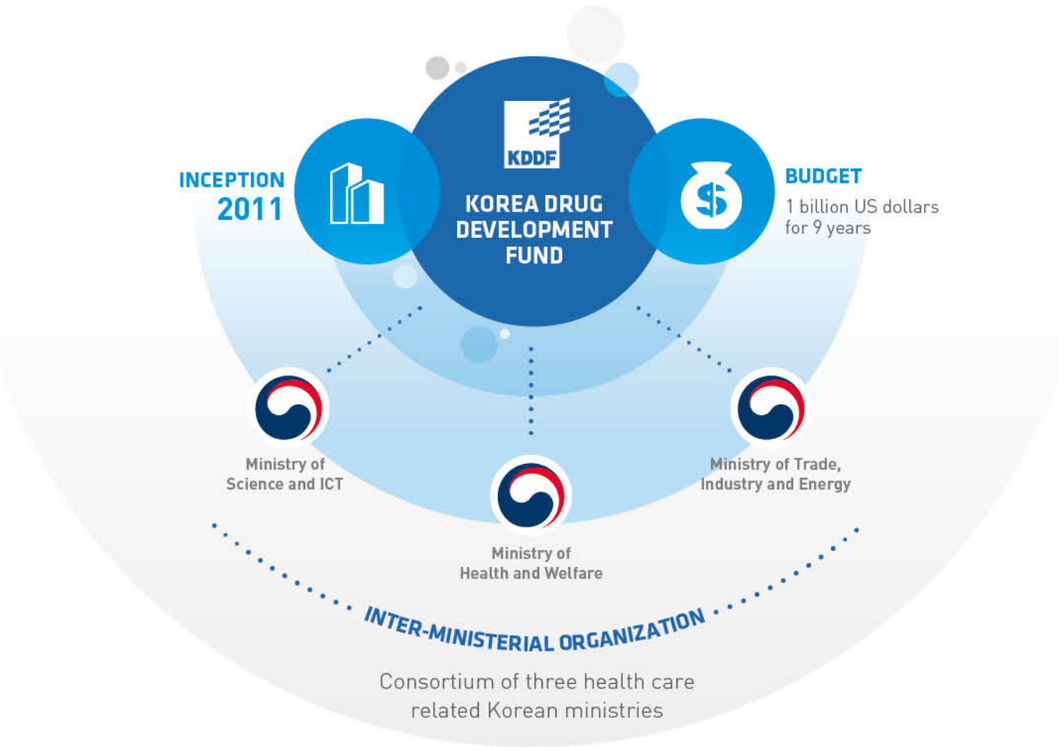
KOREA
DRUG
DEVELOPMENT
FUND

KDDF

KDDF
Korea Drug Development Fund

ABOUT KDDF

Korea Drug Development Fund (KDDF) is a government funded organization with one billion USD budget over nine years period of time to accelerate innovation activities in Korean pharmaceutical R&D communities.



KDDF has

- Top-notch proposal selection system
- Value focused project management system
- Large pool of excellent domestic and foreign experts in various drug development field
- International and domestic network in business development field
- 125 pipeline in various therapeutic areas from lead stage to clinical trial stage

ACCOMPLISHMENT

KDDF has been supporting new drug development throughout all value chains from discovery to clinical trials. As of April 2019, 42 pipeline entered into licensing agreement, of which deal value is totaled more than 6.5 billion USD.

KDDF'S PERFORMANCE (AS OF APRIL 2019)

PATENTS

638

Global: 500
Domestic: 138

LICENSING OUT

42

Global: 17
Domestic: 25

YUHAN corporation, JW Pharm, Bukwang Pharmaceutical, Dinona, HANALL Biopharma, LegoChem Bioscience, Abclon, Hanmi, CJ Healthcare, Genexine

EXECUTED MOU

27

Global: 12
Domestic: 15

US-FDA ODD*

7

Alteogen
Bio-pharm solutions
Enzychem Lifescience
Genexine
LegoChem Bioscience
PharmAbcine
Qurient

FDA

* ODD: Orphan Drug Designation

REVIEWED PROPOSALS

542

LICENSING DEAL VALUE

6.5 Billion USD

PIPELINE

125

NDA*

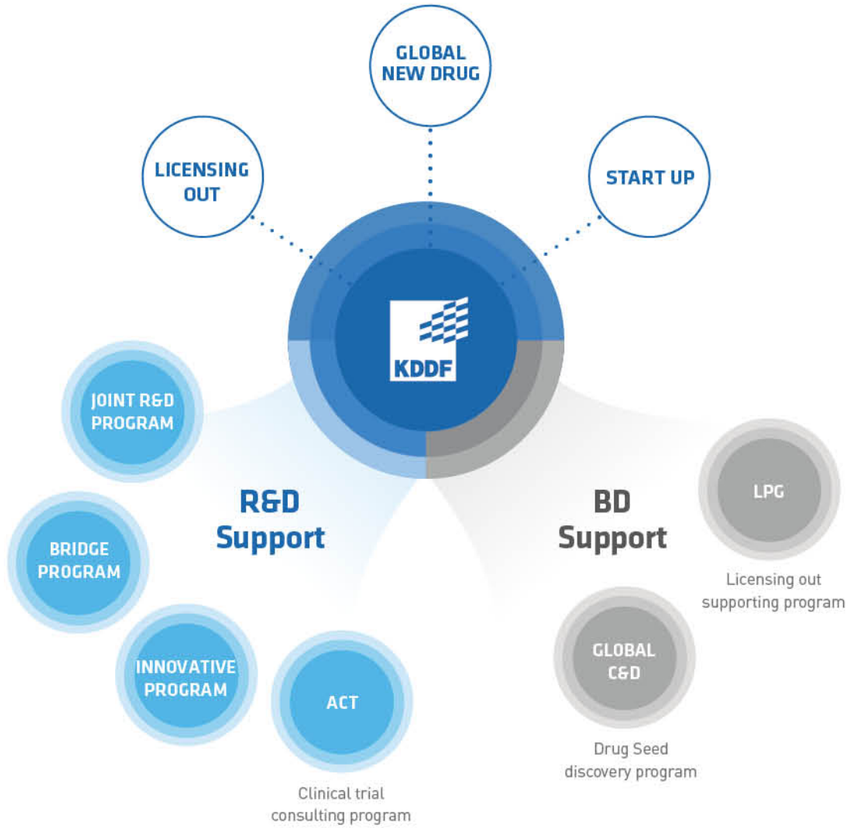
2

Global: 1, Domestic: 1

*NDA: New Drug Application

BUSINESS MODEL

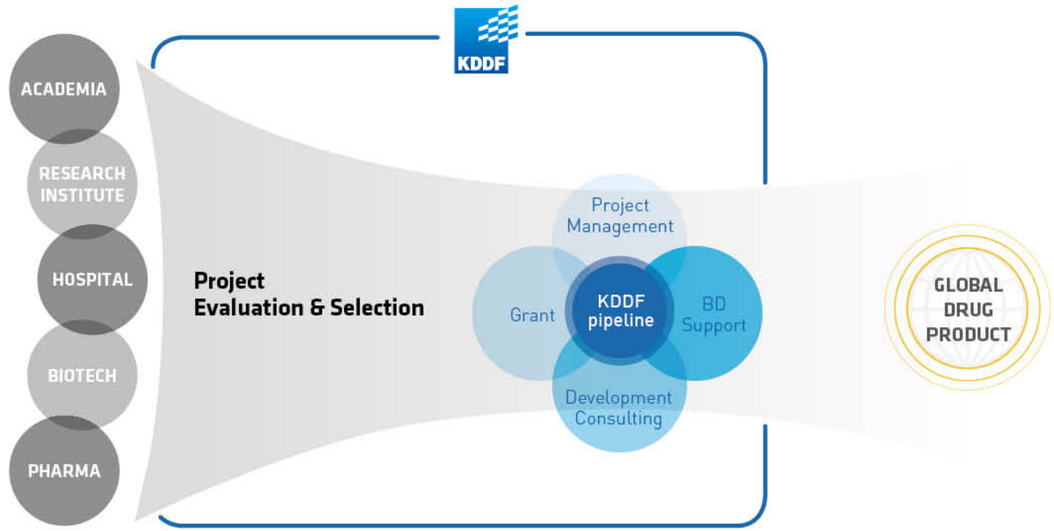
KDDF selects and manages portfolio in alignment with Global Big Pharmaceutical companies' interests who are capable of commercializing the asset globally.



What we do

KDDF funds and manages the innovative drug development projects from lead to clinical stage, covering academia, research institute, biotech, and pharmaceutical companies. KDDF does not only fund drug development project, but also supports business development, including out-licensing of the funded projects and in-sourcing drug seeds from abroad.

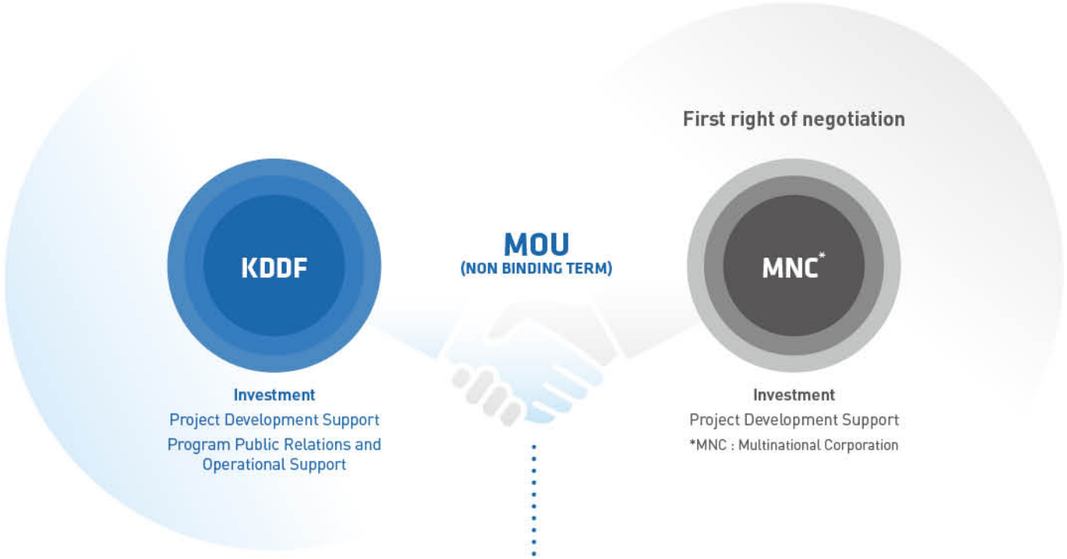
R&D PROGRAM

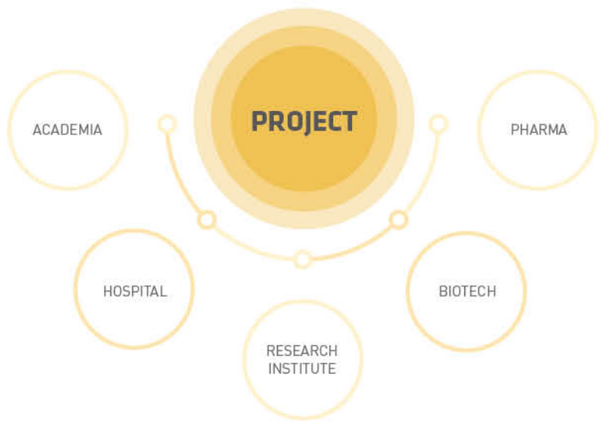


Selection Process

Innovative Track

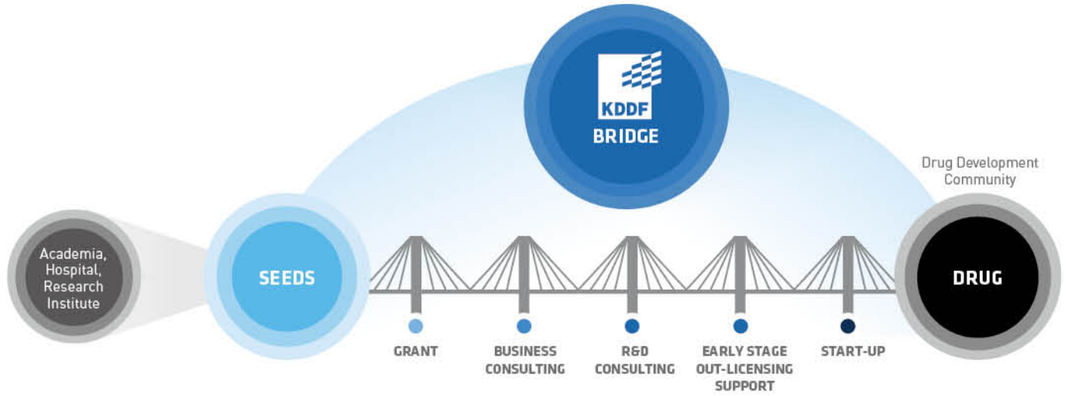
Innovative track is a bottom up model to find and support novel and innovative drug candidates in Korea. KDDF calls for proposals to Korean drug development communities and selects program through science and investment committee.





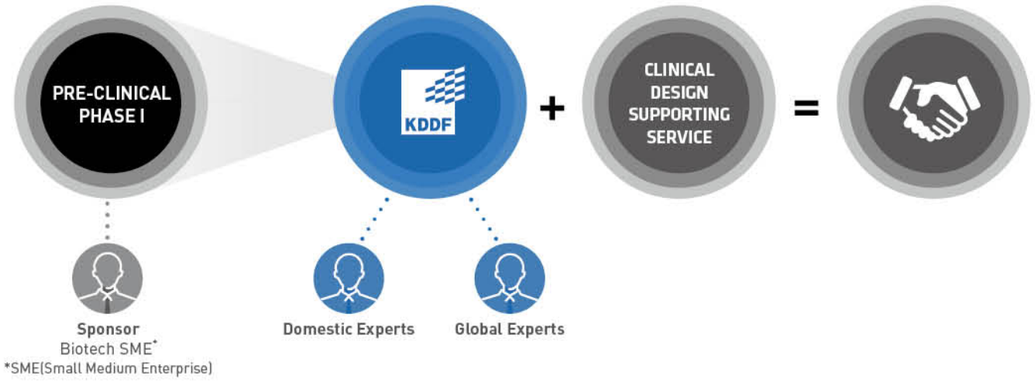
Joint R&D Track

Joint R&D track is a top-down collaboration model, partnered with Global Big Pharmaceutical companies. Call for proposal of Joint R&D Track specifically focuses on certain disease area and mode of action requested by the partner. Through this program the partner is able to find projects to enrich their pipeline.



BRIDGE Track

BRIDGE Track is specially designed to bridge very early stage drug discovery to clinical development. In BRIDGE Track, KDDF will co-manage the funded project from the very start to the commercialization, by providing not only grant but also proficient development consulting services, utilizing all the public drug development resources.



ACT (Advancing Clinical Trial)

- ACT program offers significant benefits for biotech and pharmaceutical companies looking to reduce clinical attribution rate and to increase success rate for their clinical program.
- In-depth clinical trial protocol design consulting service provided by top class clinical experts.
- Advising on study design including appropriate endpoints, statistical methods for analysis, sample size calculations, surrogate biomarkers.

BUSINESS SUPPORTING PROGRAM

KDDF does not only work as a grant agency for new drug development organizations,
but also support their business development through LPG program and Global C&D program.

LPG (Licensing Partnering for Globalization)

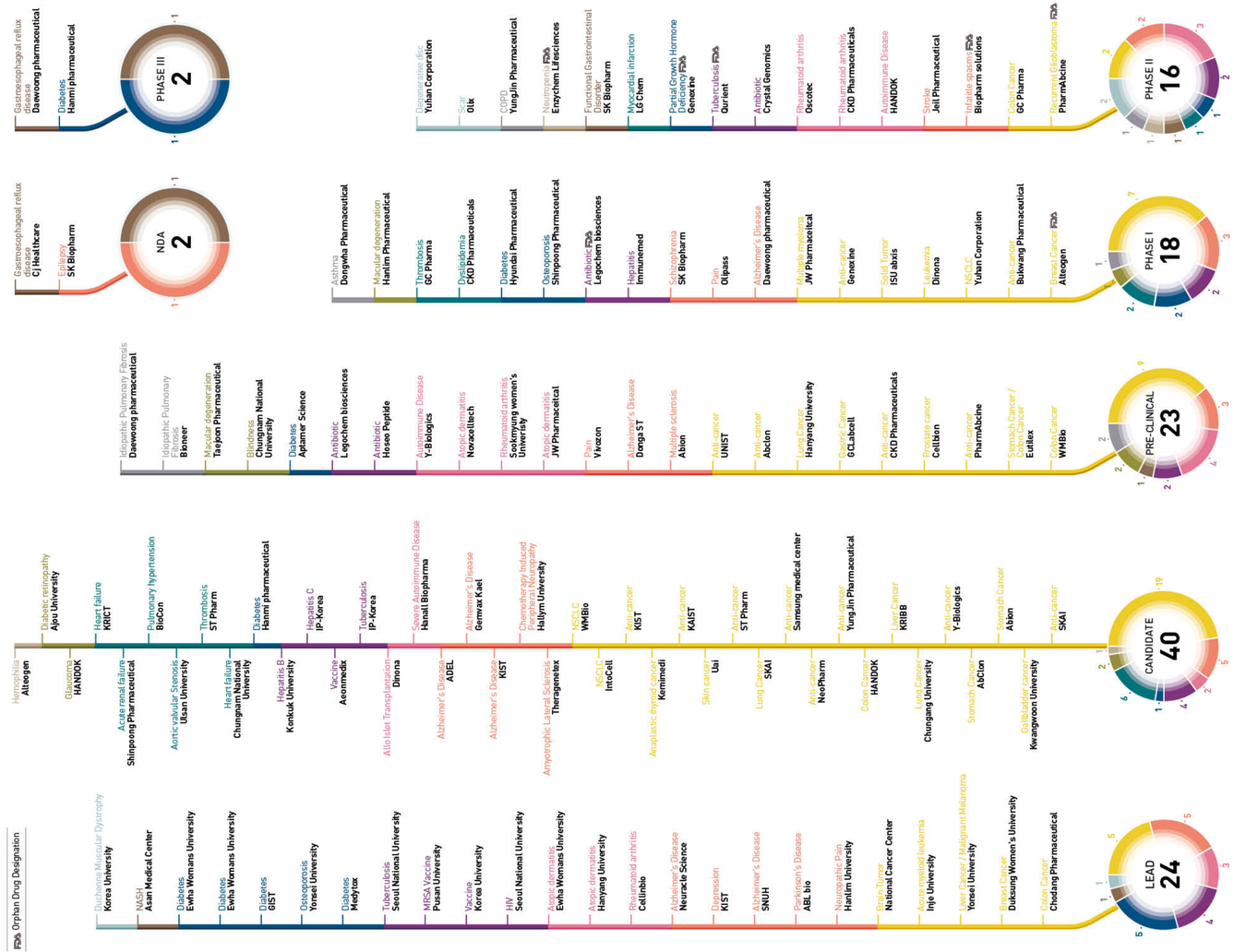
- Business development consulting services for Korean drug development communities.
- Acceleration of licensing activities via KDDF's global network, with consulting service covering all business areas necessary, including from evaluation of licensing value to finding out fittest licensee.

