

Partnering with Pfizer Worldwide R&D



Partnering with Pfizer

Pfizer is proud to offer you access to our world-class research scientists, our cutting-edge capabilities in medicine and vaccine design, our global network of external collaborations, and our industry-leading manufacturing and commercial capabilities.

To this end, we have detailed the specific areas in which we seek to create strategic partnerships in this brochure and on our website,

www.pfizer.com/wrdpartnering

External Research & Development Innovation (ERDI) – our externally-focused scientific team of high profile PhDs/MDs, embedded within our research groups – identifies late-breaking science that forms the basis of innovative therapies and drives related collaborations that deliver value to Pfizer, our partners, and patients. ERDI works closely with Pfizer's Business Development and Venture Investment groups to form an effective partnering team with a diverse blend of research, clinical, and business expertise.

To discuss opportunities, please contact the member of our partnering team listed on each page of this brochure. We are confident that you will find in Pfizer a great partner to advance your science and deliver innovative high-impact medicines and vaccines to patients.



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WRD Research Focus Areas

Therapeutic Areas

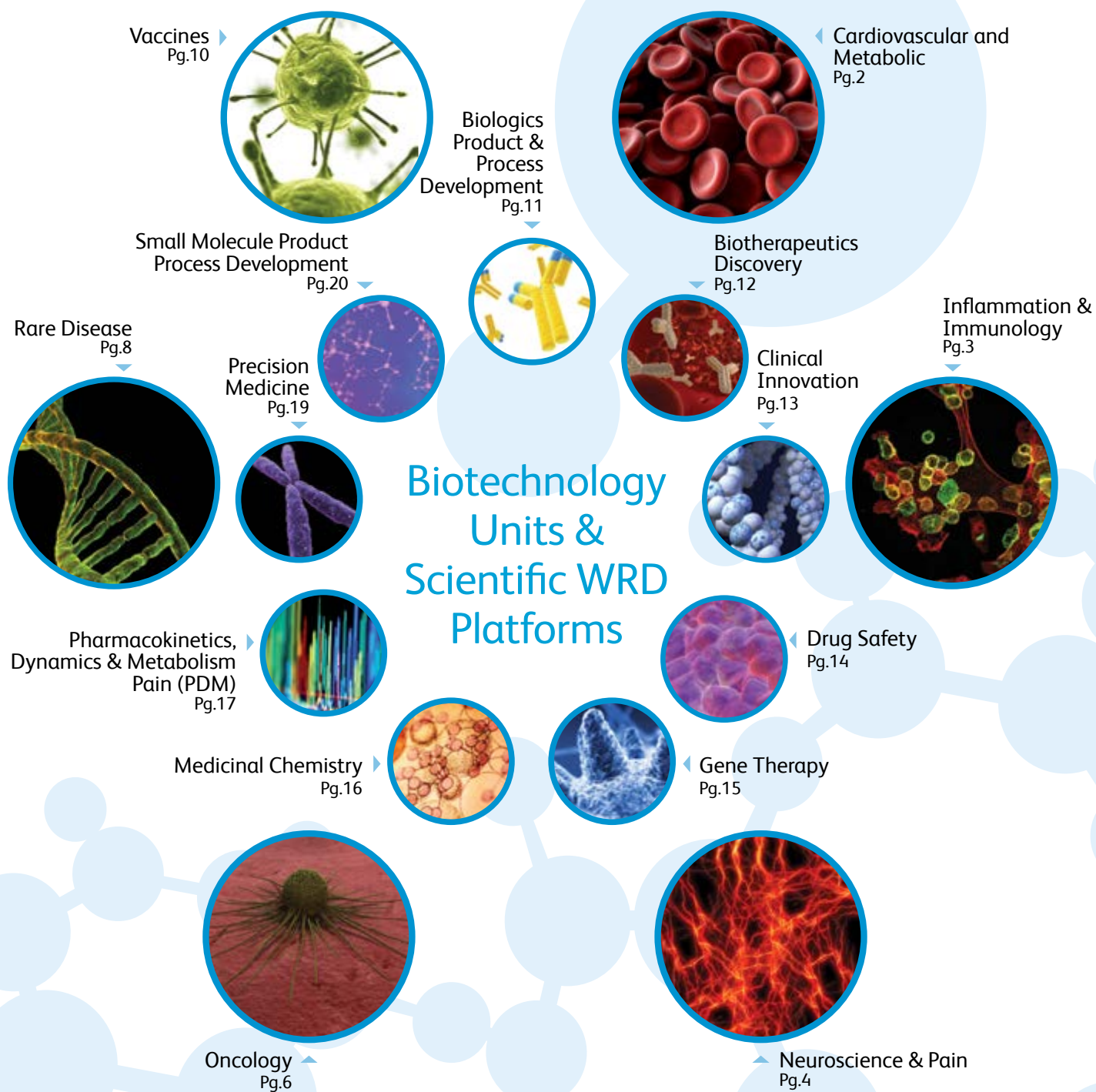


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Cardiovascular and Metabolic

Cardiovascular diseases (CVD) remain the leading cause of global mortality, accounting for one in every two adult deaths worldwide. The rates of CVD-related morbidity, including heart-failure, peripheral arterial disease and nephropathy are increasing as more patients survive hearts attacks, and the population ages. In addition, Metabolic Diseases, specifically Type 2 diabetes (T2D) and obesity, are major health problems that have reached epidemic proportions worldwide. Globally T2D and obesity incidence have more than doubled in the past two decades. Importantly, CVD and T2D impose large economic burdens on the individual patient and on national healthcare systems and economies. Pfizer scientists are eager to work with world-class partners who share our mission to develop novel and differentiated medicines to improve the lives of patients suffering from CVD.



Pfizer is interested in partnering to develop therapeutics, expand our understanding of disease biology, and identify biomarkers that can help us impact:

- CVD (Heart failure, dislipidemia, and atherosclerosis)
- Diabetes and related co-morbidities
- Non-alcoholic fatty liver disease (NAFLD), Non-alcoholic steatohepatitis (NASH) and cirrhosis
- Obesity and related co-morbidities

Specific areas of interest include:

- Preventing cardiac remodeling that is associated with heart failure
- Preventing heart failure via anti-inflammatory pathways
- Improving cardiac performance via myocardial protection or repair or improved myocardial perfusion and energetics

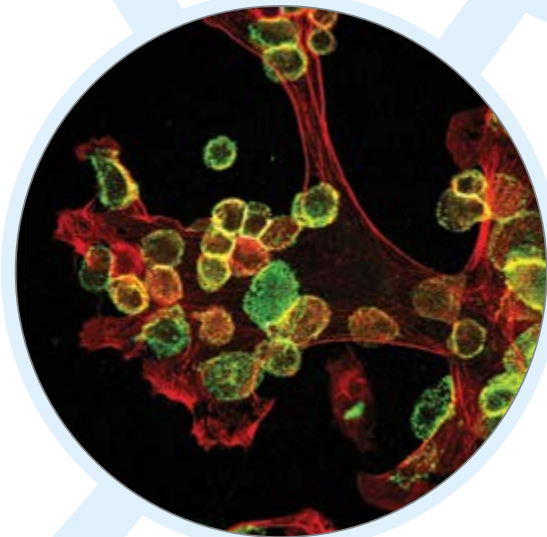
- Primary and secondary prevention of cardiovascular events in high-risk patients (T2D, end stage renal disease, and highest-risk sub-groups post-acute coronary syndrome)
- Novel therapies that reduce hyperinsulinemia and hyperglycemia
- Decreasing hepatic lipid content and inflammation and the development of liver fibrosis in patients with NASH/NAFLD
- Addressing obesity and eating disorders to induce and sustain weight loss
- Brain signals that regulate energy homeostasis and metabolism
- Centrally-acting anorectics

