

One-stop piRNA Research Solutions for Advanced Diagnostic and Therapeutic Development



Contact Us

✉ info@protheragen.us

☎ 1-631-533-2057

🌐 www.protheragen.us/pirna-tech/

📍 101-4 Colin Dr, Holbrook, NY 11741, USA





Overview

About Protheragen 3

One-stop Solutions 4

piRNA Profiling & Detection 5

piRNA Biomarker Identification 7

piRNA Target Identification 8

piRNA-Based Therapeutic Development 9

piRNA-Based Diagnostic Development 11

Collaboration Opportunities 12

As a leading provider of piRNA research services, **Protheragen** is dedicated to accelerating discoveries in epigenetics, disease mechanisms, and therapeutic development. End-to-end solutions are provided by us, from high-throughput sequencing and biomarker identification to diagnostic and therapeutic development. By bridging foundational research with translational applications, we empower clients to unlock the transformative potential of piRNA biology.



Our Mission

To accelerate breakthroughs in piRNA biology by delivering precision research tools and translational solutions that bridge discovery, diagnostics, and therapeutics.



Our Vision

To become the global leader in piRNA-driven innovation, transforming scientific insights into clinically actionable diagnostics and targeted therapies for unmet medical needs.

Integrated piRNA Solutions: From Foundational Research to Translational Applications

piRNAs (Piwi-interacting RNAs) are a critical class of small non-coding RNAs that play essential roles in gene silencing, genome stability, and epigenetic regulation. Their unique functions in germline development, transposon control, and disease pathways make them promising targets for diagnostic biomarkers and next-generation therapeutics. To accelerate breakthroughs in this transformative field, **Protheragen** offers fully integrated piRNA research solutions that streamline the entire journey from mechanistic discovery to translational applications.

Research Services

To support researchers in exploring the potential of piRNAs, we offer comprehensive piRNA research services, from systematic profiling and biomarker discovery to functional characterization.

- piRNA High-Throughput Sequencing Service
- piRNA Array Service
- piRNA Chip Development Service
- piRNA Biomarker Identification Service
- piRNA Target Identification Service



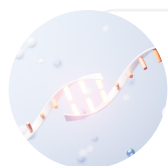
Development Services

piRNAs are emerging as powerful molecular tools with the potential to revolutionize modern medicine. Their unique properties make them ideal candidates for diagnostic and therapeutic development. Protheragen is focused on developing innovative piRNA-based diagnostics and therapeutics targeting cancer, infectious diseases and neurodegenerative diseases.

- piRNA-Based Therapeutic Development Service
- piRNA-Based Diagnostic Development Service



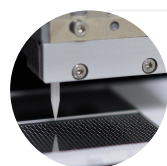
Comprehensive piRNA profiling represents the critical first step in unlocking their functional roles and therapeutic potential. Protheragen's cutting-edge detection services combine advanced technologies with deep bioinformatics expertise to deliver precise, reproducible data across diverse sample types. We offer multiple platform options to suit different research needs, from discovery-phase sequencing to targeted validation and custom solutions, all supported by our optimized small RNA analysis pipeline and dedicated technical guidance.



piRNA High-Throughput Sequencing Service

NGS-based high-throughput sequencing service provides the most complete view of piRNA populations, utilizing strand-specific sequencing to identify both known and novel piRNAs with single-nucleotide resolution.

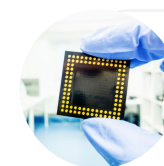
- Identifies novel piRNAs and isomiRs
- Detects low-abundance transcripts
- Compatible with challenging samples



piRNA Array Service

For focused, cost-effective profiling, our array service delivers highly reproducible quantification of curated piRNA panels. Featuring species-specific designs with rigorous QC controls, it enables efficient screening of large sample cohorts.

- 3x higher reproducibility than NGS
- Optimized for clinical sample profiling
- Rapid turnaround



piRNA Chip Development Service

Protheragen customizes piRNA chips following a rigorous development process, including probe design, performance validation, and bioinformatics analysis, making them ideal for high-throughput and cost-effective piRNA profiling.