KDDF PIPELINE

KDDF covers a wide range of organizations and indications.

For more information, please contact us.
http://eng.kddf.org/Main/
kddf_bd@kddf.org

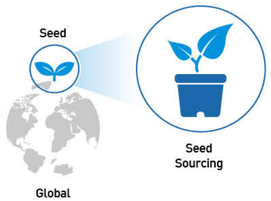
FDA Orphan Drug Designation



CARDIOVASCULAR DISEASE 42 · OPHTHALMIC DISEASE 4 · RESPIRATORY DISEASE 3 · CNS DISEASE 19 · IMMUNE DISEASE 12 · INFECTIOUS DISEASE 14 · METABOLIC DISEASE 11 · GASTROINTESTINAL DISEASE 9 · HEMATOLOGIC DISEASE 4 · OTHERS 5 · CANCER

125 TOTAL PIPELINE

01 PIPELINE SOURCING



If your seed has a potential, KDDF is able to connect the seed to appropriate development organizations

http://cnd.kddf.org

02 FARMING

Biotech, Research Institutes, Pharma Companies
Research Grant (KDDF)
Korean Pharmaceutical industry incubates and develops the seed

03 HARVESTING

Value creation, Out-licensing, IPO, M&A, etc.
Value added and optimize development

Global C&D (Connection and Development)

C&D program is to improve R&D productivity by providing open innovation platform to Korean drug development communities, facilitating their in-sourcing novel drug seeds from worldwide.

CONTENTS

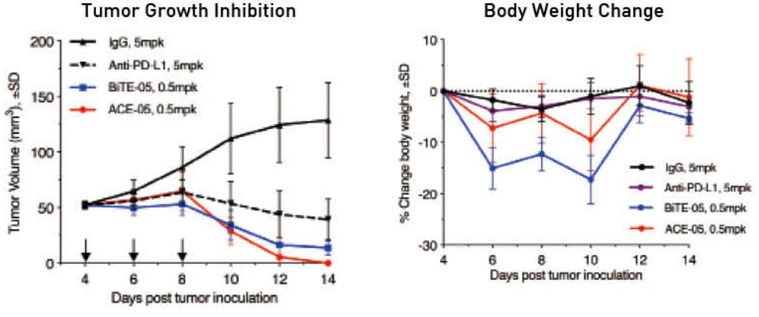
KDDF-201803-08

Development of a pre-clinical candidate of ACE-05 T cell engager to enhance T cell activation

CANCER | LEAD OPTIMIZATION

Y-BIOLOGICS

Product Type	Immunoglobulin Product (mAb) (Bispecific antibody (T cell engager))
Indication	1st indication: Non Small Cell Lung Cancer, Lung Neoplasm (MeSH term) 2nd indication: Triple Negative Breast Cancer, Breast Neoplasm (MeSH term)
Target	Programmed Death-Ligand 1 (PD-L1)
MoA (Mechanism of Action)	Redirection and engagement of T cell to PD-L1 positive cancer cell → Activated T cell can kill cancer cell by making cytotoxic immunological synapse
Differentiation Point	First In Class ACE-05 redirects and activates T cells specifically into cancer cells to maximaze anti-tumor efficacy with relatively less toxic effect compared to BiTE-format T cell engager
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intravenous
Data	- ACE-05 shows more significant tumor regression than those of anti-PD-L1 mAb and BiTE-format T cell engager (BiTE-05) in immune humanized mice model - The body weight change after ACE-05 treatment represents relatively low toxicity compared to that of BiTE-05



Patent Position	Patent No. (62 / 655,762 / U.S Provisonal Application)

Bum-Chan Park parkb2@ybiologics.com +82-10-9749-1228

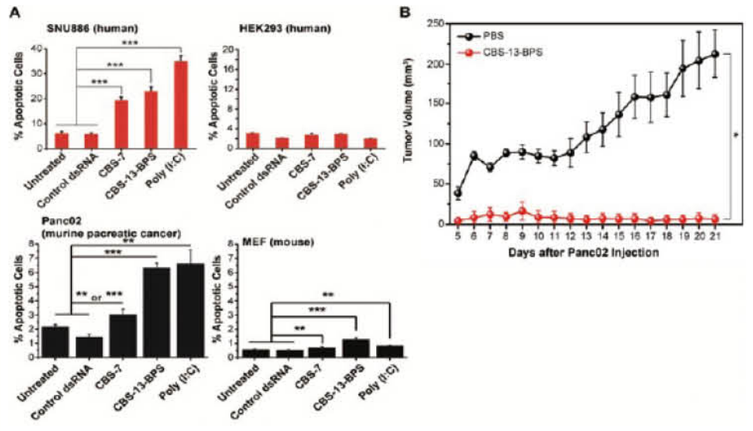
KDDF-201809-04

A novel RNA oligonucleotide developed for cancer therapy

CANCER | LEAD OPTIMIZATION

Korea Advanced Institute of Science and Technology (KAIST)

Product Type	Aptamer (RNA oligonucleotide)
Indication	1st indication: Cancer, Neoplasms (MeSH term)
Target	Retinoic acid-Inducible Gene I (RIG-I)
MoA (Mechanism of Action)	Developed a novel RNA oligonucleotide that specifically induces apoptosis of a tumor
Differentiation Point	First In Class A systematically designed RNA oligonucleotide that shows comparable anti-tumor efficacy to poly I:C
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intratumoral
Data	- Developed RNA oligonucleotide (CBS RNA) is 5'-OH dsRNA. It shows selective anti-tumor efficacy in human liver cancer (SNU886) and mouse pancreatic cancer cells (panc02). (Fig. A) - CBS RNA showed anti-tumor activity against mouse pancreatic cancer (panc02) in vivo (Fig. B). RNA was administered via intratumoral injection.



Patent Position	Patent No. 10-2016-0132754 (KR), 15 / 327,596 (US), 2018 / 16855780.9 (EP), 2018 / 2018-519475 (JP), 2018 / 2016800606377 (CN)

Byong-Seok Choi bschoi@kaist.ac.kr +82 42-350-2828

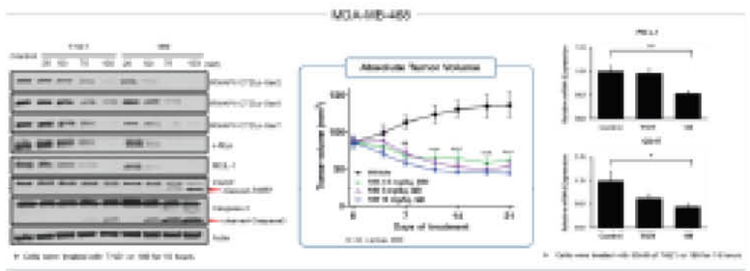
KDDF-201812-01

Development of CDK7 inhibitors for treatment of myc-driven cancers

CANCER | LEAD OPTIMIZATION

Yungjin Pharm

Product Type	Chemical Product
Indication	1st indication: TNBC, Triple Negative Breast Neoplasms (MeSH term) 2nd indication: HCC, Carcinoma, Hepatocellular (MeSH term) 3rd Indication: AML, Leukemia, Myeloid, Acute (MeSH term)
Target	Cyclin-Dependent Kinase 7 (CDK7)
MoA (Mechanism of Action)	CDK7 promotes the expression of key oncogenes such as c-Myc and MCL1 through the phosphorylation of RNA polymerase II and activation of cell cycle kinases (CDK1, CDK2, CDK4, and CDK6). The inhibition of CDK7 is an attractive strategy for the treatment of cancer by down-regulation of c-Myc and MCL1expression.
Differentiation Point	First In Class YPN005 showed significant anti-tumor activities for Myc-driven cancer models with down regulation of immune checkpoints such as PD-L1 and CD47. Therefore, YPN005 can be used for various cancer with Myc as a biomarker.
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Oral
Data	1. No. 189 showed potent cell growth inhibition in TNBC cell. Also, complete c-myc depletion in TNBC cell at the 75 nM concentration was observed. 2. Xenograft study for No. 189 was done using a MDA-MB-468 model. We have observed tumor volume regression without any signs of toxicity during treatment periods. 3. MDA-MB-468 was treated with 50 nM concentration of No. 189 which resulted in a significant decrease in mRNA expression levels of PD-L1 and CD47.
Patent Position	



Kwang-Ok Lee kolee@yungjin.co.kr +82-31-546-6970 (Ext. 201)

KDDF-201812-23

Highly stable and potent B7-H3 ADCs by a novel OHPAS linker technology

CANCER | LEAD OPTIMIZATION

IntoCell

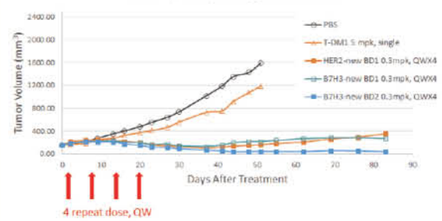
Product Type	Immunoglobulin Product (mAb) (Antibody-Drug Conjugate)
Indication	1st indication: Non-Small-Cell Lung Cancer, Carcinoma, Non-Small-Cell Lung (MeSH term) 2nd indication: Cancer, Neoplasms (MeSH term)
Target	B7 Homolog 3 (B7-H3)
MoA (Mechanism of Action)	Binding to cell surface antigen → Endocytosis → Lysosomal degradation → Active payload release → Cell death
Differentiation Point	First In Class The drug is devoid of premature payload release in circulation and efficently liberates appended payload in target cancer cells
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intravenous
Data	- Very effective against B7-H3 positive cancer cells - Very potent anti-tumor activity in mouse xenograft model
Patent Position	Patent No. KR10-2018-0076708 ; PCT / IB2018 / 000847; US 62 / 597,226

ADC (Conjugated drug)	DAR*	*In vitro* activity (nM), (B7-H3 copies/cell)					
		JIMT-1 (6.7×10^5)	Calu-6 (4.6×10^5)	NCI-H460 (3.0×10^5)	A549 (2.3×10^5)	NCI-H23 (0.8×10^5)	DU-145 (0.8×10^5)
ITC-661 (new BD dimer 1)	1.98	0.011 ±0.008	0.008 ±0.003	0.039 ±0.021	0.107 ±0.043	0.018 ±0.003	0.021 ±0.010
ITC-662 (new BD dimer 2)	2.00	0.011 ±0.009	0.010 ±0.003	0.054 ±0.032	0.074 ±0.054	0.024 ±0.007	0.033 ±0.015

* Site-specifically conjugated to anti-B7-H3 Thiomab

Effect of IntoCell ADCs on tumor volume in mouse xenograft model

JIMT-1 (B7-H3+/HER2+)_IntoCell ADC



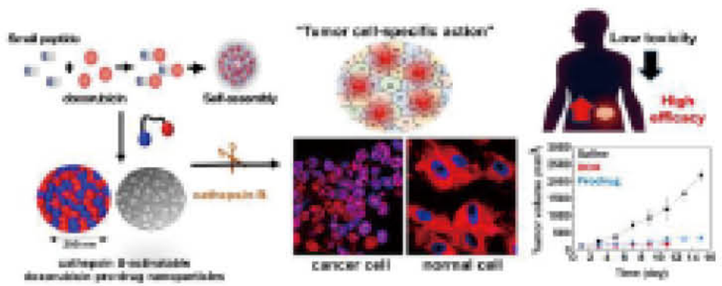
Sung Ho Woo woo@intocell.co.kr +82-42-716-0083

KDDF-201712-09

Carrier-free cathepsin B-specific cleavable anticancer prodrug

CANCER | LEAD OPTIMIZATION

Korea Institute of Science and Technology (KIST)

Product Type	Chemical Product (Peptide and Drug conjugate)
Indication	1st indication: Colorectal Cancer, Colorectal Neoplasm (MeSH term) 2nd indication: Breast Cancer, Breast Neoplasm (MeSH term)
Target	Topoisomerase (Doxorubicin based)
MoA (Mechanism of Action)	(Self-assembly small peptide-based nanoparticles without any nanocarriers) 1. Passive accumulation effect in the tumor site 2. Tumor cell specific activation by cathepsin B (biomarker) 3. Doxorubicin-based strong cytotoxic effect on cancer cells
Differentiation Point	First In Class This is the first low molecular weight drug cadidate based on self-assembly and cathepsin B-specific action among doxorubicin prodrugs
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intravenous
Data	1. Long term administration due to low toxicity by prodrug-type 2. Delivery to tumor tissue by the passive accumulation effect of nanoparticles 3. Simple synthesis and predicted efficacy with a clear biomarker
	
Patent Position	15 / 925,830 / US, 18164779 / EU, 10-1930399 / KR

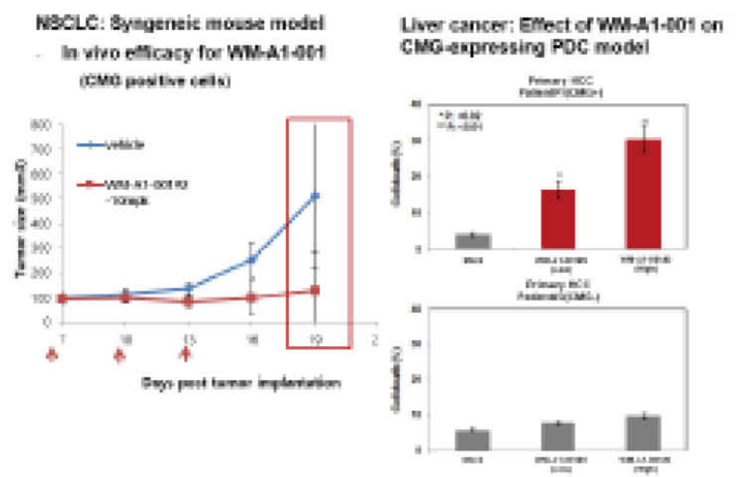
Jooho Park pkjhdn@kist.re.kr +82-2-958-5918

KDDF-201709-57

Development of new mechanism based therapeutic antibodies in non-small cell lung cancer patients

CANCER | LEAD OPTIMIZATION

Wellmarkerbio

Product Type	Immunoglobulin Product (mAb)
Indication	1st indication: Lung Cancer, Lung Neoplasms (MeSH term) 2nd indication: Liver Cancer, Liver Neoplasms (MeSH term)
Target	Undisclosed
MoA (Mechanism of Action)	Binding to CMG (Cancer Immunotherapy-related Gene)
Differentiation Point	First In Class Predictive biomarker for treatment of NSCLCs Overcoming resistance of chemo-agents in NSCLCs
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intraperitoneal
Data	
Patent Position	

Jai-Hee Moon jhmoon@wmbio.co +82-2-6952-3726

KDDF-201408-11 Unique and first-in-class, treg converter

CANCER PRE-CLINICAL

Eutilex

Eutilex Co.,Ltd.

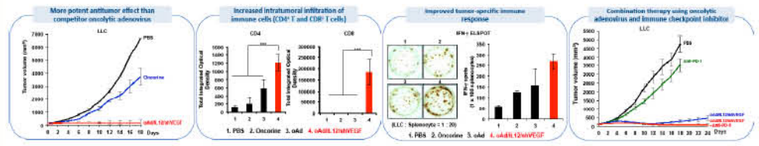
Product Type	Immunoglobulin Product (mAb)
Indication	1st indication: Solid Tumors, Neoplasms (MeSH term)
Target	AITR (Activation Inducible TNFR Receptor) GITR (Glucocoricoid-Induced TNFR-Related Protein)
MoA (Mechanism of Action)	Convert Treg into Th1, promote Th1 (CD4+), Tc1 (CD8+) and NKT cells
Differentiation Point	First In Class Eutilex mAb shows superior anti-tumor efficacy vs. Keytruda and competitors' anti-AITR mAb in humanized mice cancer models
Current Development Stage	Pre-Clinical
Route of Administration	Parenteral-Intravenous (systemic (IV, IP) only)
Data	
Patent Position	

Yonghun Jung yhj@eutilex.com +82-2-3402-7381

KDDF-201611-05 Development of gene therapeutic-mediated combination therapy regimen targeting lung cancer

CANCER PRE-CLINICAL

Hanyang University, Gene Therapy Lab.

