# Alan P. Boyle

2017 Palmer Commons
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www.BoyleLab.org

## Education

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| 2005–2009 | **Doctor of Philosophy,** Computational Biology and Bioinformatics<br>Duke University, Durham, NC |
| 2001–2005 | **Bachelor of Science,** Biochemistry and Molecular Biology<br>**Bachelor of Science,** Computer Science<br>Mississippi State University, Starkville, MS |

## Academic Appointments

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|---|---|
| 2014–present | **Assistant Professor,** Department of Computational Medicine & Bioinformatics<br>**Member,** Program in Biomedical Sciences<br>**Member,** Bioinformatics Training Program |
| 2015–present | **Assistant Professor,** Department of Human Genetics<br>**Member,** Genome Science Training Program (GSTP)<br>**Member,** Michigan Predoctoral Training Program in Genetics (GTP) |
| 2016–present | **Member,** Center for RNA Biomedicine<br>University of Michigan, Ann Arbor, MI |
| 2010–2014 | **Postdoctoral Scholar,** Genetics<br>Stanford University, Stanford, CA; Advisor: Dr. Michael Snyder |
| Spring 2010 | **Postdoctoral Associate,** Computational Biology<br>Duke University, Durham, NC; Advisor: Dr. Terrence S. Furey |

## Scholarships, Fellowships, and Honors

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|---|---|
| 2016 | Institutional nominee for W.M. Keck Foundation Medical Science Research Program |
| 2016 | Institutional nominee for Searle Scholar Award |
| 2015–2017 | Alfred P. Sloan Foundation Fellowship in Computational & Evolutionary Molecular Biology |
| 2013–2014 | NIH Pathway to Independence Award (K99/R00) [1K99HG007356-01] |
| 2012 | AAAS/Science Program for Excellence in Science |
| 2005–2008 | NSF Graduate Research Fellowship |
| 2005–2009 | James B. Duke Fellowship |
| Summer 2004 | Mayo Clinic Summer Undergraduate Research Fellow |
| 2003 | Barry M. Goldwater Memorial Scholarship |
| Summer 2003 | The Institute for Genomic Research (TIGR) Summer Fellow |
| 2001 | Robert C. Byrd Honors Scholarship |
| 2001 | Mississippi State University Presidential Scholarship |
| 2001 | National Merit Scholarship |

## Grant Support (Active)

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| 2013–2017 | R00 HG007356 Pathway to Independence Award (K99/R00) — (PI: Boyle)<br>NIH/NHGRI — Total Costs: $937,771<br>Global Discovery and Validation of Functional Regulatory Elements<br>This project seeks to extend current assays demonstrating function of genomic regions into an equivalent genome-wide assay. |
| 2015–2017 | Fellowship in Computational & Evolutionary Molecular Biology — (PI: Boyle)<br>Alfred P. Sloan Foundation — Total Costs: $50,000 |
| 2016–2020 | R01 HL130705 — (PI: Willer, Co-I:Boyle 10% Y3-4) |

NIH/NHLBI                                                          Total Costs: $2,784,005
Large-scale human genetics to understand molecular mechanisms of atrial fibrillation and related traits
This project seeks to provide new insights into atrial fibrillation mechanisms through whole-genome screening.

## Professional Service

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| Since 2009 | *Ad hoc* reviewer for the journals: *Genome Research, Genome Biology, Nature Neuroscience, Nature Communications, Nature Protocols, Bioinformatics, BMC Bioinformatics, Scientific Reports, Atherosclerosis, BioEssays, Gene* |
| 2016–current | DCM&B Faculty Recruitment Committee |
| 2016–current | DCM&B Seminar Series Committee Chair |
| 2015–current | Program Committee, Great Lakes Bioinformatics and Canadian Computational Biology Conference (GLBIO/CCBC) |
| 2015–current | Program Committee, Algorithms for Computational Biology (ALCOB) |
| 2015–current | DCM&B Admissions Committee |
| 2015–current | DHG Computational Support Committee |
| 2015–current | DCM&B Retreat Planing Committee Chair (1st annual) |
| 2015 | Reviewer for UK Medical Research Council (RCUK MRC) |
| 2015 | Reviewer for UK Biotechnology and Biological Sciences Research Council (RCUK BBSRC) |
| 2015 | Reviewer for Michigan Institute for Clinical & Health Research (MICHR) Postdoctoral Translational Scholars Program |
| 2014 | *Ad hoc* admissions reviewer, University of Michigan DCM&B |
| 2013–current | Member, International Society for Computational Biology (ISCB) |
| 2012–current | Member, American Association for the Advancement of Science (AAAS) |
| 2013–current | Program Committee, Gene Regulation and Transcriptomics, ISMB/ECCB |
| 2012–2015 | DNA Day Essay Contest Detailed Review Judge for ASHG |
| 2012 | Distinguished contributor as a leading reviewer for the journal *Bioinformatics* |
| 2008–2009 | Duke Computational Biology & Bioinformatics student committee |
| 2005–current | Member, Gamma Sigma Delta Agricultural Honor Society |

