



Landscape of Immuno-Oncology Drug Development and KDDF's strategy

2022. 05. 11. CSO, Korea Drug Development Fund Sun Nam KIM



Landscape of Immuno-Oncology Drug Development

Immuno-oncology Development: a Short History





Immuno-oncology will represent 20% of global oncology spending by 2025



Global Oncology Spending and Growth

Immuno-Oncology Spending US\$Bn, 2011-2025





Therapeutic Class	Brand (molecule)	Company/Partner 2019 Sales (\$M)		Launch Date		
				US	5EU	Japan
Checkpoint modulator	Keytruda (pembrolizumab)	Merck	\$11,084	2014	2015	2016
Checkpoint modulator	Opdivo (nivolumab)	BMS	\$8,007	2014	2015	2014
Checkpoint modulator	Tecentriq (atezolizumab)	Roche	\$1,887	2016	2017	2018
Checkpoint modulator	Yervoy (ipilimumab)	BMS	\$1,489	2011	2011	2015
Checkpoint modulator	Imfinzi (durvalumab)	AstraZeneca	\$1,469	2017	2018	2018
Cell therapy	Yescarta (axicabtagene ciloleucel)	Gilead	\$456	2017	2018	×
Bispecific antibody	Blincyto (blinatumomab)	Amgen	\$353	2014	2015	2018
Cell therapy	Kymriah (tisagenlecleucel)	Novartis	\$278	2017	2018	2019
Checkpoint modulator	Libtayo (cemiplimab)	Regeneron/Sanofi	\$194	2018	2019	×
Checkpoint modulator	Bavencio (avelumab)	Pfizer/Merck	\$115	2017	2017	2017

Source: GlobalData, Pharma Intelligence Center [Accessed December, 2020].

Immuno-oncology Products in the 7MM



Immuno-oncology Pipeline products

Source: GlobalData, Pharma Intelligence Center [Accessed December, 2020]

Trends in IO Drug Development





Nat Rev Drug Discov (2021)



GlobalData 2021

Physicians believe that IO therapies will be best coupled with targeted therapies (**39%** of survey participants), followed by chemo/radiotherapy (**32%** of participants)



- Most suitable IO treatment modality
 - Immuno-oncology + chemo/radiotherapy
 - Immuno-oncology + targeted therapy
 - Immuno-oncology + Immuno-oncology
 - Immuno-oncology monotherapy

Physicians believe that IO therapies will be optimally placed in the first line of therapy and beyond (**59%**), followed by second line (**19%**) and adjuvant/neoadjuvant (**16%**)



Source: GlobalData High-Prescriber Survey (December, 2020)

R&D Strategies



Source: GlobalData High-Prescriber Survey (December 2020)



KDDF's Strategy

Korea Drug Development Fund(KDDF) is a government-initiated agency of three health-related Korean ministries to foster drug development projects in Korea







- > KDDF is the major gateway to find blockbuster drug candidates in Korea
- KDDF's R&D pipeline comes from academia, hospitals, research institutions, biotech and pharmaceutical companies
- > The pipeline spans all stages of drug development from hit to clinical phase II



- KDDF supports project investigators to overcome major bottlenecks encountered in the course of drug discovery and development process
 - (Death Valley 1) Provide technical support so that compound/technology from academia to meet the needs of the industry
 - (Death Valley 2) Support biotech to build top-class products by providing technologies from research-centered hospitals and government infrastructure



- Support business development and assist license deals with the global pharma & biotech
 - KDDF regularly contacts and introduces KDDF projects to the global pharma & biotech
 - KDDF makes contracts with global consulting firms to promote deals
- Initiate global collaboration between global institutions, biotech, and academia and Korean drug developing researchers
 - Introduce compounds from foreign organizations by sourcing
 - Upgrade in-licensing compounds to do research collaboration or M&A
- Support co-development between global big pharma and domestic developers at the clinical trial (phase1-2) stage to increase success rate





Portfolio

-A. 0110020	Indication	Stage			Company
Drug class	Targets	Dis	PreClin Ph	I Phil	Product Code
	Cancer Doppel				Seoul National University
	Rare cancer DLL3				IntoCell, Inc
ADC	Glioblastoma FGFR3		,		AimedBio, Inc FGFR3
	TNBC, NSCLC TROP2				LegoChem Biosciences, Inc TROP2-ADC
	Gastrointestinal stromal tumor C-kit (CD117)				Novelty Nobility, Inc NN3201
	Metastatic colorectal cancer CCSP-2				Asan Medical Center
	non-Hodgkin lymphoma, Chronic lymphocytic leukemia CD20 & CD55				Korea University
	Metastatic malignant melanoma oncokine-2				Korea University
	Lung cancer DDOST				Hanyang University
Antibodies	NSCLC VISTA, VISTA inhibitor				PharmAbcine, Inc PMC-309
	Metastatic NSCLC NSN-001				NEX-I, Inc
	Esophageal squamous cell carcinoma, TNBC PTK7				Yonsei University
	Solid tumor TIGIT				HanAll BioPharma -
	Solid tumor CD300c				CentricsBio, Inc CL7

