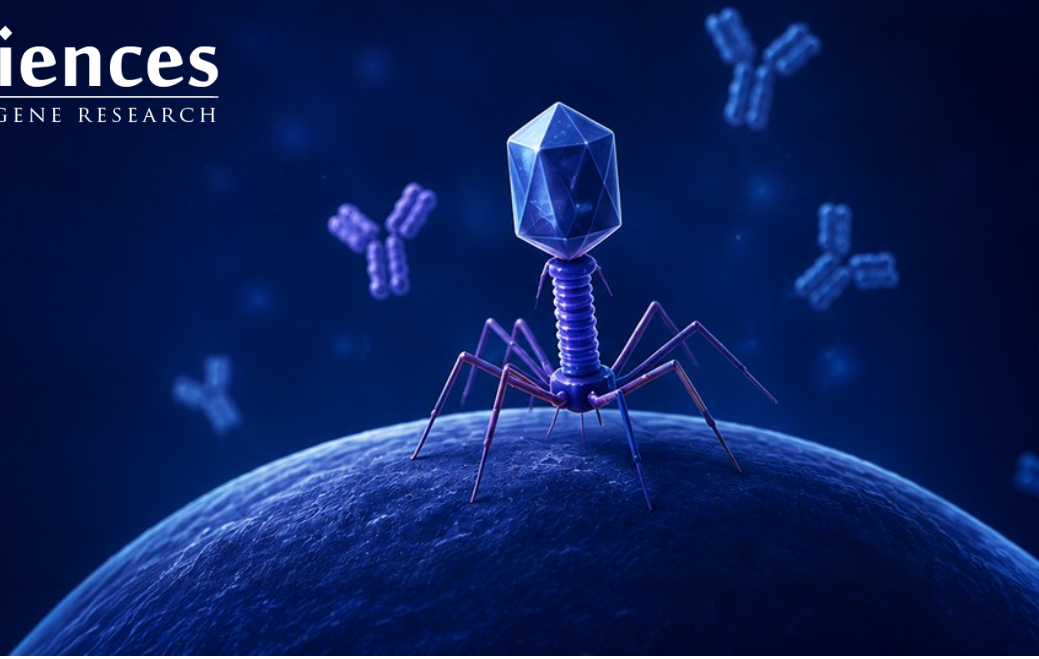




PUBLICATIONS & SCIENTIFIC IMPACT

Peer-Reviewed Literature • Patents • Government Research • Keynote Presentations

A curated portfolio of research enabled by Rx Biosciences technologies, custom library platforms, antibody engineering, and molecular discovery services.

62+

CITATIONS & PUBLICATIONS

9+

GOVERNMENT AWARDS & POS

100%

CUSTOMIZED R&D SOLUTIONS

Global

ACADEMIC & INDUSTRY PARTNERS

YOUR PARTNER IN GENE RESEARCH



SCIENTIFIC IMPACT

Advancing Research Through Innovation

For more than two decades, Rx Biosciences has partnered with pharmaceutical companies, biotechnology firms, academic institutions, and government agencies to accelerate discovery in antibody engineering, display technologies, genomic libraries, and molecular biology. **Our technologies and research have contributed to peer-reviewed publications, patents, government-funded programs, and commercial discovery projects worldwide.**

RESEARCH PLATFORMS

- Phage Display
- Yeast Display
- Ribosome Display
- Nanobody Discovery
- Affinity Maturation
- Antibody & Protein Engineering
- Custom Peptide Libraries
- BAC, Fosmid & Genomic Libraries
- cDNA & Normalized Libraries
- Next Generation Sequencing

SELECTED COLLABORATIONS

- Shire Pharmaceuticals
- Elstar Therapeutics
- Vanderbilt University
- Ossianix
- Glycobia
- MorNuco
- U.S. FDA
- National Institutes of Health
- U.S. Department of Defense
- U.S. Department of Agriculture

JOURNALS & SCIENTIFIC OUTLETS

Nature Signal Transduction and Targeted Therapy • Nature Microbiology • Nano Letters • Molecular Ecology • PLoS ONE • Journal of Experimental Botany • Journal of the American Heart Association • Gene Therapy • BMC Genomics • BMC Evolutionary Biology • Mycologia • Theoretical and Applied Genetics • RSC Advances • Journal of Heredity



PORTFOLIO 01

Phage & Surface Display Library Construction & Screening

Antibody discovery, peptide selection, nanobody engineering, affinity maturation, and partner programs.