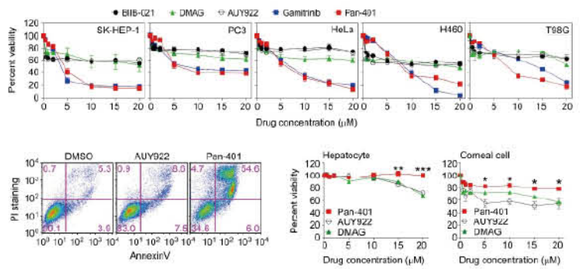
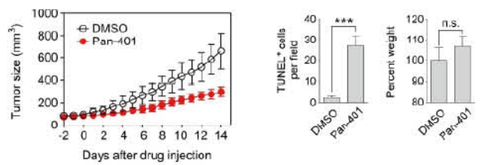
Product Type	Cellular & Gene Product (oncolytic adenovirus)
Indication	1st indication: Lung Cancer, Lung Neoplasms (MeSH term) 2nd indication: Hepatocellular Carcinoma, Breast Cancer, Prostate Cancer
Target	Hypoxia, VEGF, Immune surveillance
MoA (Mechanism of Action)	• Oncolytic adenovirus kill cancer cell specifically and multiply therapeutic transgene shVEGF and IL-12. • Novel promoter enhances induces cancer-specific killing effect. • shVEGF inhibits angiogenesis, metastasis and proliferation of cancer cell. • shVEGF reverses immunosuppressive tumor microenvironment. • IL-12 decreases the tumor metastasis by regulating tumor microenvironment. • IL-12 increases infiltration of CD4+ T, CD8+ T, natural killer, and dendritic cells in tumors tissues. • IL-12 upregulates IFN-γ to shift the T cell response toward the Th1 immunity, ultimately enhancing anti-tumor immune response.
Differentiation Point	First In Class • Targeting multiple carcinogenic pathway through novel strategy • No observable cytotoxicity or side effect in normal cells while preferentially treating tumor cells • Significantly lower production cost in comparison with competing product • Synergistic antitumor efficacy in combination with standard therapies (chemotherapy, radiotherapy, antibody,immune cells)
Current Development Stage	Pre-Clinical
Route of Administration	Local-Intratumoral
Data	
Patent Position	• PCT / KR2016 / 009717 (IL12/shVEGF) / USA, Europe, China, PCT, Rep. of KOR • PCT / KR2004 / 000427 (mTERT) / USA and 5 other countries • PCT / KR2011 / 004693 (E2F+TERT) / USA and 4 other countries

Chaeok Yun chaeok@hanyang.ac.kr +82-10-9492-0334

KDDF-201512-02 Development of cancer therapeutics targeting mitochondrial TRAP1

CANCER | PRE-CLINICAL

Ulsan National Institute of Science and Technology (UNIST)

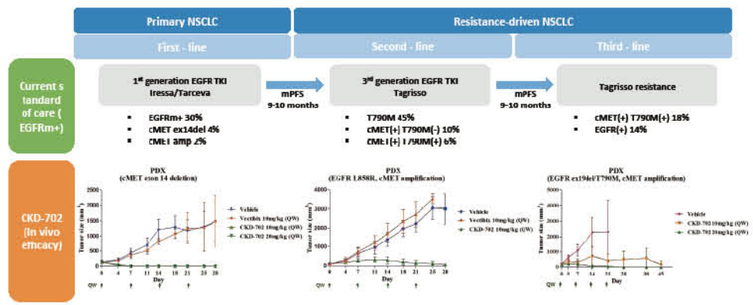
Product Type	Chemical Product
Indication	1st indication: Prostate Cancer, Prostatic Neoplasm (MeSH term) 2nd indication: Brain Cancer, Brain Neoplasm (MeSH term)
Target	TNF-Receptor Associated Protein 1 (TRAP1)
MoA (Mechanism of Action)	TRAP1 antagonist blocks cancer specific metabolic pathways by inhibiting some metabolic enzymes required for tumorigenesis.
Differentiation Point	First In Class Novel target and novel mode of action
Current Development Stage	Pre-Clinical
Route of Administration	Oral or Intravenous
Data	Cytotoxic activity of Pan-401 in cancer cells (in vitro data)  *In vivo* anticancer activity of Pan-401 (30 mg/Kg, daily i.p. injection) 
Patent Position	Patent No. (10-2016-0140260 / PCT / KR2017 / 007907) / Korea

Byoung-Heon Kang kangbh@unist.ac.kr +82-52-217-2521

KDDF-201709-11 Preclinical studies of a novel anti-cancer bispecific antibody CKD-702

CANCER | PRE-CLINICAL

Chong Kun Dang

Product Type	Immunoglobulin Product (mAb) (Bispecific antibody)
Indication	1st indication: Non-Small Cell Lung Cancer, Carcinoma, Non-Small-Cell Lung (MeSH term) 2nd indication: Gastric cancer, Glioblastoma, Colon or Colorectal cancer, Stomach Neoplasms, Glioblastoma,Colonic or Colorectal Neoplasms (MeSH term)
Target	Mesenchymal to Epithelial Transition factor receptor (cMET) or Hepatocyte Growth Factor Receptor (HGFR) and Epidermal Growth Factor Receptor(EGFR)
MoA (Mechanism of Action)	CKD-702 binds and internalizes both cMET and EGFR → Degrades the receptors and effectively blocks downstream signaling pathways → Superior antitumor activity
Differentiation Point	First In Class • Superior antitumor activity in multiple NSCLC, colon and gastric cell lines or NSCLC tumor xenograft models. • Treatment of cynomolgus monkeys with CKD-702 resulted in a low toxicity profiles, including skin rash observed with other EGFR-directed agents.
Current Development Stage	Pre-Clinical
Route of Administration	Parenteral-Intravenous
Data	CKD-702 opportunities in NSCLC: - First-line therapy for patients with EGFR wild type and cMET ex14 deletion - Second and third line treatment for patients with cMET amplification and acquired resistance to EGFR tyrosine kinase inhibitors 
Patent Position	Patent No. 10-2017-0067106 (Korea) PCT / KR2018 / 006182

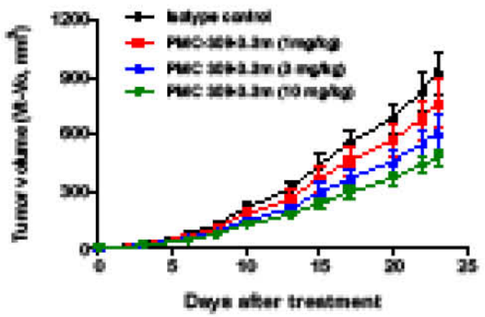
Eun-Ju Jeon ejjeon@ckdpharm.com +82-31-340-1421

KDDF-201709-55 Development of immuno-onoclogy drug PMC-309 targeting VISTA known as a negative checkpoint regulator

CANCER PRE-CLINICAL

PharmAbcine

PharmAbcine
Antibody Therapeutics for Life

Product Type	Immunoglobulin Product (mAb)
Indication	1st indication: NSCLC, Carcinoma, Non-Small Cell Lung (MeSH term) 2nd indication: Pacreatic Cancer, Breast Neoplasm (MeSH term)
Target	V-domain Ig suppressor of T-cell Activation (VISTA)
MoA (Mechanism of Action)	Increase immunity against tumor by binding to VISTA
Differentiation Point	**First In Class** fully human, best immune activation activity
Current Development Stage	Pre-Clinical
Route of Administration	Parenteral-Intravenous
Data	- Stronger anti-tumor activity than competitor in humanized mouse model - Synergic anti-tumor activity with anti-PD1 antibody
	
Patent Position	Applied in KOREA / PCT

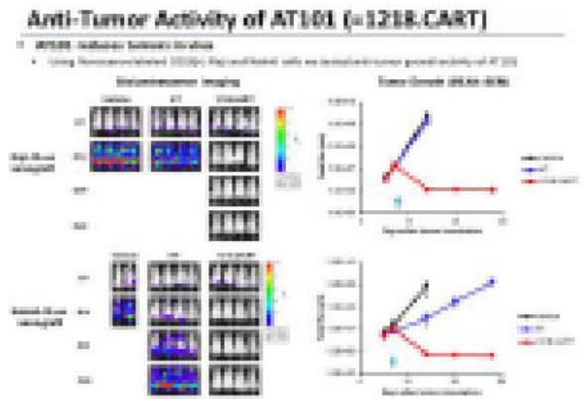
Weon Sup Lee weonsup.lee@pharmabcine.com +82-43-235-2017 (Ext. 3001)

KDDF-201712-05 Novel CD19-targeting CAR-T

CANCER PRE-CLINICAL

AbClon

AbClon

Product Type	Cellular & Gene product (CAR-T)
Indication	1st indication: Acute Lymphoid Leukemia Precursor cell lymphoblastic Leukemia-Lymphoma (MeSH term) 2nd indication: B-cell lymphoma, lymphoma, B-Cell (MeSH term)
Target	B-lymphocyte antigen CD19 (CD19)
MoA (Mechanism of Action)	Favorable formation of immune synapse of the CAR-T using a humanized CD19 antibody with novel epitope that it can increase the efficacy whereas it can reduce adverse effects including immunogenicity.
Differentiation Point	**First In Class** The drug can overcome limitations such as resistance and immunogenecity of marked CD19 targeting CAR-T on the basis of novel epitope.
Current Development Stage	Pre-clinical
Route of Administration	Parenteral-Intravenous
Data	– AT101 (1218.CART) is a novel CD19-targeting CAR-T. – AT101 inhibits CD19 (+) tumor cell growths in vivo remarkably.
	
Patent Position	10-2018-0156433 (Korea, applied) PCT / KR2018 / 015445

Kyu-Tae Kim ktkim@abclon.com +82-2-2109-1366

KDDF-201712-12 Development of novel radiopharmaceutical for prostate specific membrane antigen targeted therapy

CANCER | PRE-CLINICAL

Cellbion

CellBion

Product Type	Peptide Product
Indication	1st indication: Prostate Cancer, Prostatic Neoplasms (MeSH term) 2nd indication: Metastatic Cancer, Prostatic Neoplasms, Castration-Resistant (MeSH term)
Target	Prostate Specific Membrane Antigen (PSMA)
MoA (Mechanism of Action)	Prostate-specific membrane antigen (PSMA), also known as folate hydrolase I (FOLH1) or glutamate carboxypeptidase II (GCPII), is a transmembrane, 750 amino acid, type II glycoprotein that is primarily expressed in normal human
Differentiation Point	First In Class
Current Development Stage	Pre-Clinical
Route of Administration	Parenteral-Intravenous
Data	List of completed pre-clinical test A Single Dose Intravenous Toxicity Study of PSMA-GUL-DOTA in Sprague-Dawley Rats A Single Dose Intravenous Toxicity Study of PSMA-GUL-DOTA in Beagle Dogs A Single Dose Intravenous Toxicity Study of PSMA-GUL-DOTA-^{177}Lu in Sprague-Dawley Rats A 2-week (3 times)Repeated Dose Intravenous Toxicity ORF Study of PSMA-GUL-DOTA-^{177}Lu in Sprague-Dawley Rats A 6-week (4 times) Repeated Dose Intravenous Toxicity Study of PSMA-GUL-DOTA-^{177}Lu with a 2-week Recovery Period in Sprague-Dawley Rats A Single-Dose Intravenous Toxicity Study by Dose Escalation of PSMA-GUL-DOTA-^{177}Lu in Beagle Dogs A 2-week (3 times) Repeated Dose Intravenous Toxicity ORF Study of PSMA-GUL-DOTA-^{177}Lu in Beagle Dogs A 6-week (4 times) Repeated Dose Intravenous Toxicity ORF Study of PSMA-GUL-DOTA-^{177}Lu in Beagle Dogs A Safety Pharmacology Study : Effects of PSMA-GUL-DOTA-^{177}Lu on the body Temperature and General Behavior of ICR Mice after a Single Intravenous Dose A Safety Pharmacology Study : Effects of PSMA-GUL-DOTA-^{177}Lu on the Respiration Rate and Tidal Volume of Sprague-Dawley Rats after a Single Intravenous Dose Intravenous Dose A Safety Pharmacology Study : Effects of PSMA-GUL-DOTA-^{177}Lu on hERG Potassium Channel Expressed in CHO hERG Cells
Patent Position	AU2016352491 B2 / AU US2018339071 A1/ USA EU3375787 A4 / EU

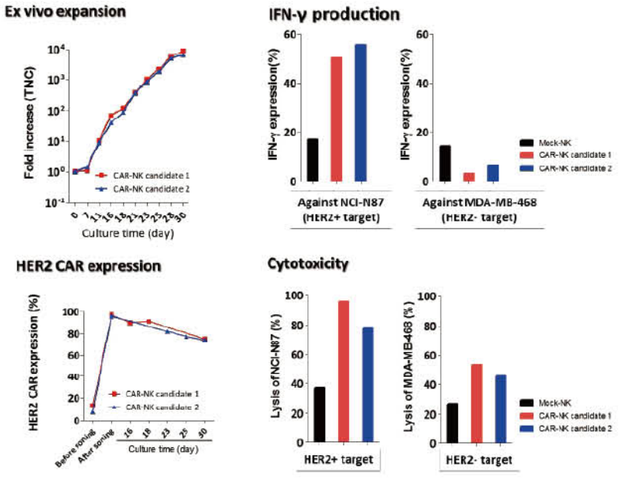
Tae-Rahk Kim trkim11@cellbion.co.kr +82-2-743-3311

KDDF-201809-12 HER2 CAR (Chimeric Antigen Receptor) expressing NK cells for gastric cancer

CANCER | PRE-CLINICAL

GCLabCell

GC LabCell

Product Type	Cellular & Gene Product(CAR (Chimeric Antigen Receptor) expressing NK)
Indication	1st indication: Gastric Cancer, Stomach Neoplasms (MeSH term)
Target	Human Epidermal growth factor Receptor 2 (HER2)
MoA (Mechanism of Action)	HER2 CAR expressing NK cells attract HER2 overexpressing tumor cells and then, it will cause priming of tumor specific T cell response.
Differentiation Point	HER2-CAR-NK has novel scFv sequence against HER2 antigen and NK specific signaling domains. Highly expressed CAR construction detects on the cord blood derived NK cell for 45 days during cell manufacturing process without any decrease of cell proliferation. GCLC has established mass production process using single use bioreactor for HER2-CAR-NK cell.
Current Development Stage	Pre-Clinical
Route of Administration	Parenteral-Intravenous
Data	1) Massive ex vivo expansion 2) Maintain CAR expression 3) HER2+ target specific IFN-γ production and cytotoxicity 
Patent Position	KR2016-0154689

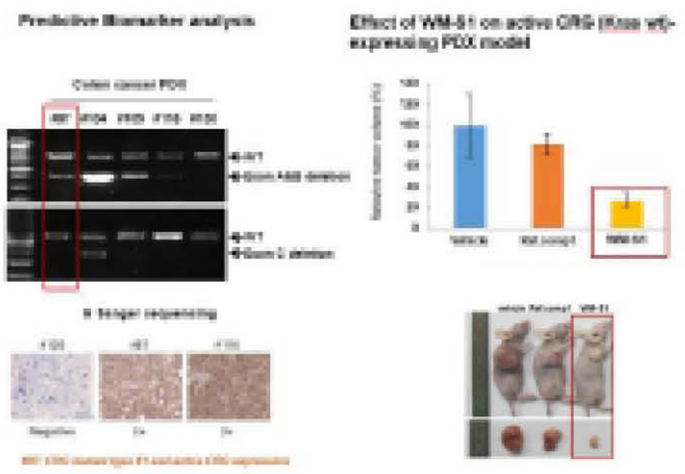
Kyoung-Gyu Lee kglee@greencross.com +82-10-4604-2641

KDDF-201812-22 Development of new anticancer drug for treatment of erbitux resistant colon cancer

CANCER | PRE-CLINICAL

Wellmarkerbio

WMBIO

Product Type	Chemical Product
Indication	1st indication: Non-responder to Erbitux in Colon Cancer, Colonic Neoplasms (MeSH term) 2nd indication: Cetuximab 2nd resistance in Colon Cancer, Colonic Neoplasms (MeSH term) 3rd indication: Mutant Kras in Colon Cancer, Colonic Neoplasms (MeSH term)
Target	Undisclosed
MoA (Mechanism of Action)	Binding to CRG (Cetuximab Resistant Gene)
Differentiation Point	Predictive biomarker based first-in class drug (Establishment of SOP for predicive biomarker analysis) Overcoming 1st and 2nd resistance for cetuximab in colon cancer patients
Current Development Stage	Pre-Clinical
Route of Administration	Oral
Data	
Patent Position	

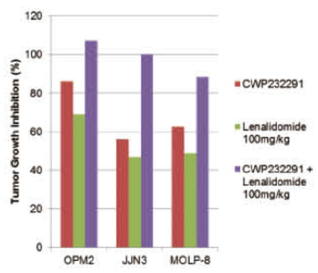
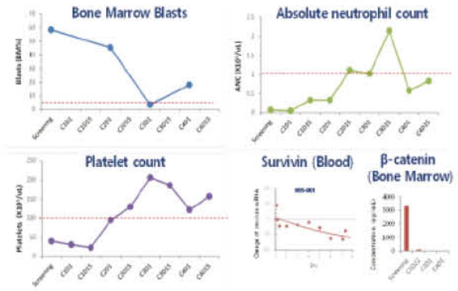
Jai-Hee Moon jhmoon@wmbio.co +82-2-6952-3726