Not actively seeking partnering opportunities in:

- Anti-thrombotics
- Anti-arrhythmics
- Stable Angina treatments

Inflammation & Immunology

Pfizer is a global leader in developing medicines for patients suffering from chronic immune diseases. Pfizer's commitment to the discovery and development of novel therapeutics to help patients living with chronic autoimmune diseases is evidenced by products such as Xeljanz® (tofacitinib citrate), Celebrex® (celecoxib capsules), Rapamune® (sirolimus), and Enbrel® (etanercept) for patients suffering from conditions such as osteoarthritis, solid organ transplant rejection, rheumatoid arthritis, and psoriasis. The Inflammation & Immunology Research Unit, led by Charles Mackay, Chief Scientific Officer, is focused on discovering, evolving and developing the next generation of therapies for immune-mediated diseases. Pfizer is interested in entering into strategic relationships with innovative collaborators to develop increasingly novel and differentiated therapies for autoimmune diseases.



We are interested in establishing alliances to develop therapeutics, expand disease biology understanding, and identify biomarkers that impact:

- Rheumatoid Arthritis
- Systemic Lupus Erythematosus
- Inflammatory GI disorders (i.e., Inflammatory Bowel Disease)
- Nonalcoholic steatohepatitis (NASH)
- Atopic Dermatitis
- Other indications with high unmet need that are mechanistically related to those above

Specific areas of interest include:

- Cytokines and their signaling pathways
- Adaptive Immunity, Lymphocyte biology including Th17 lymphocytes
- Regulatory cells and Tolerance induction
- Host-microbial interactions and microbiome with an interest in epithelial barrier

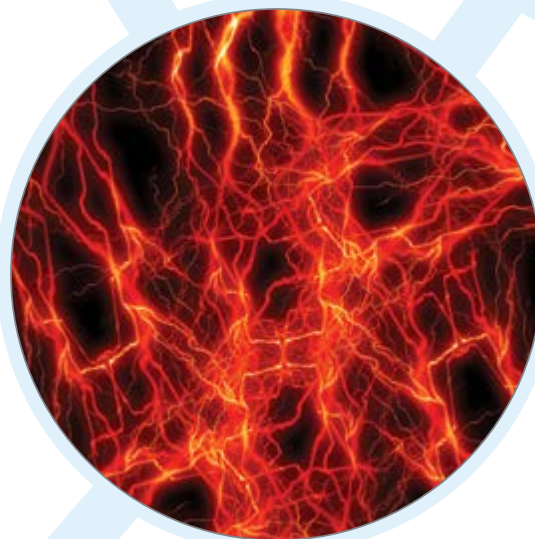
- Innate Immunity and Innate Lymphoid Cell biology
- Oxidative stress modulators
- Anti-fibrotics
- Technology platforms and products to help understand patient segmentation in the disease areas of interest and develop precision medicine strategies for innovative portfolio products
- Technology platforms and products that allow for greater tissue and cell specific delivery

Not actively seeking partnering opportunities in:

- TNF α , IL-1 β targeting biologics
- B cell depleting biologics
- Corticosteroids

Neuroscience & Pain

In the US today, seven of the ten leading causes of disability are caused by central nervous system (CNS) disorders, and the combined estimated US and EU economic burden of such disorders is over \$1.5 trillion and growing. Pfizer is a global leader in this space and continues to invest heavily with products in each of the major classes. In Neuroscience, we are investigating new ways to attack Alzheimer's Disease, Parkinson's Disease, and Schizophrenia, as well as a wide range of disorders that manifest symptoms which are common to several diagnoses, such as impaired cognition. Pain is a symptom where the CNS can both be a source as well as a potential therapeutic target. As such, our CNS expertise complements our historical pain franchise developing a new generation of analgesics.



Neuroscience – Primary areas of interest:

- Neurodegenerative Diseases
 - Alzheimer's Disease (AD) including strategic partnerships on Pfizer assets
 - Parkinson's Disease (PD)
- Trans diagnostic domains relevant to psychiatric disorders such as Cognition, Anxiety, and Motivation/Apathy

Other areas of focus:

- Huntington's Disease (HD): siRNA and knock down approaches, symptomatic and disease-modifying treatments
- Vascular Dementia (Cerebellar Amyloid Angiopathy)
- Multiple Sclerosis (MS) – Remyelination approaches targeting Chronic Progressive disease only

- Cerebrovascular disease- sensory disorders involving abnormal sensations of clinical relevance, e.g., visual, auditory, vestibular, or somatosensory systems
- Adjunctive treatment of depression
- Addiction (opiate and alcohol)
- Agents modulating (or biomarkers of) chronic neuroinflammation with evidence of impact on AD or PD neurodegeneration
- Imaging agents (e.g., tau, synuclein, neurotransmitters, neuroinflammatory markers and gliosis)
- Conformational antibodies that have cross reactivity to all “amyloids” (e.g., tau, A β , huntingtin, δ -synuclein)

Along with our Rare Disease Research Unit, we have an interest in rare CNS diseases and in novel technologies to address them (such as gene therapy).

Approaches to Trans Diagnostic Domains in Psychiatry/Behavioral Disorders:

- Ketamine-like mechanisms without side effects, approaches such as oral Ketamine and GABA B
- Standalone or adjunctive agents with superior efficacy for major depressive disorder as well as for subdomains such as anhedonia, motivation, cognition and anxiety
- Adjunctive schizophrenia agents with efficacy in treating negative symptoms

Pain-Primary areas of interest:

- Chronic Pain
 - Nociceptive pain and neuropathic pain
- Acute Pain
 - Post-operative, moderate-severe pain associated with hospital and outpatient recovery
- Novel targets where there is strong human genetic or pharmacological evidence for a role in pain initiation or treatment
- Highly differentiated opiates which offer a significantly altered side effect potential and reduced abuse potential

- Approaches to targeted delivery to pain circuits or pathways
- Technology platforms for patient segmentation and precision medicine support

Enabling Technologies:

- Novel modes of delivery of growth factors and other biotherapeutics
- Gene therapy and other oligonucleotide-based approaches with CNS application
- Technologies and models, such as imaging, enabling characterization of circuits related to neurofunctional domains (e.g., cognition, arousal, attention)
- Tools for remote monitoring of motor function and cognitive state
- *In vitro* blood brain barrier models derived from rodent, non-human primate or human sources
- Plasma/CSF biomarkers coupled with phenotype, genotype and drug history, to predict responders, monitor disease, and to identify prodromal patients

Not actively seeking partnering opportunities in:

Neuroscience

- Protein “anti-aggregators”
- A β immunotherapies or vaccines
- Anti-oxidants directed to neurology indications
- COMT Inhibitors; MAO Inhibitors
- Undifferentiated anti-psychotic or anti-depressant drugs
- GlyT1 inhibitors, H3 Inhibitors, PDE Inhibitors (2, 4, 9, 10), mGluR5 inhibitors, or α 4b2 nicotinic agonists
- Stand-alone mania treatments
- Stroke treatments without proof of concept in humans
- MS approaches that primarily target patients with relapsing remitting disease
- Large molecule therapeutics with CNS targets absent data for brain penetration
- “Black box” mechanisms

