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Education

- 1984 - 1989 Ph.D. in Organic Chemistry, Dept. of Chemistry, University of California, Berkeley, CA 94720. Advisor: Dr. Peter Schultz.
- 1980 - 1984 B.S. in Chemistry with honors and distinction, Harvey Mudd College, Claremont, CA 91711.

Research

- 2008 – present Facility Director, Biological Nanostructures Facility, The Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, CA
- 2006 – 2008 Lead Scientist, Biological Nanostructures Facility, The Molecular Foundry, LBNL
- 2003 – 2005 Research Fellow, Chiron Corp.
- 1996 – 2003 Director of Bioorganic Chemistry, Chiron Corp.
- 1993 – 1996 Associate Director, Bioorganic Chemistry, Chiron Corp.
- 1991 – 1993 Senior Scientist, Bioorganic Chemistry, Chiron Corp. Emeryville, CA.
- 1989 – 1991 Research Scientist, New Technologies, Protos Corp., Emeryville, CA.
- 1984 - 1989 Design and synthesis of hybrid sequence-specific ribonucleases (graduate research). Advisor: Dr. Peter Schultz, University of California, Berkeley.
- Summer 1984 Free-radical ring-opening polymerizations: synthesis of new copolymers (Resident Research Program). Advisor: Dr. Harry Cripps, Central Research and Development Department, E.I. Du Pont de Nemours and Company, Experimental Station, Wilmington, DE 19898.
- 1982 - 1984 Synthesis of 2-fluoro-2-alkenes as terminators for biomimetic polyene cyclizations (summer 1982, junior year, and senior thesis project). Advisor: Dr. G. William Daub, Harvey Mudd College, Claremont, CA 91711.
- Summer 1983 Synthesis of retinal analogs: investigation of the cis-trans isomerization of retinal in bacteriorhodopsin (Summer Student Program). Advisor: Dr. Stanley Seltzer, Dept. of Chemistry, Brookhaven National Laboratory, Upton, NY 11973.

Editorial Duties

1995 - 2003 Editorial Board: *Molecular Diversity*
1996 - 2004 Editorial Board: *Combinatorial Chemistry and High Throughput Screening*
1998 - 2003 Editorial Board: *Journal of Combinatorial Chemistry*
Ongoing Reviewer for: *J. Org. Chem.*, *JACS*, *J. Med Chem.*, *Org. Lett.*, *Biorg. Med. Chem. Lett.*, *Chemistry & Biology*

Awards

2003 Chiron Research Fellow
1985-86 University of California Regents Fellowship.
1984 Nomination to Sigma Xi Society.
1984 Student Award of the American Institute of Chemists Student Research and Recognition Foundation.

Research Interests

Methods and technologies for rapid combinatorial discovery.
Materials science, proteomics and drug delivery applications of sequence-specific heteropolymers.
Design and synthesis of functional artificial proteins.
Miniature parallel sensor array technology to detect ligand binding.
Massively parallel array synthesis via micro-fluidics.
In vivo delivery of functionalized nanoparticles.

Biographical

Born 1962 in California.
Graduated from Berkeley High School, Berkeley, CA; June, 1980.

Issued U.S. Patents

1. Charych, D.; Beausoleil, E.; Zuckermann, R.N. Microarrays on mirrored substrates for performing proteomic analyses. US 7,153,682, **2007**.
2. Horn, T.; Zuckermann, R.N. Peptoids incorporating Chemoselective Functionalities. US 7,030,216, **2006**.
3. Suich, D.J.; Zuckermann, R.N. Fluorogenic Dyes. US 7,026,166, **2006**.
4. Zuckermann, R.N.; Huang, C.-Y.; Murphy, J.E.; Uno, T. Method of Complexing a Nucleic Acid with a Lipid-Conjugated Polyamide. US 6,982,092 B2, **2006**.