01 Microscale BioMEMS & Nanoscale Biomimesis

Kellye Cung (2014)

Doctoral Dissertation, Princeton University • Dept. of Chemical & Biological Engineering

04 Biotemplated Synthesis of PZT Nanowires

Kellye Cung, Booyeon J. Han, Thanh D. Nguyen, Sheng Mao, Yao-Wen Yeh, Shiyong Xu, Rajesh R. Naik, Gerald Poirier, Nan Yao, Prashant K. Purohit, Michael C. McAlpine (2013)

Nano Letters • Vol. 13, pp. 6197-6202

02 SR-A and SREC-I binding peptides increase HDAd-mediated liver transduction

P. Piccolo, P. Annunziata, P. Mithbaokar, N. Brunetti-Pierri (2014)

Gene Therapy • Vol. 21(11), pp. 950-957 • PMC4224584

05 Muscle Gene Therapy: Methods and Protocols (In vitro ligand synthesis)

Ed. Dongsheng Duan (2011)

Methods in Molecular Biology • Vol. 709, Cold Spring Harbor Press

03 A novel peptide specifically binding to VEGF receptor suppresses angiogenesis in vitro and in vivo

Yuan Zhang, Bifang He, Kun Liu, Lin Ning, Delun Luo, Kai Xu, Wenli Zhu, Zhigang Wu, Jian Huang & Xun Xu (2017)

Nature / Signal Transduction and Targeted Therapy • Vol. 2, Article 17010

06 Generation of Chicken scFv Library Against Alternaria Allergen Extract

Rx Biosciences LLC • FDA Award No. HHSF223201410228A

FDA Contract Award Highlights

Constructed an scFv library from immunized chicken bone marrow and spleen; isolated 20 unique antibodies and characterized candidates by ELISA and Biacore.

PORTFOLIO 01 CONTINUED

Phage & Surface Display - Applied Discovery Programs

07 Construction of Bi-Specific Mouse TER119 scFv Recombinant Monoclonal Antibody Maturation

Rx Biosciences LLC • DOD / US Army Award No. W81XWH-14-P-0615 [DOD Research Grant Highlights](#)

TER119/Ly76 scFv antibody constructed from database sequences; CDR regions randomized and screened against mouse RBC target, yielding five high-affinity antibodies.

10-12 Human scFv Phage & Yeast Display Antibody Libraries

Rx Biosciences LLC • Partner: Elstar Therapeutics

[Contract Research Highlights](#)

Constructed human scFv phage and yeast display libraries and conducted human scFv library screening.

08 Construction of Mosquito Sporozoites cDNA Phage Display Library in T7 Vector

Rx Biosciences LLC • NIH / HHS Award No. HHSN272201600053P [NIH Contract Award Summary](#)

Constructed and characterized T7 phage displaying mosquito sporozoites-specific cDNA.

13 Construction of Human scFv Library for HIV Neutralization

Rx Biosciences LLC • Partner: Vanderbilt University

[Academic R&D Partnership](#)

09 Construction, Screening & Characterization of IgGA1 and IgGA2 Fab and scFv Libraries

Rx Biosciences LLC • Partner: Shire Pharmaceuticals

[Industry Collaboration](#)

Prepared scFv and Fab libraries from immunized llama PBMCs; performed protein-, cell-, and flow-cytometry biopanning; delivered 48 positive clones and validated the top 10.

14 Affinity Maturation of Human Antibody by CDR Randomization

Rx Biosciences LLC • Partner: MorNuco

[Biopanning & Biacore Characterization](#)

PORTFOLIO 01 CONTINUED

Phage & Surface Display - Nanobody & Affinity Engineering

15 CDR 3 Size Selected IgNAR V Nanobody Library Production

Rx Biosciences LLC • Partner: Ossianix

Nanobody Platform Engineering

Produced 10 IgNAR V nanobody libraries containing randomized CDRs of variable lengths (8 to 18 amino acids).

