

# Calen Patrick Ryan

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## Areas of specialization and current research interests

*Reproduction, Aging, Epigenetic Processes, Health, Evolutionary Theory, Trade-offs, Social Determinants of Health, Inheritance, Inequality, Computational Statistics, Longitudinal Studies, Data Science*

## Education

2020	Ph.D., Anthropology	Northwestern University
2018	M.A., Anthropology	Northwestern University
2013	M.Sc., Biological Sciences	Simon Fraser University
2010	B.Sc.(Hons.), Zoology	University of Manitoba

## Professional Appointments

2023-	Associate Research Scientist and Data Science Lead Columbia Aging Center	Columbia University Mailman School of Public Health
2022- 2023	Postdoctoral Research Scientist PI: Daniel Belsky	Columbia University Mailman School of Public Health
2021- 2022	Postdoctoral Researcher PI: Christopher Kuzawa	Northwestern University Department of Anthropology

## Research Funding

### Active Funding

- 04/2025- **National Institutes of Health (NIH), National Institute of Child Health and Human Development (NICHD)** US\$4,134,258.00  
03/2030 Leveraging IVF to Identify Prenatal Effects Independent of Shared Maternal-Child Genes  
Role: Co-PI
- 12/2024- **CUIMC Healthy Aging Initiative (CHAI) Pilot Grant** US\$55,000.00  
12/2025 Quantification of Biological Aging in Electronic Health Record Data for Precision Prognosis in ICU Patients  
Role: Co-PI

### Completed Funding

- 06/2021- **Telomere Research Network Pilot Award** US\$4,000.00  
12/2021 **(NIH/NIEHS)**  
Exploring the links between ovarian aging and somatic aging in humans: A study of leukocyte telomere length across the menopausal transition in a Philippine cohort  
Role: Co-PI
- 03/2018- **National Science Foundation (DDIG)** US\$31,205.00  
02/2021 Quantifying the costs of human reproduction using the 'Epigenetic Clock'  
Role: Co-PI

## Publications

### Peer-reviewed articles

- 2025** Balachandran, A., Pei, H., Shi, Y., Beard, J. R., Caspi, A., Cohen, A. A., Domingue, B. W., Eckstein Indik, C., Ferrucci, L., Furuya, A., Kothari, M., Moffitt, T. E., **Ryan, C. P.**, Skirbekk, V., Zhang, Y. S., Belsky, D. W. Pace of Aging analysis of healthspan and lifespan in older adults in the US and UK. *Nature Aging*, 5(6), 1132–1142. <https://doi.org/10.1038/s43587-025-00866-6>
- 2025** Nyembwe, A., Zhao, Y., Caceres, B. A., Belsky, D. W., **Ryan, C. P.**, Taylor, B., Morrison, M. T., Prescott, L., Potts-Thompson, S., Aziz, A., Aruleba, F., Matute-Arcos, E., Williams, O., Crusto, C., Taylor, J. Y. Discrimination, Coping, and DNAm Accelerated Aging Among African American Mothers of the InterGEN Study. *Epigenomes*, 9(2), Article 2. <https://doi.org/10.3390/epigenomes9020014>

