

BIOGRAPHICAL SKETCH

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NAME Rachel D. Green		POSITION TITLE Professor	
eRA commons name Rachel Green			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
University of Michigan, Ann Arbor, MI	B.S.	1986	Chemistry
Harvard University, Cambridge, MA	Ph.D.	1992	Biological Chemistry
University of California, Santa Cruz	Post-doc	1998	Biochemistry

A. Positions and Honors**Positions and Employment**

1982 – 1986 B.S., University of Michigan (Honors)
 1984 – 1986 Undergraduate Researcher, University of Michigan
 Synthesis of heterocyclic anti-filarial compounds
 1986 – 1992 Ph.D., Department of Biological Chemistry and Molecular Pharmacology, Harvard University
 Thesis: An In Vitro Genetic Analysis of the Group I Self-splicing Intron
 1993 - 1998 Post-doctoral Fellow, Department of Biology, University of California, Santa Cruz
 1998 - 2003 Assistant Professor, Molecular Biology & Genetics Department
 Johns Hopkins University School of Medicine
 2000 - 2005 Assistant Investigator, Howard Hughes Medicine Institute at Johns Hopkins University
 2003 - 2007 Associate Professor, Molecular Biology & Genetics Department
 Johns Hopkins University School of Medicine
 2005 Investigator, Howard Hughes Medical Institute, Johns Hopkins University School of
 Medicine
 2007 Professor, Molecular Biology & Genetics Department
 Johns Hopkins University School of Medicine
 2007 Editorial Board, RNA
 2007 Editorial Board, Molecular Cell
 2008 Editorial Board, Journal of Biology
 2010 Board of Directors, RNA Society

Honors

1982 – 1986 Undergraduate Academic Scholarships
 1987 – 1990 NSF Predoctoral Fellowship
 1993 – 1996 Damon Runyon Walter Winchell Postdoctoral Fellowship
 1996 American Cancer Society Postdoctoral Fellowship, California Division
 1996 – 2001 Burroughs Wellcome Career Award
 1999 RPI/RNA Award for Young Scientists
 2000 David and Lucile Packard Fellowship Award
 1999 - 2002 Searle Scholarship Award
 2000 Howard Hughes Medical Institute Assistant Investigator Award
 2005 Johns Hopkins University School of Medicine Teacher of the Year