17 IgNARV Nanobody Library for Glycosylated Protein Targets

Rx Biosciences LLC • Partner: Glycobia

Target Binder Isolation**16 New Antigen Receptor (NARV) Nanobodies: New Promise for Therapeutic Antibodies**

Qazi A. Hamid (2018)

Science Documents • Vol. 01, Issue 01, January 2018

CAPABILITY SPOTLIGHT

Human and animal scFv libraries • Llama Fab/scFv • IgNAR nanobodies • CDR engineering • protein-, cell-, and flow-cytometry screening



PORTFOLIO 02

Normalized & Subtracted cDNA Library Construction & Screening

Transcriptomics, miRNA target discovery, expression profiling, genomic DNA isolation, and normalized library applications.

18-20 MISSION® Target ID Library for Human miRNA

Target ID and Discovery

Sigma Chemical Company / Sigma-Aldrich [Coussens M.J., Forbes K., Kreader C., Sago J., Cupp C., Swarthout J.] (2011-2012)

Biowire Fall 2011 & Journal of Visualized Experiments (JoVE), (62), e3303

23 Coccidian Merozoite Transcriptome Analysis from *Eimeria maxima*

Ryan S. Schwarz, Raymond H. Fetterer, George H. Rosenberg, Katarzyna B. Miska (2010)

Journal of Parasitology • Vol. 96(1), pp. 49-57

21 Identification of genes associated with shell color in the black-lipped pearl oyster, *Pinctada margaritifera*

Sarah Lemer, Denis Saulnier, Yannick Gueguen, Serge Planes (2015)

BMC Genomics • Vol. 16(1): 568

24 Development of an *Adonis aestivalis* expressed sequence tag population as a resource for genes

Li, R., Links, M.G., Gjetvaj, B., Sharpe, A., Hannoufa, A. (2008) **Genome**

• Vol. 51(11), pp. 888-896 • EST Library

22 Computational annotation of genes differentially expressed along olive fruit development

Giulio Galla, Gianni Barcaccia, Angelo Ramina, Silvio Collani, Fiammetta Alagna, Luciana Baldoni, Nicolò GM Cultrera, Federico Martinelli, Luca Sebastiani, Pietro Tonutti (2009)

BMC Plant Biology • Vol. 9:128

25 Identification and characterization of *tac5*, a telomerase activation mutant in *Arabidopsis thaliana*

Madhuri Jasti (2007)

Thesis: Texas A&M University • Acknowledged as Virotech International, former name of Rx Biosciences

PORTFOLIO 02 CONTINUED

cDNA, Transcriptomics & Gene Expression Applications

26 Identification of genes associated with cold acclimation in blueberry using subtractive hybridization

Dhananjay Naik, Anik L. Dhanaraj, Rajeev Arora, Lisa J. Rowland (2007) **Plant Science • Vol. 173, pp. 213-222**

29 Individuazione e profilo di espressione di geni coinvolti nello sviluppo del fiore

Dipartimento di Produzioni Vegetali (2009)

Acta Italus Hortus • Vol. 1, pp. 94-98 • cDNA Library

27 Gene expression profiling of Rhizoctonia solani AG 4 reveals putative virulence factors

Dilip K. Lakshman, Nadim Alkharouf, Daniel P. Roberts, Savithiry S. Natarajan, Amitava Mitra (2012)

