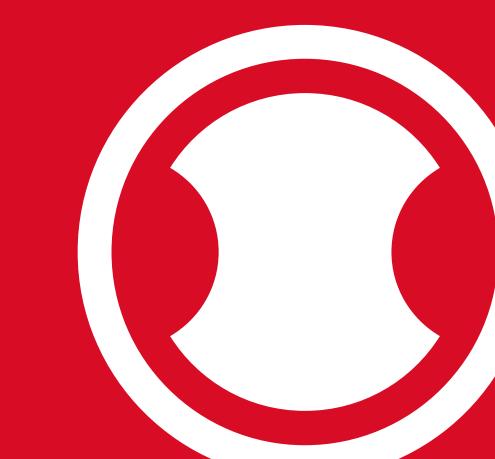


SHIONOGI Wish List

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SHIONOGI

SHIONOGI is looking for seeds and partners related to the following research themes and needs.

SHIONOGIは、以下の研究テーマ・ニーズに関するシーズやパートナーを求めています

If you have any suggestions or inquiries regarding collaboration related to Wish List, please register using the form linked below.

Wish Listに関する共同研究等のご提案・お問い合わせ等がございましたら、
以下リンクフォームよりご登録をお願い致します。

[その他のお問い合わせ](#)
(other Inquiries)

SHIONOGI Wish List

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【Infection (1/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
A cure for HIV and HBV that replaces chronic treatment	How to make a cure possible and how to confirm it			●		
						●
Drug discovery for pandemics caused by RNA viruses	Viral drug target functions and molecules that are expected to act broadly against RNA viruses	●				
			●			
				●		
Research on host response to infectious diseases	Establishment of treatments to prevent the severity and death of acute respiratory viral infections: Acquisition of intervention methods, drug discovery targets, and evaluation techniques	●				
			●			
				●		
					●	
						●
Research on host response to chronic infections	By intervening with the immune system against chronic infections, it is possible to improve the severity of the infection or cure it completely.		●			
				●		
Non-tuberculous mycobacterial infection	Non-tuberculous mycobacterial drug discovery improving infection mortality and quality of life: Target functions/molecules, and new modalities that can control them. Associated with these are rapid screening technologies, non-clinical evaluation systems that can be bridged with clinical practice, rapid diagnosis of target pathogen identification and drug susceptibility, methods for monitoring infection status, and innovative manufacturing technologies.	●				
			●			
				●		
					●	
	Establishment of methods to prevent recurrence (relapse/reinfection)		●			●
	Establishment of a diagnostic method that can determine early termination of treatment					●
	Search for indicators that allow patients to feel the effects					●

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【Infection (2/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Non-tuberculous mycobacterial infection	Evaluation system that can demonstrate NTM clinical extrapolability and technology that can shorten the evaluation period Shorter in-vivo testing and more accurate clinical extrapolation	●				
					●	
Intractable microbial infections	Drug discovery aiming for zero deaths due to infection: Target functions/molecules, and new modalities that can control them. Associated with these are rapid screening technologies, non-clinical evaluation systems that can be bridged with clinical practice, rapid diagnosis of target pathogenic microorganisms and drug susceptibility, methods for monitoring infection status, and innovative manufacturing technologies.	●				
			●			
				●		
					●	
						●
Respiratory diseases	New assets that can safely remove senescent cells, ideas for drug discovery, and technical infrastructure for evaluating senescent cell removal (It is known that senescent cells accumulate due to infection, and it is thought that this may be the starting point for the disease becoming more severe and difficult to treat. Therefore, we will build a foundation and consider applying it to new drug discovery to treat infections. Consider expanding the scope of development to respiratory diseases.)	●				
			●			
					●	
	Drug discovery ideas, technology bases, and assets that restore/improve functions of degraded MΦ and T cells	●				
			●			
					●	
	Drug discovery targets and assets that can be expected to restore tissue and improve respiratory function in respiratory diseases		●			
				●		
MRSA infection	The Information & Method for understanding the unmet medical needs for MRSA. (Especially the information about beta-lactam).	●				

