Andrew Fire
George D. Smith Professor in Molecular and Genetic Medicine and Professor of Pathology and of Genetics

Bio

ACADEMIC APPOINTMENTS

• Professor, Pathology
• Professor, Genetics
• Member, Bio-X
• Member, Child Health Research Institute
• Member, Stanford Cancer Institute

ADMINISTRATIVE APPOINTMENTS

• Professor of Pathology and Genetics, Stanford University School of Medicine, (2003-present)
• Assistant Professor -> Professor of Biology (Adjunct), Johns Hopkins University, (1989-2009)
• Staff Associate, Carnegie Institution of Washington, (1986-1989)

LINKS

• Fire Lab: https://sites.stanford.edu/firelab/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

->What We Do:

Our lab studies the mechanisms by which cells and organisms respond to genetic change.

The genetic landscape faced by a living cell is constantly changing. Developmental transitions, environmental shifts, and pathogenic invasions lend a dynamic character to both the genome and its activity pattern. We study a variety of natural mechanisms that are utilized by cells adapting to genetic change. These include mechanisms activated during normal development and systems for detecting and responding to foreign or unwanted genetic activity. At the root of these studies are questions of how a cell can distinguish "self" versus "nonself" and "wanted" versus "unwanted" gene expression.

We primarily make use of the nematode C. elegans in our experimental studies. C. elegans is small, easily cultured, and can readily be made to accept foreign DNA or RNA. The results of such experiments have outlined a number of concerted responses that recognize (and in most cases work to silence) the foreign nucleic acid. One such mechanism ("RNAi") responds to double stranded character in RNA: either as introduced experimentally into the organism or as produced from foreign DNA that
has not undergone selection to avoid a dsRNA response. Much of the current effort in the lab is directed toward a molecular understanding of the RNAi machinery and its roles in the cell. RNAi is not the only cellular defense against unwanted nucleic acid, and substantial current effort in the lab is also directed at identification of other triggers and mechanisms used in recognition and response to foreign information.

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->Who we are:

PI: Andrew Fire, Professor of Pathology and Genetics, Stanford University School of Medicine

Postdoctoral Fellows:
Loren Hansen (Ph.D. Boston University/NIH Joint Program, 2012)
Joshua Arribere (Ph.D. Massachusetts Institute of Technology, 2013)
Lamia Wahba (Ph.D. Johns Hopkins University, 2013)
Elif Sarinay Cenik (Ph.D. University of Massachusetts, 2012)
Massa Shoura (Ph.D. Univ. Texas at Dallas, Molecular-Cellular Biology 2013, Bioengineering 2014)

Graduate Students:
Ryan Bell [Stanford Genetics Ph.D. Program] (B.S. Brown University, 2011)
Becky Xu Hua Fu [Stanford Genetics Ph.D. Program] (B.S. UC Davis, 2012)
Sukrit Silas [Stanford Chemical and Systems Biology] (B.S. Princeton, 2011)
Nimit Jain [Stanford Bioengineering] (B.S. Yale, 2011)

Visiting Scientist (Instructor):
Christian Frokjaer-Jensen (Ph.D. University of Copenhagen, 2008)

Laboratory Manager:
Karen Artiles (Ph.D. UC Santa Cruz, 2008)

Laboratory Specialist:
Krisztina Perez

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-> Joining The Fire Lab

We welcome new applicants to the lab.

Prospective postdoctoral applicants should send a resume and summary of research to Dr. Fire (afire@stanford.edu), and arrange to have 3–4 letters of reference likewise sent to this address.

Prospective graduate students are encouraged to apply to the Stanford Genetics Ph.D. program (or to any of the biosciences Ph.D. programs): http://biosciences.stanford.edu/prospective/

Rotation Students: We welcome rotation students from any program at Stanford, with Spring being the preferred quarter. Email the PI.
We occasionally have positions for undergraduate researchers in the lab (especially summers, and particularly straightforward for current or incoming Stanford students). Email the PI at the above address.