Mycologia • Vol. 104(5), pp. 1020-1031 • Normalized cDNA Library

30 Methadone Blockade of Cardiac Inward Rectifier K⁺

Current Augments Membrane Instability

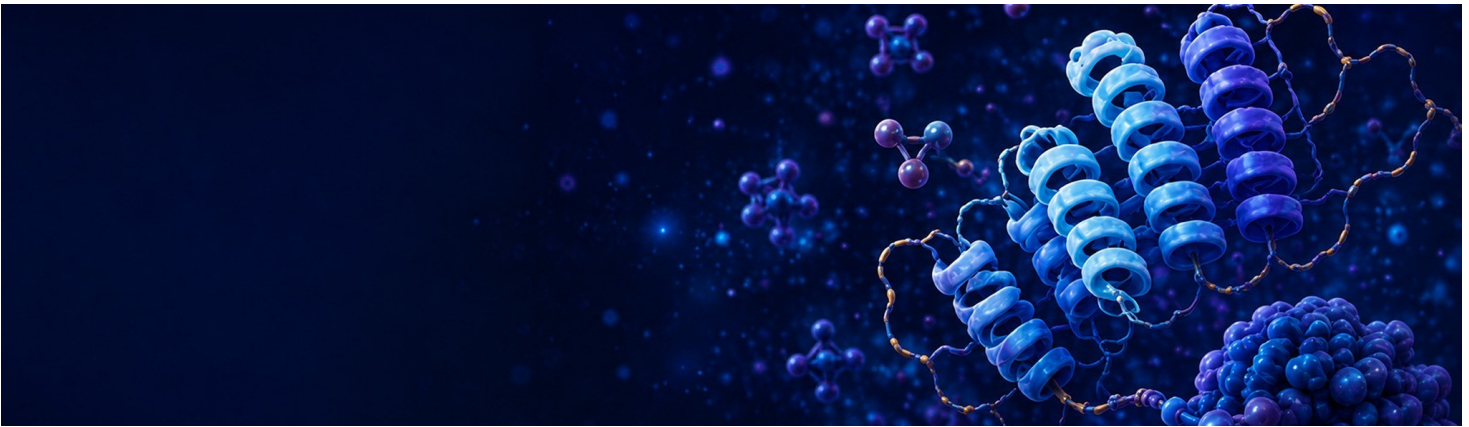
Michael G. Klein, Mori J. Krantz, Naheed Fatima, Ashlie Watters, Dayan Colon-Sanchez, Robert M. Geiger, Robert E. Goldstein, Soroosh Solhjoo, Philip S. Mehler, Thomas P. Flagg, Mark C. Haigney (Jun 2022)

Journal of the American Heart Association • Vol. 11: e023482

28 An SNP within ACE Distinguishes between Sprint and Distance Performing Alaskan Sled Dogs

Heather J. Huson, Alexandra M. Byers, Jonathan Runstadler, Elaine A. Ostrander (2011)

Journal of Heredity • Vol. 102(S1): S19-S27 • Genomic DNA Isolation



PORTFOLIO 03

BAC, Cosmid & Fosmid Genomic DNA Libraries

Custom genomic library construction and screening supporting plant, animal, evolutionary, and anti-phage research.

31 Intragenic homogenization and multiple copies of prey-wrapping silk genes in *Argiope* garden spiders

R. Crystal Chaw, Yonghui Zhao, Jie Wei, Nadia A. Ayoub, Ryan Allen, Kirmanj Atrushi, Cheryl Y. Hayashi (2014)
BMC Evolutionary Biology • Vol. 14: 31

34 Identification of a Differentially Expressed TIR-NBS-LRR Gene in Leaf Rust Resistance in *Salix*

Tom Martin, Ann-Christin Rönnberg-Wästljung, Jan Stenlid, Berit Samils (2016)
PLoS ONE • Vol. 11(12): e0168776 • Custom BAC Library Construction

32 Local interspecies introgression is the main cause of extreme levels of intraspecific differentiation in mussels

Fraïsse C., Belkhir K., Welch J.J., Bierne N. (2015)
Molecular Ecology • Vol. 24(16), PMID: 26137909

35-39 Cloning and Exploitation of Functional R-Gene from *Solanum x edinense* / *Phytophthora* Resistance Genes

Jacobus Hubertus Vossen, Kwang Ryong Jo, Richard Gerardus Franciscus Visser (2008-2015)
WIPO Patent WO/2011/152722 & US Patents CA2961553A1 • BAC Library Screening

33 Draft genome sequence of the rubber tree *Hevea brasiliensis*

Ahmad Yamin Abdul Rahman et al. (2013)
BMC Genomics • Vol. 14: 75 • Custom BAC Library Construction & Screening

36 Functional analysis of developmental control genes in California poppy (*Eschscholzia californica*)

Matthias Lange (2010)
Ph.D. Thesis: Universität Bremen, Germany • Custom BAC Library

