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Dharmacon Publications

Dharmacon scientists take pride that their contributions to the scientific community go beyond research and development of experimental reagents. Below is a list of peer-reviewed publications from research performed at Dharmacon and external collaborations.

CRISPR-Cas9 genome engineering

1. Basila, M., M. L. Kelley, *et al.* Minimal 2'-O-methyl phosphorothioate linkage modification pattern of synthetic guide RNAs for increased stability and efficient CRISPR-Cas9 gene editing avoiding cellular toxicity. *PLoS One.* **12**, e0188593 (2017). doi: 10.1371/journal.pone.0188593
2. Strezoska, Ž., M. Perkett, *et al.* High-content analysis screening for cell cycle regulators using arrayed synthetic crRNA libraries. *J. Biotechnol.* **251**, 189-200 (2017). doi: 10.1016/j.jbiotec.2017.04.017
3. He, K., E. Chou, *et al.* Conjugation and evaluation of triazole-linked single guide RNA for CRISPR-Cas9 gene editing. *ChemBioChem.* DOI: 10.1002/cbic.201600320 (2016).
4. Kelley, M.L., Ž. Strezoska, *et al.* Versatility of chemically synthesized guide RNAs for CRISPR-Cas9 genome editing. *J. Biotechnol.* **233**, 74-83 (2016).
5. Anderson, E.M., A. Haupt, *et al.* Systematic analysis of CRISPR-Cas9 mismatch tolerance reveals low levels of off-target activity. *J. Biotechnol.* **211**, 56-65 (2015).
6. Barrangou, R., A. Birmingham, *et al.* Advances in CRISPR-Cas9 genome engineering: lessons learned from RNA interference. *Nucleic Acids Res.* **43**, 3407–3419 (2015).
7. Glemzaite, M., E. Balciunaite, *et al.* Targeted gene editing by transfection of in vitro constituted Streptococcus thermophilus Cas9 nuclease complex. *RNA Biology.* **12**, 1-4 (2015).

RNAi library screening

1. Stombaugh, J., A. Licon, *et al.* The Power Decoder Simulator for the Evaluation of Pooled shRNA Screen Performance. *J. Biomolecular Screening.* **20**, 965-75 (2015).
2. Freeley, M., E. Derrick, *et al.* RNAi Screening with Self-Delivering, Synthetic siRNAs for Identification of Genes That Regulate Primary Human T Cell Migration. *J. Biomolecular Screening.* **209**, 943-956 (2015).
3. Vermeulen, A., A. van Brabant Smith, *et al.* Pooled shRNA Screening. *Frontiers in RNAi.* **1**, 58-78 (2014).
4. Couts, K.L., E.M. Anderson, *et al.* Oncogenic B-Raf signaling in melanoma cells controls a network of microRNAs with combinatorial functions. *Oncogene.* **32**, 1959-1970 (2013).
5. Meliopoulos, V.A., L.E. Andersen, *et al.* Host gene targets for novel influenza therapies elucidated by high-throughput RNA interference screens. *The FASEB Journal.* **26**, 1372-1386 (2012).
6. Schoolmeesters, A., D.D. Brown, *et al.* Kinome-Wide Functional Genomics Screen Reveals a Novel Mechanism of TNFα-Induced Nuclear Accumulation of the HIF-1α Transcription Factor in Cancer Cells. *PloS One.* **7**, e31270 (2012).
7. Strezoska, Ž., A. Licon, *et al.* Optimized PCR Conditions and Increased shRNA Fold Representation Improve Reproducibility of Pooled shRNA Screens. *PloS One.* **7**, e42341 (2012).
8. Santhakumar, D., T. Forster, *et al.* Combined agonist-antagonist genome-wide functional screening identifies broadly active antiviral microRNAs. *P. Natl. Acad. Sci-Biol.* **107,** 13830-13835 (2010).
9. Zumbansen, M., L.M. Altrogge, *et al.* First siRNA library screening in hard-to-transfect HUVEC cells. *Journal of RNAi and Gene Silencing: an International Journal of RNA and Gene Targeting Research.* **6**, 354 (2010).
10. Kwan, P., A. Birmingham, *et al.* NoiseMaker: simulated screens for statistical assessment. *Bioinformatics.* **26**, 2484-2485 (2010).
11. Birmingham, A., L.M. Selfors, *et al.* Statistical methods for analysis of high-throughput RNA interference screens. *Nat. Methods.* **6**, 569-575 (2009).
12. K.J. Simpson, L.M. Selfors, *et al.* Identification of genes that regulate epithelial cell migration using an siRNA screening approach. *Nat. Cell Bio.* **10**, 1027-1038 (2008).
13. Kolokoltsov, A.A., D. Deniger, *et al.* Small interfering RNA profiling reveals key role of clathrin-mediated endocytosis and early endosome formation for infection by respiratory syncytial virus. *J. Virol.* **81**, 7786-7800 (2007).
14. Boese, Q.F., D. Samarsky, *et al.* siARRAY reverse transfection format (RTF): a rapid method for RNAi-based high-throughput studies of biological pathways. *Nat. Methods Application Notes.* **1**, (2006).
15. Hsieh, A.C., R. Bo, *et al.* A library of siRNA duplexes targeting the phosphoinositide 3-kinase pathway: determinants of gene silencing for use in cell-based screens. *Nucleic Acids Res.* **32**, 893-901 (2004).