B. Research Activities

1. Green, R. and Szostak, J.W. Selection of a ribozyme that functions as a superior template in a self-copying reaction. *Science* 1992; 258, 1910-5.
2. Kumar, Y., Green, R., Wise, D.S., Wotring, L.L. and Townsend, L.B. Synthesis of 2,4-disubstituted thiazoles and selenazoles as potential antifilarial and antitumor agents. 1. Methyl 4-(Isothiocyanatomethyl)thiazole-2-carbamates, -selenazole-2-carbamates, and related derivatives. *J. Med. Chem* 1993; 36, 3843-8.
3. Kumar, Y., Green, R., Wise, D.S., Wotring, L.L. and Townsend, L.B.. Synthesis of 2,4-disubstituted thiazoles and selenazoles as potential antifilarial and antitumor agents. 2. 2-Arylamido and 2-alkylamido derivatives of 2-amino-4-(isothiocyanatomethyl)thiazole and 2-amino-4-(isothiocyanatomethyl)selenazole. *J. Med. Chem* 1993; 36, 3849-52.
4. Green, R. and Szostak, J.W. In vitro genetic analysis of the hinge region between helical elements P5-P4-P6 and P7-P3-P8 in the sunY group I self-splicing intron. *J. Mol. Biol* 1994; 235, 140-55.
5. Samaha, R.R., Green, R. and Noller, H.F. A base pair between tRNA and 23S rRNA in the peptidyl transferase centre of the ribosome. *Nature* 1995; 377, 309-14.
6. Green, R. and Noller, H.F. In vitro complementation analysis localizes 23S rRNA post-transcriptional modifications that are required for *E. coli* 50S ribosomal subunit assembly and function. *RNA* 1996; 2, 1011-21.
7. Green, R., Samaha, R.R. and Noller, H.F. Mutations at nucleotides G2251 and U2585 of 23S rRNA perturb the peptidyl transferase center of the ribosome. *J. Mol. Biol* 1997; 266, 40-50.
8. von Ahlsen, U., Green, R., Schroeder, R. and Noller, H.F. Identification of 2'-hydroxyl groups required for interaction of a tRNA anticodon stem-loop with the ribosome. *RNA* 1997; 3, 49-56.
9. Puglisi, E.V., Green, R., Noller, H.F. and Puglisi, J.D. Structure of a universally conserved hairpin loop in the P site of the 23S ribosomal RNA. *Nat. Struct. Biol* 1997; 4, 775-8.
10. Green, R., Switzer, C. and Noller, H.F. Ribosome-catalyzed peptide-bond formation with an A-site substrate covalently linked to 23S rRNA. *Science* 1998; 280, 286-8.
11. Green, R. and Noller, H.F. Reconstitution of functional 50S ribosomes from in vitro transcripts of *Bacillus stearothermophilus* 23S rRNA. *Biochem* 1999; 38, 1772-9.
12. Khaitovich, P., Mankin, A.S., Green, R., Lancaster, L. and Noller, H.F. Characterization of functionally active subribosomal particles from *Thermus aquaticus*. *Proc. Natl. Acad. Sci* 1999; 96, 85-90.
13. Khaitovich, P., Tenson, T., Mankin, A.S. and Green, R. Peptidyl transferase activity catalyzed by proteinfree 23S ribosomal RNA remains elusive. *RNA* 1999; 5, 605-8.
14. Sardesai, N.Y., Green, R. and Schimmel, P. Efficient 50S Ribosome-catalyzed peptide bond synthesis with an aminoacyl helix. *Biochem* 1999; 38, 12080-8.
15. Kim, D.F. and Green, R. Base-pairing between 23S rRNA and tRNA in the ribosomal A site. *Mol. Cell* 1999; 4, 859-64.
16. Thompson, J., Kim, D.K., O'Connor, M., Lieberman, K.R., Bayfield, M.A., Gregory, S.T., Green, R., Noller, H.F. and A.E. Dahlberg. Analysis of mutations at residues A2451 and G2447 of 23S rRNA in the peptidyl transferase active site of the 50S ribosomal subunit. *Proc. Natl. Acad. Sci* 2001; 98, 9002-7.
17. Semrad, K. and Green, R. Osmolytes stimulate the reconstitution of functional 50S ribosomes from in vitro transcripts of *Escherichia coli* 23S rRNA. *RNA* 2002; 8,401-11.
18. Southworth, D. R., Brunelle, J., and Green, R. EF-G independent translocation of the mRNA:tRNA complex is promoted by modification of the ribosome with thiol-specific reagents. *J. Mol. Biol* 2002; 324,611-623.
19. Southworth, D. R., and Green, R. Ribosomal translocation: sparsomycin pushes the button. *Current Biology* 2003; 13, R652-4.
20. Cukras, A. R., Southworth, D. R., Brunelle, J.L., Culver, G.M., and Green, R. Ribosomal Proteins S12 and S13 Function as Control Elements for Translocation of the mRNA:tRNA Complex. *Mol. Cell* 2003; 12,321-8.
21. Sharma, D., Southworth, D.R., and Green, R. EF-G-independent reactivity of a pre-translocation state ribosome complex with the aminoacyl tRNA substrate puromycin supports an intermediate (hybrid) state of tRNA binding. *RNA* 2004; 10,102-113.
22. Semrad, K., Green, R., Schroeder, R. (2004) RNA chaperone activity of large ribosomal subunit proteins from *Escherichia coli*. *RNA* 12; 1855-60.