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【Infection (3/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
LAP (Long-acting parenteral formulation) drug discovery	New fundamental technology and evaluation method for LAP				●	
LAP (Long-acting parenteral formulation) drug discovery (Oral long-term drug)	Fundamental technologies and evaluation methods to realize oral long-lasting drugs				●	
Nucleic acid analog drug discovery research	Mechanism analysis method, co-crystal structure analysis method (technology that easily obtains the crystal structure of the ternary complex of nucleic acid analog triphosphate + RNA + RdRp), etc.				●	
Drug discovery method aimed at covalent binders	Fundamental technologies and evaluation methods for drug discovery aimed at covalent binders				●	
Drug discovery technology and screening method for targeting undruggable targets	Fundamental technologies and evaluation methods for attacking undruggable targets				●	
Prediction systems and other drug discovery assets aimed at avoiding Ames	Ames avoidance measures and prediction tools in nucleic acid analog drug discovery, etc.				●	
Cell construction technology that allows various virus assays	Improving task efficiency and reducing time when performing various virus assays. Measures to address the current situation where it is difficult to simply increase tasks and horizontally compare activity values because the cell line changes for each virus. (CPE assay if possible. Techniques other than MucilAir.)				●	

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【Central Nervous System (1/2)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Drug discovery for the treatment of attention deficit hyperactivity disorder (ADHD)	Evaluation system that can quantitatively determine efficacy (non-clinical)				●	
	Evaluation system with higher human extrapolation				●	
	Ideas, concepts, and drug targets for the next generation ADHD drug and exploration of medical needs in response to changes in the external environment		●			
	Intermediate phenotype (Biomarker) related to ADHD that is highly extrapolate to human					●
	Model construction and expansion of evaluation system				●	
	New intervention points and targets different from existing mechanisms		●			
	Translational medicinal biomarkers					●
Drug discovery for the treatment of behavioral and psychiatric symptoms of dementia (BPSD)	Novel drug target to be effective in treating BPSD		●			
	Pathological model and evaluation system enabling drug efficacy evaluation for BPSD				●	
Drug discovery for the treatment of core symptoms of dementia	Drug targets or their tool compounds that can be effective even when dementia-related proteins accumulate in the brain. for example: 1) Targets that can enhance memory through transcription and translation 2) Targets that can enhance memory through energy metabolism		●			
	Efficacy evaluation system that can reflect brain activity (non-clinical)				●	
	Measurement technology for cell-specific biomarkers using extracellular vesicles (EV)				●	

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【Central Nervous System (2/2)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Dependency	Elucidation of dependence mechanisms and new drug targets		●			
	A simple and highly extrapolable evaluation model other than existing evaluation methods, such as CPP, discrimination, or self-administration				●	
	Novel drug targets for relapse prevention		●			
Biomarker research: fMRI	Mouse MRI measurement and analysis technology				●	
	Preparation of IT/analysis environment for constructing fMRI-based symptoms/neural network database				●	
Biomarker research: patient stratification	Biomarkers to identify patient segments that are particularly likely to benefit from drugs to improve cognitive function and behavioral and psychiatric symptoms of dementia (BPSD)					●
Biomarker research: fluid biomarker	Fluid biomarkers to identify patients with cognitive impairment and BPSD					●
Biomarker research: Others	Biomarker analysis technology to detect the mechanism of action on drug discovery targets and predict pathological changes					●
Drug discovery research targeting neuroinflammation	Human primary microglial culture system using samples from patients with central nervous system disorders.				●	
	Collaborators who have the capabilities for single cell transcriptome technologies of human microglia, not single-nucleus transcriptomics.				●	

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【Oncology (1/1)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Biomarker research for cancer immunotherapy	Minimally invasive biomarkers that can detect immune activity or destruction of tumor tissue in the tumor microenvironment.					●
Biomarker research technology for cancer immunotherapy	Innovative technology for identifying biomarkers that can evaluate the tumor microenvironment in a minimally invasive manner.				●	
Bioinformatics technology for cancer immunotherapy	Bioinformatics technology to accurately identify parameters that correlate with drug efficacy and mechanism of action from numerous data.				●	

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【New Therapeutic Area (1/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Drug discovery research targeting Sensorineural Hearing Loss	Drug targets related to human hearing loss		●			
	Drug target discovery methods related to human hearing loss				●	
Sensorineural Hearing Loss: Research on pathophysiology, diagnosis and stratification of hearing-impaired patients	Biomarker that can detect auditory neuropathy					●
	Biomarker that can detect inner ear inflammation and oxidative stress					●
	Biomarker that can detect hair cell shedding					●
Sensorineural Hearing Loss: Non-clinical evaluation systems, DDS techniques	Inner ear administration technique Continuous injection technology into the inner ear using a pump for mice and rats				●	
	Inner ear administration technique Intracochlear administration technique to mice and rats				●	
Sensorineural Hearing Loss: Non-clinical evaluation systems	High throughput and high resolution inner ear tissue analysis technology Cutting-edge nervous system and inner ear tissue immunostaining analysis technology				●	
	High throughput and high resolution inner ear tissue analysis technology Image analysis technology using machine learning				●	
	High throughput and high resolution inner ear tissue analysis technology Automated technology for inner ear whole mount tissue immunostaining				●	
	How to assess hearing quality System for evaluating auditory nerve function				●	
	Hearing loss non-clinical model, evaluation system Non-clinical hearing loss model with less variation in pathogenesis				●	
	Hearing loss non-clinical model, evaluation system Adult mouse ex vivo inner ear tissue evaluation system				●	
	Hearing loss non-clinical model, evaluation system Nonclinical in vivo model of sudden hearing loss				●	