RNAi *in vivo*

1. Fernanda Lara, M., E. González-González, *et al.* Inhibition of CD44 Gene Expression in Human Skin Models Using Self-Delivery Short Interfering RNA Administered by Dissolvable Microneedle Arrays. *Hum. Gene Ther.* **23**, 1-8 (2012).
2. Lobovkina, T., G.B. Jacobson, *et al.* In vivo sustained release of siRNA from solid lipid nanoparticles. *ACS Nano.* **5**, 9977-9983 (2011).
3. Hickerson, R.P., M.A. Flores, *et al.* Use of self-delivery siRNAs to inhibit gene expression in an organotypic pachyonychia congenita model. *J. Invest. Dermatol.* **131**, 1037-1044 (2011).
4. Jacobson, G.B., E. Gonzalez-Gonzalez, *et al.* Biodegradable nanoparticles with sustained release of functional siRNA in skin. *J. Pharm. Sci.* **99**, 4261-4266 (2010).
5. Ra, H., W. Piyawattanametha, *et al.* In vivo imaging of human and mouse skin with a handheld dual-axis confocal fluorescence microscope. *J. Invest. Dermatol.* **131**, 1061-1066 (2010).
6. Gonzalez-Gonzalez, E., T.J. Speaker, *et al.* Silencing of reporter gene expression in skin using siRNAs and expression of plasmid DNA delivered by a soluble protrusion array device (PAD). *Mol. Ther.* **18**, 1667-1674 (2010).
7. Wang, Q., H. Ilves, *et al.*Delivery and inhibition of reporter genes by small interfering RNAs in a mouse skin model. *J. Invest. Dermatol.* **127**, 2577-2584 (2007).
8. Smith, F.J.D., R.P. Hickerson, *et al.*Development of therapeutic siRNAs for pachyonychia congenita. *J. Invest. Dermatol.* **128**, 50-58 (2007).