Oncology

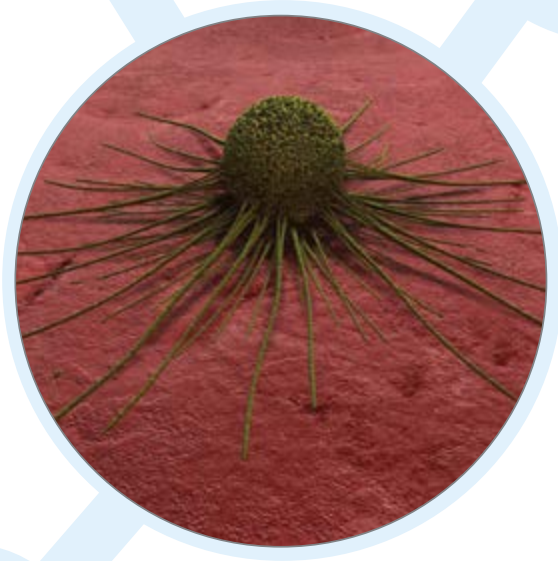
Pfizer Oncology strives to advance the frontiers of cancer biology and to translate this knowledge into high-impact medicines for cancer patients. Our core areas of interest include: Tumor Cell Biology; Bioconjugates Discovery and Development; Precision Medicine; Integrative Biology and Biochemistry; and Immuno-Oncology. In Tumor Cell Biology we are focused on oncogenic drivers, tumor metabolism, and epigenetics. Our Bioconjugates group efforts emphasize our expertise in antibody-drug conjugates (ADCs). Precision Medicine represents an integrated cluster of technology platforms and translational science configured to enable patient-tailored, hypothesis-driven experimental medicine approaches. Our Integrative Biology and Biochemistry team supports novel target identification and validation through functional genomics, proteomics, and other “omic” approaches.

We are interested in establishing alliances to develop therapeutics, expand disease biology understanding, and identify biomarkers that impact:

- Lung, colorectal, breast, ovarian, renal, and hematologic cancers
- Cancers prevalent in Asia (e.g., gastric cancer, hepatocellular carcinoma)

Specific areas of interest include:

- Targets and technologies that enable antibody and ADC approaches
- Oncogenic signaling mechanisms
- Tumor metabolism
- Epigenetics
- Small molecule immuno modulators



- Directed tumor cell killing via immune-based mechanisms
- Precision medicine
- Functional genomics
- Liquid biopsy technologies
- Technologies that deliver drugs asymmetrically to specific tissues
- Targeted nanoparticle technologies and assets

Immuno-Oncology



The recent clinical successes reported with cancer immunotherapy are reshaping the field of oncology. Pfizer plans to significantly advance its leadership in this area by partnering to develop cutting edge science beyond the current mainstream immune checkpoints, e.g., CAR-T, vaccinia, and small molecules. The IO programs at Pfizer uniquely leverage a combination of our scientific and clinical strength in immuno-biology alongside our historical expertise in developing first-in-class cancer and vaccine therapies.

Pfizer's efforts in IO include external collaborative alliances with leading academic medical centers (e.g., MD Anderson) and visionary biotech firms (e.g., Cellectis). Our IO efforts are driven primarily within our Rinat laboratory site in South San Francisco, CA. Leveraging its strength in biotherapeutics alongside core expertise in immuno-biology, Rinat has a strong record of converting validated targets into novel protein-based therapeutics, and advancing molecular and cell-based IO treatments. We would like to partner in the IO space on pre-clinical and clinical stage antibody and small molecule-based immunomodulatory opportunities, with an emphasis on those agents that directly engage or impact T-cell and other tumor infiltrating lymphocyte cell populations.

We are interested in establishing alliances to develop and access:

- Novel Targets for Overcoming Tumor-induced Immune Resistance
 - Targets that promote immune response whether alone or in combination with checkpoint inhibitors
 - Targets that provide Innate immune support/activation
 - Targets that reduce immune suppression
- Cell-based Therapies
 - CAR-T, TCR, and other hybrid targeting modalities with a focus on allogeneic approaches

■ Platform Technologies

- Mechanisms, biomarkers, and screening approaches to identify and accelerate the most promising combination therapies
- New modalities to induce immune responses: Bi-specific mAbs, nanoparticles, oncolytic viruses, tumor vaccines, chimeric antigen receptors (CARs), or novel T cell receptors (TCRs)
- Identification of new immune modulating targets
- Monitoring of immune-supporting and immune-suppressing biomarkers within the tumor as well as of the anti-tumor immune responses
- Novel animal models that accurately recapitulate human tumor-immune system interactions

Not actively seeking partnering opportunities in:

- Antisense/siRNA/shRNA therapeutics
- Reformulated cytotoxic agents
- Radioconjugates

Rare Disease

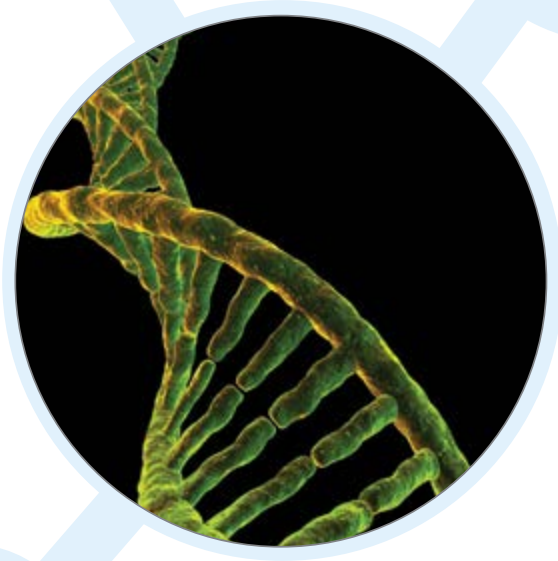
Pfizer is adopting an innovative and collaborative approach to the development of new medicines for patients with rare diseases. We have a track record of creating innovative strategic partnerships with academic institutions, patient advocacy groups, and commercial enterprises to accelerate the development of novel therapeutics across the entire spectrum of rare diseases. Our commitment to academic collaboration is highlighted by the Rare Disease Consortium agreement with six of the leading Universities in the UK, providing a vehicle to work collaboratively with leading physician scientists on drug discovery projects. We are looking to capitalize on recent scientific advances linking diseases to specific genetic defects. As 70% of rare diseases are monogenic in origin, we believe this is an area where scientific knowledge is enabling significant advances in drug development. Our expertise in large molecule therapeutics, small molecule protein chaperones, and transcriptional modulators has resulted in a broad pipeline of potentially transformative medicines across multiple disease areas.