KDDF-201408-09 CWP232291: First-in-class wnt signaling pathway inhibitor

CANCER | PHASE I

JW Pharmaceutical

JW Pharmaceutical

Product Type	Chemical Product
Indication	1st indication: Relapsed / Refractory Multiple Myeloma, Multiple Myeloma (MeSH term) 2nd indication: Relapsed / Refractory Acute Myeloid Leukemia, Leukemia, Myeloid, Acute (MeSH term)
Target	Wnt signaling pathway
MoA (Mechanism of Action)	Inhibit Wnt signaling pathway by disrupting the unfolded protein response and endoplasmic reticulum stress, resulting in tumor-selective apoptosis
Differentiation Point	**First In Class** CWP232291 showed single agent efficacy and good candidate for combo with SOC.
Current Development Stage	Phase Ib
Route of Administration	Parenteral-Intravenous
Data	• Synergistic effect with SOC in Multiple Myeloma xenograft model  • Single-agent efficacy in RR-AML patients with excellent tolerability 
Patent Position	

Jiseon Lim jiseon_lim@jw-pharma.co.kr +82-2-840-6883

KDDF-201709-04

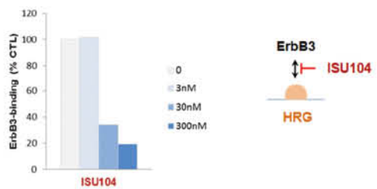
ISU104, A fully human IgG1 monoclonal antibody blocking human ErbB3

CANCER PHASE I

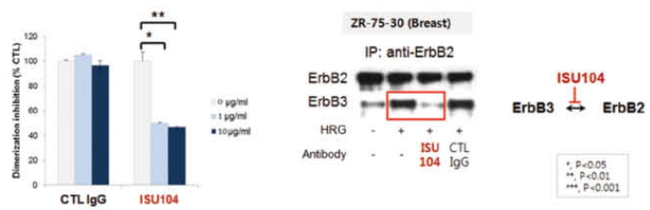
ISU ABXIS

Product Type	Immunoglobulin Product (mAb)
Indication	1st indication: Head and Neck Cancer, Head and Neck Neoplasms (MeSH term) 2nd indication: Breast Cancer Colorectal Cancer, Breast Neoplasms Colorectal Neoplasms (MeSH term)
Target	Human epidermal growth factor receptor 3 (ErbB3)
MoA (Mechanism of Action)	Anti-cancer mAb via blocking ErbB3 signaling
Differentiation Point	First In Class - Dual blocker (ligand binding & receptor dimerization) - Tumor growth regression (TGR) in HNSCC, >50% tumor growth inhibition (TGI) (>10sc/orthotopic xenograft & syngeneic models) - Confirmed ErbB3 upregulation by Erbitux-resistance (Bypass MOA for SOC resistance) - TGR (Erbitux-resistant xenograft model) & stronger TGI by various combination w / SOC (HNSCC)
Current Development Stage	Phase I
Route of Administration	Parenteral-Intravenous
Data	ISU104 is a specific dual blocker for ligand binding and ErbB3 dimerization

• Ligand Blocker

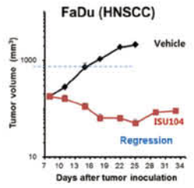


• Dimerization Blocker

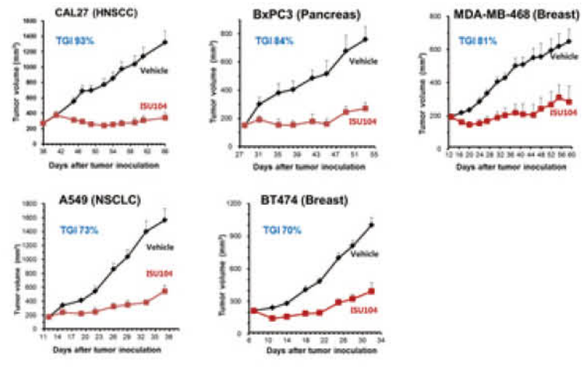


Efficacy in vivo : Tumor growth in mice

• Tumor growth regression (TGR) in HNSCC

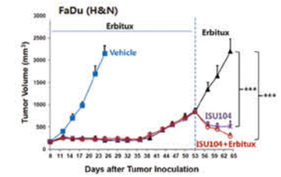


• Tumor growth inhibitions (TGI) in various xenografts & syngeneic models

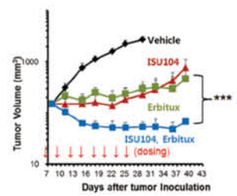


Resistance Overcome: Tumver growth & Cell proliferation

• TGR in Erbitux-resistant H&N cancer model



• TGR by combination of ISU104 w/ Erbitux



Patent Position	KR 10-1746152 / Korea KR 10-1927732 / Korea TW I615406 / Taiwan

Sanghoon Kim ksh526@isu.co.kr +82-31-696-4771

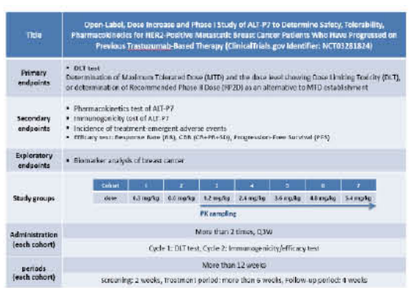
KDDF-201706-04 Phase I clinical study of HER2-positive breast cancer by an antibody-drug conjugate ALT-P7

CANCER PHASE I

Alteogen, Inc.

ALTEOGEN Inc.

Product Type	Immunoglobulin Product (mAb) Antibody-Drug Conjugate (ADC)
Indication	1st indication: Her2-positive Breast Cancer, Breast Neoplasms (MeSH term) 2nd indication: Her2-positive Gastric Cancer, Stomach Neoplasms (MeSH term)
Target	Human epidermal growth factor receptor 2 (Her2)
MoA (Mechanism of Action)	Antibody-based Her2-positive cancer cell targeting followed by a payload-dependent cancer cell death
Differentiation Point	First In Class 1. Drug conjugation at a specific site of the antibody allows ALT-P7 a structural stability and low in vivo toxicity, compared to non-specifically conjugated ADC. 2. Cleavable linker permits ALT-P7 the bystander killing effect and shows superior efficacy to non-cleavable linker-adopted ADC in Herceptin-resistant in vivo models.
Current Development Stage	Phase I
Route of Administration	Parenteral-Intranvenous
Data	1. Superior in vivo efficacy in mouse xenograft studies. - Higher in vivo efficacy and a complete regression of tumor in BT-474 breast carcinoma xenograft model. - Better in vivo efficacy even in lower dose in NCI-N87 gastric carcinoma xenograft model. 2. Phase I study is underway for the determination of MTD, dose level for DLT, and RP2D, along with pharmacokinetics, immunogenicity, and safety on a first-in-human setting. The study is near completion now.
Patent Position	Registered in major countries including Korea, USA, China, and Japan.



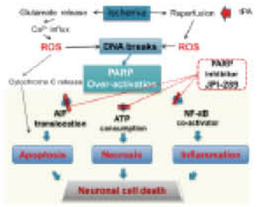
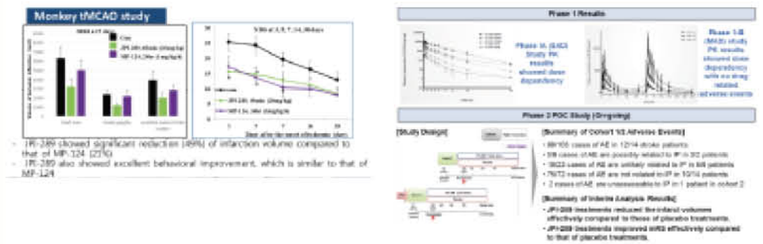
Kyeong-Hoon Jeong khjeong@alteogen.com +82-42-867-8782

KDDF-201512-08 Phase 2A clinical study of JPI-289 for the treatment of stroke

CANCER PHASE II

JEIL Pharmaceutical

JEIL PHARMACEUTICAL CO.,LTD.

Product Type	Chemical Product
Indication	1st indication: Stroke, Stroke (MeSH term)
Target	Poly(ADP-ribose) polymerase-1 (PARP-1)
MoA (Mechanism of Action)	
Differentiation Point	1. Inhibition of PARP-1 is a significantly distinct mechanism of action and is expected to show high efficacy in clinical trials with ischemic stroke patients through the neuroprotective effects. 2. In a monkey tMCAO stroke model, JPI-289 showed 49% decrease in infarction volume, which is the best result in the world when compared with that of 21% decrease in infarction volume by MP-124. Therefore, JPI-289 among PARP inhibitors is considered as one of the most promising agents for the treatment of stroke. 3. Safety of JPI-289 has been confirmed in healthy volunteers and stroke patients because there were no drug related serious adverse events (SAEs) during phase 1 and phase 2A cohort 1 (900 mg) and cohort 2 (1,800 mg) studies.
Current Development Stage	Phase IIa
Route of Administration	Parenteral-Intravenous
Data	
Patent Position	WO2010056038, WO2013115535

Jeong-Min Kim jminkim@jeilpharm.co.kr +82-31-332-4457 (Ext. 772)

KDDF-201509-07

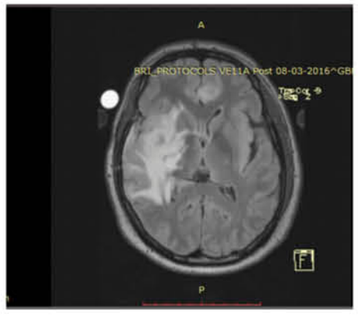
Clinical phase IIa trial with tanibirumab, a novel anti-cancer antibody therapeutics, in recurrent glioblastoma patients

CANCER PHASE II

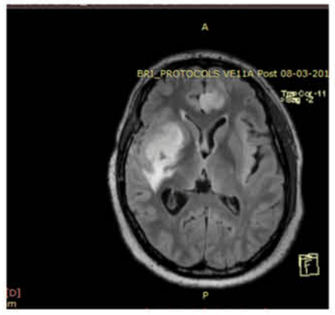
PharmAbcine

Product Type	Immunoglobulin Product (mAb)
Indication	1st indication: Recurrent Glioblastoma, Glioblastoma (MeSH term) 2nd indication: Breast Cancer, Breast Neoplasm (MeSH term)
Target	VEGFR-2
MoA (Mechanism of Action)	Inhibit tumor angiogenesis by blocking VEGFs binding to VEGFR-2
Differentiation Point	fully human, good safety and activity
Current Development Stage	Phase II
Route of Administration	Parenteral-Intravenous
Data	25% diseae control rate (upto 16 cycles (1.5 years)) in rGBM phase IIa 42% patients showed relief of edema in rGBM phase IIa (figure) 16.7% patients showed steroid use reduction in rGBM phase IIa
Patent Position	Patent No. WO2008153237

Before



After



Weon Sup Lee weonsup.lee@pharmabcine.com +82-42-861-2017 (Ext. 3001)

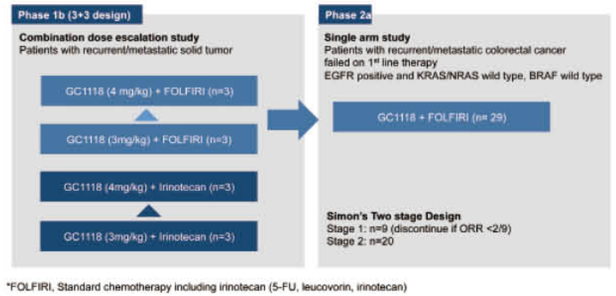
KDDF-201412-08

Anti-EGFR antibody with more potent binding inhibitiory activity on a broad spectrum of EGFR ligands

CANCER PHASE II

GC Pharma

Product Type	Immunoglobulin Product (mAb) (Fully Humanized antibody)
Indication	1st indication: Colorectal Cancer, Colorectal Neoplasm (MeSH term) 2nd indication: Gastric Cancer, Stomach Neoplasm (MeSH term)
Target	Epidermal Growth Factor Receptor (EGFR)
MoA (Mechanism of Action)	Binds to EGFR and interrupts the interaction of EGFR and its ligands
Differentiation Point	**First In Class** Different binding epitope / More efficient inhibition on EGFR-EGFR ligand interaction esp. high-affinity ligands
Current Development Stage	Phase IIa
Route of Administration	Parenteral-Intravenous
Data	**Phase 1b/2a study of GC1118** **in combination with irinotecan or FOLFIRI in patients with recurrent/metastatic solid tumor**
Patent Position	Patent No. WO2011 / 040668, WO2013 / 147509



*FOLFIRI, Standard chemotherapy including irinotecan (5-FU, leucovorin, irinotecan)

1) Phase 1 dose escalation study indicated that weekly infusion of GC1118 (4mg/kg) is safe and tolerable and recommended as RP2D.
2) Partial response was observed from dose level of 4 and 5 mg/kg and best disease control rate was 67%.
3) Phase 1b/2a is open to evaluate the safety and efficacy of GC1118 in combination with FOLFIRI or irinotecan.
4) RP2D of GC1118 for combination with FOLFIRI is 3mg/kg.

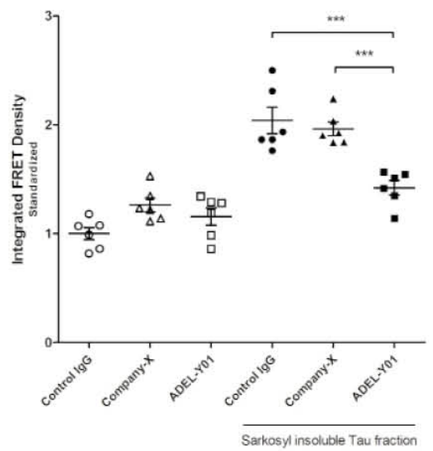
Hyunwoo Lee hyunwoo.lee@greencross.com +82-31-270-1524

KDDF-201706-02 Tau antibody development for Alzheimer's disease (ADEL-Y01)

CNS DISEASE | LEAD OPTIMIZATION

ADEL

Product Type	Immunoglobulin Product (mAb)
Indication	1st indication: Alzheimer's Disease, Alzheimer Disease (MeSH term) 2nd indication: Tauopathies, Tauopathies (MeSH term)
Target	Tau protein with X-post-translational-modification at X-residue
MoA (Mechanism of Action)	Anti-Propagation & Anti-Aggregation of pathologic Tau
Differentiation Point	• First epitope with first post-translational-modification in tau antibody field • Superior to the another company's tau antibody in inhibiting tau seeding
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intravenous
Data	• Superior to the another company's tau antibody in inhibiting tau seeding • *In vivo* efficacy validated • Antibody humanized • RCB being generated
Patent Position	



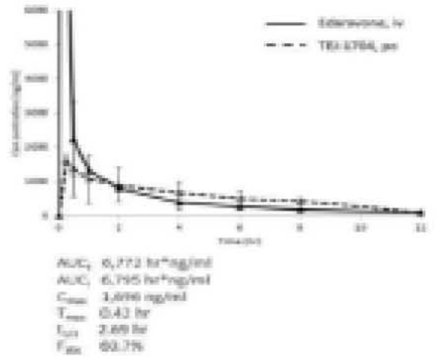
Seung-Yong Yoon yoonseungyong@gmail.com +82-10-4217-4241

KDDF-201812-16 Development of oral drug for the treatment of amyotrophic lateral sclerosis

CNS DISEASE | LEAD OPTIMIZATION

Theragen Etex

Product Type	Chemical Product
Indication	1st indication: Amyotrophic Lateral Sclerosis, Amyotrophic Lateral Sclerosis (MeSH term)
Target	Antioxidant
MoA (Mechanism of Action)	Improved oral bioavailability and blood-brain barrier permeability as a prodrug for the free Radical scavenger, Edaravone.
Differentiation Point	First In Class It is expected to suggest the specialized medicine which is more effective and patient-friendly than existing drugs for the treatment of ALS and other neurodegenerative diseases.
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Oral
Data	Comparison of drug concentration after oral administration shows high oral bioavailability compared with iv infusion of Edaravone.
Patent Position	Patent No. (10-2018-0111079) / Korea



Seung Myung Dong smdong@tetexpharm.com +82-2-3463-7111

KDDF-201606-18 OLP-1002 : A novel pain killer SCN9A oligonucleotide

CNS DISEASE | PHASE I

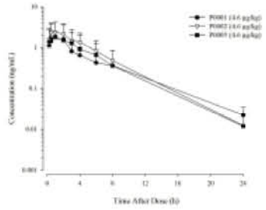
OliPass

we create breakthru medicines

Product Type	Antisense Oligonucleotide
Indication	1st indication: Pain, Chronic Pain (MeSH term)
Target	Sodium Voltage-Gated Channel Alpha Subunit 9 (SCN9A)
MoA (Mechanism of Action)	OliPass Oligonucleotide reversibly binds to the target pre-mRNA, and effectively blocks the splicing involving the target binding position.
Differentiation Point	Novel Peptide Nucleic Acid
Current Development Stage	Phase I
Route of Administration	Parenteral-Subcutaneous
Data	Key Findings from GLP-Safety Studies

	Description	Remarks
DRF	2X per week	• No findings in monkeys • No findings in rats
Main Study	12W Repeat Dose	• Recovery groups included • No findings in monkeys and rats
Safety Pharmacology	Radio-Telemetry	• Non-human primates (control + treated)
	hERG	• Completed
	Invin	• Completed (in rats)
PK & ADME	PK in Rats	• ^{14}C-labelled OLP-1002 by AMS detection
	PK in Monkeys	• PK detection in rats
	ADME in Rats	• PK detection in monkeys
Genotoxicity	AMES, CA, Rat Micronucleus	• Negative in AMES & CA (human lymphocytes) • No findings
Immune Tox	Complement Activation	• C3 + Bb

Pharmacokinetics of ^{14}C-OLP-1002 after Single Subcutaneous Administration to Cynomolgus Monkeys



- Single 4.6 ug/kg of ^{14}C-OLP-1002 was subcutaneously administered to three Cynomolgus monkeys.
- Accelerated mass spectroscopy (AMS) technology was applied to precisely measure sub-nanogram level plasma concentration of ^{14}C-OLP-1002.
- The maximum concentrations of ^{14}C-OLP-1002 in plasma were observed at 0.5 and 1hour postdose and ranged from 1.64 to 2.39 ng/mL.
- The mean C_{max}, T_{max} and $t_{1/2}$ of ^{14}C-OLP-1002 in plasma were 1.96 ng/mL, 0.833 hours and 84 hours, respectively.
- Based on AUC_{inf} the mean plasma exposure of ^{14}C-OLP-1002 was 12.7 ng·h/mL.