- Multi-species customization
- High detection sensitivity and specificity
- Diversified application scenarios

Objective: To investigate the potential role of piRNAs in heart failure, we performed comparative profiling of exosomal piRNAs between heart failure patients and healthy volunteers.

Methods: Exosomes were isolated from serum samples of heart failure patients and healthy controls, followed by comprehensive characterization using electron microscopy, nanoparticle tracking analysis, and Western blot. RNA was then extracted from purified exosomes and subjected to high-throughput sequencing for transcriptome-wide piRNA profiling. Differential expression analysis and bioinformatics approaches were employed to compare piRNA signatures between groups.

Results: RNA sequencing and bioinformatics analysis revealed that 578 piRNAs were upregulated and 4,617 piRNAs were downregulated in patients with heart failure. Among these piRNAs, has-piR-020009 and has-piR-006426 were the most significantly downregulated.

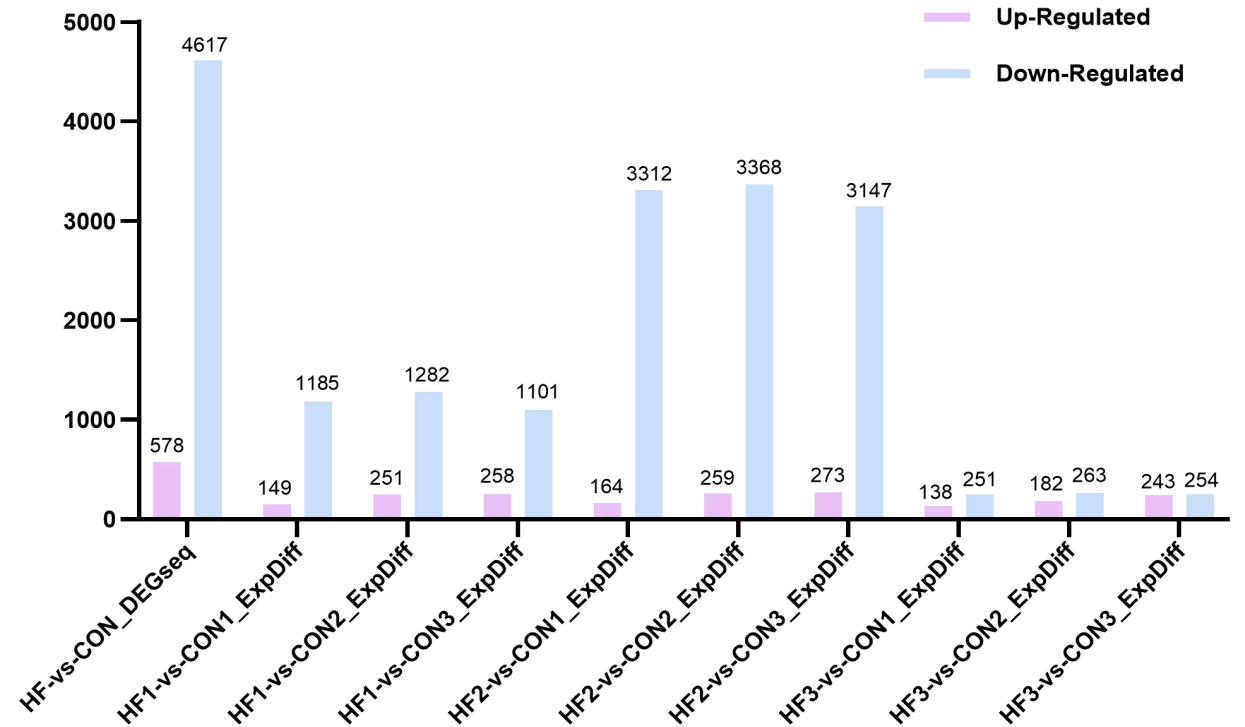


Fig.1 Differential expression of piRNAs. Overall, 578 piRNAs were upregulated and 4,617 piRNAs were downregulated in HF patients. When comparing individual samples, most piRNAs were downregulated in HF patients. (HF: heart failure; CON: control.)

piRNAs are considered ideal biomarker candidates due to their high tissue specificity and excellent stability. They have the potential to be used in early disease detection, precise disease subtyping, and real-time treatment monitoring. Currently, piRNA biomarkers have been applied to cancer screening, neurodegenerative disease tracking, and cardiometabolic risk prediction.