Teaching

COURSES

2017-18

• Advanced Genetics: GENE 205 (Win)
• C. Elegans Genetics: GENE 235 (Spr)
• Computational Analysis of Biological Information: Introduction to Python for Biologists: GENE 218, MI 218, PATH 218 (Sum)

2016-17

• Advanced Genetics: GENE 205 (Win)
• Computational Analysis of Biological Information: Introduction to Python for Biologists: GENE 218, MI 218, PATH 218 (Sum)

2015-16

• Advanced Genetics: GENE 205 (Win)
• C. Elegans Genetics: GENE 235 (Spr)
• Computational Analysis of Biological Information: Introduction to Python for Biologists: GENE 218, MI 218, PATH 218 (Sum)

2014-15

• Advanced Genetics: GENE 205 (Win)
• Computational Analysis of Biological Information: Introduction to Python for Biologists: GENE 218, MI 218, PATH 218 (Sum)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)
Albert Hinman, Ian Winters

Postdoctoral Faculty Sponsor
Ryan Bell, Xu Hua Fu, Elif Sarinay Cenik, Massa Shoura, Lamia Wahba

Postdoctoral Research Mentor
Elif Sarinay Cenik

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

• Cancer Biology (Phd Program)
• Genetics (Phd Program)
• Immunology (Phd Program)

Publications

PUBLICATIONS

• Sequence-Modified Antibiotic Resistance Genes Provide Sustained Plasmid-Mediated Transgene Expression in Mammals MOLECULAR THERAPY
  Lu, J., Zhang, F., Fire, A. Z., Kay, M. A.
  2017; 25 (5): 1187-1198

• An Abundant Class of Non-coding DNA Can Prevent Stochastic Gene Silencing in the C. elegans Germline CELL
- Translation readthrough mitigation. *Nature*
  2016; 534 (7609): 719-?

- Distinct patterns of Cas9 mismatch tolerance in vitro and in vivo. *Nucleic Acids Research*
  Fu, B. X., Onge, R. P., Fire, A. Z., Smith, J. D.
  2016; 44 (11): 5365-5377

- Persistence and evolution of allergen-specific IgE repertoires during subcutaneous specific immunotherapy. *Journal of Allergy and Clinical Immunology*
  2016; 137 (5): 1535-1544

- Maturation Pathway from Germline to Broad HIV-1 Neutralizer of a CD4-Mimic Antibody. *Cell*
  2016; 165 (2): 449-463

- A streamlined tethered chromosome conformation capture protocol. *BMC Genomics*
  Gabdank, I., Ramakrishnan, S., Villeneuve, A. M., Fire, A. Z.
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- Direct CRISPR spacer acquisition from RNA by a natural reverse transcriptase-Cas1 fusion protein. *Science*
  2016; 351 (6276): 932-?

  Wang, C., Saborio, S., Gresh, L., Esvarappa, M., Wu, D., Fire, A., Parameswaran, P., Balmaseda, A., Harris, E.
  2016; 94 (2): 400-403

- Cas9 Variants Expand the Target Repertoire in Caenorhabditis elegans. *Genetics*
  Bell, R. T., Fu, B. X., Fire, A. Z.
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- Associations between nucleosome phasing, sequence asymmetry, and tissue-specific expression in a set of inbred Medaka species. *BMC Genomics*
  2015; 16

- Functional relevance of "seed" and "non-seed" sequences in microRNA-mediated promotion of C. elegans developmental progression. *RNA*
  Zhang, H., Artiles, K. L., Fire, A. Z.

- Landscape of target:guide homology effects on Cas9-mediated cleavage. *Nucleic Acids Research*
  2014; 42 (22): 13778-13787

- Efficient Marker-Free Recovery of Custom Genetic Modifications with CRISPR/Cas9 in Caenorhabditis elegans. *Genetics*
  2014; 198 (3): 837-U842

- Immunoglobulin gene insertions and deletions in the affinity maturation of HIV-1 broadly reactive neutralizing antibodies. *Cell Host & Microbe*
  2014; 16 (3): 304-313

- Human responses to influenza vaccination show seroconversion signatures and convergent antibody rearrangements. *Cell Host & Microbe*
2014; 16 (1): 105-114

- Effects of Aging, Cytomegalovirus Infection, and EBV Infection on Human B Cell Repertoires JOURNAL OF IMMUNOLOGY
  2014; 192 (2): 603-611

- Gamete-Type Dependent Crossover Interference Levels in a Defined Region of Caenorhabditis elegans Chromosome V. G3 (Bethesda, Md.)
  Gabdank, I., Fire, A. Z.
  2014; 4 (1): 117-120

- Comprehensive whole-genome sequencing of an early-stage primary myelofibrosis patient defines low mutational burden and non-recurrent candidate genes. Haematologica
  2013; 98 (11): 1689-1696

- Unusual DNA packaging characteristics in endoreduplicated Caenorhabditis elegans oocytes defined by in vivo accessibility to an endogenous nuclease activity EPIGENETICS & CHROMATIN
  Gu, S. G., Goszcynski, B., McGhee, J. D., Fire, A. Z.
  2013; 6