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【New Therapeutic Area (2/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea/Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Drug discovery research targeting sleep disorders	Drug targets related to sleep disorders such as sleep related movement disorder and parasomnia		●			
	Drug target discovery methods related to sleep disorders such as sleep related movement disorder and parasomnia				●	
Drug discovery research for sleep apnea syndrome Non-clinical /Clinical evaluation systems	High-throughput genioglossus muscle activity evaluation system One of the important pathological traits of OSAS is the reduced responsiveness on the genioglossus muscle to negative pressure caused by respiratory effort resulting upper airway obstruction. How to evaluate this feature with EMG(ElectroMyoGraphy) is needed. Since the controlling nerves change depending on the sleep stage, it would be better if there was a system for simultaneous measurement with EEG(ElectroEncephaloGraphy).A surrogate index of muscle activity would also be acceptable.				●	
Drug discovery research for sleep apnea syndrome Non-clinical evaluation systems	Arousal threshold evaluation system in response to hypercapnia or hypoxia One of the important pathological traits of OSAS is the lowered arousal threshold that is the phenomenon in which awakening occurs when blood CO2 and O2 concentrations rise and negative pressure in the esophagus exceeds a certain threshold during sleep. How to assess this function in vivo is needed.				●	
	Loop gain evaluation system Respiration is controlled by chemical regulation according to the blood CO2 or O2 concentration during sleep, but one of the important pathological traits of OSAS is that this control function becomes excessive and breathing becomes unstable. How to assess this function in vivo is needed.				●	

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【New Therapeutic Area (3/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea/Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Drug discovery research for sleep apnea syndrome Understanding the unmet medical needs for OSAS	Ideas for exploring and validating unmet healthcare needs for OSAS. Proposals for RWD obtained from OSAS patients and ideas for its analysis.	●				
Allosteric modulator or biased ligand screening technology	A technology that can screen for allosteric modulators. The way to obtain compounds with high selectivity between receptor subtypes that have very similar binding sites. Biased ligand screening technology that may lead to avoidance of side effects by selecting 2nd signals				●	

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【Vaccine (1/2)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Themes related to predicting the emergence of new pathogens and mutant strains	Technologies related to predicting the emergence of new pathogens and mutant strains In silico analysis method for predicting the emergence of pathogenic mutant strains that enable immune evasion and/or enhanced infectivity, and prediction method for next pandemic infectious disease species				●	
Antigen Design	Technologies related to search and design of vaccine antigens New antigens that are vaccine candidates for infectious diseases, including viruses and bacteria		●			
	Technologies related to search and design of vaccine antigens In silico techniques for discovering and optimizing new antigens that are vaccine candidates for infectious diseases, including viruses and bacteria				●	
Particularization of vaccine antigens	Technologies related to particularization of vaccine antigens New particle technology such as VLPs and nanoparticles to enhance the immunogenicity of antigens				●	
	Technologies related to particularization of vaccine antigens New microparticulation technology capable of loading multiple antigens and enhancing cross-immunogenicity				●	
Vaccine antigen evaluation technology	Technologies related to vaccine antigen evaluation Systems and evaluation systems that can predict the in vivo immunity induction ability of vaccine antigens in vitro				●	
	Technologies related to vaccine antigen evaluation A small animal model that extrapolates highly to humans in evaluating the immunogenicity of vaccines				●	
	Technologies related to vaccine antigen evaluation Protein engineering technology for optimal vaccine antigen design				●	