PORTFOLIO 03 CONTINUED

Genomic Library Research, Patents & Screening

41 The *Solanum demissum* R8 late blight resistance gene is an Sw-5 homologue deployed worldwide

Jack H. Vossen, Gert van Arkel, Marjan Bergervoet, Kwang-Ryong Jo, Evert Jacobsen, Richard G.F. Visser (2016)

Theoretical and Applied Genetics • Vol. 129, pp. 1785-1796

43 & 45 A functional selection reveals previously undetected anti-phage defence systems in the *E. coli* pangenome

Christopher N. Vassallo, Christopher R. Doering, Megan L. Littlehale, Gabriella I.C. Teodoro, Michael T. Laub (2022)

Nature Microbiology • Vol. 7, pp. 1568-1579 & bioRxiv • Fosmid Library Construction

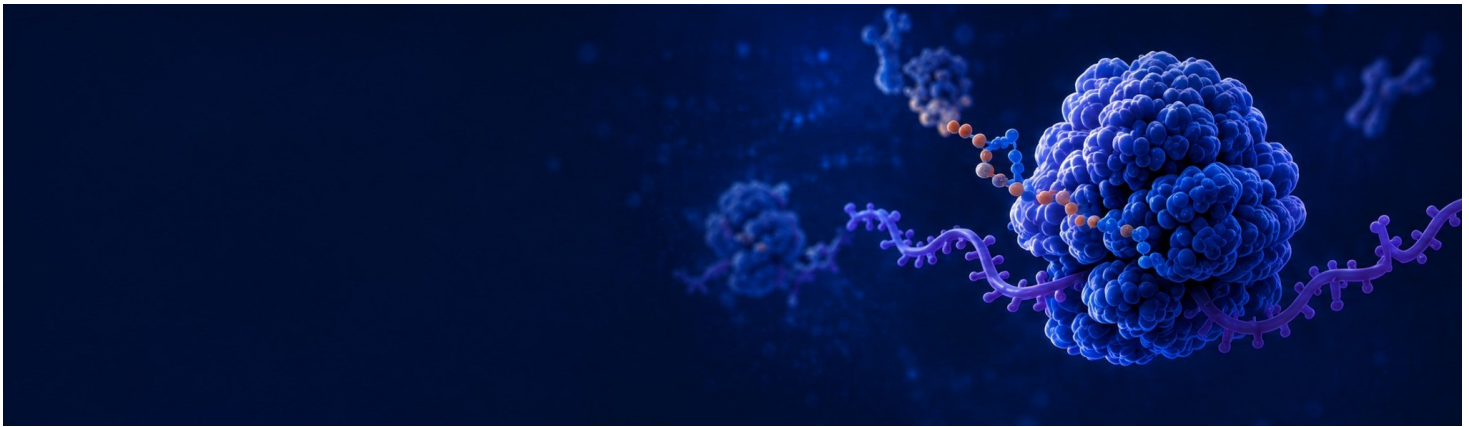
42 Detecting Selection in Natural Populations: Making Sense of Genome Scans

Christelle Fraïsse, Khalid Belkhir, John J. Welch, Nicolas Bierne (2015) **Molecular Ecology • DOI: 10.1111/mec.13299 • BAC Library Construction**

44 Two wrongs make a right: heat stress reversion of a male-sterile *Brassica napus* line

Petra Schuhmann, Carina Engstler, Kai Klöpfer, Irene L. Gügel, Amine Abbadi, Felix Dreyer, Gunhild Leckband, Bettina Bölter, Franz Hagn, Jürgen Soll (2022)

Journal of Experimental Botany • Vol. 73(11), pp. 3531-3551 • Next Generation Sequencing



PORTFOLIO 04

Peer-Reviewed Studies Acknowledging Rx Biosciences Products

Additional studies, patents, and doctoral research that cite or acknowledge Rx Biosciences products and technologies.

46 Starting from scratch: Step-by-step development of diagnostic tests for SARS-CoV-2 detection by RT-LAMP

Tapia-Sidas D.A. et al. (2023)

PLoS ONE • e0279681

49 & 53 Intranasal delivery of quercetin-loaded mucoadhesive nanoemulsion for cerebral ischaemia & UPLC-MS/MS studies

Ahmad N. et al. (2018)

Artificial Cells, Nanomedicine and Biotechnology & Current Pharmaceutical Analysis

47 Prevalence of zoonotic species of *Campylobacter* in broiler chicken and humans in Assiut governorate, Egypt

Abushahba M.F.N. et al. (2018)

Poult. Dairy Vet. Sci.