Drug class Small molecule	Indication	Stage		Company			
	Targets	Dis	PreClin	PhI	Phil	Product Code	
	Dyspepsia Ghrelin receptor	Dyspepsia Ghrelin receptor				Kyungpook National University KARI101.201	
	Ulcerative colitis PYGL (Glycogen phosphorylase) inhibitor					Innovo Therapeutics Inc. BJ-80F	
	TORY DISEASE						
	Indication	Stage				Company	
Drug class	Targets	Dis	PreClin	Phl	Phil	Product Code	
Antibodies	Pulmonary emphysema Robo1					Asan Medical Center	
Small	Pneumonia Foxj1				_	Chongnam National University	

	Indication	Stage				Company	protein
Drug class	Targets	Dis	PreClin	Phi	Phil	Product Code	
Antibodies	Multiple Sclerosis					PB Immunetherapeutics PB-40N	
ASO	Refractory epilepsy eIF4E Suppressor				_	SoVarGen, Inc SVG102_N075, SVG102_ N182	
Exosome	Parkinson's disease Parkin, PGC-1α					Sungkyunkwan University	
Peptide	Parkinson's disease				_	Whan In Pharmaceutical Co., Ltd	Small
RNA-AAV	Rett syndrome MeCP2				_	Rznomics, Inc	molecule
	Major depressive disorder α2 adrenergic, NDRI					Kyung Hee University	
Small molecule	Parkinson's disease α-synuclein	•			Hanyang University		
	Parkinson's disease ASK1					KRICT	
	Progressive supranuclear palsy 4R Tau Oligomers					KIST DTC0148	

14	Indication	Cinec				Company
Drug class	Indication	Stage	-			Company
-	largets	Dis	PreClin	Phi		Product Code
Antibodies	Advanced solid tumor PD-1					Y-biologics, Inc. YBL-006
	Solid tumor PD-L1SIRPa					PharmAbcine, Inc
	Solid tumor PD-L1XCD3					MustBio
	Solid tumor B7-H4[VTCN1], 4-1BB[CD137]					ABL Bio ABL103
Bispecific	Advanced or metastatic solid tumor PD-L1, LAG-3			•		ABL Bio ABL501
	Colorectal cancer HLA-G/CD3		•			Y-biologics, Inc. HLA-GxCD3 ALICE
	TNBC PD-L1, CD47					ImmuneOncia Therapeutics Inc. IOH-001
	NSCLC c-MET, EGFR				_	ChongKunDang CKD-702
CAR-NK	Blood cancer CD5 CAR-NK					KRIBB
	Solid Tumor B7H3 CAR-T					Seoul National University
CAR-T	Blood tumor CD40		,			TiCARos CD40 switchable CAR cells
	Non-small cell lymphoma CD19					CuroCell, Inc CRC01-01
Exosome	Pancreatic cancer, Liver cancer FAF1					Chungnam National University
Fc recombinant protein	Cancer IL-21, PD-1					BIOnSYSTEMS, Inc BNS001
Hybrid nano DC	Cancer Dendritic cell					Yonsei University HynaDC
Nanoparticle	Cancer Topoisomerase /IAPs					KIST KM0022
4) HETHONI	0.00000000					
METABULI	CDISORDERS	_				-
Drug class	Indication	Stage	DesClin	DLI	DLU	Company Deedwat Cada
AAV-based	NASH CR-P1		Precun			Curogen Co., Ltd CR-G001
	NASH Resistin, CAP1 binding inhibitor					Seoul National University Hospital
Antibodies	Congenital hyperinsulinism glucagon			_		Hanmi Pharmaceutic Co., Ltd HM15136
Peptide+ shRNA plasmid	Obesity FABP4, FABP5					Hanyang University
Recombinant	Acromegaly hGH receptor		,			Alteogen, Inc ALT-B5
protein	NASH					Onegene

Cirrhosis SMS1

Diabetes SGLT1/2

Diabetes PPARγ/AMPA dual agonist

Diabetes, Obesity atypical PKC subtype

Type II Diabetes PAK4

Obesity IP6K

NASH MLKL

NASH USP1

	Indication	Stage			Company
Drug class	Targets	Dis	PreClin PhI	Phil	Product Code
Oncolytic virus (Herpes)	Ovarian cancer EpCAM				Gencellmed, Inc oHSV-1
Oncolytic virus (adeno) + MSC conjugate	Pancreatic cancer, Liver cancer TGFb1, HSP27				Yonsei University -
Peptide	Pancreatic cancer, Lung cancer KRAS mutant				NA Vaccine Institute NexaVac
PROTAC-CART conjugate	Blood cancer CAR-DEGRON-T				KRICT
Radio- liganded	Prostate cancer Prostate-Specific Membrane Antigen				FutureChem Co., Ltd [177Lu]Ludotadipep
Recombinant protein	Solid tumor IL-2R8y				Genuv -
	Cancer TPST2				GIST -
	Cancer TRIM29				SPARK Biopharma, Inc SB24011
	Cancer PIN1				Pimedbio, Inc PMB212
	NSCLC EGFR mutation				Cyrus Therapeutics
C	NSCLC GLS1				KRICT TRG-0039
molecule	NSCLC C797S mutation in EGFR				Bridge Biotherapeutics, Inc BBT-176
	Breast cancer HER2				B2SBio, Inc BTS-A, B
	TNBC HDAC6/8 dual-inhibitor				Sookmyung Women's University
	TNBC Mps1				Voronoi, Inc VRN081569
	TNBC TRIB2				GENESEN Co., Ltd

