Regulation of BMP and TGFβ signaling pathway in cancer progression

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List of Abbreviations

αSMA	α-smooth muscle actin
ACVR2A/B	activin receptor, type II A/B
ALDH	aldehyde dehydrogenase
ALK	activin receptor-like kinase
AP	activator protein
ATCC	american type culture collection
βgal	β-galactosidase
BAMBI	BMP and activin membrane-bound inhibitor
BMP	bone morphogenetic protein
BMPRIA/B	bone morphogenetic protein receptor, type I A/B
BMPRII	bone morphogenetic protein receptor, type II
BRE	BMP response elements
BSA	bovine serum albumin
CAFs	cancer associated fibroblasts
ChIP	chromatin immunoprecipitation
CHT	caudal hematopoietic tissue
CM	conditional medium
COL	collagen
CSC	cancer stem cell
CTC	circulating tumor cell
CTLA	cytotoxic T-lymphocyte-associated protein
CTGF	connective tissue growth factor
dpf/i	days post fertilization/injection
DAN	differential screening-selected gene aberrative in neuroblastoma
D/LCIS	ductal/lobular carcinoma in situ
Doc	Duct of cuvier
ECM	extracellular matrix
EGF	epidermal growth factor
EGFP	enhanced green fluorescent protein
EGFR	EGF receptor
EMT	epithelial–mesenchymal transition
ER	estrogen receptor
ERK	extracellular signal-regulated kinase
FAP	fibroblast activation protein

FACS	fluorescence-activated cell sorting
FBS	fetal bovine serum
FGF	fibroblast growth factor
FN	fibronectin
FOX	forkhead box
fRMA	frozen robust multiarray analysis
FSP1	fibroblast-specific protein 1
GAPDH	glyceraldehyde 3-phosphate dehydrogenase
G-CSF	granulocyte colony stimulating factor
GDF	growth and differentiation fctor
GO	gene ontology
Grem	Gremlin
GSEA	Gene set enrichment analysis
HER	human epidermal growth factor receptor
HMEC	human mammary epithelial cells
HGF	hepatocyte growth factor
hpf/i	hours post fertilization/injection
ICIs	immune checkpoint inhibitors
ID	inhibitor of differentiation
IHC	immunohistochemical
IL	interleukin
i.p.	intraperitoneal
ISH	*in situ* hybridization
JAK	janus kinase
JNK	c-Jun NH2-terminal kinase
KEGG	Kyoto encyclopedia genes and genomes
LAG	lymphocyte-activation gene
MAPK	mitogen-activated protein kinase
MFS	metastasis-free survival
MMP	matrix metalloprotease
MOI	multiplicity of infection
MSCs	mesenchymal stem cells
NF-κB	nuclear factor-κB
NK	natural killer
OCT	octamer-binding transcription factor
OPG	osteoprotegerin

PD-L1	programmed death-ligand 1
PI3K	phosphoinositide 3-kinase
PK	protein kinase
pRb	retinoblastoma protein
PRDC	protein related to Dan or Cerberus
pSMAD	phospho-SMAD
PTEN	phosphatase and tensin homolog
PTHrP	parathyroid hormone-related protein
PTP	protein tyrosine phosphatase
qRT-PCR	quantitative real-time polymerase chain reaction
RANKL	nuclear factor-κB ligand
RGM	repulsive guidance molecule
s.d	standard deviation
s.e.m	standard error
SMAD	small mothers against decapentaplegic
SMURF	SMAD ubiquitin regulatory factor
SNP	single nucleotide polymorphism
SOX	SRY-related HMG-box
STAT	signal transducers and activators of transcription
TAZ	tafazzin
TGFβ	transforming growth factor β
TGFBRI/II	TGFβ receptor, type I/II
TNBC	triple negative breast cancer
TNFα	tumor necrosis factor α
THBS	thrombospondin
ZEB1	E-box-binding homeobox 1

List of Publications

1. **Ren J**, Smid M, Iaria J, Salvatori DC, van Dam H, Zhu HJ, Martens JW, ten Dijke P. Cancer-associated fibroblast-derived Gremlin 1 promotes breast cancer progression. Breast Cancer Res 2019, 21(1):109.

2. Sow HS*, **Ren J***, Camps M, Ossendorp F, ten Dijke P. Combined inhibition of TGFβ signaling and the PD-L1 immune checkpoint is differentially effective in tumor models. Cells 2019, 8(4):E320.

3. **Ren J**, ten Dijke P. Bone morphogenetic proteins in the initiation and progression of breast cancer. Bone Morphogenetic Proteins: Systems Biology Regulators, Springer 2017, p.409-33.

4. **Ren J***, Liu S*, Cui C, ten Dijke P. Invasive behavior of human breast cancer cells in embryonic zebrafish. J Vis Exp 2017, (122):e55459.

5. Sundqvist A*, Morikawa M*, **Ren J**, Vasilaki E, Kawasaki N, Kobayashi M, Koinuma D, Aburatani H, Miyazono K, Heldin CH, van Dam H, ten Dijke P. JUNB governs a feed-forward network of TGFβ signaling that aggravates breast cancer invasion. Nucleic Acids Res 2017, 46(3):1180-95.

6. Li Y, Drabsch Y, Pujuguet P, **Ren J**, van Laar T, Zhang L, van Dam H, Clément-Lacroix P, ten Dijke P: Genetic depletion and pharmacological targeting of αv integrin in breast cancer cells impairs metastasis in zebrafish and mouse xenograft models. Breast Cancer Res 2015, 17(1):28.

7. **Ren J***, Wang Y*, Iaria J, ten Dijke P, Zhu HJ: Synergistic reactivation of BMP signaling by MEK inhibitor and FK506 reduces breast cancer metastasis. (Manuscript in submission)

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Curriculum Vitae

Jiang Ren (任 江) was born on 10th of December 1987 in Longzhong, Sichuan province, China. He finished Master study in State Key Laboratory of Biotherapy at West China hospital, Sichuan university, China (September, 2010-June, 2013). His Masters research project focused on immunotherapy of lung cancer in humanized mouse model. Thereafter, he worked 1 year as a Research Assistant in State Key Laboratory of Biotherapy. During that period, he mainly performed pharmacokinetic preclinical studies on newly discovered therapeutic compounds. In September, 2014, he started his PhD research in the group of Prof. Dr. Peter ten Dijke. While his initial studies focused on the role of the BMP pathway in breast cancer cell invasion and metastasis, in subsequent research projects he examined the effector role of JUNB in TGFβ/SMAD-induced breast cancer invasion and whether targeting TGFβ can improve therapy with immune checkpoint inhibitors.

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