Current Steps
- Phase I clinical study on going in UK.
- ClinicalTrials.gov identifier (NCT number): NCT01507493

Patent Position	Patent # WO2018051175A1 Application date 2018. 03. 22

Hanyoung Lee | GSS@OliPass.com | +82-31-8060-8102

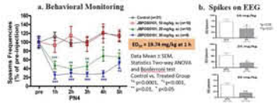
KDDF-201512-10 JBPOS0101: Novel infantile spasms profile of rare disease epilepsy

CNS DISEASE | PHASE II

Bio-Pharm Solutions

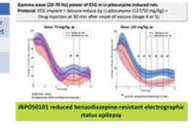
Global Bio-Pharmaceutical Science B-PS Bio-Pharm Solutions Co., Ltd.

Product Type	Chemical Product
Indication	1st indication: Infantile Spasms, Spasms, Infantile (MeSH term) 2nd indication: Status Epilepticus, Status Epilepticus (MeSH term)
Target	Metabotropic Glutamate Rceptor (mGluR)
MoA (Mechanism of Action)	Metabotropic Glutamate Rceptor Group I and III modulator (mGluR 1 and 7 antagonist, mGluR 4 agonist)
Differentiation Point	**First In Class** 1. Newer generation of felbamate and carisbamate. 2. MOA: novel, mGluR Family. 3. Effects of symptomatic infantile spasms (SIS) model and broad spectrum. 4. Effects of drug resistant epilepsy (LTZ/BDZ) and refractory epilepsy model. 5. Excellent effect of neuroprotection induced by Li-pilocarpine resistant model.
Current Development Stage	Phase II
Route of Administration	Oral
Data	1. Infantile Spasms: Excellent efficacy of JBPOS0101 in Symptomatic Infantile Spasms (SIS) Model

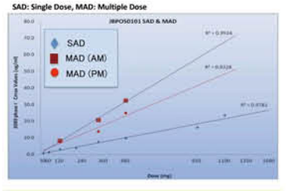


2. Status Epilepticus: Excellent efficacy in Li-Pilocarpine-induced Status Epilepticus (by B-PS) & Benzodiazepine-resistant Electrographic Status Epilepticus Models (by NIH / NINDS ETSP)

	Prevention	Intervention	Resistant	Resistant
Timing	2 hour before seizure onset	At Seizure onset	30 min after seizure onset	30 min after seizure onset
Route	ip	iv	iv	ip
ED_{50} (mg/kg)	19.1	20.4	35.3	54.2



3. Clinical Study (Phase I): JBPOS0101 has a good safety profile in human volunteers up to 1100 mg in single ascending dose studies and up to 480 mg BID (up to 960mg/day for 10 days) in multiple ascending dose studies. Only mild adverse effects (which are commonly observed in other AEDs) were observed in phase 1 studies under US IND. No signs of liver and cardiac toxicity have been observed. A QD dose regimen is highly likely as JBPOS0101 has a half-life of about 22 hours.



C_{max} increases proportionally with increasing dose.

Patent Position	Patent No. USP9956197 including 9 countries

Unkyoo Lee / Brandon Choi | uklee@b-psol.com / bjc220l@gmail.com | +82-10-9411-2766 / +1-973-224-0567

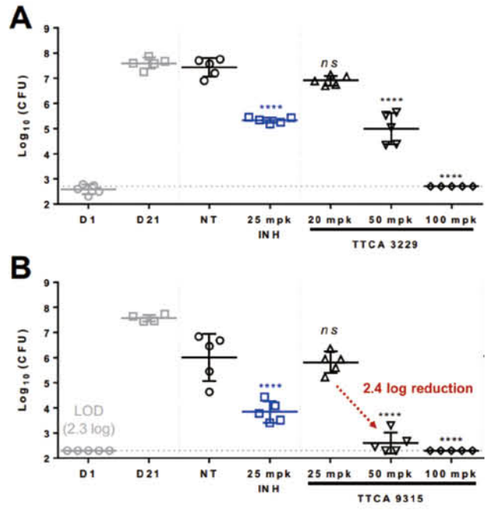
KDDF-201712-07 Discovery of novel anti-tubercular agent for the treatment of MDR / XDR TB

INFECTIOUS DISEASE | LEAD OPTIMIZATION

Institut Pasteur Korea

한국파스퇴르연구소 Institut Pasteur Korea

Product Type	Chemical Product
Indication	1st indication: Tuberculosis, Pulmonary, Bacterial Infections and Mycoses (MeSH term)
Target	MDR/XDR TB patients including drug sensitive TB patients
MoA (Mechanism of Action)	Novel (Not identified yet)
Differentiation Point	First In Class Active against latent TB and MDR TB strains / Much more active against TB within macrophage than in liquid broth culture medium / Potent bactericidal effect *in vivo* / Expected novel MOA related to host or mycobacterial factor within macrophage
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Oral
Data	- Improved candidate compared to TTCA3229 (previous lead candidate) - Significantly reduced bacterial load (more potent than INH and TTCA3229)



Patent Position	Patent No. (PCT / EP2015 / 063982) / Filed patent for 6 countries

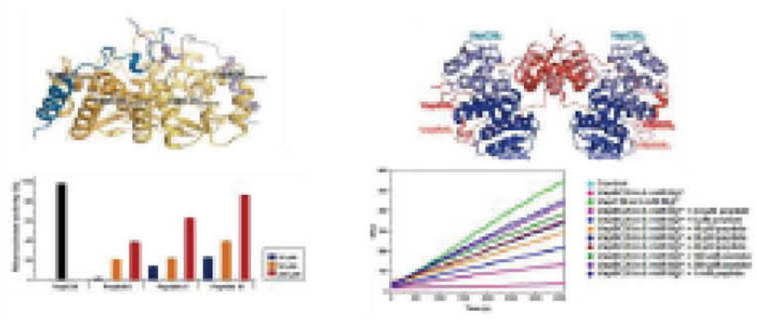
Kaapjoo Park kaapjoo.park@ip-korea.org +82-31-8018-8009

KDDF-201712-03 Novel antibiotic peptide based on toxin-antitoxin system

INFECTIOUS DISEASE | LEAD OPTIMIZATION

Seoul National University

Product Type	Peptide Product Antimicrobial peptide
Indication	1st indication: Tuberculosis, Tuberculosis (MeSH term)
Target	Toxin-Antitoxin system
MoA (Mechanism of Action)	Antimicrobial peptides dirupt the Toxin-Antitoxin complex → Free toxin release and cell death
Differentiation Point	First In Class Inhibitory peptides target new mechanism of bacterial physiology
Current Development Stage	Lead Generation (Hit to Lead)
Route of Administration	Parenteral-Intravenous
Data	The toxicity is not detected in the toxin-antitoxin complex where the toxin toxicity is neutralized by the antitoxin. When the complex is collapsed due to the designed drug, the toxin is liberated and toxicity is detected.



Patent Position	Patent No. 10-1746160 / Korea

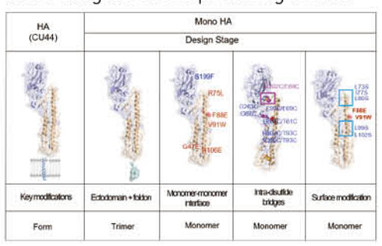
Sung-Min Kang men0528@snu.ac.kr +82-10-6660-1697

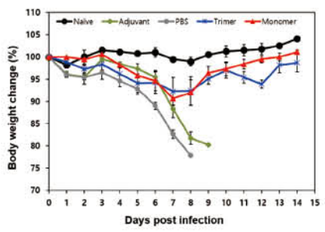
KDDF-201712-14 Monomeric hemagglutinin and scaffold-fused monomeric multi-antigens

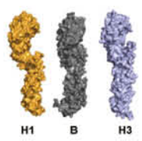
INFECTIOUS DISEASE | LEAD OPTIMIZATION

Korea University Research and Business Foundation Sejong

Product Type	Vaccine Monomeric Hemagglutinin (HA) / Scaffold-fused multi-antigens
Indication	1st indication: Influenza HA monomer vaccine, Influenza Vaccines (MeSH term) 2nd indication: Scaffold-based multi-antigens
Target	Universal influenza vaccines
MoA (Mechanism of Action)	virus attachment, fusion, maturation, and budding
Differentiation Point	First In Class First monomeric antigens and scaffold-based multi-antigens
Current Development Stage	Lead Generation (Hit to Lead)
Route of Administration	Intramuscular / Intranasal
Data	1. Use of monomeric forms of hemagglutinin (HA) proteins enhances the probability of finding highly conserved epitopes including stem and interface regions. Since the monomeric forms are unstable compared to the trimeric forms of HA, structure-based antigen design was used as a strategy to generate monomeric forms and to enhance their stability. 2. The scafold molecule of 9-10 nm in size was fused with monomeric forms of HA, to make a multi-HA fusion antigen of 30 nm in size. This strategy provides multiple antigens exposed with high epitope density and organization. 3. Protection of mice against virus infection by HA monomers and scaffold-fused multi-antigens shows promising results.
Patent Position	Patent No. 10-1921384 / Korea







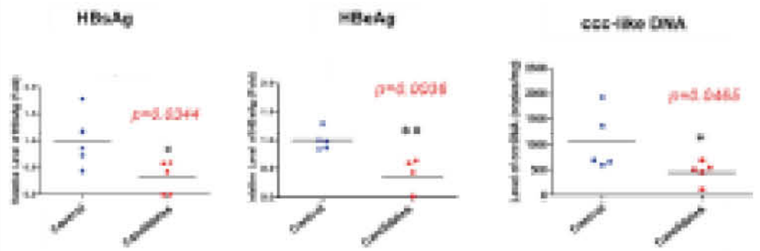
Ji-Hye Lee jihyelee@korea.ac.kr +82-2-3290-3945

KDDF-201612-13 A novel anti-viral agent targeting the covalently closed circular DNA of HBV

INFECTIOUS DISEASE | LEAD OPTIMIZATION

Konkuk University

Product Type	Oligonucleotide
Indication	1st indication: Hepatitis B, Hepatitis B Virus Infection (MeSH term) 2nd indication: Virus Diseases, Viral Diseases (MeSH term)
Target	Covalently closed circular DNA of HBV
MoA (Mechanism of Action)	Direct targeting and removal of the covalently closed circular DNA of HBV
Differentiation Point	First In Class The drug candidate can bind to cccDNA of HBV and significantly down-regulate viral replication and propagation. In addition, it showed pan-genomic anti-viral efficacy on HBV infection.
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Undecided (Subcutaneous or Intravenous)
Data	Administration with oligo targeting to HBV cccDNA via i.v. injection reduced the levels of serum HBsAg, serum HBeAng, as well as ccc-like DNA in persistent HBV replicating mouse model.
Patent Position	



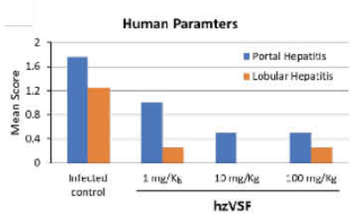
Kyun-Hwan Kim khkim10@kku.ac.kr +82-2-2030-7833

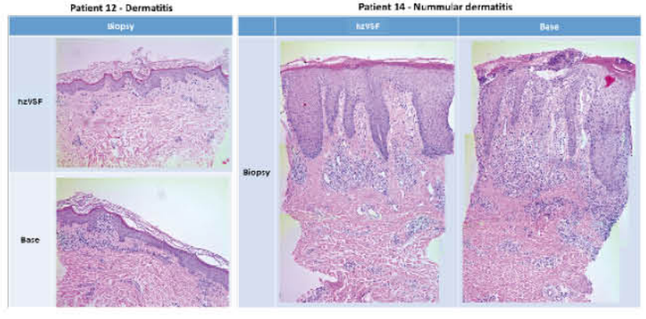
KDDF-201406-08 Anti-inflammatory mAb, VSF, as hepB & dermatitis treatment

INFECTIOUS DISEASE — PHASE I

ImmuneMed, Inc.

Product Type	Immunoglobulin Product (Humanized IgG4)
Indication	1st indication: Hepatitis B, Hepatits B, Chronic & Acute (MeSH term) 2nd indication: Dermatitis, Psoriasis (MeSH term)
Target	Vimentin
MoA (Mechanism of Action)	VSF target to cell surface vimentin after viral infection and give to anti-viral and anti-inflammatory activities to the infected cells.
Differentiation Point	First In Class This is a novel target for inflammation related diseases.
Current Development Stage	Phase I
Route of Administration	Parenteral-Intravenous (Further pursuing Intramuscular Injection)
Data	1. Reduced inflammation in acute and chronic woodchuck hepatitis model: Extrapolation woodchuck liver histology results to human. 2. Reduced inflammatory immune cells in dermatitis patient.





Patient Position	10-1912375 / South Korea (registered)

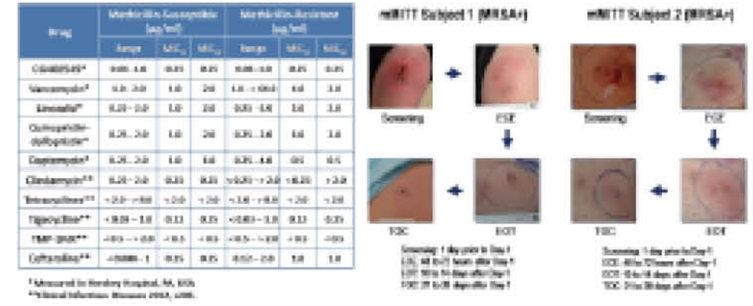
Park Sungman smpark@immunemed.co.kr +82-33-248-2639

KDDF-201412-14 A First-in-class anti-MRSA agent

INFECTIOUS DISEASE — PHASE II

CrystalGenomics

Product Type	Chemical Product
Indication	1st indication: Methicillin-resistant *Staphylococcus aureus*, Bacterial Infection and Mycoses (MeSH term)
Target	Enoyl-acyl carrier protein reductase (FabI)
MoA (Mechanism of Action)	A novel mechanism of blocking synthesis of fatty acid, a key component of bacterial cell membrane formation process.
Differentiation Point	First In Class
Current Development Stage	Phase IIa
Route of Administration	Oral / Intravenous infusion
Data	• CG-549 demonstrated the lowest MIC values against MRSA and VRSA • Drastic reduction of redness & edema by ECE and clinical cure by EOT (Phase IIa study in US)



Patent Position	Fab I INHIBITOR AND PROCESS FOR PREPARING SAME 60 / 726,814 (US, 2005-10-13)

GwangSu Kim gskim@cgxinc.com +82-031-628-2718

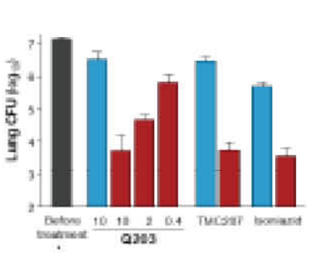
KDDF-201806-05

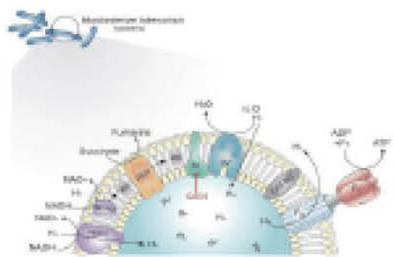
Phase 2 clinical development of Q203: A novel drug candidate against MDR/XDR tuberculosis

INFECTIOUS DISEASE | PHASE II

Qurient

Product Type	Chemical Product
Indication	1st indication: Tuberculosis, Tuberculosis, Pulmonary (MeSH term)
Target	Cytochrome bc1 complex (Complex III) QcrB subunit in TB
MoA (Mechanism of Action)	Blocking of ATP synthase (both aerobic and hypoxic) and decrease in oxygen consumption rate
Differentiation Point	First In Class • Novel mode of action • Potent in vitro/in vivo, activity against drug resistant • Reduce treatment period (latency) • QD or less frequent dosing schedule (increase adherence)
Current Development Stage	Phase IIa
Route of Administration	Oral
Data	1. Strong efficacy in an established mouse TB model 2. Strong efficacy against 13 MDR & 15 XDR clinical isolates 3. Phase I completed in the US 4. Phase IIa EBA study ongoing in South Africa with US IND open 5. Orphan Drug Designation and Fast Track Designation obtained
Patent Position	PCT / EP2011 / 001345





June Kim | jkim@qurient.com | +82-31-8060-1610

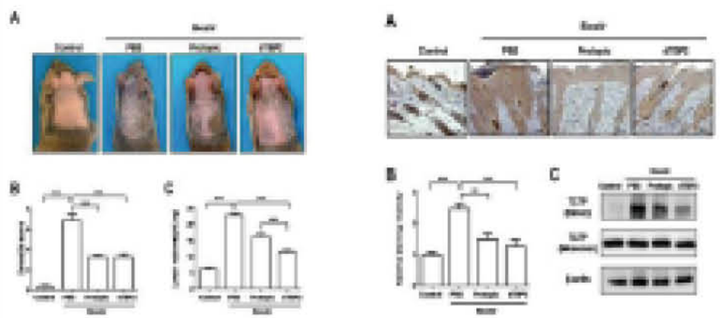
KDDF-201609-01

Development of a new lead compound targeting Histamine-releasing factor to treat atopic dermatitis