50 Sorption of Cobalt (II) Ions from Aqueous Solutions Using Modified Chitosan

Al-Shahrani H. et al. (2018)

Global NEST Journal • 20(3), 620-627

48 Dysregulated piRNAs in head and neck squamous cell carcinoma

Saad M.A. et al. (2019)

Oncology Letters • 18, 2615-2622

51-56 Series of studies on self-nanoemulsifying drug delivery systems, glycyrrhizic acid nanoparticles, and curcumin nanoemulsions

Ahmad N. et al. (2017-2020)

RSC Advances, 3 Biotech, Drug Research

SCIENTIFIC IMPACT

Additional Citations & Why Researchers Choose Rx Biosciences

A final set of acknowledgments followed by a concise view of Rx Biosciences' research value proposition.

57 Competitive probes for engineering signal generation

Patent (2019)

US Patent US20190233882A1

58 Evolution of metal and peptide binding in the S100 protein

Wheeler L.C. (2017)

Ph.D. Dissertation, University of Oregon

WHY RESEARCHERS CHOOSE RX BIOSCIENCES

20+ YEARS

Scientific expertise

END-TO-END

Library to lead characterization

GLOBAL

Industry, academia & government

SCIENTIFIC LEADERSHIP

Rx Biosciences scientists have delivered keynote presentations on antibody engineering and display technologies at international conferences, highlighting advances in therapeutic antibodies, phage display, and molecular discovery platforms.

SELECTED PUBLICATION OUTLETS

Nature Microbiology • Nature / Signal Transduction and Targeted Therapy • Nano Letters • Molecular Ecology • PLoS ONE • Gene Therapy • BMC Genomics • Journal of Experimental Botany • Journal of the American Heart Association • Theoretical and Applied Genetics

PORTFOLIO 05

U.S. Government Issued Grants, Contracts & Purchase Orders

Selected awards and purchase orders supporting custom research and library development programs.

AWARD DATE	GOVERNMENT AGENCY / INSTITUTION	CONTRACT / PURCHASE ORDER ID
Sep 19, 2014	Medical Command (DOD - US Army)	W81XWH14P0615
Sep 04, 2014	Food and Drug Administration (HHS - FDA)	HHSF223201410228A
Aug 13, 2013	National Institutes of Health (HHS - NIH)	HHSN272201300849P
Sep 22, 2010	Northeast Area (USDA - ARS - FRIID)	AG2328PO10A0113
Aug 17, 2009	Pacific West Area (USDA - ARS - FRIID)	AG81J8PO9SH01
Aug 21, 2008	Southeast Area (USDA - ARS - FRIID)	AG4431P08HV144
Jan 23, 2008	Northeast Area (USDA - ARS - FRIID)	AG3K47P080023
Aug 20, 2007	Northeast Area (USDA - ARS - FRIID)	AG3K84P07HS033
Mar 05, 2007	Northeast Area (USDA - ARS - FRIID)	AG3K843K84JWCC7395

KEYNOTE CONFERENCE PRESENTATIONS

60 Therapeutic antibodies: Technology, applications and future prospects.

Keynote lecture at 5th International Conference on Food and Neurocognitive Diseases, Sultan Qaboos University (Nov 29-30, 2016).

61 Engineering Antibodies in Therapeutics and Diagnostics.

Keynote lecture at 4th International Conference on Food and Neurocognitive Diseases, Sultan Qaboos University (Nov 29-30, 2016).

62 New Frontiers in Phage Display Technology: From Drug Discovery to Delivery.

Keynote lecture at 2nd International Conference on Food and Neurocognitive Diseases, Sultan Qaboos University (Dec 10, 2014).



PROJECT CONSULTATION & ENQUIRIES

Turn Scientific Questions Into Discovery Programs

Custom display libraries, antibody engineering, molecular biology, and research services designed around your program.

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