RNAi

1. Mutisya, D., T. Hardcastle, *et al.* Amide linkages mimic phosphates in RNA interactions with proteins and are well tolerated in the guide strand of short interfering RNAs. *Nucleic Acids Res.* (2017) gkx558. doi: 10.1093/nar/gkx558
2. Mutisya, D., T. Hardcastle, *et al.* Amide linkages mimic phosphates in RNA interactions with proteins and are well tolerated in the guide strand of short interfering RNAs. *Nucleic Acids Res.* In press (2017).
3. Caoa, Y-A., R.P. Hickerson, *et al.* Gene expression profiling in pachyonychia congenita skin. *J. Dermatol. Sci.* **77**, 156-165 (2015).
4. Cuellar, T.L., D. Barnes, *et al.* Systematic evaluation of antibody-mediated siRNA delivery using an industrial platform of THIOMAB-siRNA conjugates. *Nucleic Acids Res.* **43**, 1189-11203 (2015).
5. Birmingham, A., A. Kaufmann and K. Kozak. RNAi and Off-Target Effects. *Frontiers in RNAi.* **1**, 3-20 (2014).
6. Schmidt, E.E., M.S. Banos, *et al.* Public Repositories for RNAi Screening Data. *Frontiers in RNAi*, **1**, 40-57 (2014).
7. Hickerson, R.P., S.A. Leachman, *et al.* Development of quantitative molecular clinical end points for siRNA clinical trials. *J. Invest. Dermatol. 131*, 1029-1036 (2010).
8. DiFeo, A., F. Huang, et al. KLF6-SV1 is a novel antiapoptotic protein that targets the BH3-only protein NOXA for degradation and whose inhibition extends survival in an ovarian cancer model. *Cancer Res.* **69**, 4733-4741 (2009).
9. Hickerson, R.P., D. Leake, *et al.* Rapamycin selectively inhibits expression of an inducible keratin (K6a) in human keratinocytes and improves symptoms in pachyonychia congenita patients. *J. Dermatol. Sci.* **56**, 82-88 (2009).
10. Baskin, L., S. Urschel and B. Eiberger. A novel ex-vivo application of RNAi for neuroscience. *Biotechniques.* **45**, 338-339 (2008).
11. Rugg, E.L., F.J.D. Smith, et al. Development of Therapeutic siRNAs for Pachyonychia Congenita. Commentary. *J. Invest. Dermatol.* **128**, (2008).
12. Hickerson, R.P., A.V. Vlassov, *et al.* Stability study of unmodified siRNA and relevance to clinical use. *Oligonucleotides.* **18**, 345-354 (2008).
13. Hickerson, R.P., F.J.D. Smith, *et al.*Single-nucleotide-specific siRNA targeting in a dominant-negative skin model. *J. Invest. Dermatol.* **128**, 594-605 (2007).
14. Anderson, J.S., A. Vermeulen, *et al.* Complete Suppression of CCR5 Expression and Inhibition of HIV-1 Infection by Transfected and Lentiviral Vector Expressed shRNAs. *Mol. Ther.* **13**, S310 (2006).
15. Radisky, D.C., D.D. Levy, *et al.* Rac1b and reactive oxygen species mediate MMP-3-induced EMT and genomic instability. *Nature.* **436**, 123-127 (2005).
16. Anderson, E.M., P. Miller, *et al.* Gene profiling study of G3139-and Bcl-2-targeting siRNAs identifies a unique G3139 molecular signature. *Cancer Gene Ther.* **13**, 406-414 (2005).
17. Benimetskaya, L., J.C. Lai, *et al.* Induction of apoptosis by G3139 in melanoma cells. Ann. *NY Acad. Sci.* **1058**, 235-245 (2005).
18. Lai, J.C., L. Benimetskaya, et al. Phosphorothioate oligodeoxynucleotides and G3139 induce apoptosis in 518A2 melanoma cells. *Mol. Cancer Ther.* **4**, 305-315 (2005).
19. Benimetskaya, L., J.C. Lai, *et al.* Relative Bcl-2 independence of drug-induced cytotoxicity and resistance in 518A2 melanoma cells. *Clinical Cancer Res.* **10**, 8371-8379 (2004).
20. Raffo, A., J.C. Lai, *et al.* Antisense RNA down-regulation of bcl-2 expression in DU145 prostate cancer cells does not diminish the cytostatic effects of G3139 (Oblimersen). *Clinical Cancer Res.* **10**, 3195-3206 (2004).
21. Huang, F., A. Khvorova, *et al.*Analysis of clathrin-mediated endocytosis of epidermal growth factor receptor by RNA interference. *J. Biol. Chem.* **279**, 16657-16661 (2004).
22. Li, T., C-Y. Chang, *et al.* Identification of the gene for vitamin K epoxide reductase. Nature. 427, 541-544 (2004).
23. Jiang, Z.Y., Q.L. Zhou, *et al.* Insulin signaling through Akt/protein kinase B analyzed by small interfering RNA-mediated gene silencing. *P. Natl. Acad. Sci-Biol.* **100**, 7569-7574 (2003).