IMMUNE DISEASE | LEAD GENERATION

Ewha Womans University

Product Type	Peptide Product (7mer)
Indication	1st indication: Atopic Dermatitis, Dermatitis, Atopic (MeSH term)
Target	Histamine Releasing Factor
MoA (Mechanism of Action)	HRF inhibiting peptide(dTBP2) → HRF inhibition → Targeted therapy for AD
Differentiation Point	First In Class
Current Development Stage	Lead Generation (Lead to Candidate)
Route of Administration	Parenteral-Subcutaneous
Data	Dimerized translationally controlled tumor protein-binding peptide 2 (dTBP2) ameliorates house dust mite-induced atopic dermatitis. dTBP2 suppresses level of dTCTP (target) in AD-like skin lesions.
Patent Position	Patent no.1018030780000 / Republic of Korea Patent no. 15382277 / USA Patent no. 15810505.6 / Europe



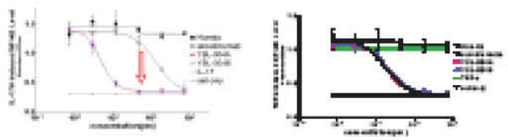
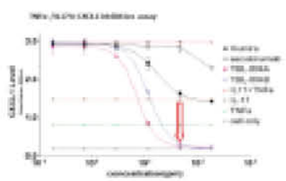
Kyunglim, Lee | klyoon@ewha.ac.kr | +82-2-3277-3018

KDDF-201606-04

YBL-004 : Bi-specific antibody that inhibit dual inflammatory axis

IMMUNE DISEASE | PRE-CLINICAL

Y-Biologics

Product Type	Immunoglobulin Product (Bispecific antibody)
Indication	1st indication: Ankylosing Spondylitis, Spondylitis, Ankylosing (MeSH term) 2nd indication: Psoriatic Arthritis, Arthritis, Psoriatic (MeSH term)
Target	Tumor Necrosis Factor alpha (TNFα) and Interleukin 17A (IL-17A)
MoA (Mechanism of Action)	YBL-004 neutralize TNFα and IL-17A simultaneously. → Completly Inhibits the expression of pro-inflammatory cytokines than other single antibody.
Differentiation Point	First In Class • One shot Two kill: response rate & Disease modifying compared to TNF- α, IL-17A blockade • Could be applied to Non-responders to TNF- α blockade as an alternative strategy • Easy to treat & low cost compared to combination therapy • May be a choice for TNF- α blockade discontinuation
Current Development Stage	Pre-clinical
Route of Administration	Parenteral-Subcutaneous
Data	YBL-004 : Synergy in inhibition of inflammatory cytokine production.  YBL-004 shows better efficacy to inhibit IL-17 activity compared to Secukinumab & similar efficacy to inhibit TNFα activity compared to Humira.  YBL-004 shows synergy effect to inhibit the production of inflammatory cytokine.
Patent Position	Patent No. 10-2017-0149362 / Korea PCT / KR2018 / 013601

Young-gyu Cho younggyucho@ybiologics.com +82-42-716-4979

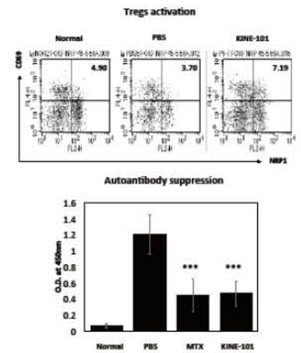
KDDF-201612-09

Development of drug candidate for treatment of rheumatoid arthritis with regulatory T cells activation

IMMUNE DISEASE | PRE-CLINICAL

Sookmyung Women's University

(This project is being studied at KINESCIENCES after Licence-in from)

Product Type	Peptide Product
Indication	1st indication: Rheumatoid Arthritis (RA), Arthritis, Rheumatoid (MeSH term)
Target	Regulatory T cells (Tregs)
MoA (Mechanism of Action)	KINE-101 activates and increases Tregs population → It causes reduction of autoantibodies production and osteclastogenesis.
Differentiation Point	First In Class KINE-101 shows high efficacy in RA model by activation of Tregs with different mode of action from existed RA durgs.
Current Development Stage	Pre-Clinical
Route of Administration	Parenteral-Subcutaneous
Data	- Treg cells population and activation are significantly induced by treatment of KINE-101 and its efficacy is confirmed by Tregs depletion in prophylactic CIA mouse model. - Autoantibody production is decreased by treatment of KINE-101 in prophylactic CIA mouse model. - Completed in vivo preliminary toxicology studies testing safety, pharmacokinetics accomplished by Pharmaron and showed no toxicologically significant findings observed.  Preliminary toxicology summary Species | Injection Route | Study | Dose | Results | Comments Rat | Sub Cutaneous | 7-day SC Dose Range Finding Toxicity in Rats | 100, 300, 1000 mg/kg/day | No mortality No in-life and post-life changes except decreased thyroid weight in treated males | Well tolerated MTD >1000 mg/kg/day Beagle | Sub Cutaneous | Single Escalated SC Dose MTD Toxicity in Dogs | 200, 500 mg/kg | No abnormality detected | Well tolerated MTD >500 mg/kg/day Beagle | Sub Cutaneous | 7-day SC DRFT oxicity in Dogs | 20, 100, 200 mg/kg/day | No toxicologically significant findings detected | Well tolerated MTD >200 mg/kg/day
Patent Position	Patent No. KR101897121B1 / Republic of Korea US10206969B2 / USA PCT No. WO2017155233A1 / PCT

Sunyoung, Park syparkl@kinesciences.com +82-10-9030-6236

KDDF-201812-08

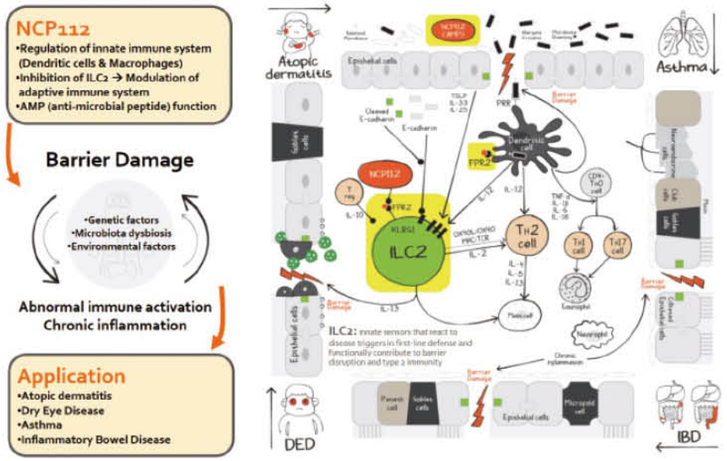
First-in-class topical peptide immunotherapy for atopic dermatitis by targeting FPR2

IMMUNE DISEASE | PRE-CLINICAL

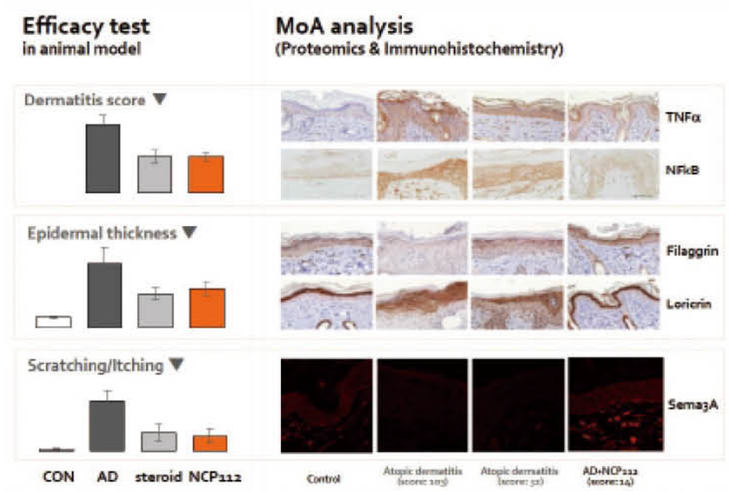
Novacell Technology

NOVACELL TECHNOLOGY INC.

Product Type	Peptide Product (7-mer)
Indication	1st indication: Atopic Dermatitis, Dermatitis, Atopic (MeSH term) 2nd indication: Dry Eye Syndrome, Dry Eye Syndrome (MeSH term)
Target	Formyl Peptide Receptor 2 (FPR2)
MoA (Mechanism of Action)	FPR2 acivation by binding of pro-resolving peptide ligand (NCP112) leads to alleviation of skin manifestations. - Modulation of pro-resolving process and innate immune response. - Inhibition of ILC2 activation linked to adaptive immune system. - Skin barrier recovery and itching relief. Expandable to other diseases associated with barrier damage and immunological dysfunctions; dry eye disease, asthma, and inflammatory bowel disease.



Differentiation Point	First In Class • Novel target - Novel strategy targeting FPR2 to induce pro-resolving function. - First-in-class topical immunotherapy that can control complex factors including skin inflammation, skin barrier disruption, and pruritus. • Safety (long-term use) - High biocompatibility of peptide material and low systemic effects of topical treatment. - Safe topical agents replacing steroid drugs for long-term use in mild-to-moderate patients, especially for pediatric patients. • Patient-convenient and cost-effective - Topical agent providing convenient administration for pediatric patients. - Chemically synthesizable small size peptide which can secure cost efficiency than expensive biologics drug.
Current Development Stage	Pre-Clinical
Route of Administration	Topical
Data	- Effects of NCP112 on skin inflammation, skin barrier, and pruritus (Left) - Recovery of factors related in each skin manifestation; MoA analysis (right)



Patent Position	Patent No. KR101855170 / South Korea Patent No. WO2017086596A1

Jaewang Ghim jwghim@novacelltech.com +82-54-279-0625

KDDF-201806-03 Development of SYK inhibitor for rheumatoid arthritis (SKI-O-703)

IMMUNE DISEASE | PHASE II

Oscotec

Product Type	Chemical Product
Indication	1st indication: Rheumatoid Arthritis, Arthritis, Rheumatoid (MeSH term) 2nd indication: Autoimmune Thrombocytopenia Purpura, Thrombocytopenic, Idiopathic (MeSH term)
Target	Spleen Tyrosine Kinase (SYK)
MoA (Mechanism of Action)	ATP competitiive SYK inhibitors
Differentiation Point	**First In Class** SKI-O-793 has better efficacy and safety characteristics in animal and human study when compared to existing SYK inhibitors (R788, P505-15).
Current Development Stage	Phase IIa
Route of Administration	Oral
Data	1. Phase I clinical study (US) 1) Single ascending dose (SAD) study : completed - Clinical safety (50 to 800 mg oral qd dosing) : no outstanding issue found at any test dose and no other significant findings, including vital signs, ECG and laboratory tests (hematology, serum chemistry, urinalysis) - Strong PD effect in activated basophil followed by anti-IgE stimulation Estimated EC50 of SKI-O-703, ~350 nM in the % activated basophil 2) Multiple ascending dose (MAD) study : completed - 200 mg (qd & bid) and 400 mg (qd): completed at Q2, 2017 - Clinical safety : no outstanding issue found at any test dose - Reproducible PD effect in activated basophil followed by anti-IgE stimulation 2. Phase II clinical study (US, EMEA, S. Korea) 1) Rheumatoid arthritis : US FDA IND in 2017 Q4 EMEA MoH CTA in 2019 Q1 S. Korea MFDS IND in 2019 Q1 2) Immune thrombocytopenic purpura : US FDA IND in 2019 Q1
Patent Position	

Jung-Ho Kim jhkim@oscotec.com +82-31-628-7666

KDDF-201812-09 CKD-506, a selective HDAC6 inhibitor for rheumatoid arthritis

IMMUNE DISEASE | PHASE II

Chong Kun Dang Pharmaceutical Corporation

Product Type	Chemical Product
Indication	1st indication: Rheumatoid Arthritis, Arthritis, Rheumatoid (MeSH term) 2nd indication: Inflammatory Bowel Disease, Inflammatory Bowel Disease (MeSH term)
Target	Histone Deacetylase 6 (HDAC6)
MoA (Mechanism of Action)	TNF alpha Inhibition and Regulatory T cell Activiation
Differentiation Point	**First In Class** CKD-506 has dual functions, inhibition of inflammation (TNFα) and enhancement of Treg function. In addition, CKD-506 with MTX has strong synergistic efficacy in rat adjuvant-induced arthritis (AIA) model.
Current Development Stage	Phase IIa
Route of Administration	Oral
Data	Fig. 1 Synergistic efficacy of CKD-506 with MTX in AIA model Fig. 2 Pharmacokinetics profile of CKD-506 in healthy volunteers Fig. 3 Dual mechanism of CKD-506, inhibition of inflammation and enhancement of T_{reg} function
Patent Position	10-2014-0051151 / Korea, 14792173.8 / Europe, 14 / 785812 / US

Fig. 1

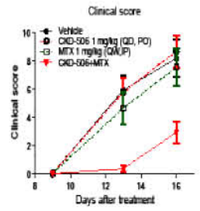


Fig. 2

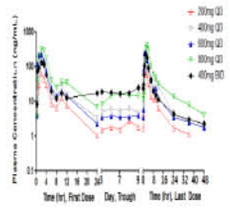
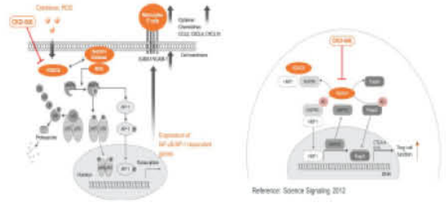


Fig. 3

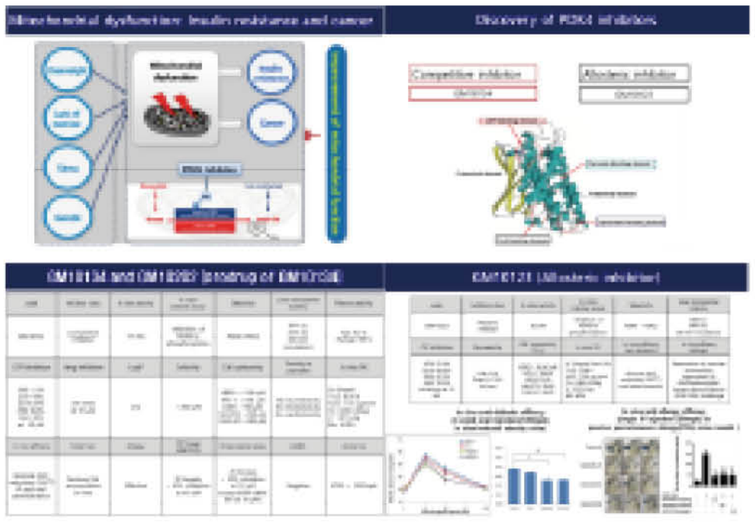


BD&L licensing@ckdpharm.com +82-2-2194-0300

KDDF-201601-03 Discovery of PDK4 inhibitor for meatabolic disease and cancer

METABOLIC DISEASE | LEAD OPTIMIZATION

Gwangju Institute of Science and Technology

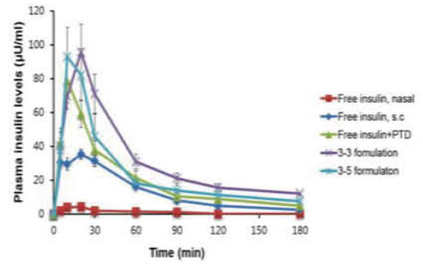
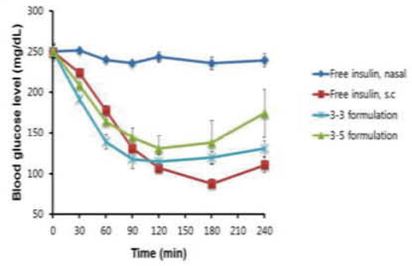
Product Type	Chemical Product
Indication	1st indication: Metabolic disease, Diabetes, Allergy (MeSH term) 2nd indication: Cancer, Breast cancer (MeSH term)
Target	Pyruvate Dehydrogenase Kinase (PDK) 4
MoA (Mechanism of Action)	PDK inhibition → Control PDC (Pyruvate Dehydrogenase Complex) activity → Control Glucose metabolism (Mitochondria function)
Differentiation Point	First In Class
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Oral
Data	
Patent Position	Patent No. (2018-0172655 / 20181228) / Korea

Jin Hee Ahn jhahn@gist.ac.kr +82-62-715-4621

KDDF-201402-01 Development of intranasal insulin using TCTP-PTD

METABOLIC DISEASE | LEAD OPTIMIZATION

Ewha Womans University

Product Type	Peptide Product (Cell penentrating Peptide)
Indication	1st indication: Diabetes, Diabetes Mellitus (MeSH term)
Target	Insulin resistance
MoA (Mechanism of Action)	Insulin/TCTP-PTD formulation → Nasal delivery of insulin → Change in blood glucose levels
Differentiation Point	First In Class Nasal delivery of insulin using TCTP-PTD may serve the user-friendly medications that are safe and effective for the treatment of diabetes.
Current Development Stage	Lead Generation (Hit to Lead)
Route of Administration	Nasal
Data	Completed studies testing pharmacokinetics of insulin / TCTP-PTD. Changes in blood glucose levels in diabetic rats following nasal administration of insulin / TCTP-PTD  
Patent Position	Patent no.1020130011432 / Republic of Korea, Patent no. WO2007097561 / Japan