Seoul National University

Jeil Pharmaceutical Co., Ltd JP-2266 Seoul National University Hospital

Yonsei University

Jeonbuk National University ND201651

Hanyang University

Yonsei University WUXI1

KAIST

og#	Indication	Stane		Company		
Drug class	Targets	Dis	PreClin	PhI	Phil	Product Code
Macromolecule	Ischemia reperfusion injury ROS					Bilix Co., Ltd Brixelle (PEGylated bilirubin 3a)
Nanoparticles	Psoriasis, Contact dermatitis Hyaluronic acid					Ajou University
Peptide	Atopic dermatitis FPR2					Novacell Technology, Inc NCP112
	Atopic dermatitis EGR1					Konkuk University
	Atopic dermatitis STAT3					C&C Research Laboratories AD-1045
	Psoriasis CR-E1					Curogen Co., Ltd CR-PSZ
	Psoriasis, NASH NLRP3					Ajou University
5mall molecule	Psoriasis, Rheumatoid Arthritis Tyk2					Crystal Genomics, Inc
	Systemic Sclerosis SOS1/RAS					Kyungpook National University
	Asthma IL-33					Azcuris Co., Ltd KB1518
	IPF CHIT1(Chitotriosidase)		_		_	Innovo Therapeutics, Inc INV-005
	IPF, NASH PKM2					Lmito Therapeutics

	Indication	Stage				Company
Drug class	Targets	Dis	PreClin	PhI	Phil	Product Code
	CML, AML HMGCLL1					Samsung Medical Center
	CML BTK (C481S)					Medytox, Inc
	AML PIM Kinase					Jeil Pharmaceutical Co., Ltd JPC-089
Small molecule	Lung cancer p53 or USE1					KRICT
	Metastatic colorectal cancer USP21					Daegu Gyeongbuk Medical Innovation Foundation -
	Malignant tumor EZH1/2					Hanmi Pharmaceutical Co., Ltd HM97662
	Prostate cancer Prostate-Specific Membrane Antigen					CellBion Co., Ltd PSMA-DGUL

	Indication	Stage			Company	
Drug class	Targets	Dis	PreClin	PhI	Phil	Product Code
Oligonucleotide	Acute heart failure miRNA (miR-A, 12803p, 34a-5p, B, 203a-3p)					StemMediTech, Inc ANT-A/B
pDNA- micoparticle conjugate	Peripheral arterial disease, Diabetic peripheral neuropathy c-Met receptor					G&P Bioscience Co., Ltd GB107
Peptide	Pulmonary hypertension PP1					NadianBio Co., Ltd WK7003
Small	Congestive heart failure, Chronic renal disease pendrin	-				Yonsei University A4948
molecule	Aortic Stenosis DPP-4					REDNVIA Co., Ltd Evoqliptin

	Indication	Stage		Company	
Drug class	Targets	Dis	PreClin PhI	Phil	Product Code
CRISPR pegRNAs	Leber congenital amaurosis CEP290				Seoul National University
	Age-related macular degeneration PDK4				Kyungpook National University
Small molecule	Diabetic retinopathy TGase2				Daegu Gyeongbuk Medical Innovation Foundation -
	Diabetic retinopathy				SmartinBio, Inc

🕸 OTHERS						
Davis alassa	Indication	Stage				Company
Drug class	Targets	Dis	PreClin	PhI	Phil	Product Code
	Osteoporosis Cathepsin K					Ewha Womans University
Antibodies	Paroxysmal nocturnal hemoglobinuria C5 Inhibitor					ImmunAbs, Inc IM-101
Bispecific	Organ Failure ABO BCR, CD3					KAIST
MRI contrast agent	MRI contrast agent Gadolinium-based contrast agents [D03A-tranexamic acid conjugated]					Hana Pharm Co., Ltd HNP-2006
Destide	Sarcopenia TLQP21					Asan Medical Center
Peptide	Achondroplasia NPR-B					Peptron, Inc PND3174
miRNA	Sarcopenia Atrogin-1					Aventi, Inc AVTM201
Small	Hearing loss DRAK1, ADCK4, CDC42BPA kinase					Kyungpook National University KPLO-2004
molecule	Genetic Hearing Loss KV7.4					Yonsei University

KDDF's Strategy



Thank You!