We are interested in partnering to develop therapeutics, expand disease biology understanding, and identify biomarkers that impact:

- Hematology (non-malignant)

- Hemophilia

- Coagulation factors with extended duration of activity and/or improved delivery
 - Oral agents to treat hemophilia
 - Immune tolerance
 - Novel approaches (including gene therapy) to treat hemophilia patients



- Other rare hematologic (non-malignant) indications

- Sickle cell anemia, & beta-Thalassemia follow on with focus on disease modifying and/or therapies that significantly change disease pathology
 - Hemostasis (systemic and topical)
 - Opportunistic approaches in the field of hematology that promise well differentiated novel medicines

- Neuromuscular Diseases

- Duchenne/Becker muscular dystrophy and other muscular dystrophies, disease-modifying therapies preferred
 - Spinal Muscular Atrophy
 - Friedreich's ataxia: Upregulate frataxin expression, inhibition of degradation or frataxin pathway bypass
 - Amyotrophic lateral sclerosis: Protein misfolding approaches and other disease-modifying approaches

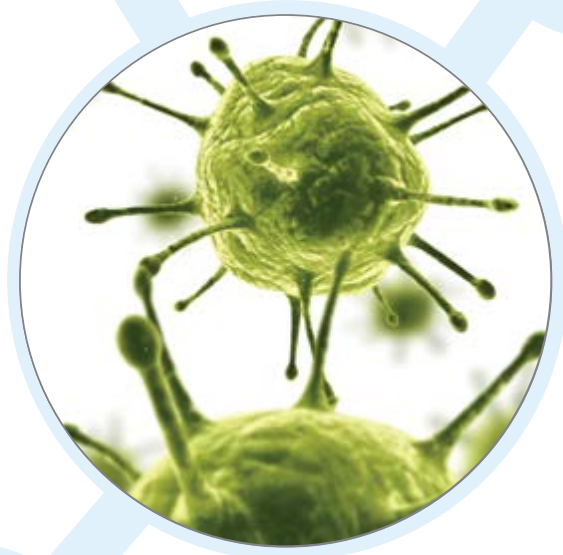
- Pulmonary Diseases
 - Cystic Fibrosis (in conjunction with the CF Foundation)
 - Pulmonary arterial hypertension and idiopathic pulmonary fibrosis
- Disease modifying approaches for other diseases such as transthyretin amyloidosis, myasthenia gravis, Huntington's disease
- General mechanisms of interest
 - Pharmacologic chaperones and other modifiers of protein trafficking, misfolding, or degradation that could apply to multiple diseases (e.g., a small molecule approach that could apply across multiple lysosomal storage disorders)
 - Targeting technologies/platforms (e.g., muscle and CNS targeting)
 - Modifiers of gene transcription via epigenetic approaches
 - Nucleic acid/gene therapy approaches to therapy
 - Antibody-drug conjugates
 - Oral small molecule and biologics approaches

Not actively seeking partnering opportunities in:

- Undifferentiated approaches in well-served markets
- Medical devices
- Diagnostic tests (in absence of a therapeutic approach)

Vaccines

Our vision is to become a recognized leader in the discovery and development of innovative prophylactic and therapeutic vaccines for unmet medical needs throughout all stages of life and for all geographies and markets. We focus on Prevention of viral and bacterial infections in infants, children, adolescents and older adults; hospital acquired infections and active immune oncology (cancer vaccine) targets



We are interested in establishing alliances to pursue development of:

- Vaccines for the prevention and/or treatment of infectious diseases
- Vaccines for the prevention and/or treatment of non-infectious diseases with special emphasis on cancer vaccines through the active elicitation of disease-modifying immune responses
- Novel animal models for assessment of vaccine effectiveness
- Novel immunomodulators of the adaptive immune response
- Novel vaccine target antigen identification systems
- Novel vaccine delivery platforms

We are also interested in:

- Adjuvants
- Novel immune system enhancers to bolster the immune system of an older population
- Novel *in vitro* systems for assessment of vaccine immunogenicity

Not actively seeking partnering opportunities in:

- Novel vaccines in disease areas for which effective vaccines are already available/licensed (with the exception of novel influenza virus vaccines)

Biologics Product & Process Development

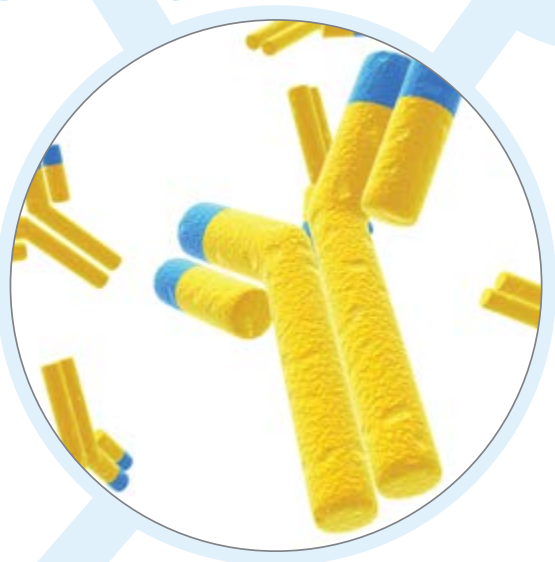
Pharmaceutical Sciences envisions a network of strategic partnerships integral to its biologics technology initiatives, which include biopharmaceutical and vaccine development and manufacturing and prokaryotic expression to augment core competencies.

I. We are interested in establishing alliances to develop and access:

- Next generation of microbial and mammalian cell protein production systems
- Next generation process and manufacturing technologies

Specific areas of interest include:

- Systems and Synthetic Biology
 - Technologies to design and influence host cell performance and product quality
 - Novel expression systems with alternative post-translational modifications (e.g., glycosylation)
 - Automated methods for mammalian cell line screening, selection and scale up
 - Next generation cell culture process technologies
 - Next generation purification process technologies
 - Harvesting technologies (e.g., smart polymer, automation)
 - High throughput analytics for product quality attributes
 - Advanced analytics for glycoconjugates and antibody drug conjugates
 - Flexible and adaptive manufacturing technologies for biotherapeutics



II. We are interested to ensure commercial and clinical differentiation of products by accessing leading drug delivery technologies.

Specific areas of interest include:

- Tissue specific delivery
- Alternative routes of delivery (transdermal, transmucosal)
- Analytics (biophysics) to predict stability and ease of development
- Advanced formulations (high dose delivery, convenient dose administration)
- Innovative injectors including large volume bolus injectors, and compliance and adherence supporting systems

Not actively seeking partnering opportunities in:

- Transgenic animal-based or plant-based production systems for biologics

Biotherapeutics Discovery

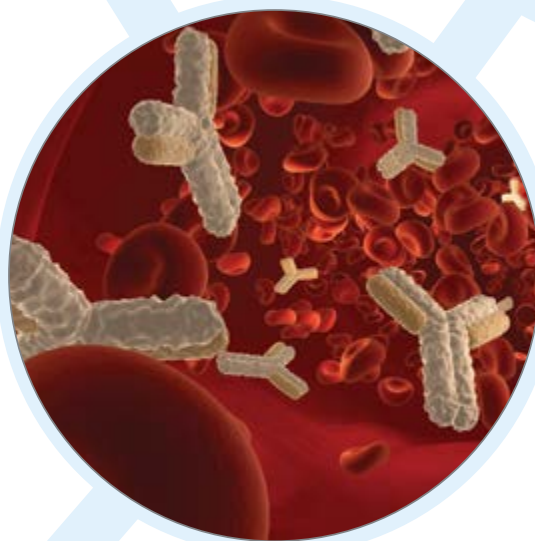
Pfizer strives to become the leading biotherapeutics company by building on internal expertise and fostering strategic partnerships to access the best technologies with patent protection and technical capabilities that provide a competitive advantage.