## Teaching and Mentorship

### Teaching

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|---|---|
| 2017–current | Bioinformatics Seminar Course (BIOINF 601) [Course Director] |
| 2016 | Experimental Genetics Systems (HUMGEN 632) [1 discussion] |
| 2015–current | Gene Structure and Regulation (HUMGEN 541) [3 lectures + 2 discussions / yr.] |
| 2015–current | Introduction to Bioinformatics & Computational Biology (BIOINF 527) [2 lectures + lab / yr.] |
| 2015–current | Bioinformatics Journal Club (BIOINF 602/603) |
| 2015–current | Basic Biology for Graduate Students with Quantitative Training (BIOINF 523) [2 lectures / yr.] |
| 2014 | BIOINF 527 Panel on "Challenges in Biology, Biomedicine, Data & Analysis" |
| 2010 | Co-taught Cold Spring Harbor Systems Biology Pre-meeting Workshop |
| 2009 | Duke student panelist for "How to prepare for and get into graduate school" |
| 2008 | Taught Duke mini-course on Genome Browsers & Databases |
| Fall 2003 | Lab TA for Isotopes Tech I (MS. State, BCH 4414) |

### Mentorship

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|---|---|
| 2016–current | Cody Morterud (Undergraduate, UROP Computer Science, University of Michigan) |
| 2016–current | Colten Williams (Undergraduate, UROP Computer Science, University of Michigan) |
| 2016–current | Haley Amemiya (Rotation Student, Molecular, Cellular, and Developmental Biology, University of Michigan) |
| 2016–current | Shriya Sethuraman (Ph.D. Student, Bioinformatics, University of Michigan) |
| 2016–current | Courtney Asman (Undergraduate, Neuroscience, University of Michigan) |
| 2016–current | Shengcheng Dong (Ph.D. Student, Bioinformatics, University of Michigan) |
| 2016–current | Christopher Castro (Ph.D. Student, Bioinformatics, University of Michigan) |
| 2015–current | Ningxin Ouyang (M.S. Student, Bioinformatics, University of Michigan) |
| 2015–current | Torrin McDonald (Ph.D. Student, Human Genetics, University of Michigan) |

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| 2015–current | Greg Farnum (Ph.D. Student, Bioinformatics, University of Michigan) |
| 2015–current | Sierra Nishizaki (Ph.D. Student, Human Genetics, University of Michigan) |
| 2014–2016 | Maxwell Spadafore (Undergraduate, LS&A Honors Informatics, University of Michigan) |
| 2013–2014 | Natalie Ng (High School, Stanford Institutes of Medicine Summer Research) |
| 2013–2014 | Dana Wyman (Undergraduate, Biology, Stanford University) |
| 2013 | Justin Young (High School, Stanford Institutes of Medicine Summer Research) |
| 2012 | Melanie Connick (Undergraduate, Biology, University of New Mexico) |
| 2012 | Edward Dai (Undergraduate, Computer Science, Stanford University) |

**Doctoral Thesis Committees**

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|---|---|
| 2016–current | Mohd Hafiz Bin Mohd Rothi (Molecular, Cellular, and Developmental Biology, University of Michigan) |
| 2015–current | Zhengting Zou (Bioinformatics, University of Michigan) |
| 2015–current | Ari Allyn-Feuer (Bioinformatics, University of Michigan) |
| 2015–current | Raymond Cavalcante (Bioinformatics, University of Michigan) |

# Industry Experience

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| 2013–2014 | Consultant, Color Genomics |
| | Personalized medicine / genomics startup |

# Publications
<span style="float:right">* Indicates co-first authorship</span>

[1] Nishizaki SS, **Boyle AP**. "Mining the Unknown: Assigning Function to Noncoding Single Nucleotide Polymorphisms." *Trends in Genetics* 2017, 33:34–45. PMID: 27939749.