5. Barron, A.E.; Zuckermann, R.N.; Wu, C.W. Polypeptoid pulmonary surfactants. US 6,887,845, **2005**.
6. Innis, M.A.; Reinhardt, C.J.; Zuckermann, R.N. Chimeric antisense oligonucleotides and cell transfecting formulations thereof. US 6,846,921, **2005**.
7. Innis, M.A.; Reinhardt, C.J.; Zuckermann, R.N. Chimeric antisense oligonucleotides and cell transfecting formulations thereof. US 6,677,445, **2004**.
8. Zuckermann, R.N.; Beausoleil, E.; Wachowicz, M.; Kothakota, S. Biological sample component purification and differential display. US 6,783,929, **2004**.
9. Zuckermann¹, R.N.; Huang, C.-Y.; Murphy, J.E.; Uno, T. Lipid-conjugated polyamide compounds and related compositions and methods thereof. US 6,572,881, **2003**.
10. Zuckermann, R.N.; Huang, C.-Y.; Murphy, J.E.; Uno, T. Lipid-conjugated polyamide compounds and related compositions and methods thereof. US 6,569,450, **2003**.
11. Zuckermann, R.N.; Dubios-Stringfellow, N.; Dwarki, V.; Innis, M.A.; Murphy, J.E.; Cohen, F.E.; Uno, T. Compositions and methods for polynucleotide delivery. US 6,468,986, **2002**.
12. Zuckermann, R.N.; Dubios-Stringfellow, N.; Dwarki, V.; Innis, M.A.; Murphy, J.E.; Cohen, F.E.; Uno, T. Polycationic Polymers. US 6,251,433, **2001**.
13. Zuckermann, R.N.; Huang, C.-Y.; Murphy, J.E.; Uno, T. Lipid-conjugated polyamide compounds and related compositions and methods thereof. US 6,197,332, **2001**.
14. Zuckermann, R.N.; Truong, K.; DeRose-Juarez, S.; Kuey, K.S.; Owings, M.G.; Steeg, B.J.V.; Chin, H. Synthesizer with reagent recycling. US 6,033,631, **2000**.
15. Zuckermann¹, R.N.; Kerr, J.M.; Kent, S.B.H.; Moos, W.H.; Simon, R.J.; Goff, D.A. Synthesis of N-Substituted Oligomers. US 5,977,301, **1999**.
16. Zuckermann, R.N.; Goff, D.A.; Ng, S.; Spear, K.; Scott, B.O.; Siegmund, A.C.; Goldsmith, R.A.; Marlowe, C.K.; Pei, Y.; Richter, L.; Simon, R. Synthesis of N-substituted oligomers. US 5,877,278, **1999**.
17. Zuckermann¹, R.N.; Huebner, V.D.; Santi, D.V.; Siani, M.A. Method and apparatus for biopolymer synthesis. US 5,705,610, **1998**.
18. Zuckermann², R.N.; Kerr, J.M.; Kent, S.B.H.; Moos, W.H.; Simon, R.J.; Goff, D.A. Synthesis of N-Substituted Oligomers. US 5,831,005, **1998**.
19. Zuckermann, R.N.; Huebner, V.D.; Santi, D.V.; Siani, M.A. Method and apparatus for biopolymer synthesis. US 5,840,841, **1998**.

20. Ng, S.; Warne, R.L.; Zuckermann, R.N.; Martin, E.J.; Simon, R.J. Opiate receptor ligands. US 5,605,932, **1997**.
21. Ng, S.; Warne, R.L.; Zuckermann, R.N.; Martin, E.J.; Simon, R.J. Opiate receptor ligands. US 5,481,020, **1996**.
22. Ng, S.; Warne, R.L.; Zuckermann, R.N.; Martin, E.J.; Simon, R.J. Opiate receptor ligands. US 5,536,868, **1996**.
23. Spellmeyer, D.C.; Moos, W.H.; Martin, E.J.; Zuckermann, R.N.; Stauber, G. Peptoid alpha-1 adrenergic receptor ligands. US 5,480,871, **1996**.
24. Spellmeyer, D.C.; Moos, W.H.; Martin, E.J.; Zuckermann, R.N.; Stauber, G.; Shoemaker, K.R.; Goff, D. Opiate receptor ligands. US 5,536,853, **1996**.
25. Spellmeyer, D.C.; Moos, W.H.; Martin, E.J.; Zuckermann, R.N.; Stauber, G. Peptoid alpha-1 adrenergic receptor ligands. US 5,447,916, **1995**.
26. Zuckermann, R.N.; Banville, S. Automated apparatus for use in peptide synthesis. US 5,240,680, **1993**.
27. Zuckermann, R.N.; Huebner, V.D.; Santi, D.V.; Siani, M.A. Method and apparatus for biopolymer synthesis. US 5,252,296, **1993**.