23. Weinger, J.S., Parnell, K.M., Dorner, S., Green, R., Strobel, S.A. (2004) Substrate-assisted catalysis of peptide bond formation by the ribosome. *Nat Struct. Mol Biol.* 11;1101-6.
 24. Merryman, C., Green, R. (2004) Transformation of aminoacyl tRNAs for the in vitro selection of “drug-like” molecules. *Chemistry & Biology* 11, 575-82.
 25. Youngman, E.M., Brunelle, J.L., Kochaniak, A.B., Green, R. (2004) The active site of the ribosome is composed of two layers of conserved nucleotides with distinct roles in peptide bond formation and peptide release. *Cell* 117, 589-99.
 26. Cochella, L., Green, R. (2004) Isolation of antibiotic resistance mutations in the rRNA by using an in vitro selection system. *PNAS* 101, 3786-3791.
 27. Cochella, L., Green, R. (2004) Wobble during decoding: more than third-position promiscuity. *Nature Structural & Molecular Biology* 11,12 1160-62.
 28. Cukras, A.R., Green, R. (2005) Multiple effects of S13 in modulating the strength of inter subunit interactions in the ribosome during translation. *JMB*, 349, 47-59.
 29. Cochella, L., Green, R. (2005) An Active Role for tRNA in Decoding Beyond Codon: Anticodon Pairing. *Science* 20 May, 308, 1178 – 1180.
 30. Youngman, E. Green, R. (2005) Affinity purification of in vivo-assembled ribosomes for in vitro biochemical analysis. *Methods*, 36, 305-12.
 31. Cochella, L., Green, R. (2005) Fidelity in protein synthesis. *Current Biology* 15, 14, R536-40.
 32. Brunelle, J.L., Youngman, E.M., Sharma, D., and Green, R. (2006) The interaction between C75 of tRNA and the A loop of the ribosome stimulates peptidyl transferase activity. *RNA* 12:33-39.
 33. Dorner, S., Brunelle, J.L., Sharma, D., Green, R. (2006) The hybrid state of tRNA binding is authentic translation elongation intermediate. *Nat Struct Mol Biol* 13, 234-41.
 34. Dorner, S., Lum, L., Para, K., Beachy, P., Green, R. (2006) A genomewide screen for components of the RNAi pathway in Drosophila cultured cells. *PNAS* 32, 11880-5.
 35. Green, R., Doudna, J.A. (2006) RNAs regulate biology. *ACS Chem Biol.* 6,335-8.
 36. Cochella, L., Brunelle, J., Green, R. (2007) Mutational analysis reveals two independent molecular requirements during transfer RNA selection on the ribosome. *Nat Struct Mol Biol* 14, 30-6.
 37. Youngman, EM., Green, R. (2007) Ribosomal Translocation:LepA Does It Backwards. *Curr Biol.* 4, 136-9.
 38. Youngman, EM., He, SL., Nikstad, LJ., Green, R. (2007) Stop codon recognition by release factors induces structural rearrangement of the ribosomal decoding center that is productive for peptide release. *Molecular Cell* 28(4),533-43.
 39. Sharma, D., Cukras, AR., Southworth, DR., Green, R. (2007) Mutational analysis of S12 protein and implications for the accuracy of decoding by the ribosome. *Journal of Molecular Biology* 374(4),1065-76.
 40. Shaw, JJ., Green, R. (2007) Two distinct components of release factor function uncovered by nucleophile partitioning analysis. *Molecular Cell* 28(3),358-67.
 41. Youngman, EM, McDonald, ME, Green, R. (2008) Peptide Release on the Ribosome: Mechanism and Implications for Translational Control. *Annu Rev Microbiol.* 62, 353-373.
 42. Brunelle, JL, Shaw, JJ, Youngman, EM, Green, R. (2008) Peptide release on the ribosome depends critically on the 2' OH of the peptidyl-tRNA substrate. *RNA* 8,1526-31.
 43. Agirrezabala, X, Lei, J, Brunelle, JL, Ortiz-Meoz, RF, Green, R, Frank, J. (2008) Visualization of the hybrid state of tRNA binding promoted by spontaneous ratcheting of the ribosome. *Mol Cell* 32 (2), 190-7.
 44. Li, W, Agirrezabala, X, Lei, L, Bouakaz, L, Brunelle, JL, Ortiz-Meoz, RF, Green, R, Sanyal, S, Ehrenberg, M, Frank, J. (2008) Recognition of aminoacyl-tRNA: a common molecular mechanism revealed by cryo-EM. *EMBO J* 27(24):3322-31.
 45. Zaher, HS, Green, R. (2009) Quality control by the ribosome following peptide bond formation. *Nature* 457(7226): 161-6.
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 47. Saini, P., Eyler D.E., Green, R., Dever, T.E. (2009) Hypusine-containing protein eIF5A promotes translation elongation. *Nature* 459:118-21.
 48. Djuranovic, S., Zinchenko, M.S., Hur, J.K., Nahvi, A., Brunelle, J.L., Rogers, E.J., Green, R. (2010) Allosteric regulation of Argonaute proteins by miRNAs. *Nat Struct Mol Biol* 17:144-50.
 49. He, S., and Green, R. (2010) Visualization of codon-dependent conformational rearrangements during translation termination. *Nat Struct Mol Biol* 17:465-70.
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Principal Investigator (Last, First, Middle): Green, Rachel

50. Schneider-Poetsch, T., Ju, J. Eyler, D.E., Dang, Y., Bhat, S., Merrick, W.C., Green, R., Shen, B., Liu, J.O. (2010) Inhibition of eukaryotic translation elongation by cycloheximide and lactidomycin. *Nature Chemical Biology* 6:209-17.
 51. Zaher, H.S. and Green, R. (2010) Hyperaccurate and error-prone ribosomes exploit distinct mechanisms during tRNA selection. *Mol Cell* 2010 39:110-20.
 52. Zaher, H.S. and Green, R. (2010) Kinetic basis for global loss of fidelity arising from mismatches in the P-site codon:anticodon helix. *RNA* 2010 16:1980-9.
 53. Ortiz-Meoz, R.F. and Green, R. (2010) Functional elucidation of a key contact between the tRNA and the large ribosomal subunit rRNA during decoding. *RNA* 2010 16:2002-13.
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