We are interested in establishing alliances to develop and access:

- Transformational technologies to design, construct, and optimize biotherapeutics
 - Informed protein design optimizes molecular properties resulting in superior efficacy, pharmacokinetics, pharmacodynamics, safety, manufacturability and differentiations
- Antibody drug conjugate technologies
 - Novel ADC platforms, novel payloads, linkers, conjugation sites
- Bioconjugation technologies
 - Novel approaches that enhance antibody function or improve site-specific bioconjugation
- Combinatorial biologics such as bi-specific and multi-functional platforms with promising biophysical and manufacturing properties
- Structure-based and computational design of therapeutics
 - Novel technologies to rationally design antibody, protein and peptide therapeutics that display superior pharmaceutical properties (including selectivity, half-life extension, stability, formulatability)
- Technologies that enhance multi-transmembrane protein target expression/presentation for antibody generation and screening
- Technologies and patient sample access for antibody discovery from human antibody responses
- Targeted delivery technologies that address/overcome cell membrane penetration, cross blood brain barrier
- Technologies that can significantly enhance general protein expression, purification, stability for discovery
- Integrated service providers to support early discovery activities for development of therapeutics
- Broadly applicable platforms to enhance speed/quality of antibody generation
- Novel biologics, combination therapies, and "biobetters" that fit Pfizer strategies

Not actively seeking partnering opportunities in:

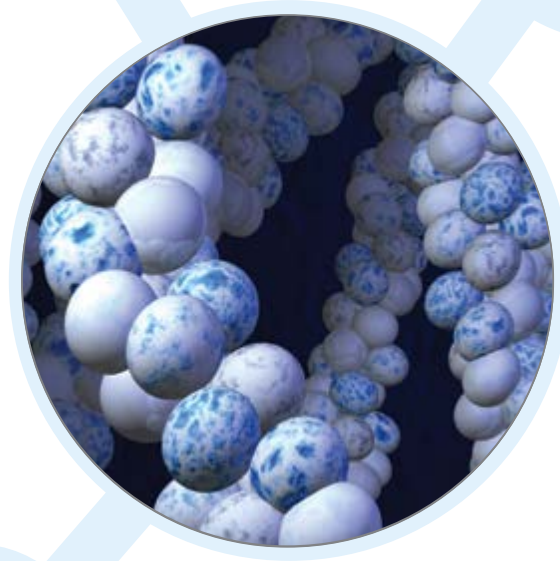
- PEGylation for bioconjugation
- Protein scaffold platforms with challenging stability attributes and/or difficult manufacturability



Clinical Innovation

Pfizer Clinical Innovation is leading the industry in applying novel technologies, innovative partnerships, and new approaches to enhance and transform clinical trials and the development of new medicines. Clinical Innovation areas of focus include:

- Patient Engagement – Raising awareness and supporting patient recruitment & retention for clinical trials, enhancing patient participation, improving generation of patient insights into study design, sharing data & information with trial participants
- Real World Data – Leveraging diverse data sources and analytics tools to enhance study design and protocol optimization, capture clinical trial data more efficiently
- Mobile & Digital Tools – Supporting the informed and engaged patient during studies, improving study access and convenience, and enabling robust data capture whether reported by the patient or leveraging novel sensors
- Biospecimen Management – Enabling robust acquisition, innovative consent approaches, and advanced tracking and storage capabilities to enable ready access to human clinical specimens to advance both traditional and precision medicine R&D
- Innovative Partnerships – Partnerships spanning other biopharma companies, others in healthcare, technology partners and beyond to stimulate new approaches to rapidly understanding the efficacy and safety of medicines in development



Clinical Innovation seeks partners from all sectors with a shared interest in improving study start-up, enriching high-quality data collection, enhancing patient engagement, and supporting robust relationships with investigators. With hundreds of clinical trials at thousands of institutions around the world, Clinical Innovation links innovators with opportunities to impact the development of new medicines for patients. Please visit: http://www.pfizer.com/research/clinical_trials/clinical_innovation

Drug Safety

Pfizer's Drug Safety R&D group develops and applies the skills, experience and scientific tools necessary for safety assessment and risk management of targets and compounds across the research, development and commercial phases of drug development. We seek to enhance our capabilities for target safety assessment, selection of safer compounds, toxicity risk management and translation of preclinical models.

We are interested in establishing alliances to develop and access:

- Mechanisms, translatable and monitorable biomarkers, and screening approaches related to target organ toxicity
 - Cardiovascular safety including vascular injury and early detection of cardiotoxicity
 - CNS biomarkers including peripheral neuropathy
 - Liver injury in particular immune-mediated DILI and transporters
 - Immunostimulation, including hypersensitivity, autoimmunity, cytokine release
 - Nephrotoxicity – glomerular and tubular
 - Skeletal and cardiac muscle toxicity
 - Pancreatic toxicity
 - Ocular safety
 - Screening for abuse potential
- Animal models, biomarkers and screening approaches for preclinical immuno-oncology investigation, supporting mono- and combination-therapy approaches (interpretation and translatability)
 - Immune system components and responses comparability between preclinical species and human
- Biotherapeutics-related analytical technologies
 - Immunogenicity and other safety-relevant assays
 - Assays related to aggregation, subvisible particles
- 3D and complex models including stem cell approaches and microfluidics
- Deeper knowledge of targets and pathways
 - Knock-in, knock-out technologies
 - Novel technologies and increased throughput for target localization studies
- Safety biomarker technologies/enablers
 - Emerging platforms, including miRNA-based multiplex; analytical approaches
 - Academic collaborations to leverage annotated biofluid collections to understand target organ toxicities and enable clinical translation
- Advancing Regulatory Science
 - Systems pharmacology approaches for prediction of adverse events
 - Novel *in silico* modelling approaches for pro-arrhythmia detection

Not actively seeking partnering opportunities in:

- Genetox Screening
- hERG related assays
- *In vitro* screening models without significant validation

Gene Therapy

Gene therapy (GTx) has changed significantly with the discovery of novel AAV vectors that have the potential to be safe and more efficient than previous approaches. Pfizer is committed to leading in this space by bringing together the foremost expertise in vector design and development with in-house knowledge of disease biology and manufacturing capabilities. Our current collaboration with Spark Therapeutics Inc. on hemophilia, as well as the establishment of the Genetics Medicines Institute at Pfizer, led by Dr. Michael Linden, help to form the basis upon which we intend to continue building our gene therapy programs and capabilities. Toward that end, we are interested in creating additional relationships to build one of the leading gene therapy companies in the world.



With Pfizer's commitment to rare monogenic diseases, we also see gene therapy as a key pillar of our Rare Disease strategy. In addition we are interested in the application of gene therapy to select central nervous system (CNS) and heart diseases. Beyond expansion of our development portfolio, we seek to build our technical capabilities by partnering in the gene therapy space on novel vectors that can target the liver, brain, and heart. We are also seeking promoter technologies, as well as industry leading vector analytics and immune surveillance approaches.