Publications

1. Ding, B.; Cabrini, S.; Zuckermann, R.N.; Bokor, J., DNA directed assembly of nanoparticle linear structure for nanophotonics. *J. Vac. Sci. Technol. B* **2009**, *27*, 184-187.
2. Thakkar, A.; Cohen, A.S.; Connolly, M.D.; Zuckermann, R.N.; Pei, D., High-Throughput Sequencing of Peptoids and Peptide–Peptoid Hybrids by Partial Edman Degradation and Mass Spectrometry. *J. Comb. Chem.* **2009**, *11*, 294-302.
3. Ballister, E.R.; Lai, A.H.; Zuckermann, R.N.; Cheng, Y.; Mougous, J.D., In vitro self-assembly of tailorable nanotubes from a simple protein building block. *Proc. Natl. Acad. Sci. U. S. A.* **2008**, *105*, 3733-3738.
4. Chongsiriwatana, N.P.; Patch, J.A.; Czyzewski, A.M.; Dohm, M.T.; Ivankin, A.; Gidalevitz, D.; Zuckermann, R.N.; Barron, A.E., Peptoids that mimic the structure, function and mechanism of helical antimicrobial peptides. *Proc. Natl. Acad. Sci. U. S. A.* **2008**, *105*, 2794-2799.
5. Lee, B.-C.; Chu, T.K.; Dill, K.A.; Zuckermann, R.N., Biomimetic Nanostructures: Creating a High-Affinity Zinc-Binding Site in a Folded Nonbiological Polymer. *J. Am. Chem. Soc.* **2008**, *130*, 8847-8855.

6. Ross, T.M.; Zuckermann, R.N.; Reinhard, C.; Frey, W.H., Intranasal administration delivers peptoids to the rat central nervous system. *Neuroscience Letters* **2008**, *439*, 30-33.
7. Lee, B.-C.; Zuckermann, R.N., Bio-inspired Polymers for Nanoscience Research. *Proc. NSTI Nanotech. Conf.* **2007**, *2*, 28-31.
8. Huang, K.; Wu, C.W.; Sanborn, T.J.; Patch, J.A.; Kirshenbaum, K.; Zuckermann, R.N.; Barron, A.E.; Radhakrishnan, I., A Threaded Loop Conformation Adopted by a Family of Peptoid Nonamers. *J. Am. Chem. Soc.* **2006**, *128*, 1733-1738.
9. Paulick, M.G.; Hart, K.M.; Brinner, K.M.; Tjandra, M.; Charych, D.H.; Zuckermann, R.N., A Cleavable Hydrophilic Linker for One-Bead-One-Compound Sequencing of Oligomer Libraries by Tandem Mass Spectrometry. *J. Comb. Chem.* **2006**, *8*, 417-426.
10. Utku, Y.; Dehan, E.; Ouerfelli, O.; Piano, F.; Zuckermann, R.N.; Pagano, M.; Kirshenbaum, K., A peptidomimetic siRNA transfection reagent for highly effective gene silencing. *Mol. BioSyst.* **2006**, *2*, 312-317.
11. Lee, B.-C.; Dill, K.A.; Zuckermann, R.N., Synthesis of Long Non-natural Sequence-Specific Heteropolymers. *Polymer Preprints* **2005**, *46*, 174-175.
12. Lee, B.-C.; Zuckermann, R.N.; Dill, K.A., Folding a Nonbiological Polymer into a Compact Multihelical Structure. *J. Am. Chem. Soc.* **2005**, *127*, 10999-11009.
13. Horn, T.; Lee, B.-C.; Dill, K.A.; Zuckermann, R.N., Incorporation of Chemoselective Functionalities into Peptoids via Solid-Phase Submonomer Synthesis. *Bioconj. Chem.* **2004**, *15*, 428-435.
14. Patch, J.A.; Kirshenbaum, K.; Seuryneck, S.L.; Zuckermann, R.N.; Barron, A.E., Versatile Oligo(N-Substituted) Glycines: The Many Roles of Peptoids in Drug Discovery. In *Pseudo-Peptides in Drug Discovery*, Nielsen, P.E., Ed. Wiley-VCH: Weinheim, **2004**; pp 1-31.
15. Burkoth, T.S.; Fafarman, A.T.; Charych, D.H.; Connolly, M.D.; Zuckermann, R.N., Incorporation of Unprotected Heterocyclic Side Chains into Peptoid Oligomers via Solid-Phase Submonomer Synthesis. *J. Am. Chem. Soc.* **2003**, *125*, 8841-8845.
16. Lobo, B.A.; Vetro, J.A.; Suich, D.M.; Zuckermann, R.N.; Middaugh, R.C., Structure/Function Analysis of Peptoid/Lipitoid: DNA Complexes. *J. Pharm. Sci.* **2003**, *92*, 1905-1918.
17. Wu, C.W.; Kirshenbaum, K.; Sanborn, T.J.; Patch, J.A.; Huang, K.; Dill, K.A.; Zuckermann, R.N.; Barron, A.E., Structural and Spectroscopic Studies of Peptoid Oligomers with a-Chiral Aliphatic Side Chains. *J. Am. Chem. Soc.* **2003**, *125*, 13525-13530.
18. Burkoth, T.S.; Beausoleil, E.; Kaur, S.; Tang, D.; Cohen, F.E.; Zuckermann, R.N., Toward the Synthesis of Artificial Proteins: The Discovery of an Amphiphilic Helical Peptoid Assembly. *Chemistry & Biology* **2002**, *9*, 647-654.