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【Vaccine (2/2)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Antigen Design	Technologies related to search and design of vaccine antigens Technology related to antigen design or technologies or screening method to enhance cross-immunogenicity or to expand the spectrum to pathogens of vaccines including both of Bcell and Tcell reactivity.				●	
New administration routes of vaccines	Technologies related to new administration routes of vaccines New technologies related to new delivery systems that can effectively inducer mucosal immunity by nasal or oral administration routes				●	
	Technologies related to new administration routes of vaccines Innovative ideas and concepts related to immunity induced by new administration routes	●				
Vaccine adjuvants	Vaccine adjuvants New targets of adjuvants for inducing antibodies with enhanced function (e.g., duration, neutralization, effector activity, and CTL induction)		●			
	Vaccine adjuvants New technologies for creating adjuvants for inducing antibodies with enhanced function (e.g., duration, neutralization, effector activity, and CTL induction)				●	
	Vaccine adjuvants New targets for creating novel adjuvants that induce mucosal immunity in the nasal cavity and intestinal tract		●			
	Vaccine adjuvants New technologies for creating novel adjuvants that induce mucosal immunity in the nasal cavity and intestinal tract				●	
	Vaccine adjuvants Pre-clinical evaluation system (animal model, in vitro evaluation system) that can predict clinical side effects caused by adjuvants (local pain, fever, etc.)				●	



【Drug Discovery Technology (1/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Research related to the analysis of simple RNA and, complexes of RNA and low-molecular-weight compounds	An efficient method for evaluating the three-dimensional structure of RNA (including highly accurate prediction method)				●	
Research on virtual screening of small molecule compounds against RNA targets	High through put in silico screening technology for RNA				●	
Research on reliable method for measuring the binding affinity of RNA and small molecule.	Method for measuring the binding affinity of RNA-targeting small molecules , which reflects cellular or in vivo activity. (Excludes existing technologies such as SPR, ITC, MST, AS-MS and SHAPE)				●	
High through put in silico screening technology	virtual screening methods that can screen a large-scale virtual library with high accuracy and speed				●	
Research on protein design by in silico technology	Protein design methods utilizing state-of-the-art AI technologies				●	
Research on PROTACs, molecular glue	Technologies to identify targets that are the main cause of disease and would be beneficial to degrade (especially those related to infection diseases, excludes cancer and tumors)	●				
			●			
	Technologies that can comprehensively analyze on-target and off-target				●	
	Efficient evaluation method for degraders (cell-free if possible, including computational methods)				●	
Discovery of novel drug targets by PPI (protein-protein interaction) inhibitors	Identification of intracellular PPI targets for treatment of SHIONOGI's focus diseases including infectious diseases	●				
			●			
Intra-cellular drug delivery research or technologies for medium sized compounds	An efficient method for transferring peptide drug molecules into cells				●	
Research on docking of peptides to target proteins	Technology for highly accurate docking (SBDD) and simulation (LBDD) of peptide drug molecules. In particular, calculation methods or indicators to measure the degree of conformational locking of peptide drug molecules				●	
Automation in chemistry	An automated system in chemistry which can operate throughout the day				●	



【Drug Discovery Technology (2/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea/Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ DrugDiscoveryTechnology	診断技術・BM Diagnosis・ Biomarker
Drug delivery technologies for antibody therapeutics	A technology to deliver antibodies into brain				●	
Novel drug targets for antibody therapeutics	Novel antibody-drug targets of chronic infectious diseases, central nervous system diseases, and motor dysfunction diseases		●			
Novel drug targets for siRNA therapeutics	Novel drug targets of neurodegenerative diseases and motor dysfunction diseases for siRNA therapeutics, which include ALS.		●			
Drug delivery technologies for oligonucleotide therapeutics	A technology for systemic delivery that can deliver siRNA into the brain and immune cells for neurological diseases and infectious diseases.				●	
In vitro evaluation method for ocular toxicity	An in vitro model that can evaluate ocular toxicity and identify the mechanism of ocular toxicity				●	
Research on ototoxicity	An in vitro evaluation system that can evaluate damage and regeneration of inner ear hair cells and an in vivo evaluation system for ototoxicity using ABR (Auditory Brainstem Response), etc.				●	
System toxicology research	In silico toxicity mechanism analysis system that can estimate the toxicity mechanism from molecular networks, expression changes, etc.				●	
Imaging technology for organ toxicity	A technology for predicting toxicity target organs using live animal image diagnosis (CT, MRI, etc.) as a substitute for pathological examination or tests or pre-evaluation for prioritization				●	
Technology that can identify drug targets with in silico/AI	Development of an alert system that roughly distinguishes whether it is adverse or non-adverse based on the input of biochemical data; ie., a system using AI and machine learning technology based on non-clinical biochemical parameter data (quantitative values) from toxicity studies conducted in-house				●	