Service Workflow

At **Protheragen**, we provide piRNA biomarker identification services, aiming to accurately discover and validate disease-specific piRNA signatures from tissues or body fluids (*e.g.*, serum, cerebrospinal fluid, urine) for early diagnosis, prognosis, and treatment monitoring. Combining NGS-based discovery, qPCR validation, and multi-omics integration, we deliver clinically actionable biomarkers with superior sensitivity and specificity.



Sample
Preparation



High-Throughput
Sequencing



Bioinformatics
Analysis



Experimental
Validation

Multiple Disease Research

Our scientists identify piRNA biomarkers for a variety of diseases, including but not limited to the following:

- **Cancer:** Breast cancer, prostate cancer, colorectal cancer, lung cancer, gastric cancer, ovarian cancer, *etc.*
- **Neurodegenerative Diseases:** Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis, *etc.*
- **Reproductive System Diseases:** Infertility, endometriosis, polycystic ovary syndrome, *etc.*
- **Metabolic and Cardiovascular Diseases:** Diabetes mellitus, atherosclerosis, hypertension, *etc.*

piRNAs have emerged as extraordinary therapeutic targets for many prominent diseases, such as cancer, neurological and reproductive disorders, viral infections, cardiovascular diseases, and even metabolic disorders. Researchers could target certain piRNAs to develop novel therapeutics. **Protheragen** uses modern technology to provide efficient piRNA target identification services that allow researchers to investigate the therapeutic possibilities and molecular mechanisms of piRNAs.

- ◇ **piRNA Profiling:** High-throughput sequencing, microarray analysis, qubit fluorometry, spike-in controls, annotation, *etc.*
- ◇ **Target Prediction:** Computational prediction tools (*e.g.*, miRanda and TargetScan), Ping-Pong cycle analysis, crosslinking data integration, machine learning, functional enrichment, *etc.*
- ◇ **Target Validation:** Luciferase reporter assays, RNA immunoprecipitation, gene editing knockout, qRT-PCR, Western blot, cell proliferation/apoptosis assays, *etc.*
- ◇ **Data Analysis:** Statistical analysis (*e.g.*, DESeq2/edgeR and Cytoscape), gene set enrichment analysis, survival analysis, multi-omics integration, *etc.*



As a therapeutic agent, piRNA boasts unique advantages such as high target specificity, epigenetic regulatory capabilities, and exceptional stability. At **Protheragen**, we offer piRNA-based therapeutic development services that leverage proprietary design algorithms, clinical-grade delivery systems, and validated preclinical models to overcome critical development challenges, expediting your journey from target identification to IND application research.



Target Identification: Pinpoint high-value mRNA targets using our multi-omics validated pipelines.



piRNA Design: Engineer optimal piRNA sequences using AI-driven computing platform for maximal on-target activity.



Chemical Modification: Enhance stability and PK/PD through optimized nucleotide modifications.



Delivery System Optimization: Tailor LNPs or exosomes for tissue-specific delivery (*e.g.*, brain-targeting formulations).



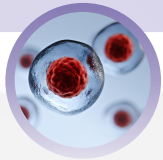
***In Vitro* and *In Vivo* Validation:** Validate efficacy in disease-relevant models (PDX, organoids, NHP).



IND-Enabling Studies: Conduct comprehensive preclinical safety and manufacturing studies for clinical transition.