19. Sanborn, T.J.; Wu, C.W.; Zuckermann, R.N.; Barron, A.E., Extreme stability of helices formed by water-soluble poly-N-substituted glycines (polypeptoids) with α -chiral side chains. *Biopolymers* **2002**, *63*, 12-20.
20. Beausoleil, E.; Truong, K.T.; Kirshenbaum, K.; Zuckermann, R.N., Influence of Monomer Structural Elements in Hydrophilic Peptoids. In *Innovations and Perspectives in Solid Phase Synthesis and Combinatorial Libraries: Peptides, Proteins and Nucleic Acids*, Epton, R., Ed. Mayflower Scientific Press: Kingswinford, UK, **2001**; pp 239-242.
21. Kleschick, W.A.; Davis, L.N.; Dick, M.R.; Garlich, J.R.; Martin, E.J.; Orr, N.; Ng, S.C.; Pernich, D.J.; Unger, S.H.; Watson, G.B.; Zuckermann, R.N., The Application of Combinatorial Chemistry in Agrochemical Discovery. In *ACS Symp. Ser. N. 774*, Baker, D.R.; Umetsu, N.K., Eds. American Chemical Society: **2001**.
22. Wu, C.W.; Sanborn, T.J.; Huang, K.; Zuckermann, R.N.; Barron, A.E., Peptoid Oligomers with α -Chiral Side Chains: Sequence Requirements for the Formation of Stable Peptoid Helices. *J. Am. Chem. Soc.* **2001**, *123*, 6778-6784.
23. Wu, C.W.; Sanborn, T.J.; Zuckermann, R.N.; Barron, A.E., Peptoid Oligomers with α -Chiral, Aromatic Sidechains: Effects of Chain Length on Secondary Structure. *J. Am. Chem. Soc.* **2001**, *123*, 2958-2963.
24. Nguyen, J.T.; Porter, M.; Amoui, M.; Miller, T.W.; Zuckermann, R.N.; Lim, W.A., Improving SH3 Domain Ligand Selectivity Using a Non-natural Scaffold. *Chem. Biol.* **2000**, *7*, 463-473.
25. Barron, A.E.; Zuckermann, R.N., Bioinspired Polymeric Materials: In-between Proteins and Plastics. *Curr. Op. Chem. Biol.* **1999**, *3*, 681-687.
26. Kirshenbaum, K.; Zuckermann, R.N.; Dill, K.A., Designing Polymers that Mimic Biomolecules. *Curr. Opin. Struct. Biol.* **1999**, *9*, 530-535.
27. Uno, T.; Beausoleil, E.; Goldsmith, R.A.; Levine, B.H.; Zuckermann, R.N., New Submonomers for Poly N-Substituted Glycines (Peptoids). *Tetrahedron Lett.* **1999**, *40*, 1475-1478.
28. Zuckermann, R.N., Parallel Personal Comments on "Classical" Papers in Combinatorial Chemistry. *J. Comb. Chem.* **1999**, *1*, 3-24.
29. Armand, P.; Kirshenbaum, K.; Goldsmith, R.A.; Farr-Jones, S.; Barron, A.E.; Truong, K.T.V.; Dill, K.A.; Mierke, D.F.; Cohen, F.E.; Zuckermann, R.N.; Bradley, E.K., NMR Determination of the Major Solution Conformation of a Peptoid Pentamer with Chiral Side Chains. *Proc. Natl. Acad. Sci. U. S. A.* **1998**, *95*, 4309-4314.
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31. Kirshenbaum, K.; Barron, A.E.; Goldsmith, R.A.; Armand, P.; Bradley, E.K.; Truong, K.T.V.; Dill, K.A.; Cohen, F.E.; Zuckermann, R.N., Sequence-Specific Polypeptoids: A Diverse Family of Heteropolymers with Stable Secondary Structure. *Proc. Natl. Acad. Sci. U. S. A.* **1998**, *95*, 4303-4308.
32. Murphy, J.E.; Uno, T.; Hamer, J.D.; Cohen, F.E.; Dwarki, V.; Zuckermann, R.N., A Combinatorial Approach to the Discovery of Efficient Cationic Peptoid Reagents for Gene Delivery. *Proc. Natl. Acad. Sci. U. S. A.* **1998**, *95*, 1517-1522.