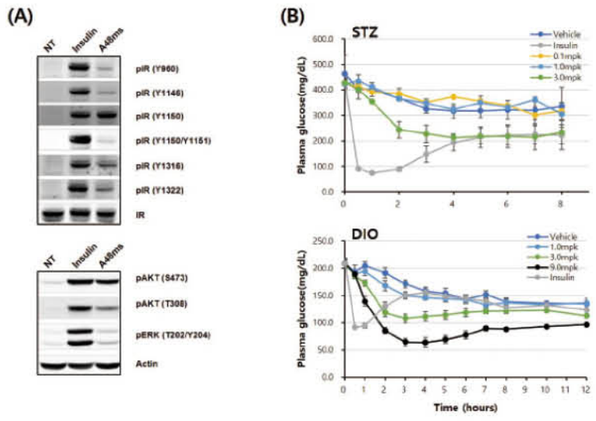
Kyunglim, Lee klyoon@ewha.ac.kr +82-2-3277-3024

KDDF-201809-05 Anti-diabetic agonist aptamer modulating insulin receptor with novel MOA

METABOLIC DISEASE | **PRE-CLINICAL**

Aptamer Sciences

Product Type	Aptamer
Indication	1st indication: Diabetes Mellitus, Diabetes Mellitus (MeSH term)
Target	Insulin Receptor (InsR)
MoA (Mechanism of Action)	Allosteric modulation of insulin receptor (activating only glucose metabolic signal, not mitogenic signal)
Differentiation Point	First In Class - Basal therapy for sustained glycemic control (long-acting) - Prevention of the progression of insulin resistance - Activation of AKT signal only (no activation of mitogenic MAPK signal) → reducing potential CVD risk - No hyperglycemia & No weight gain
Current Development Stage	Pre-Clinical
Route of Administration	Parenteral-Subcutaneous
Data	- Selective activation of insulin receptor & biased signaling without mitogenic signal induction - Dose-dependent & sustained glycemic control effect in both type 1 & 2 diabetes mouse models
Patent Position	Patent No. PCT / KR2018 / 005400



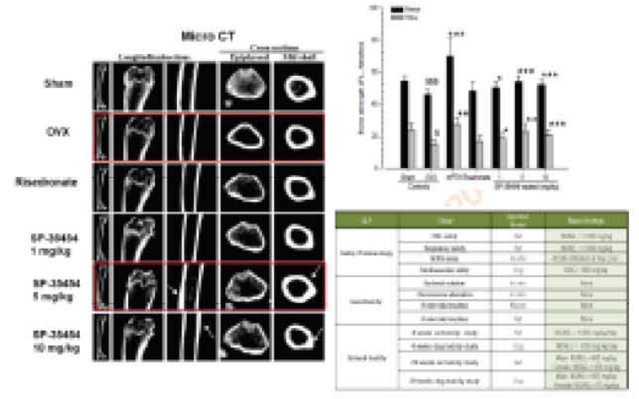
Daekyun Lee | d.lee@aptsci.com | +82-31-711-0315

KDDF-201212-10 New drug development study for osteoporosis with novel mechanism to improve the clinical unmet needs

METABOLIC DISEASE | **PHASE I**

Shin Poong Pharm. Co., LTD.

Product Type	Chemical Product
Indication	1st indication: Osteoporosis, Osteoporosis (MeSH term) 2nd indication: Fractures, Fracture Healing (MeSH term)
Target	Undisclosed
MoA (Mechanism of Action)	Undisclosed
Differentiation Point	First In Class Dual action: Increase of bone formation and decrease of bone resorption. Oral application with much less side effects.
Current Development Stage	Phase I
Route of Administration	Oral
Data	Increase of the mid-shaft BMD / Bone thickness / Bone strength / Non-clinical toxicity studies / Clinical Phase I study
Patent Position	PCT / KR2009 / 006085, WO2011030955 / US, EP, JP, AU, CA, CN, IL, WO



- **Results: Clinical Phase I study was completed on March 2017 in Europe**
  - Volunteers: healthy postmenopausal women
  - **No SAE** (AE: fatigue, diarrhea, back pain, myalgia(muscle pain), headache)
  - **No issues**: ECGs, vital signs, physical examination
  - Pharmacokinetics (Food effects): delayed T_{max} and **dose-proportional increased AUC**
  - Pharmacodynamics : Bone biomarker (MAD)

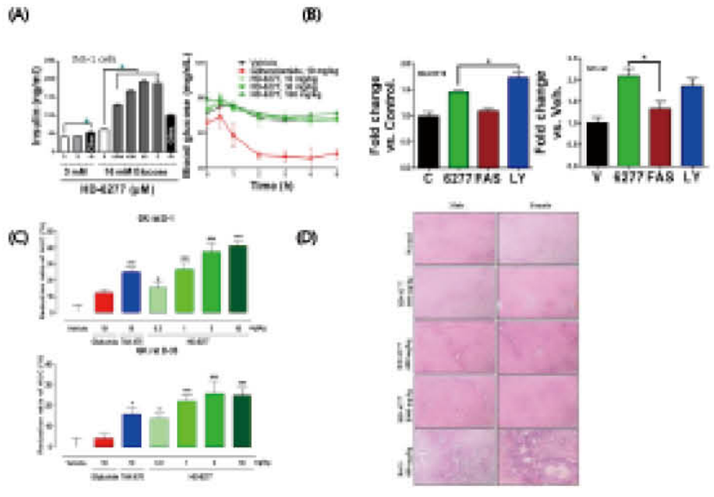
Sung Chung | sungchung@shinpoong.co.kr | +82-70-5175-4104

KDDF-201306-07 A novel GPR40 agonist, HD-6277, on glycemic control and insulin sensitivity in type 2 diabetes

METABOLIC DISEASE | **PHASE I**

Hyundai Pharmaceutical

Product Type	Chemical Product
Indication	1st indication: Type 2 Diabetes, Diabetes Mellitus, Type 2 (MeSH term)
Target	G-protein-Coupled Receptor 40 (GPR40)
MoA (Mechanism of Action)	Insulin secretagogue, Glucose dependent beta cell function regulation
Differentiation Point	First In Class HD-6277 showed the differentiated liver toxicity profile compared to that of TAK-875 both in vitro and in vivo.
Current Development Stage	Phase I
Route of Administration	Oral
Data	A. Dose dependent insulin secretion study in vitro. No hypoglycemic risk in vivo. B. GLP-1 secretion assay in vitro and in vivo. C. Dose dependent glucose lowering effects. D. Comparison of liver toxicity vs. Fasiglifam (TAK-875) with 2 weeks DRF study in Beagle dogs.
Patent Position	



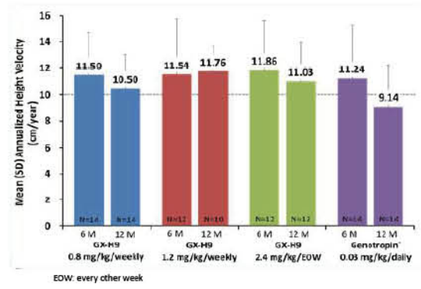
Jeon, Jin-Seok jsjeon@hdpharm.co.kr +82-2-2600-3879

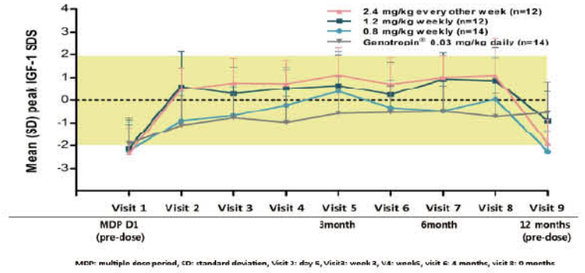
KDDF-201502-11 A randomized phase 2 study result of long-acting Fc-fused hGH versus Daily GH in children with growth hormone deficiency

METABOLIC DISEASE | **PHASE II**

Genexine

Product Type	Protein Product (Growth hormone)
Indication	1st indication: Growth Hormone, Growth Hormone (MeSH term)
Target	Growth Hormone Deficiency
MoA (Mechanism of Action)	hyFc fused long-acting growth hormone enables weekly or every other week treatment, instead of daily injection
Differentiation Point	First In Class
Current Development Stage	Phase II
Route of Administration	Parenteral-Subcutaneous
Data	Figure 1. Annualized height velocity in cm/year Figure 2. Mean (SD) peak IGF-1 SDS through 12 months of treatment
Patent Position	10-2018-0161062 / US8529899 / EP3173484





Yun-Jung Choi yunjung.choi@genexine.com +82-10-9199-0164

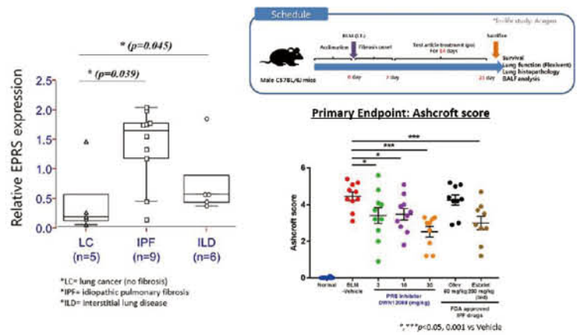
KDDF-201812-20

Development of a novel small molecule inhibitor for idiopathic pulmonary fibrosis treatment

RESPIRATORY DISEASE | PRE-CLINICAL

Daewoong Pharmaceutical

Product Type	Chemical Product
Indication	1st indication: Idiopathic Pulmonary Fibrosis, Idiopathic Pulmonary Fibrosis (MeSH term) 2nd indication: Systemic sclerosis, Scleroderma, Systemic (MeSH term)
Target	Prolyl-tRNA Synthetase (PRS)
MoA (Mechanism of Action)	Suppressing proline delivery by PRS inhibitor (DWN12088) may decrease collagen formation (canonical function) and suppressing PRS may down-regulate pro-fibrotic markers via FMT (Fibroblast-to-Myofibroblast Transition)
Differentiation Point	**First In Class** 1. DWN12088 is a first-in-class PRS inhibitor, which has shown superior anti-fibrotic efficacy in pulmonary fibrosis animal models compared to reference compounds. DWN12088 was developed using X-ray co-crystallography of recombinant PRS protein and the compound (structure-based drug design). Currently there is no pipeline directly inhibits collagen, which is a pathological hallmark in fibrosis. 2. Highly selective and specific inhibition of PRS to decrease collagen production, and wide safety margin. 3. Expandable to various fibrotic indications in addition to lung. (liver, heart, kidney, skin, etc.)
Current Development Stage	Pre-Clinical
Route of Administration	Oral
Data	- Expression level of EPRS is increased in fibrotic lung of IPF patients - DWN12088 shows therapeutic efficacy in BLM mouse model
Patent Position	PCT / KR2018 / 001625



Joon Seok Park | joonchem@daewoong.co.kr | +82-31-270-8482

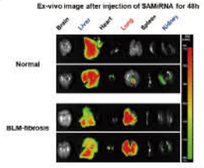
KDDF-201706-03

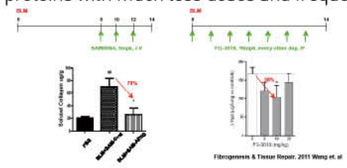
Preclinical toxicology study & clinical IND approval for the development of idopathic pulmonary fibrosis using SAMiRNA

RESPIRATORY DISEASE | PRE-CLINICAL

Bioneer

Product Type	RNAi Nanoparticles
Indication	1st indication: Idiopathic Pulmonary Fibrosis, Respiratory Tract Diseases (MeSH term) 2nd indication: Chronic Kidney Disease, Urogenital Diseases (MeSH term)
Target	Amphiregulin
MoA (Mechanism of Action)	• Amphiregulin: highly expressed downstream genes by TGF-β signaling in lung Fibroblast cells • SAMiRNA-AREG: inhibit the expression of AREG → block the differentiation of fibroblast to myofibroblast → inhibit proliferation, secretion of ECM in the lung tissues
Differentiation Point	Esbriet® (Pirfenidone) and Ofev® (Nintedanib), which are approved by FDA in 2014, is expensive and exhibits limited efficacy. Urgent need for the development of new effective drug which can actively reverse the process of fibrosis. *in vivo* efficacy test: The efficacy of the SAMiRNA-IPF drug has been evaluated with TGF-ß transgenic & Bleomycin induced mouse models of pulmonary fibrosis. Based on these comprehensive evaluations, the candidates show the more significant therapeutic potential for IPF treatment than Pirfenidone of InterMune, Inc and FG-3019 (CTGF mAb) of Fibrogen, Inc.
Current Development Stage	Pre-Clinical
Route of Administration	Parenteral-Intravenous
Data	• In vivo biodistrubution of SAMiRNA by I.V inj. in BLM-induced IPF models • SAMiRNA by I.V injection shows collagen clearance efficacy compare to FG-3019 targeting proteins with much less doses and frequency
Patent Position	1. KR (10-1224828, 10-1241852, 10-1392973), US (8779114, 8772472, 9211343), DE (2463371, 2682466), GB (2463371, 2682466), FR (2463371), CH (2463371), BE (2463371), NL(2463371), JP (5758381, 5797688), CN (102439148, 102888404, 103233003), CA (2761749), AU (2010248239), RU (2558258, 2571218) 2. (10-1862349), US (10030243), JP (6422961), AU (2014284834), RU (2670164) 3. KR (1867414), RU (2656154), AU (2014284836) 4. US (10208309), JP (6426268)





Tae-Rim Kim | trkim@bioneer.co.kr | 82-42-930-8753

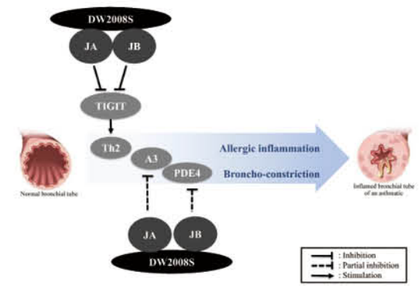
KDDF-201803-06 Development of anti-allergic asthma agents

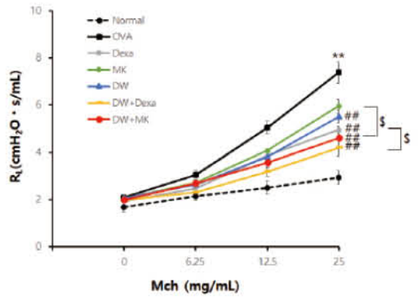
RESPIRATORY DISEASE | PHASE I

Dong-Wha Pharmaceutical

DONGWHA PHARM SINCE1897

Product Type	Naturally Occuring Substance
Indication	1st **indication**: Asthma, Respiratory Tract Diseases (MeSH term)
Target	TIGIT, PDE4 (partial), Adenosine Receptor 3 (A3AR, partial)
MoA (Mechanism of Action)	Th2 selective inhibition & Bronchodilation
Differentiation Point	**First In Class**
Current Development Stage	Phase I
Route of Administration	Oral
Data	1. Safety: NOAEL - SD Rat: 2,000 mg/kg, Beagle: 250 mg/kg → Safety Margin (H.E.D) :Approximately 80 fold 2. Efficacy (Animal) : Superior to Montelukast
Patent Position	Patent No. 10-1747139 / Korea; 6381818 /Japan, 10-19018280000 / Korea





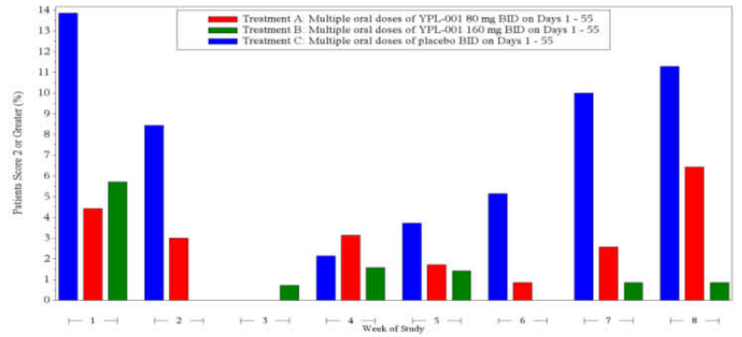
Joobyoung Yoon joobyoung.yoon@dong-wha.co.kr +82-31-270-0735

KDDF-201410-05 Next generation oral treatment for COPD

RESPIRATORY DISEASE | PHASE II

YUNGJIN Pharmaceutical

YUNGJIN PHARM

Product Type	Naturally Occuring Substance
Indication	1st **indication**: COPD, Pulmonary Disease (MeSH term) 2nd **indication**: Asthma, Asthma (MeSH term)
Target	Histone Deacetylase 2 (HDAC2) & Nuclear factor-like 2 (Nrf 2)
MoA (Mechanism of Action)	Anti-oxidant & Anti-inflammatory effects
Differentiation Point	**First In Class** YPL-001 prevents and relieves COPD associated exacerbation by reducing IL-8 mediated inflammation and activating the anti-oxidative pathway.
Current Development Stage	Phase IIa
Route of Administration	Oral
Data	A dose-related trend in reduction in the percentage of patients with weekly mean COPD symptom scores ≥ 2, consistent with an effect of YPL-001 treatment on reducing the incidence of respiratory symptoms, was observed.  It is to be noted that a higher incidence of COPD scores occurred following the bronchoscopy procedures performed prior to first YPL-001 dosing and at the end of the study.
Patent Position	1. PCT / KR2013 / 011986 / US, JP, CN, EP, CA, AU, MX, RU, KR 2. PCT / KR2014 / 003080 / US, JP, CN, EP, CA, AU, MX, RU, KR

Hojin Namgung nghojin@yungjin.co.kr +82-2-2041-8222

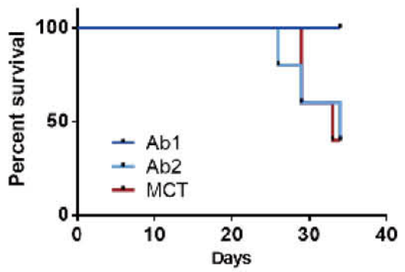
KDDF-201812-07

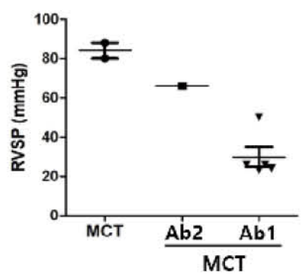
Process development and indication expansion of an anti-fibrotic antibody