[2] Diehl AG, **Boyle AP**. "Deciphering ENCODE." *Trends in Genetics* 2016, 32(4):238–249. PMID: 26962025.

[3] Phanstiel DH, **Boyle AP**, Heidari N, Snyder MP. "Mango: A bias correcting ChIA-PET analysis pipeline." *Bioinformatics* 2015. PMID: 26034063.

[4] Cheng Y, Ma Z, Kim BH, Wu W, Cayting P, **Boyle AP**, Sundaram V, Xing X, Dogan N, Li J, Euskirchen G, Lin S, Lin Y, Visel A, Kawli T, Yang X, Patacsil D, Keller CA, Giardine B, Mouse ENCODE Consortium, Kundaje A, Wang T, Pennacchio LA, Weng Z, Hardison RC, Snyder MP. "Principles of regulatory information conservation between mouse and human." *Nature* 2014, 515(7527):371–375. PMID: 25409826.

[5] Yue F, Cheng Y, Breschi A, Vierstra J, Wu W, Ryba T, Sandstrom R, Ma Z, Davis C, Pope BD, Shen Y, Pervouchine DD, Djebali S, Thurman RE, Kaul R, Rynes E, Kirilusha A, Marinov GK, Williams BA, Trout D, Amrhein H, Fisher-Aylor K, Antoshechkin I, DeSalvo G, See LH, Fastuca M, Drenkow J, Zaleski C, Dobin A, Prieto P, Lagarde J, Bussotti G, Tanzer A, Denas O, Li K, Bender MA, Zhang M, Byron R, Groudine MT, McCleary D, Pham L, Ye Z, Kuan S, Edsall L, Wu YC, Rasmussen MD, Bansal MS, Kellis M, Keller CA, Morrissey CS, Mishra T, Jain D, Dogan N, Harris RS, Cayting P, Kawli T, **Boyle AP**, Euskirchen G, Kundaje A, Lin S, Lin Y, Jansen C, Malladi VS, Cline MS, Erickson DT, Kirkup VM, Learned K, Sloan CA, Rosenbloom KR, Lacerda de Sousa B, Beal K, Pignatelli M, Flicek P, Lian J, Kahveci T, Lee D, Kent WJ, Ramalho Santos M, Herrero J, Notredame C, Johnson A, Vong S, Lee K, Bates D, Neri F, Diegel M, Canfield T, Sabo PJ, Wilken MS, Reh TA, Giste E, Shafer A, Kutyavin T, Haugen E, Dunn D, Reynolds AP, Neph S, Humbert R, Hansen RS, De Bruijn M, Selleri L, Rudensky A, Josefowicz S, Samstein R, Eichler EE, Orkin SH, Levasseur D, Papayannopoulou T, Chang KH, Skoultchi A, Gosh S, Disteche C, Treuting P, Wang Y, Weiss MJ, Blobel GA, Cao X, Zhong S, Wang T, Good PJ, Lowdon RF, Adams LB, Zhou XQ, Pazin MJ, Feingold EA, Wold B, Taylor J, Mortazavi A, Weissman SM, Stamatoyannopoulos JA, Snyder MP, Guigo R, Gingeras TR, Gilbert DM, Hardison RC, Beer MA, Ren B, Mouse ENCODE Consortium. "A comparative encyclopedia of DNA elements in the mouse genome." *Nature* 2014, 515(7527):355–364. PMID: 25409824.

[6] **Boyle AP**, Araya CL, Brdlik C, Cayting P, Cheng C, Cheng Y, Gardner K, Hillier LW, Janette J, Jiang L, Kasper D, Kawli T, Kheradpour P, Kundaje A, Li JJ, Ma L, Niu W, Rehm EJ, Rozowsky J, Slattery M, Spokony R, Terrell R, Vafeados D, Wang D, Weisdepp P, Wu YC, Xie D, Yan KK, Feingold EA, Good PJ, Pazin MJ, Huang H, Bickel PJ, Brenner SE, Reinke V, Waterston RH, Gerstein M, White KP, Kellis M, Snyder M. "Comparative analysis of regulatory information and circuits across distant species." *Nature* 2014, 512(7515):453–456. PMID: 25164757.