33. Nguyen, J.T.; Turck, C.W.; Cohen, F.E.; Zuckermann, R.N.; Lim, W.A., Exploiting the Basis of Proline Recognition by SH3 and WW Domains: Design of N-Substituted Inhibitors. *Science* **1998**, *282*, 2088-2092.
34. Armand, P.; Kirshenbaum, K.; Falicov, A., Jr., R.L.D.; Dill, K.A.; Zuckermann, R.N.; Cohen, F.E., Chiral N-Substituted Glycines Can Form Stable Helical Conformations. *Folding Des.* **1997**, *2*, 369-375.
35. Bradley, E.K.; Kerr, J.M.; Richter, L.S.; Figliozzi, G.M.; Goff, D.A.; Zuckermann, R.N.; Spellmeyer, D.C.; Blaney, J.M., NMR Structural Characterization of Oligo-N-substituted Glycine Lead Compounds from a Combinatorial Library. *Mol. Diversity* **1997**, *3*, 1-15.
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37. Richter, L.S.; Goff, D.A.; Spear, K.S.; Martin, E.J.; Zuckermann, R.N., Submonomer Approaches for the Generation of Molecular Diversity: Non-natural Oligomer and Organic Template Libraries. In *Combinatorial Chemistry and Molecular Diversity in Drug Discovery*, Gordon, E.M.; Kerwin, J.F., Eds. Wiley-Liss: New York, **1997**; pp 151-163.
38. Banville, S.C.; Zuckermann, R.N., Accelerating Drug Discovery by High-Throughput Combinatorial Synthesis. *ISLAR '96 Proceedings* **1996**, 77-92.
39. Figliozzi, G.M.; Goldsmith, R.; Ng, S.; Banville, S.C.; Zuckermann, R.N., Synthesis of N-(substituted)glycine Peptoid Libraries. *Methods Enzymol.* **1996**, *267*, 437-447.
40. Gibbons, J.A.; Hancock, A.A.; Vitt, C.R.; Knepper, S.; Buckner, S.A.; Brune, M.E.; Milicic, I.; Jr., J.F.K.; Richter, L.S.; Taylor, E.W.; Spear, K.L.; Zuckermann, R.N.; Spellmeyer, D.C.; Braeckman, R.A.; Moos, W.H., Pharmacologic Characterization of CHIR 2279, an N-Substituted Glycine Peptoid with High-Affinity Binding for α 1-Adrenoreceptors. *J. Pharm. Exp. Ther.* **1996**, *277*, 885-899.
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43. Goff, D.A.; Zuckermann, R.N., Solid-Phase Synthesis of Highly Substituted Peptoid 1(2*H*)-Isoquinolinones. *J. Org. Chem.* **1995**, *60*, 5748-5749.
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52. Zuckermann, R.N.; Goff, D.A., Synthesis of (N-Substituted)Glycine Polymers of Defined Length and Sequence. *Polymer Preprints* **1994**, *35*, 975-976.
53. Zuckermann, R.N.; Martin, E.J.; Spellmeyer, D.C.; Stauber, G.B.; Shoemaker, K.R.; Kerr, J.M.; Figliozzi, G.M.; Goff, D.A.; Siani, M.A.; Simon, R.J.; Banville, S.C.; Brown, E.G.; Wang, L.; Richter, L.S.; Moos, W.H., Discovery of Nanomolar Ligands for 7-Transmembrane G-Protein Coupled Receptors from a Diverse (N-Substituted)Glycine Peptoid Library. *J. Med. Chem.* **1994**, *37*, 2678-2685.

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62. Zuckermann, R.N.; Kerr, J.M.; Kent, S.B.H.; Moos, W.H., Efficient Method for the Preparation of Peptoids [Oligo(N-substituted glycines)] by Submonomer Solid Phase Synthesis. *J. Am. Chem. Soc.* **1992**, *114*, 10646-10647.
63. Zuckermann, R.N.; Kerr, J.M.; Siani, M.A.; Banville, S.C.; Santi, D.V., Identification of Highest-Affinity Ligands by Affinity Selection from Equimolar Peptide Mixtures Generated by Robotic Synthesis. *Proc. Natl. Acad. Sci. U. S. A.* **1992**, *89*, 4505-4509.
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