We are interested in partnering to develop and access:

- Novel Targets in key areas of interest
 - Parkinson's Disease
 - Friedrich's Ataxia
 - Spinal Muscular Atrophy
 - Duchene's Muscular Dystrophy
 - Heart Failure
- Novel AAV vectors with strong tissue-specific tropism (CNS, liver, and heart) with favorable transduction/expression
- Promoter technology to ensure regulated and sustained tissue-specific gene expression
- Vector analytics to identify viruses with superior bioactivity
- AV immunology expertise to test/challenge existing hypotheses and develop more robust gene therapy products

Medicinal Chemistry

Pfizer's Worldwide Medicinal Chemistry core capabilities include small molecule design and associated functions including structural biology and computational chemistry, synthetic innovation and compound safety prediction. Our partnering strategy is designed to maintain and enhance these areas as well as generate new synergistic capabilities.

Pfizer is interested in establishing alliances to develop and access:

- Computational methods to integrate, manage, visualize, and mine large-scale compound-centric datasets from published literature and patents
- Technology to expand NCE target space – orally bioavailable and cell penetrable peptides, and non-Ro5 compounds
- Natural product synthetic biology and screening technologies
- Ion channel modulator design and screening technologies
- Membrane protein structural biology technologies and capabilities, including ion channels, GPCRs and solute carrier proteins
- Computational methods for quantitative affinity prediction and molecular dynamics simulation
- New high efficiency synthetic transformations and novel flow chemistry approaches
- Systems/chemical biology technologies enabling mechanism determination for phenotypic screening hits
- Bioinformatic approaches to define target selectivity
- CH activation chemistry
- Novel synthetic methodology to access small conformationally constrained multifunctional templates
- Novel strategies for enhancing permeability of poorly absorbed molecules
- Novel fragment or compound collections validated for protein-protein interaction targets
- Identification of and access to novel sub-nanomolar cytotoxic agents
- New chemistry to develop disease imaging agents (e.g., plaques/AD, beta cells/T2D, angiogenesis/cancer)
- Novel methodology and capabilities to enable ^{18}F chemistry
- Biophysical techniques to enable rapid state dependent ion channel screening
- Novel receptor mediated and transporter mediated tissue targeting strategies
- High content and *in silico* approaches to predict small molecule toxicity

Not actively seeking partnering opportunities in:

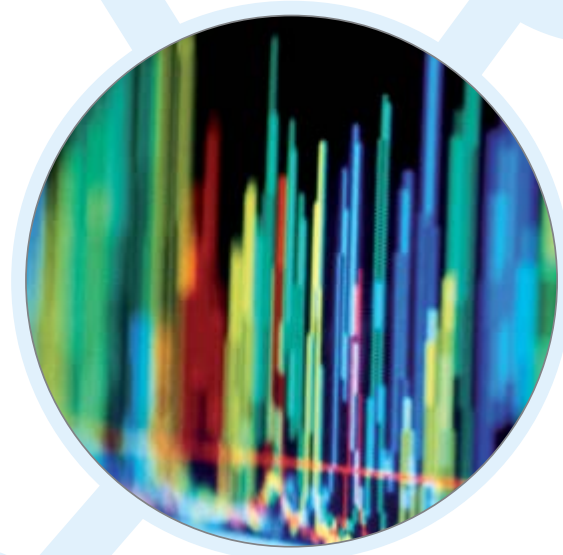
- *De novo in silico* approaches without wet lab experimental validation
- Compound libraries with a limited track record of finding hits

Pharmacokinetics, Dynamics & Metabolism (PDM)

Our PDM group is focused on development of innovative therapies through an improved understanding of targets, pathways and modeling for preclinical efficacy, and discrete toxicity. We will pursue collaborations to enhance physiological relevance of pharmacological endpoints, biomarkers/biomeasures and metabolomics, systems pharmacology/PKPD, quantitative bioanalytics, prediction of transporter-mediated disposition, tissue targeting.

We are interested in establishing alliances to develop and access:

- Translational research – large and small molecule efforts
 - Translational modeling and simulation approaches, systems pharmacology/PK-PD, integrated with quantitative biomeasures; deeper knowledge of targets and pathways; and increased confidence in target and drug selection
 - Systems models of specific areas of toxicity, e.g., cardiovascular toxicity and application of PKPD to safety biomarker technologies increasing confidence in safety
 - Understanding and de-risking the influence of hepatic and renal uptake and clearance on toxicology in these organs – focus on disorders of bile production and bile acid transport
- Quantitative Bioanalytics, Biomarkers, Biomeasures, and Immunogenicity (ADA) Assays
 - Novel LC-MS/MS large molecule bioanalysis and automation techniques
 - Stable isotope labelled pulse chase studies with LC-MS/MS for measurement of target turnover
 - Flow cytometry, cellular imaging techniques (Amnis) for biomarkers and biomeasures, and highly multiparametric single cell analysis using mass cytometry (CyTOF)
- Development of a universal platform for cell-based neutralizing antibody assays
- Biocomparability: identification of critical attributes influencing PK and disposition
- Targeted and untargeted metabolomics and fluxomics
- Biotherapeutics bioanalytical capabilities across various modalities
- Next-generation of advanced intelligent high-throughput automation platforms for bioanalysis
- Alternative methodologies to analytical reagent generation, characterization and modification
 - Methods & reagents for high specificity ligand binding and affinity capture LCMS
- Disposition of Antibody-Drug Conjugates
 - Cellular and systemic fate of the conjugate and components
 - Quantification and prediction of pharmacokinetics



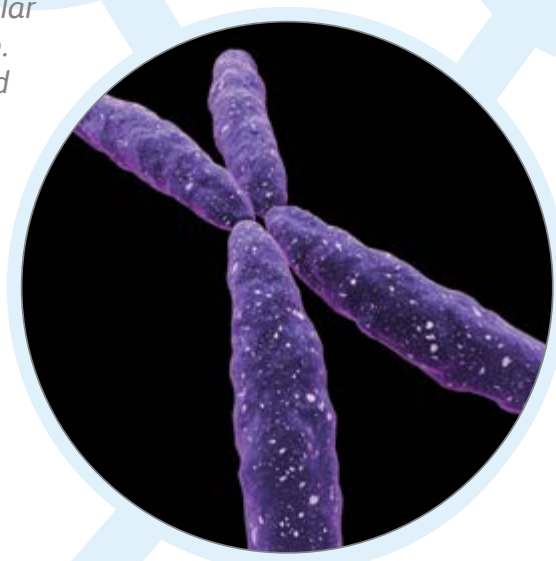
- Biodistribution of large molecules (drug and target) at whole organ and cellular level
 - Catabolism of large molecules (drug and target) at tissue level
- Disposition and delivery of therapies – large and small molecule efforts
 - Novel commercially viable delivery technologies (oral and non-oral)
 - Predictive tools and technologies targeting oral absorption and disposition of peptides
- Targeting, prediction and modeling of transporter-mediated disposition and DDIs – small molecules
 - Quantitation and scaling of transporters for input into physiological PK models of tissue penetration and clearance
 - Determination of intracellular unbound concentrations of transported drugs
 - Prediction and quantification of human transport mediated (e.g., biliary) clearance
 - Novel approaches to achieving selective tissue distribution
- Immunogenicity prediction – large molecules
 - *In silico* immune epitope prediction
 - *In vitro* drug-specific immune response (e.g., PBL stimulation; whole protein & epitope mapping; DC-T cell assays, Bcell response assays)
 - *Ex vivo* immune response and immune tolerance biomarkers
 - Models for predicting immunogenicity impact of product and treatment-related risk factors
 - ADA Clinical relevance predictors to include: ADA affinity measures and prediction of adverse events, e.g., infusion reactions
- Physiologically relevant *in vitro* assays
 - Methods for expanding cell numbers or stabilizing phenotypes of directly isolated primary cells (particularly from patients)
 - Robust, reliable *in vitro* differentiation protocols from human pluripotent stem cells for difficult to obtain cell types
 - Non-natural amino acid substitutions in target proteins to create novel screening readouts
 - Advances in human genome editing technologies for greater speed and efficiency and reduction of off-target effects
 - Advances in High Content Analysis cell based assays
- Endogenous gene reporter and genetically encoded biosensor models in human primary cells and stem cells
- Detection of tagged-protein at physiologically relevant concentrations in human cell based assays
- Visualization of drug interaction with targeted-protein within the cellular environment
- Quantification of cellular environment changes by biosensors
- Advances in 3D culture systems and high content analysis for metabolism, safety, distribution and pharmacology
- Novel expression approaches for functional expression of difficult gene families e.g., solute transporters
- *In vitro* Phenotypic Screening:
 - Novel deconvolution advances for *in vitro* phenotypic screening
 - Prediction of *in vitro* cellular phenotypic changes due to patient-derived single point mutation and genetic defects
 - Quantification of electro-physiologic measurement in plate cell based assays
 - Advances in single cell mass cytometry technology for phenotypic screening
- Optimizing Human ADME Properties and PK Prediction Capabilities
 - Novel technologies to enhance SAR for ADME properties utilizing chemical library, high-throughput *in vitro* assays coupled to LC-MS detection and computational models
 - Full complement of drug metabolism assays, including biotransformation and induction capabilities
 - Ability to conduct a suite of nonclinical studies to develop robust human PK prediction for routine and less common elimination pathways (AO, UGT, GST etc.,)
 - Integration *in vitro* and *in silico* PK data and mechanisms into PB-PK models to predict human plasma-time profiles for small and large molecules
 - Selection and deselection of monoclonal antibody drug candidates based on PK properties that are predictive of human PK by using a characterized human FcRn transgenic mouse model and allometric scaling
 - Prediction of routine and complex DDI involving CYPs and transporters

