin | CD326 (EpCAM) |
| ASGPR 1 | GATA4 |
| CD26 | HNF-1α |
| CD29 (Integrin β1) | HNF-1β (TCF-2) |
| CD44H (Pgp-1, H-CAM) | LDLR |
| CD49f (Integrin α6) | Tat-SP1 |

### Intestinal Stem Cell Markers

| | |
|---|---|
| BMI-1 | Lgr5 |
| EphB2 | Sox9 |

### Pancreatic Endoderm Markers

| | |
|---|---|
| CD49f (Integrin α6) | Neurogenin 3 |
| CD142 | Neuropilin-2 |
| Chromogranin A | Nkx2.2 |
| Gad65 | Nkx6.1 |
| Glucagon | Pancreatic polypeptide |
| Glut2 | Pax-6 |
| Insulin | PDX-1 |
| Islet-1 | PTF1A |
| Islet-2 | Somatostatin |
| NeuroD1 | Synaptophysin |

### Primitive Gut Tube Markers

| | |
|---|---|
| CDX2 | HNF-1β (TCF-2) |

## Stem Cell Relevant Signaling

### Erk-MAPK Signaling

| | |
|---|---|
| basic FGF | Mek1 |
| C-Raf | Mek1 (pS298) |
| ERK | Mek1/2 (pS222) |
| ERK1 | Mek2 |
| ERK1/2 (pT202/pY204) | p38 MAPK (PT180/pY182) |
| ERK2 | Ras |
| ERK3 | |

### Jak-STAT Signaling

| | |
|---|---|
| CD130 (gp130) | STAT4 |
| STAT1 (C-TERMINUS) | STAT4 (pY693) |
| STAT1 (pY701) | STAT5 (MGF) |
| STAT3 | STAT5 (MGF) (PY694) |
| STAT3 (pS727) | STAT6 |
| STAT3 (pY705) | STAT6 (pY641) |

### Notch Signaling

| | |
|---|---|
| CBP (CREB-Binding Protein) | Notch1 |
| Jagged1 | Notch2 |
| Jagged2 | Notch3 |
| Neurogenin 3 | Notch4 |
| Nicastrin | |

### TGF Beta Signaling

| | |
|---|---|
| BMPR-II | Id3 |
| CD119 (IFN-γ receptor α-chain) | p16 INK4 |
| c-Myc | p107 |
| DP-1 | p300 |
| E2F-1 | PP2A Catalytic α |
| E2F-2 | ROCK-I |
| E2F-3 | ROCK-II |
| Id1 | Smad2/3 |
| Id2 | SP1 |

### Wnt Signaling

| | |
|---|---|
| 14-3-3 | GSK-3β |
| α-Catenin | GSK-3β (pY216) |
| β-Catenin | HDAC3 |
| δ-Catenin | Jagged1 |
| γ-Catenin | Lgr5 |
| Akt | Neurogenin 3 |
| CaM Kinase II | Nicastrin |
| Casein Kinase I ε | Notch1 |
| Casein Kinase II α | PP2A Catalytic α |
| Casein Kinase II β | SNAI2 (Slug) |
| CBP (CREB-Binding Protein) | Wnt16 |

For Research Use Only. Not for use in diagnostic or therapeutic procedures.
BD, BD Logo and all other trademarks are property of Becton, Dickinson and Company. © 2015 BD

bdbiosciences.com/stemcell