CARDIOVASCULAR DISEASE | LEAD OPTIMIZATION

Medicinal Bioconvergence Research Center

Product Type	Immunoglobulin Product (mAb)
Indication	1st indication: Pulmonary Arterial Hypertension, Hypertension, Pulmonary (MeSH term) 2nd indication: Alport Syndrome, Nephritis, Hereditary (MeSH term)
Target	Lysyl-tRNA synthetase
MoA (Mechanism of Action)	Anti-KRS (lysyl-tRNA synesthetase) mAb binds to a region of KRS that is exposed on the cell surface of monocytes and macrophages and inhibits the KRS-dependent cell migration which is critical for the pathogenesis of pulmonary arterial hypertension.
Differentiation Point	First In Class The antibody does not induce systemic hypotension which is frequently observed in the case of other treatments, therefore, it can be considered as an early treatment option for PAH patients with systemic hypotension. The antibody showed synergic effect when combined with Sildenafil and is expected to be used in other fibrotic diseases where chronic inflammation is invovled.
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intravenous
Data	Efficacy of the antibodies (1 mpk) on survival rate and RVESP (right ventricular end systolic pressure) of MCT-treated rats (PAH model)





Patent Position	Patent No. PCT / KR2018 / 003594 Patent No. PCT / KR2018 / 006820 Patent No. PCT / KR2018 / 010903

Sunghoon Kim | sungkim@biocon.snu.ac.kr | +82-31-888-9292

KDDF-201304-05

Development of novel acute heart failure medicine targeting actin-myosin cycle

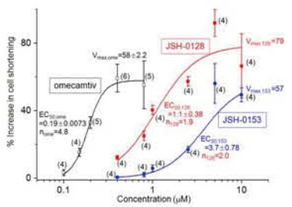
CARDIOVASCULAR DISEASE | LEAD OPTIMIZATION

Shin Poong Pharm

Product Type	Chemical Product
Indication	1st indication: Heart Failure, Heart Failure (MeSH term) 2nd indication: Myocardial Failure, Heart Failure (MeSH term)
Target	Cardiac myosin ATPase
MoA (Mechanism of Action)	Cardiac myosin activator binds S1 sub-domain of myosin, increasing the duration and amount of myocyte contraction.
Differentiation Point	First In Class Establishment of strategic position for world wide market of ionotrope through the discovery of novel Ca^{2+} non-dependent inotrope abolishing the serious side effects of current ionotropes.
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intravenous
Data	• In vitro Cardiac myosin ATPase activity and selectivity study

Compound	% ATPase Activity					
	Cardiac		Smooth		Skeletal	
	1 μM	10 μM	10 μM	100 μM	10 μM	100 μM
JSH-0128	ND	48.5	1.4	5.2	0	-4.8
JSH-0153	15.0	47.6	1.4	3.9	11.1	-20.2
Omecamtiv		~ 68.0	0	4.0	-5.5	2.8

• In vitro cardiac ventricular cell contractility study



• Omecamtiv mecabil VS. JSH

	OMM	JSH-0128	JSH-0153
Cardiac ventricular cell contractility, Vmax [in vitro]	58±2.2	79±13	57±8.6
FS% increase [in vivo, normal rat, 16㎍/kg/min for 3min]	20.60	31.85	24.07
NOAEL [mg/kg, 7 days repeated toxicity]	1.5	9.0	4.0

Patent Position	

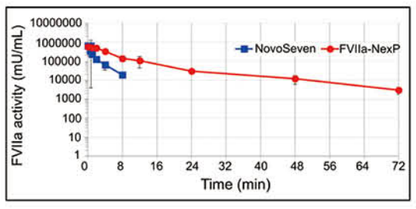
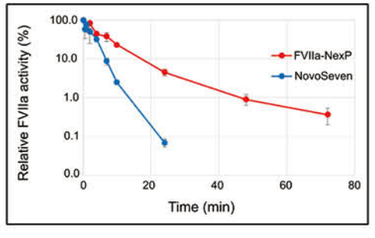
Jeong-sik Lee | grayfox80@shinpoong.co.kr | +82-70-5175-4147

KDDF-201606-02 A long-acting coagulation factor vIIa with NexP™ technology

HEMATOLOGIC DISEASE | LEAD OPTIMIZATION

Alteogen

ALTEOGEN Inc.

Product Type	Protein Product
Indication	1st indication: Hemophilia, Hemophilia A (MeSH term)
Target	Coagulation factor VIIa (FVIIa)
MoA (Mechanism of Action)	Recombinant FVIIa + NexP™ fusion → Long-acting factor VIIa (FVIIa-NexP™)
Differentiation Point	**First In Class** Long-acting factor VIIa among those of competitors
Current Development Stage	Lead Optimization (Lead to Candidate)
Route of Administration	Parenteral-Intravenous (The possibility of subcutaneous admininstration is also being explored)
Data	- Significantly enhanced pharmacokinetics of factor VIIa as a NexP™ fusion in hemophilia mice and cynomolgus monkeys - Prolonged coagulation activity of factor VIIa compared to NovoSeven **PK in hemophilia mice**  **FVIIa activity in cynomolgus monkeys** 
Patent Position	1. PCT / KR2010 / 002520 / 13 countries including USA 2. PCT / KR2012 / 006441 / 12 countries including USA 3. 10-2018-0069221 / Korea

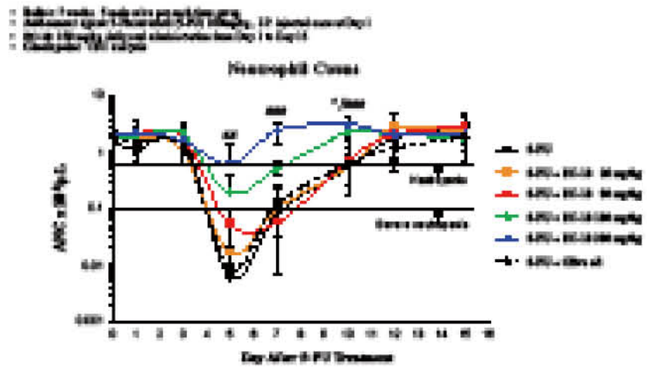
Jaehyeong Ko jhko@alteogen.com +82-42-867-8785

KDDF-201606-08 Management of chemotherapy-induced neutropenia in advanced breast caner patients

HEMATOLOGIC DISEASE | PHASE II

Enzychem Lifesciences

ENZYCHEM LIFESCIENCES

Product Type	Chemical product_Diacylglycerol
Indication	1st indication: Chemotherapy-Induced Neutropenia (CIN), Neutropenia (MeSH term) 2nd indication: ChemoRadiation-Induced Oral mucositis (CRIOM), Stomatitis (MeSH term)
Target	Scavenger receptor family
MoA (Mechanism of Action)	Accelation of phagocytosis → Down-regulation of chemokines/Decrease of DAMP → Regulation of neutrophil migration/induction of bacterial clearance
Differentiation Point	• First In Class-The drug can maintain blood levels of neutrophils with no direct impact on bone marrow functions, especially in the condition that homeostasis imbalance happens • EC-18 was granted orphan drug designation to potential acute radiation syndrome treatment by FDA on 17 December 2017. EC-18 was also granted fast track designation to the first-in-class CRIOM drug on 08 March 2018
Current Development Stage	Phase II
Route of Administration	Oral (Softgel capsule)
Data	
Patent Position	Patent No (Korea). 10-2016-7035244 Patent No (Japan). PA17-676 Currently applied to Canada, India, Russia, EU and China

Do Young Lee dylee@enzychem.com +82-2-6213-7120

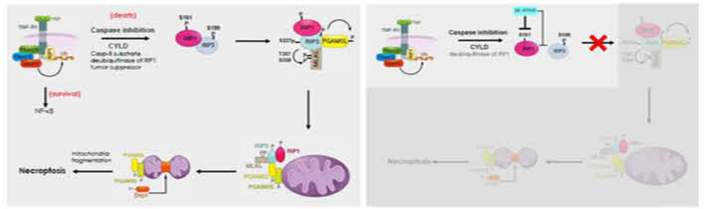
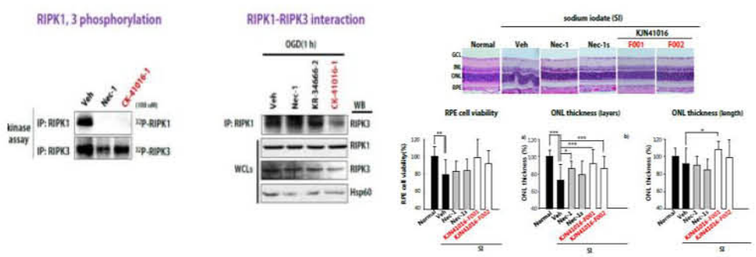
KDDF-201202-10 Development of the dry AMD treatment (CK41016)

OPHTHALMIC DISEASE | PRE-CLINICAL

Chungnam National University

(This project is being studied at KUKJE Pharma after Licence-in from ChungnamNational University in 2014)

충남대학교 CHUNGNAM NATIONAL UNIVERSITY

Product Type	Chemical Product
Indication	1st indication: Blindness, Eye diseases (MeSH term) 2nd indication: Macular Degeneration, Retina (MeSH term)
Target	RIP1 Kinase (Receptor Interacting Protein Kinase 1)
MoA (Mechanism of Action)	RIP-dependent necroptosis signal pathway
	
Differentiation Point	First In Class - New molecular entity (NME) with a New structure - There are currently no available treatments in market
Current Development Stage	Pre-Clinical
Route of Administration	Local (Eye drop)
Data	- Inhibition of RIPK1 phosphorylation/RIPK1-RIPK3 interaction of CK41016 - Following eye drops administration in animals model of dry AMD, in vivo protective effects of CK41016 were superior to those of competitors
	
Patent Position	Patent No: KR10-1551313 / KR10-1515985 PCT / KR2015 / 007562

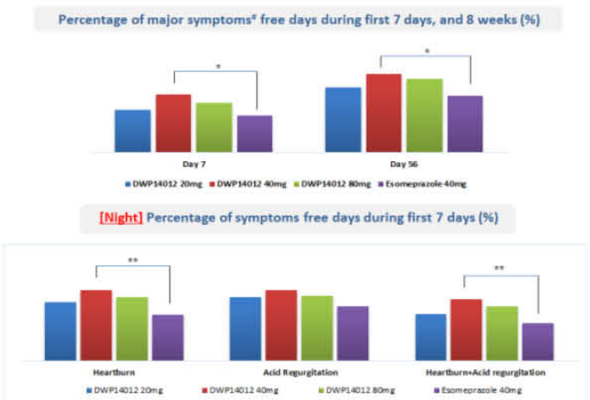
Kim, Younggwan ykkim@kukjepharm.co.kr +82-31-781-9081

KDDF-201709-16 Development of acid pump antagonist for gastric acid related disease, DWP14012

GASTROINTESTINAL DISEASE | PHASE III

Daewoong Pharmaceutical

DAEWOONG

Product Type	Chemical Product
Indication	1st indication: Gastroesophageal Reflux Disease (GERD) Gastroesophageal Reflux (MeSH term) 2nd indication: Peptic Ulcer, Peptic Ulcer (MeSH term)
Target	Acid Pump Antagonist (P-CAP)
MoA (Mechanism of Action)	Reversible and potassium-competitive inhibition of acid secretion
Differentiation Point	First In Class DWP14012 inhibits acid secretion in a reversible and potassium-competitive manner with fast onset of action. Phase II clinical trial shows that DWP14012 exhibited non-inferiority to esomeprazole 40mg in endoscopic healing rates, faster and higher symptoms relief and excellent safety & tolerability up to 8 weeks with a once a day regimen.
Current Development Stage	Phase III
Route of Administration	Oral
Data	Phase II Clinical Study: Efficacy Endpoint - Symptom relief : DWP14012 showed better symptom relief effects at night within 7 days of administration compared to esomeprazole.
	
Patent Position	Patent No. 10-1613245 PCT No. PCT / KR2016 / 004411

Hyunjung Kim hjkim36@daewoong.co.kr +82-2-550-8271

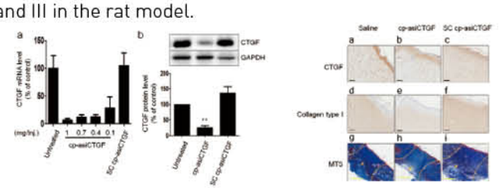
KDDF-201806-09

OLX10010, a novel potential treatment for hypertrophic scar

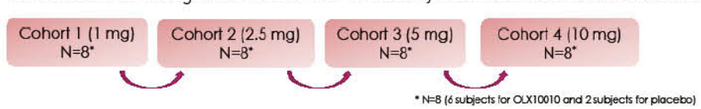
OTHERS | PHASE I

OliX Pharmaceuticals

Product Type	Oligonucleotides (siRNA)
Indication	1st indication: Hypertrophic Scar, Cicatrix, Hypertrophic (MeSH term) 2nd indication: Kelloid scar
Target	Connective Tissue Growth Factor (CTGF)
MoA (Mechanism of Action)	OLX10010, a self-delivered siRNA upon OliX's own patent platform, interferes the expression of CTGF, a factor in the formation of hypertrophic scars. → It degrades CTGF mRNA, resulting in no translation and preventing the development of hypertrophic scars.
Differentiation Point	**First In Class** The drug is fundamentally designed to inhibit well-established target, CTGF, in the development process of hypertrophic scars. In-vitro and in-vivo data suggest highly effective to inhibit CTGF developments with well tolerated safety profile. Weekly or biweekly treatments of OLX10010 for 3 months will provide with effective prevention of recurrences of hypertrophic scars in the planned clinical trials.
Current Development Stage	Phase I
Route of Administration	Parenteral-Intradermal
Data	• Effectively inhibit the expression of both mRNA and protein for CTGF, collagen type I, and III in the rat model.



• Well tolerated in first in human trial with mild and transient adverse events including local reactions, etc. (A randomized, single blind, single dose, placebo-controlled, dose-escalation phase I study to investigate the pharmacokinetics, safety, tolerability of intradermal dosage form of BMT101 in healthy male volunteers. NCT03133130)

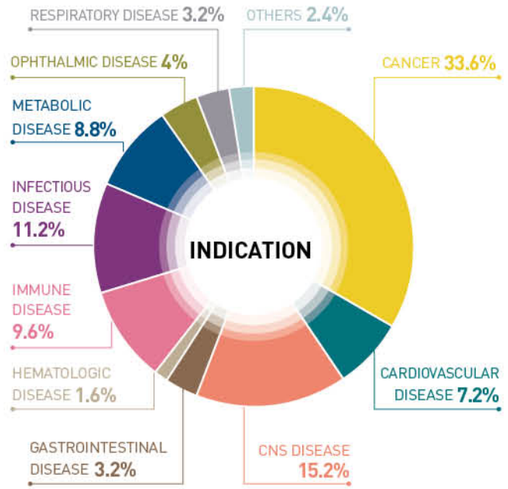


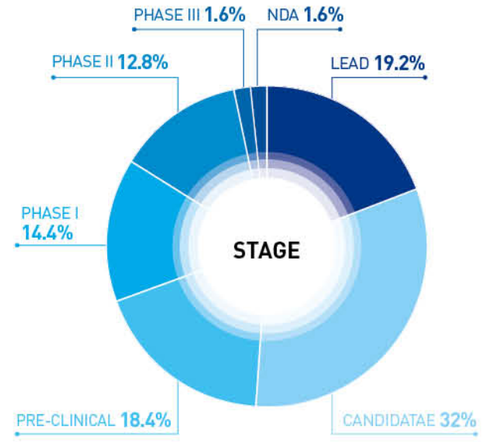
Patent Position	Patent No. PCT / KR2008 / 007530 Patent No. PCT / KR2011 / 006632 Patent No. PCT / KR2013 / 004463

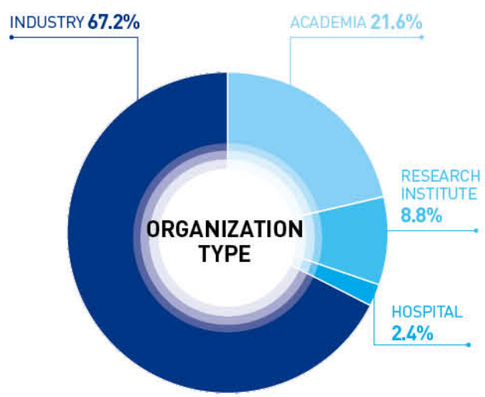
David Lee kyleel@olixpharma.com +82-31-779-8406

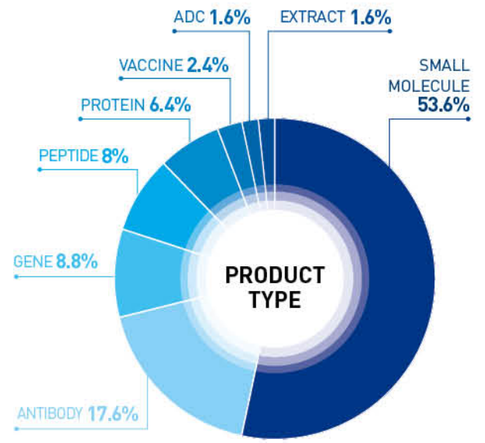
R&D PIPELINE OVERVIEW

KDDF covers broad range of drug development fields









Homepage www.kddf.org **Contact** kddf_bd@kddf.org **TEL** +82-2-6379-3050
Address 9F KPX building, 137 Mapodaero, Mapo-gu, Seoul, 04143, Korea