[7] Araya CL, Kawli T, Kundaje A, Jiang L, Wu B, Vafeados D, Terrell R, Weissdepp P, Gevirtzman L, Mace D, Niu W, **Boyle AP**, Xie D, Ma L, Murray JI, Reinke V, Waterston RH, Snyder M. "Regulatory analysis of the C. elegans genome with spatiotemporal resolution." *Nature* 2014, 512(7515):400–405. PMID: 25164749.

[8] Phanstiel DH, **Boyle AP**, Araya CL, Snyder MP. "Sushi.R: flexible, quantitative and integrative genomic visualizations for publication-quality multi-panel figures." *Bioinformatics* 2014. PMID: 24903420.

[9] *Xie D, ***Boyle AP**, *Wu L, Kawli T, Zhai J, Snyder M. "Dynamic trans-acting factor colocalization in human cells." *Cell* 2013, 155(3):713–724. PMID: 24243024.

[10] *Kasowski M, *Kyriazopoulou-Panagiotopoulou S, *Grubert F, *Zaugg JB, *Kundaje A, Liu Y, **Boyle AP**, Zhang QC, Zakharia F, Spacek DV, Li J, Xie D, Steinmetz LM, Hogenesch JB, Kellis M, Batzoglou S, Snyder M. "Extensive variation in chromatin states across humans." *Science* 2013, 342(6159):750–752. PMID: 24136358.

[11] **Boyle AP**, Hong EL, Hariharan M, Cheng Y, Schaub MA, Kasowski M, Karczewski KJ, Park J, Hitz BC, Weng S, Cherry JM, Snyder M. "Annotation of functional variation in personal genomes using RegulomeDB." *Genome Research* 2012, 22(9):1790–1797. PMID: 22955989.

[12] Schaub MA, **Boyle AP**, Kundaje A, Batzoglou S, Snyder M. "Linking disease associations with regulatory information in the human genome." *Genome Research* 2012, 22(9):1748–1759. PMID: 22955986.

[13] The ENCODE Project Consortium. "An integrated encyclopedia of DNA elements in the human genome." *Nature* 2012, 489(7414):57–74. PMID: 22955616.

[14] *Gerstein MB, *Kundaje A, *Hariharan M, *Landt SG, *Yan KK, *Cheng C, *Mu XJ, *Khurana E, *Rozowsky J, *Alexander R, *Min R, *Alves P, Abyzov A, Addleman N, Bhardwaj N, **Boyle AP**, Cayting P, Charos A, Chen DZ, Cheng Y, Clarke D, Eastman C, Euskirchen G, Frietze S, Fu Y, Gertz J, Grubert F, Harmanci A, Jain P, Kasowski M, Lacroute P, Leng J, Lian J, Monahan H, O'Geen H, Ouyang Z, Partridge EC, Patacsil D, Pauli F, Raha D, Ramirez L, Reddy TE, Reed B, Shi M, Slifer T, Wang J, Wu L, Yang X, Yip KY, Zilberman-Schapira G, Batzoglou S, Sidow A, Farnham PJ, Myers RM, Weissman SM, Snyder M. "Architecture of the human regulatory network derived from ENCODE data." *Nature* 2012, 489(7414):91–100. PMID: 22955619.

[15] *Chen R, *Mias GI, *Li-Pook-Than J, *Jiang L, Lam HYK, Chen R, Miriami E, Karczewski KJ, Hariharan M, Dewey FE, Cheng Y, Clark MJ, Im H, Habegger L, Balasubramanian S, O'Huallachain M, Dudley JT, Hillenmeyer S, Haraksingh R, Sharon D, Euskirchen G, Lacroute P, Bettinger K, **Boyle AP**, Kasowski M, Grubert F, Seki S, Garcia M, Whirl-Carrillo M, Gallardo M, Blasco MA, Greenberg PL, Snyder P, Klein TE, Altman RB, Butte AJ, Ashley EA, Gerstein M, Nadeau KC, Tang H, Snyder M. "Personal omics profiling reveals dynamic molecular and medical phenotypes." *Cell* 2012, 148(6):1293–1307. PMID: 22424236.