Precision Medicine

We are focused on Precision Medicine as an approach to discovering and developing medicines and vaccines that deliver superior outcomes for patients, by integrating clinical and molecular information to understand the biological basis of disease. This effort leads to better selection of disease targets and identification of patient populations that demonstrate improved clinical outcomes.

Pfizer is interested in establishing alliances to develop and/or access:

- Patient cohorts with high quality longitudinal molecular and phenotypic data and/or DNA and appropriately-consented, IRB-approved tissue samples in diseases of interest to Pfizer for
 - clinical trials
 - data mining
 - biomarker studies
 - genetic and pharmaco-genomic studies
- Systems Biology/Pharmacology
 - Databases with high quality treatment and disease outcomes associated with genetic, as well as molecular (metabolomic, proteomic, transcriptomic, epigenetic, clinical chemistry markers) or functional measures in particular imaging data
 - Databases of searchable eQTLs, pQTLs across tissues
 - Disease biology guided combination therapy design platforms
 - Systems biology approaches and proven *in silico* tools to evaluate pharmacological perturbation and elucidate mechanisms of *in vivo* toxicity
 - Mining of data for correlation and understanding of causality
- Breakthrough diagnostic technologies that also are highly quantitative, require minimal specimen/tissue, offer quick turnaround time and can be multiplexed. This will include but not limited to:
 - Near-patient Point-of-Care technologies
 - Next Generation Sequencing technologies
 - Circulating cells
 - Circulating and urinary cell-free nucleic acids
 - Antigen receptor sequencing
 - Microbiome, including virome characterization
- *In vivo* imaging technologies (including MRI, PET, CT, optical imaging technologies, imaging agents, genetically encoded tags, etc.,) with particular interest in
 - Imaging agents for small and large molecule compound distribution studies
 - Imaging agents monitoring physiology mechanisms and disease
 - Analytical tools and technologies
- Biospecimen Analysis
 - Circulating tumor cell and Nucleic Acid quantification and analysis
 - Multiplexed flow cytometry for leukocyte analysis
 - Automated IHC for tissue analysis (cancer, safety)
 - Advanced ADME – related genotyping
 - 3D cell models for safety and efficacy assessment that ideally incorporate genetic diversity
- Physiological Biomarkers
 - Technologies adding precision to pain management and treatment in pre-clinical and clinical studies
 - EEG-based biomarker for assessment of central pharmacology
- iPS cell resources and technologies to generate iPS cells that may be used to enable Precision Medicine strategies
 - Validated cell differentiation protocols
 - iPS cells derived from sub populations with specific genotypic/phenotypic data
 - Technology to create iPS cells in a rapid and reproducible fashion without insertional approaches



Small Molecule Product & Process Development

Our Pharmaceutical Sciences group envisions a network of partners to enhance active pharmaceutical ingredients (API) and drug product development and manufacturing of small molecules.

We are interested in establishing alliances to develop and access:

- **Computational Product and Process Design (CPPD)** – Complement and advance our experimentation and manufacturing processes with computational tools, including translating drug molecular structures to material properties *in silico*. Specific areas of interest include:
 - Computational models for process operations
 - Prediction of oral absorption in humans
 - Computational Chromatography
 - Multi-scale integrated modeling platform technologies for systems-based pharmaceuticals predictions and simulations
 - *In silico* design and screening of API synthetic pathways
 - Predictive science of stability, including structure-based stability prediction
- **Materials Sciences and Particle Engineering** – Development of molecular structure-based particle design and engineering tools that allow for the prediction and manipulation of crystal form/morphology, solid-state stability and material properties. Specific areas of interest include:
 - Computational Materials Science for particle engineering, including predicting crystallizability
 - Solid State Chemical Stability Prediction and Control
 - Delivery of API ensuring physical integrity during ensuing process operations
 - Particle engineering through directed assembly
- **Portable, Continuous, Miniature and Modular Development and Manufacturing Equipment** – Design and development of fit-for-purpose, small footprint, plug-and-play (modular) processing platforms, for drug product and/or API that allow the same equipment to be used for development and commercial manufacturing. Continuous/semi-continuous operation, rapid deployment, and rapid changeovers between products are cornerstone concepts that are being pursued. Desired state is for processing modules to be capable of manufacturing multiple products at a wide range of manufacturing scales and enable significant reduction in scale-up/tech transfer efforts.

■ **Innovative and Chemical Synthesis –**

Development of new platform syntheses that include sustainable/“green” chemical technologies and innovative chemical transformations. Specific areas of interest include:

- Replacement of endangered metal catalysts
- General methods for catalytic preparation of chiral amines
- General methods for “direct” amide formation

■ **Drug Delivery Technologies –** Advanced drug delivery technologies to enable differentiated therapies and the next generation of precision medicine. Specific areas of interest include:

- Tissue targeting of drugs to improve therapeutic index (e.g., brain delivery, tumor targeting, etc.,)
- Technologies to improve/monitor patient adherence/compliance
- Abuse-deterrent technologies
- Differentiated pediatric dosage forms that
 - 1) Neutralize or improve taste without affecting the pharmacokinetics for oral immediate-release products,
 - 2) use a “solids-based” platform (versus conventional liquids), and/or
 - 3) are enabled by use innovative dosing/administration aids

■ **Rapid Analytics –** Innovative analytical

platforms to enable real-time process understanding and/or control via on-line or at-line technology for Drug Product and Active Pharmaceutical Ingredients (API). Specific areas of interest include:

- Rapid, precise, robust, and integrated *in-situ* Process Analytical Technologies (PAT) for routine process monitoring and control
- 3-D mapping/imaging of drug products
- Real-time data integration from disparate sources

Innovative Partnering Models

Academic Partnerships

Pfizer currently supports numerous collaborative partnerships with researchers at world-class research institutions such as the University of California, Colorado, the University of Virginia, and Peking University among many others, and is seeking additional opportunities to collaborate in areas of strategic interest to Pfizer Research. We are committed to exploratory research and have empowered our External R&D Innovation team to seek opportunities to identify seed-stage investment opportunities to support early-stage technologies as they transition from the academic environment into new start-up companies that align with our core research interests. These investments complement our Pfizer Venture Investments activities and include recent funding of Neoantigenics and Circle Pharma.