Targets	Biological Role	Associated Disorders
piR-54265	Silences oncogenic KRAS mutations	Pancreatic/Colorectal Cancers
piR-017645	Inhibits PARP1-mediated DNA repair	BRCA1/2-deficient breast cancer
piR-823	Regulates DNA damage repair in neurons	Alzheimer's/Parkinson's
piR-012887	Reduces C9orf72 repeat expansion toxicity	ALS/FTD
piR-36712	Suppresses HBV cccDNA replication	Chronic Hepatitis B
piR-004153	Binds HIV-1 integrase mRNA	HIV/AIDS
piR-019324	Targets SARS-CoV-2 ORF1a replication frame	COVID-19
piR-19066	Maintains spermatogenesis integrity	Male Infertility
piR-20365	Modulates insulin receptor splicing	Type 2 Diabetes

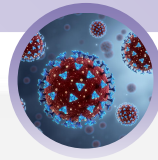
Due to its unique ability for precise gene expression regulation and targeting pathogenic RNAs, piRNA has demonstrated exceptional therapeutic potential in the realms of cancer, infectious diseases, and neurodegenerative disorders. For these pivotal disease areas, **Protheragen** offers end-to-end piRNA therapeutic development services, leveraging our expertise in target design, delivery optimization, and translational development to advance novel RNA therapeutics.



Cancer Therapy Development

By silencing oncogenic piRNAs and restoring tumor suppressor functions, we carefully design piRNA drugs and integrate them with customized delivery systems to ensure high specificity and precise tumor targeting.

- piRNA Inhibitor Development
- piRNA Mimic Development



Infectious Disease Therapy Development

Targeting multiple pathogens, we strategically design piRNA therapeutics to degrade viral RNA genomes, silence antimicrobial resistance genes, and disrupt essential parasite transcripts.

- Antiviral piRNA Development
- Antimicrobial piRNA Development
- Antiparasitic piRNA Development



Neurodegenerative Disease Therapy Development

Protheragen customizes piRNA-based therapies to target multiple pathological pathways involved in neurodegenerative diseases.

- Protein Misfolding Inhibitor Development
- Excitotoxicity Inhibitor Development
- Anti-inflammatory piRNA Development
- Antioxidant piRNA Development

piRNAs have emerged as highly stable, tissue-specific biomarkers with exceptional potential for disease diagnosis. **Protheragen** specializes in developing piRNA-based precision diagnostic solutions across multiple therapeutic areas, including oncology, neurology, infectious diseases, genetic diseases, metabolic disorders, and more.



piRNA Detection Kit Development

Protheragen develops high-sensitivity piRNA detection kits for research use, utilizing qPCR and NGS-based technologies. Our kits are optimized for diverse sample types (serum, plasma, FFPE), delivering reliable and reproducible results.



piRNA Point-of-Care Testing (POCT) Development

Focusing on designing rapid, portable POCT products, we aim to make piRNA diagnostics available at the point of care, whether it is bedside, clinic or field location. These easy-to-use tools allow instant decision making and real-time detection.



piRNA Companion Diagnostic Development

The service intends to integrate piRNA biomarkers into the clinical decision-making systems. Our companion diagnostic solutions are aimed at augmenting the effectiveness of therapeutic interventions and formulating personalized therapeutics.

// Collaboration Opportunities

At **Protheragen**, we provide end-to-end piRNA solutions from biomarker discovery to therapeutic and diagnostic development, empowering breakthroughs in precision medicine. Whether you're exploring novel piRNA biology, developing targeted therapies, or advancing clinical diagnostics, our integrated platforms, disease-specific expertise, and regulatory-ready pipelines accelerate your path to success.

Customized Solutions



- piRNA Profiling & Detection
- piRNA Biomarker and Target Identification
- piRNA-Based Therapeutic Development
- piRNA-Based Diagnostic Development

Our Advantages



Innovative
Platform



Rich
Expertise



Customized
Solutions



Trusted
Partner

Your Trusted piRNA Research Partner for Cutting-edge Diagnostic and Therapeutic development



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