[16] *Song L, *Zhang Z, *Grasfeder LL, ***Boyle AP**, *Giresi PG, *Lee B, *Sheffield NC, Graff S, Huss M, Keefe D, Liu Z, London D, McDaniell RM, Shibata Y, Showers KA, Simon JM, Vales T, Wang T, Winter D, Zhang Z, Clarke ND, Birney E, Iyer VR, Crawford GE, Lieb JD, Furey TS. "Open chromatin defined by DNaseI and FAIRE identifies regulatory elements that shape cell-type identity." *Genome Research* 2011, 21(10):1757–1767. PMID: 21750106.

[17] The ENCODE Project Consortium. "A user's guide to the encyclopedia of DNA elements (ENCODE)." *PLoS Biology* 2011, 9(4):e1001046. PMID: 21526222.

[18] **Boyle AP**, Song L, Lee B, London D, Keefe D, Birney E, Iyer VR, Crawford GE, Furey TS. "High-resolution genome-wide in vivo footprinting of diverse transcription factors in human cells." *Genome Research* 2011, 21:456–464. PMID: 21106903.

[19] *Stitzel ML, *Sethupathy P, Pearson DS, Chines PS, Song L, Erdos MR, Welch R, Parker SCJ, **Boyle AP**, Scott LJ, Margulies EH, Boehnke M, Furey TS, Crawford GE, Collins FS. "Global epigenomic analysis of primary human pancreatic islets provides insights into type 2 diabetes susceptibility loci." *Cell Metabolism* 2010, 12(5):443–455. PMID: 21035756.

[20] McDaniell R, Lee B, Song L, Liu Z, **Boyle AP**, Erdos MR, Scott LJ, Morken MA, Kucera KS, Battenhouse A, Keefe D, Collins FS, Willard HF, Lieb JD, Furey TS, Crawford GE, Iyer VR, Birney E. "Heritable individual-specific and allele-specific chromatin signatures in humans." *Science* 2010, 328(5975):235–239. PMID: 20299549.

[21] Georgiev S, **Boyle AP**, Jayasurya K, Mukherjee S, Ohler U. "Evidence-ranked motif identification." ***Genome Biology*** 2010, 11(2):R19. PMID: 20156354.

[22] Babbitt CC, Fedrigo O, Pfefferle AD, **Boyle AP**, Horvath JE, Furey TS, Wray GA. "Both noncoding and protein-coding RNAs contribute to gene expression evolution in the primate brain." ***Genome Biology and Evolution*** 2010, 2:67–79. PMID: 20333225.

[23] Xu X, Tsumagari K, Sowden J, Tawil R, **Boyle AP**, Song L, Furey TS, Crawford GE, Ehrlich M. "DNaseI hypersensitivity at gene-poor, FSH dystrophy-linked 4q35.2." ***Nucleic Acids Research*** 2009, 37(22):7381–7393. PMID: 19820107.

[24] **Boyle AP**, Furey TS. "High-resolution mapping studies of chromatin and gene regulatory elements." ***Epigenomics*** 2009, 1(2):319–329. PMID: 20514362.

[25] **Boyle AP**, Guinney J, Crawford GE, Furey TS. "F-Seq: a feature density estimator for high-throughput sequence tags." ***Bioinformatics*** 2008, 24(21):2537–2538. PMID: 18784119.

[26] **Boyle AP**, Davis S, Shulha HP, Meltzer P, Margulies EH, Weng Z, Furey TS, Crawford GE. "High-resolution mapping and characterization of open chromatin across the genome." ***Cell*** 2008, 132(2):311–322. PMID: 18243105.

[27] **Boyle AP**, Boyle JA. "Global analysis of microbial translation initiation regions." In ***Journal of the Mississippi Academy of Sciences***, *Volume 48* 2003:138–150.

[28] **Boyle AP**, Boyle JA. "Visualization of aligned genomic open reading frame data." ***Biochemistry and Molecular Biology Education*** 2003, 31:64–68.

[29] Wan X, Boyle JA, Bridges SM, **Boyle AP**. "Interactive clustering for exploration of genomic data." In ***Proceedings of the Artificial Neural Networks in Engineering Conference***, *Volume 12*, St. Louis, MO 2002:753–758.

## Patents

[30] Karczewski K, Snyder M, Butte AJ, Dudley JT, Hong E, Boyle A, Cherry MJ. "Method and system for the use of biomarkers for regulatory dysfunction in disease." 2013, (US Patent Application 20130116931).