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Centers for Therapeutic Innovation

The Centers for Therapeutic Innovation (CTI) facilitates authentic collaboration between Pfizer scientists and select academic medical centers, disease foundations, the National Institutes of Health. Pfizer has CTI labs in San Francisco, New York, Boston and San Diego. These state-of-the-art laboratories are populated with Pfizer scientists and post-docs who are creating and advancing novel therapeutics, with the goal of moving the therapeutics rapidly into first-in-human proof of mechanism studies.

CTI's research collaborators work side-by-side with Pfizer scientists in the discovery and development of new therapies for unmet medical needs.

Pfizer's CTI demonstrates the company's deep commitment to establishing close collaborations with leading academic medical centers, U.S. government agencies, and foundations to find new ways to translate ground-breaking research into important, new therapies for patients.

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Pfizer Venture Investments

Pfizer Venture Investments (PVI), the venture capital arm of Pfizer, invests in private companies in traditional venture capital syndicates. PVI also uses equity to support novel business structures such as consortium-based technology development (e.g., Ablexis), product out-licensing (e.g., Clovis Oncology) and business spinouts (e.g., Ziarco). Further, PVI invests in funds that offer geographic reach to provide a view into the development of healthcare and life sciences businesses in developing countries such as Africa, Brazil and China. PVI has an interest in working with others to explore new business models that can create value for all players in the healthcare/lifesciences ecosystem and ensure the continued development of therapeutics, technologies and services for all those whose medical needs are not being met.

Please visit www.pfizerventureinvestments.com

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Open Innovation Portal

Working with Pfizer Worldwide Innovation, WRD has established a web-based Open Innovation (OI) portal to attract breakthrough ideas from external partners to tackle some of the scientific and technological challenges in our drug discovery and development programs. By expanding our networks within academic and biotech sectors, our OI efforts are helping to identify new pre-clinical and early stage clinical partnering opportunities that can be supported through our novel collaboration models.

Visit the Pfizer Needs Gallery at <https://ninesights.ninesigma.com/web/pfizer-gallery> to find some of our most immediate partnering needs.

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ERDI Global Scouting

The Global Scouting team is composed of skilled scientists with pharmaceutical and biotechnology research experience, working to support Pfizer's global research interests by scouting for collaborative relationships with both academic and biopharmaceutical partners. These scientists are deployed globally to ensure Pfizer is an active participant in regional scientific discussions helping us to closely collaborate with our partners once relationships are established. By working with our 100+ Pfizer country organizations, we have built a strong international scouting network capable of connecting our R&D scientists to innovative opportunities around the world.

This team also directs the investment of a seed fund available to support collaborations with start-up companies founded by experienced entrepreneurs pursuing the commercialization of inventions that benefit patients and which closely align with Pfizer's research interests and portfolio.

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Biotherapeutics Discovery
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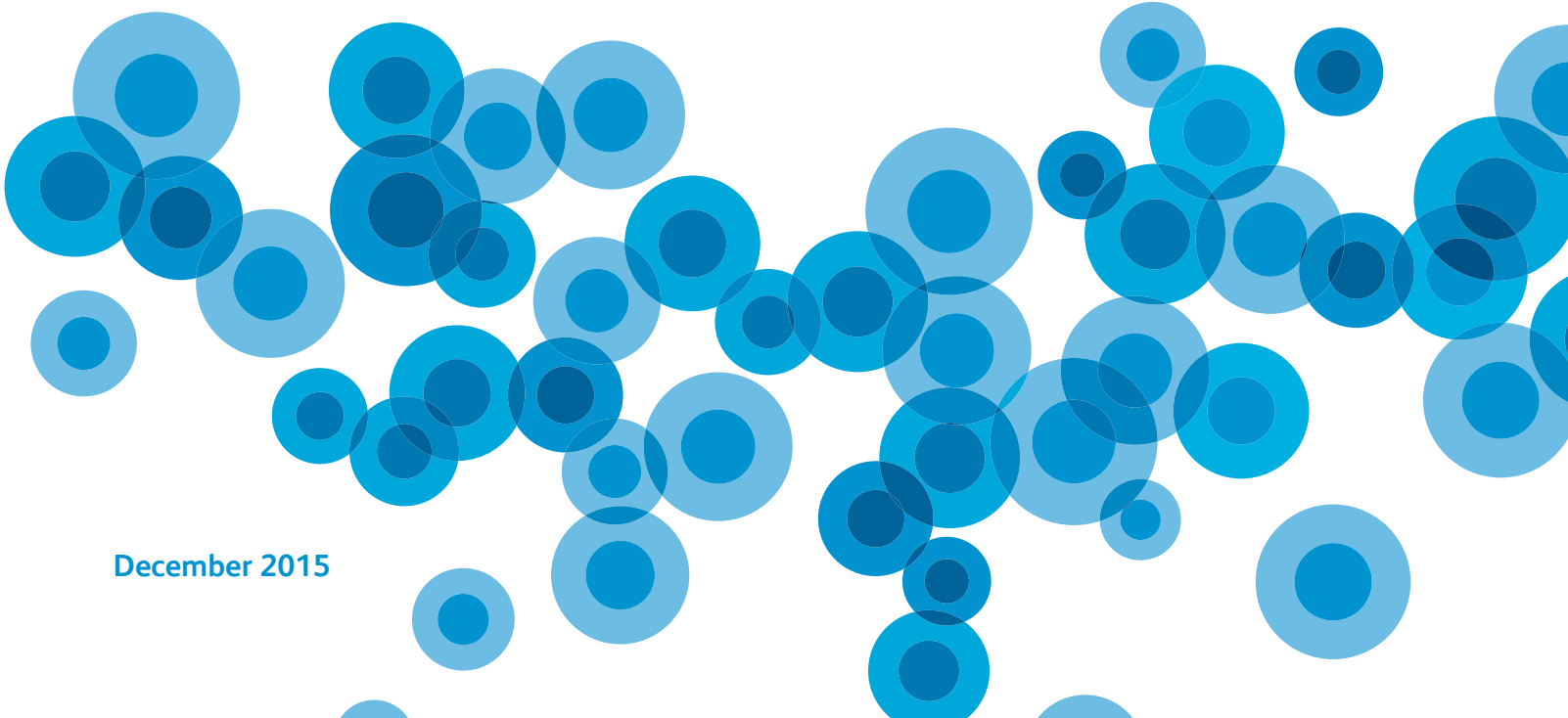
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