【Drug Discovery Technology (3/3)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 EvaluationSystem・ DrugDiscoveryTechnology	診断技術・BM Diagnosis・ Biomarker
Establishment of human P-gp and BCRP transgenic or knock in animals	An in vivo model that can evaluate P-gp and BCRP mediated drug transports to predict the in vivo impact of human P-gp and BCRP and the their drug-drug interaction risks.				●	
Identification of P-gp and BCRP biomarkers for drug-drug interactions	A biomarker that can predict the risk of P-gp or BCRP inhibitory effects on drug (NMEs) absorption and disposition.					●
in vitro evaluation method for human biliary clearance and enterohepatic circulation	An in vitro system that can predict the biliary clearance of candidate compounds and whether they undergo enterohepatic circulation in human.				●	
Analysis of intracellular pharmacokinetics using imaging technology	Quantitative evaluation of intracellular drug distribution can analyze accurate PK/PD correlation and understanding of the mechanism of action.				●	
Exploration and Improvement Techniques of Enzymes for Metabolite Biosynthesis using a Bioreactor	We aim to establish an improved method for screening and optimizing enzyme activity based on substrate specificity of metabolite biosynthetic enzymes using bioinformatics techniques, including enzyme sequence data from sources such as metagenomics.				●	
Data-driven cultivation techniques.	We aim to develop a methodology that enables improved reproducibility of scale-up cultivation by optimizing cultivation conditions based on diverse measurement parameters and cultivation data.				●	

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【CMC R&D Technology (1/1)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Crystal and powder properties of drug substances (small molecule)	Evaluation and control technology for crystal/powder properties of drug substances (small molecule)				●	
LAP (Long-acting parenteral formulation) formulation technology	・To avoid subcutaneous/intramuscular irritation ・To increase dose volume in subcutaneous/intramuscular				●	
	An inexpensive LAP formulation to be developed				●	
LAP formulation human PK prediction technology	To predict the human PK of LAP preparations in a short period of time.				●	
Oral administration long-acting formulation technology	To release the drug for NLT one week with an oral formulation.				●	
Long-acting formulation technology for improved absorption	To sustained release a drug improved absorption without reducing AUC and Ctrough.				●	
Stability improvement technology	To store products that are stored in the refrigerator at room temperature.				●	
orally disintegrating tablets (ODTs) formulation technology	Long-term patented technology for orally disintegrating tablets (ODTs) Estimated patent term: Exclusivity period over 2040				●	
GMP manufacturing technology for ligand-modified mRNA-LNP (ligand addition technology after LNP formation)	To increase manufacturing feasibility in preparation for the launch of ligand-modified LNP formulations.				●	



【CMC R&D Technology for Biologics (1/1)】

テーマ Theme	ニーズ "Needs"	アイデア・コンセプト Idea / Concept	創薬標的 Drug Target	シーズ化合物 Seeds Compound	評価系・創薬技術 Evaluation Syetem・ Drug Discovery Technology	診断技術・BM Diagnosis・ Biomarker
Innovative medium component for cell culture	To increase and improve cell culture performance for biologics production.	●				
Development of universal chromatography affinity resin	to achieve high purity of recombinant protein produced by BEVS or CHO in minimum process development.				●	
HTS technologies.: SDS-PAGE	To increase throughput of analytical activity.				●	
HTS technologies.: downstream process development	To increase throughput of process development of downstream using chromatography system (not 96 well format technology).				●	
Automation to optimize the process development	To decrease the number of experiments and achieve the goal of manufacturing fast				●	
Characterization technology of lipid particle and emulsion	Understanding of lipid particle and emulsion characterization such as existence mode of the components, the component release profile in biological environment, particle solidness and membrane fluidity.				●	
Device technology for injectable formulation to administrate 2 types liquid with one shot	Enhancement usability without complicated preparation				●	
Structural characterization of biotherapeutics	An efficient identification method for O-glycosylated site of peptide using mass spectrometry				●	
	An efficient data analysis method for conformational change by hydrogen deuterium exchange mass spectrometry (HDX-MS)				●	
Biochemical monitoring of virus-like particles(VLPs)/virus vectors	An efficient method for analyzing VLP/virus vectors by Raman spectroscopy using machine learning models				●	
Structural characterization of biotherapeutics	Efficient analysis methods for non-enzymatic and spontaneous post-translational modifications, focusing on deamidation, isomerization and racemization.				●	