- Conserved translatome remodeling in nematode species executing a shared developmental transition. PLoS genetics
  Stadler, M., Fire, A.
  2013; 9 (10)

- The transcription start site landscape of C. elegans GENOME RESEARCH
  Saito, T. L., Hashimoto, S., Gu, S. G., Morton, J. J., Stadler, M., Blumenthal, T., Fire, A., Morishita, S.
  2013; 23 (8): 1348-1361

- Convergent antibody signatures in human dengue. Cell host & microbe
  2013; 13 (6): 691-700

- Co-evolution of a broadly neutralizing HIV-1 antibody and founder virus. Nature
  2013; 496 (7446): 469-476

- Minicircle DNA vectors achieve sustained expression reflected by active chromatin and transcriptional level. Molecular therapy : the journal of the American Society of Gene Therapy
  Gracey Maniar, L. E., Maniar, J. M., Chen, Z., Lu, J., Fire, A. Z., Kay, M. A.
  2013; 21 (1): 131-138

- Minicircle DNA Vectors Achieve Sustained Expression Reflected by Active Chromatin and Transcriptional Level MOLECULAR THERAPY
  Maniar, L. E., Maniar, J. M., Chen, Z., Lu, J., Fire, A. Z., Kay, M. A.
  2013; 21 (1): 131-138

- Contributions of mRNA abundance, ribosome loading, and post- or peri-translational effects to temporal repression of C-elegans heterochronic miRNA targets GENOME RESEARCH
  Stadler, M., Artiles, K., Pak, J., Fire, A.
  2012; 22 (12): 2418-2426

- Whole Genome Sequence Analysis of Primary Myelofibrosis. 54th Annual Meeting and Exposition of the American-Society-of-Hematology (ASH)
  Merker, J. D., Roskin, K., Ng, D., Pan, C., Fisk, D. G., Jones, C. D., Gojenola, L., Clark, M. J., Zhang, B., Cherry, M., Snyder, M., Boyd, S. D., Zehnder, et al
  AMER SOC HEMATOLOGY.2012

- Protection from Feed-Forward Amplification in an Amplified RNAi Mechanism CELL
  Pak, J., Maniar, J. M., Mello, C. C., Fire, A.
  2012; 151 (4): 885-899
- **The Extragenic Spacer Length Between the 5' and 3' Ends of the Transgene Expression Cassette Affects Transgene Silencing From Plasmid-based Vectors** *MOLECULAR THERAPY*
  Lu, J., Zhang, F., Xu, S., Fire, A. Z., Kay, M. A.
  2012; 20 (11): 2111-2119

- **A nuclear Argonaute promotes multigenerational epigenetic inheritance and germline immortality** *NATURE*
  2012; 489 (7416): 447-451

- **Amplification of siRNA in Caenorhabditis elegans generates a transgenerational sequence-targeted histone H3 lysine 9 methylation footprint** *NATURE GENETICS*
  Gu, S. G., Pak, J., Guang, S., Maniar, J. M., Kennedy, S., Fire, A.
  2012; 44 (2): 157-164

- **The Inference of Phased Haplotypes for the Immunoglobulin H Chain V Region Gene Loci by Analysis of VDJ Gene Rearrangements** *JOURNAL OF IMMUNOLOGY*
  2012; 188 (3): 1333-1340

- **High-throughput VDJ sequencing for quantification of minimal residual disease in chronic lymphocytic leukemia and immune reconstitution assessment** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  2011; 108 (52): 21194-21199

- **Wobble base-pairing slows in vivo translation elongation in metazoans** *RNA-A PUBLICATION OF THE RNA SOCIETY*
  Stadler, M., Fire, A.
  2011; 17 (12): 2063-2073

- **Initial antibodies binding to HIV-1 gp41 in acutely infected subjects are polyreactive and highly mutated** *JOURNAL OF EXPERIMENTAL MEDICINE*
  2011; 208 (11): 2237-2249

- **Competition between ADAR and RNAi pathways for an extensive class of RNA targets** *NATURE STRUCTURAL & MOLECULAR BIOLOGY*
  Wu, D., Lamm, A. T., Fire, A. Z.
  2011; 18 (10): 1094-U24

- **'Inc-miRs': functional intron-interrupted miRNA genes** *GENES & DEVELOPMENT*
  Zhang, H., Maniar, J. M., Fire, A. Z.
  2011; 25 (15): 1589-1594