microRNA/noncoding RNA

1. Hodzic J., Sie Daoud, A. Vermeulen Annaleen, *et al.* Functional Screening Identifies Human miRNAs that Modulate Adenovirus Propagation in Prostate Cancer Cells. *Human Gene Therapy.* January 2017, ahead of print. DOI: 10.1089/hum.2016.143.
2. Zhang, Z., J.E. Lee, *et al.* High-efficiency RNA cloning enables accurate quantification of miRNA expression by deep sequencing. *Genome Biology.* **14**, R109 (2013).
3. Robertson, B., A.B. Dalby, *et al.* Specificity and functionality of microRNA inhibitors. *Silence.* **1**, 2-9 (2010).
4. Schoolmeesters, A., T. Eklund, *et al.* Functional profiling reveals critical role for miRNA in differentiation of human mesenchymal stem cells. *PLoS One.* **4**, e5605 (2009).

RNAi specificity & functionality

1. Brown, J.W., A. Birmingham, *et al.* The RNA structure alignment ontology. *RNA*. **15**, 1623-1631 (2009).
2. de Zwart I., *et al.* in Handbook of RNA Biochemistry, R. K. Hartmann, A. Bindereif, Eds. (Wiley, New York, 2008) pp. 783-806.
3. Anderson, E.M., A. Birmingham, *et al.* Experimental validation of the importance of seed complement frequency to siRNA specificity. *RNA*. **14**, 853-861 (2008).
4. Anderson, E.M., Q.F. Boese, *et al.* Identifying siRNA-induced off-targets by microarray analysis. *Methods Mol. Bio.* **442**, 45 (2008).
5. Birmingham, A., E.M. Anderson, *et al.* A protocol for designing siRNAs with high functionality and specificity. *Nat. Protoc.* **2**, 2068-2078 (2007).
6. Vermeulen, A., B. Robertson, *et al.* Double-stranded regions are essential design components of potent inhibitors of RISC function. *RNA*. **13**, 723-730 (2007).
7. Li, L., X. Lin, *et al.* Defining the optimal parameters for hairpin-based knockdown constructs. *RNA*. **13**, 1765-1774 (2007).
8. Birmingham, A., E.M. Anderson, *et al.* 3' UTR seed matches but not overall identity are associated with RNAi off-targets. *Nat. Methods*. **3**, 199-204 (2006).
9. Reynolds, A., E.M. Anderson, *et al.* Induction of the interferon response by siRNA is cell type- and duplex length-dependent. *RNA*. **12**, 988-993 (2006).
10. Fedorov, Y., E.M. Anderson, *et al.* Off-target effects by siRNA can induce toxic phenotype. *RNA*. **12**, 1188-1196 (2006).
11. Jackson, A.L., J. Burchard, *et al.* Position-specific chemical modification of siRNAs reduces "off-target" transcript silencing. *RNA*. **12**, 1197-1205 (2006).
12. Boese, Q.F., W.S. Marshall, *et al.* Design and synthesis of small interfering RNA (siRNA) in RNA Interference Technology: From Basic Science to Drug Development, (Cambridge Univ. Press, 2005), chap. 6, pp. 103-117.
13. Khvorova, A., Boese, Q. and Marshall, W. S. (2005) Rational siRNA Design for RNA Interference: Optimizations for Therapeutic Use and Current Applications, in Modern Biopharmaceuticals: Design, Development and Optimization (ed J. Knäblein), Wiley-VCH Verlag GmbH, Weinheim, Germany.
14. Fedorov, Y., A. King, *et al.* Different delivery methods—different expression profiles. *Nat. Methods*. **2**, 241-241 (2005).
15. Boese, Q.F., D. Leake, *et al.* Mechanistic insights aid computational short interfering RNA design. *Method Enzymol.* **392**, 73-96 (2005).
16. Vermeulen, A., L. Behlen, *et al.* The contributions of dsRNA structure to Dicer specificity and efficiency. *RNA*. **11**, 674-682 (2005).
17. Reynolds, A., D. Leake, *et al.* Rational siRNA design for RNA interference. *Nat. Biotechnol.* **22**, 326-330 (2004).
18. Karpilow, J., D. Leake, *et al.* siRNA: enhanced functionality through rational design and chemical modification. *PharmaGenomics*. **32**, 40 (2004).
19. Jackson, A.L., S.R. Bartz, *et al.* Expression Profiling reveals off-target gene regulation by RNAi. *Nat. Biotechnol.* **21**, 635-637 (2003).
20. Boese, Q.F., S.A. Scaringe, *et al.* siRNA as a tool for streamlining functional genomic studies. *Targets*. **2**, 93-100 (2003).
21. Khvorova, A., A. Reynolds, *et al.* Functional siRNAs and miRNAs exhibit strand bias. *Cell.* **115**, 209-216 (2003).