- **Determinants of nucleosome organization in primary human cells** *NATURE*
  2011; 474 (7352): 516-U148

- **Up-Regulated Dicer Expression in Patients with Cutaneous Melanoma** *PLOS ONE*
  Ma, Z., Swede, H., Cassarino, D., Fleming, E., Fire, A., Dadras, S. S.
  2011; 6 (6)

- **On the nature of in vivo requirements for rde-4 in RNAi and developmental pathways in C-elegans** *RNA BIOLOGY*
  2011; 8 (3): 458-467

- **EGO-1, a C. elegans RdRP, Modulates Gene Expression via Production of mRNA-Templated Short Antisense RNAs** *CURRENT BIOLOGY*
  Maniar, J. M., Fire, A. Z.
  2011; 21 (6): 449-459

- **Multimodal RNA-seq using single-strand, double-strand, and CircLigase-based capture yields a refined and extended description of the C. elegans transcriptome** *GENOME RESEARCH*
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  AMER SOC HEMATOLOGY.2010: 552–52

• Cell autonomous specification of temporal identity by Caenorhabditis elegans microRNA lin-4 *DEVELOPMENTAL BIOLOGY*
  Zhang, H., Fire, A. Z.
  2010; 344 (2): 603-610

• Distributed probing of chromatin structure in vivo reveals pervasive chromatin accessibility for expressed and non-expressed genes during tissue differentiation in C. elegans *BMC GENOMICS*
  Sha, K., Gu, S. G., Pantalena-Filho, L. C., Goh, A., Fleenor, J., Blanchard, D., Krishna, C., Fire, A.
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• An in vitro-identified high-affinity nucleosome-positioning signal is capable of transiently positioning a nucleosome in vivo *EPIGENETICS & CHROMATIN*
  2010; 3

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  2010; 184 (12): 6986-6992

• Ultra-high throughput sequencing-based small RNA discovery and discrete statistical biomarker analysis in a collection of cervical tumours and matched controls *BMC BIOLOGY*
  Witten, D., Tibshirani, R., Gu, S. G., Fire, A., Lui, W.
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• Human tRNA-derived small RNAs in the global regulation of RNA silencing *RNA-A PUBLICATION OF THE RNA SOCIETY*
  Hauasseker, D., Huang, Y., Lau, A., Parameswaran, P., Fire, A. Z., Kay, M. A.
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• Distinct Phases of siRNA Synthesis in an Endogenous RNAi Pathway in C. elegans Soma *MOLECULAR CELL*
  2010; 37 (5): 679-689

• Six RNA Viruses and Forty-One Hosts: Viral Small RNAs and Modulation of Small RNA Repertoires in Vertebrate and Invertebrate Systems *PLOS PATHOGENS*
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• Partitioning the C. elegans genome by nucleosome modification, occupancy, and positioning *CHROMOSOMA*
  Guoping, S., Fire, A.
  2010; 119 (1): 73-87

• Measurement and Clinical Monitoring of Human Lymphocyte Clonality by Massively Parallel V-D-J Pyrosequencing *SCIENCE TRANSLATIONAL MEDICINE*
  2009; 1 (12)

• A Caenorhabditis elegans RNA-Directed RNA Polymerase in Sperm Development and Endogenous RNA Interference *GENETICS*
  Gent, J. I., Schvarzstein, M., Villeneuve, A. M., Gu, S. G., Jantsch, V., Fire, A. Z., Baudrimont, A.
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• Profiling and Discovery of Novel miRNAs from Formalin-Fixed, Paraffin-Embedded Melanoma and Nodal Specimens *JOURNAL OF MOLECULAR DIAGNOSTICS*
  Ma, Z., Lui, W., Fire, A., Dadras, S. S.
• **Caudal-like PAL-1 directly activates the bodywall muscle module regulator hlh-1 in C. elegans to initiate the embryonic muscle gene regulatory network** - *DEVELOPMENT*
  Lei, H., Liu, J., Fukushige, T., Fire, A., Krause, M.
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• **Chromatin-Associated Periodicity in Genetic Variation Downstream of Transcriptional Start Sites** - *SCIENCE*
  2009; 323 (5912): 401-404