RNA/structure/synthesis

1. Wang, R., Z. Lou, *et al.* Base pairing and structural insights into the 5-formylcytosine in RNA duplex. *Nucleic Acids Res*. **44**, 4968-4977 (2016).
2. Tanui, P., S.D. Kennedy, *et al.* Synthesis, biophysical studies and RNA interference activity of RNA having three consecutive amide linkages. *Org. Biomol. Chem*. **12**, 1207-1210 (2014).
3. Mutisya, D., C. Selvam, *et al.* Amides are excellent mimics of phosphate internucleoside linkages and are well tolerated in short interfering RNAs. *Nucleic Acids Res*. **42**, 6542-51 (2014).
4. Cantara, W.A., Y. Bilbille, *et al.* Modifications modulate anticodon loop dynamics and codon recognition of E. coli $tRNA^{Arg1,2}$. *J. Mol. Bio.* **416**, 579-597 (2012).
5. Bilbille, Y., E.M. Gustilo, *et al.* The Human Mitochondrial tRNAMet: Structure/Function Relationship of a Unique Modification in the Decoding of Unconventional Codons. *J. Mol. Bio.* **406**, 257-274 (2011).
6. Lusic, H., E.M. Gustilo, *et al.* Synthesis and investigation of the 5-formylcytidine modified, anticodon stem and loop of the human mitochondrial tRNAMet. *Nucleic Acids Res*. **36**, 6548-6557 (2008).
7. Delaney, M.O., A. Thomas, *et al.* Chromophoric 5'-O-Silyl Protection of N-Protected 2'-ACE Ribonucleosides for Solid-Phase RNA Synthesis. Curr. Protoc. *Nucleic Acid Chem.* **2.14**, 2-14 (2008).
8. Scaringe, S.A., D. Kitchen, *et al.* Preparation of 5'-Silyl-2'-Orthoester Ribonucleosides for Use in Oligoribonucleotide Synthesis. *Curr. Protoc. Nucleic Acid Chem.* **2-10** (2004).
9. Marshall, W.S., R.J. Kaiser, *et al.* Recent advances in the high-speed solid phase synthesis of RNA. *Curr. Opin. Chem. Bio.* **8**, 222-229 (2004).

Protein coding

1. Wiemann, S., C. Pennacchio, *et al.* The ORFeome Collaboration: a genome-scale human ORF-clone resource. *Nature Methods.* **13**, 191–192 (2016).

Detection/qPCR/RT-qPCR

1. Strezoska, Ž., Y. Fedorov, *et al.* hMSC differentiation marker detection using Thermo Scientific Solaris™ qPCR Gene Expression Assays. *Nat. Methods Application Notes.* **6**, (2009).

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