• **High-Throughput Sequencing for Diagnosis, Prognosis and Monitoring of Lymphoid Malignancies.** - 50th Annual Meeting of the American-Society-of-Hematology/ASH/ASCO Joint Symposium
  Boyd, S. D., Merker, J. D., Zehnder, J. L., Fire, A. Z.
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• **Transmission Dynamics of Heritable Silencing Induced by Double-Stranded RNA in Caenorhabditis elegans** - *GENETICS*
  Alcazar, R. M., Lin, R., Fire, A. Z.
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• **CED-9 and mitochondrial homeostasis in C-elegans muscle** - *JOURNAL OF CELL SCIENCE*
  Tan, F. J., Husain, M., Manlandro, C. M., Koppenol, M., Fire, A. Z., Hill, R. B.
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• **A high-resolution, nucleosome position map of C. elegans reveals a lack of universal sequence-dictated positioning** - *GENOME RESEARCH*
  2008; 18 (7): 1051-1063

• **Capped small RNAs and MOV10 in human hepatitis delta virus replication** - *NATURE STRUCTURAL & MOLECULAR BIOLOGY*
  Haussiecker, D., Cao, D., Huang, Y., Parameswaran, P., Fire, A. Z., Kay, M. A.
  2008; 15 (7): 714-721

• **MicroRNA expression signature of human sarcomas** - *ONCOGENE*
  2008; 27 (14): 2015-2026

• **Regulation of apoptosis by C-elegans CED-9 in the absence of the C-terminal transmembrane domain** - *CELL DEATH AND DIFFERENTIATION*
  Tan, F. J., Fire, A. Z., Hill, R. B.

• **A pyrosequencing-tailored nucleotide barcode design unveils opportunities for large-scale sample multiplexing** - *NUCLEIC ACIDS RESEARCH*
  Parameswaran, P., Jalili, R., Tao, L., Shokralla, S., Gharizadeh, B., Ronaghi, M., Fire, A. Z.
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• **Distinct ribonucleoprotein reservoirs for microRNA and siRNA populations in C-elegans** - *RNA-A PUBLICATION OF THE RNA SOCIETY*
  Gu, S. G., Pak, J., Barberan-Soler, S., Ali, M., Fire, A.; Zahler, A. M.
  2007; 13 (9): 1492-1504

• **Patterns of known and novel small RNAs in human cervical cancer** - *CANCER RESEARCH*
  Lui, W., Pourmand, N., Patterson, B. K., Fire, A.
  2007; 67 (13): 6031-6043

• **Distinct populations of primary and secondary effectors during RNAi in C-elegans** - *SCIENCE*
  Pak, J., Fire, A.
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  Fire, A. Z.
  2007; 46 (37): 6966-6984

• Gene silencing by double-stranded RNA (Nobel Lecture) ANGEWANDTE CHEMIE-INTERNATIONAL EDITION
  Fire, A. Z.
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  Blanchard, D., Hutter, H., Fleenor, J., Fire, A.
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• An antagonistic role for the C-elegans Schnurri homolog SMA-9 in modulating TGF beta signaling during mesodermal patterning DEVELOPMENT
  2006; 133 (15): 2887-2896

• Unusual DNA structures associated with germline genetic activity in Caenorhabditis elegans GENETICS
  Fire, A., Alcazar, R., Tan, F.
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• Structural analysis of hyperperiodic DNA from Caenorhabditis elegans NUCLEIC ACIDS RESEARCH
  2006; 34 (10): 3057-3066

• Nucleic acid structure and intracellular immunity: some recent ideas from the world of RNAi Workshop on Fundamentals of Biomolecular Function - Nucleic Acids, Proteins and Membranes
  Fire, A.
  CAMBRIDGE UNIV PRESS.2005: 303–9

• Imprinting capacity of gamete lineages in Caenorhabditis elegans GENETICS
  Sha, K., Fire, A.
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• Cyclin D involvement demarcates a late transition in C-elegans embryogenesis DEVELOPMENTAL BIOLOGY
  Yanowitz, J., Fire, A.
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  Timmons, L., Tabara, H., Mello, C. C., Fire, A. Z.
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  2002; 12 (15): 1317-1319

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  Kostas, S. A., Fire, A.
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Genes and mechanisms related to RNA interference regulate expression of the small temporal RNAs that control C-elegans developmental timing *CELL*
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Liu, J., Fire, A.
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Parrish, S., Fleenor, J., Xu, S. Q., Mello, C., Fire, A.
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The RING finger/B-box factor TAM-1 and a retinoblastoma-like protein LIN-35 modulate context-dependent gene silencing in Caenorhabditis elegans *GENES & DEVELOPMENT*
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  Kelly, W. G., Fire, A.
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  Montgomery, M. K., Fire, A.
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  Harfe, B. D., Branda, C. S., Krause, M., Stern, M. J., Fire, A.
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  Harfe, B. D., Fire, A.
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