- 2025** Zhuang, B. C., Jude, M. S., Konwar, C., Yusupov, N., **Ryan, C. P.**, Engelbrecht, H.-R., Whitehead, J., Halberstam, A. A., MacIsaac, J. L., Dever, K., Tran, T. K., Korinek, K., Zimmer, Z., Lee, N. R., McDade, T. W., Kuzawa, C. W., Huffman, K. M., Belsky, D. W., Binder, E. B., ... Kobor, M. S. Accounting for differences between Infinium MethylationEPIC v2 and v1 in DNA methylation-based tools. *Life Science Alliance*, 8(9). <https://doi.org/10.26508/lsa.202403155>
- 2024** **Ryan, C.P.**, Corcoran, D.L., Banskota, N., Eckstein Indik, C., Floratos, A., Friedman, R.A., Kobor, M.S., Kraus, V.B., Kraus, W., MacIsaac, J. and Orenduff, M.C., Pieper, C.F., White, J.P., Ferrucci, L., Horvath, S., Huffman, K.M., Belsky, D.W. The CALERIE Genomic Data Resource. *Nature Aging*. <https://doi.org/10.1038/s43587-024-00775-0>.
- 2024** Zhou J., Indik, C.E., Kuipers, T.B., Li, C., Nivard, M.G., **Ryan, C.P.**, Tucker-Drob, E.M., Taeubert, M.J., Wang, S., Wang, T., Conley, D., Heijmans, B.T., Lumey L.H., Belsky, D.W. Genetic analysis of selection bias in a natural experiment: Investigating in-utero famine effects on elevated body mass index in the Dutch Hunger Winter Families Study. *American Journal of Epidemiology*. kwae376, <https://doi.org/10.1093/aje/kwae376>
- 2024** Savin, M.J., Wang, H., Pei, H, Aiello, A.E., Assuras, S., Caspi, T.E., Moffit, T.E., Muenning, C.P., **Ryan, C.P.**, Shi, B., Stern, Y., Sugden, K., Valeri, L., Belsky, D.W. Faster DunedinPACE, an epigenetic clock for pace of biological aging, is associated with accelerated cognitive aging among older adults in the Framingham Heart Study. *Alzheimer's & Dementia: Diagnosis, Assessment and Disease Monitoring*. 16:e70031. <https://doi.org/10.1002/dad2.70038>.
- 2024** Cheng, M., Conley, D., Kuipers, T.B., Li, C., **Ryan, C.P.**, Taubert, M.J., Wang, S., Wang, T., Zhou, J., Schmitz, L.L., Tobi, E.W., Heijmans, B.T., Lumey, L.H., Belsky, D.W. Accelerated biological aging six decades after prenatal famine exposure. *Proceedings of the National Academy of Sciences of the United States of America*. 121(24). e2319179121.
- 2024** Domingo-Relloso, A., Riffo-Campos, A.L., Zhao, N., Ayala, G., Haack, K., Manterola, C., Rhoades, D.A., Umans, J.G., Fallin, M.D., Herreros-Martinez, M., Pollan, M., Boerwinkle, E., Platz, E.A., Jones, M.R., Bressler, J., Joehanes, R., **Ryan, C.P.**, Gonzalez, J.R., Levy, D., Belsky, D.W., and Tellez-Plaza, M. Multicohort Epigenome-Wide Association Study of All-Cause Cardiovascular Disease and Cancer Incidence: A Cardio-Oncology Approach. *JACC: CardioOncology*. 6(5): 731-742.
- 2024** **Ryan, C.P.**, Lee, N.R., Carba, D.B., MacIsaac, J.L., Lin, D.S., Atashzay, P., Belsky, D.W., Kobor, M.S., Kuzawa, C.W. Pregnancy is linked to faster epigenetic aging in young women. *Proceedings of the National Academy of Sciences of the United States of America*. 121(16). e2317290121.
- 2024** Hastings, W.J., Ye, Q., Wolf, S.E., **Ryan, C.P.**, Das, S.K., Huffman, K.M.,

- Kobor, M.S., Kraus, W.E., MacIsaac, J., Martin, C.K., Racette, S.B., Redman, L.M., Belsky, D.W., Shalev, I. Effect of long-term caloric restriction on telomere length in healthy adults: CALERIE™ 2 trial analysis. *Aging Cell*.
- 2024** Bareja, A., Lee, D.E., Ho, T., Waitt, G., McKay, L.H., Hannou, S.A., Orenduff, M.C., McGreevy, K.M., Binder, A., **Ryan, C.P.**, Soderblom, E.J., Belsky, D.W., Kraus, V.B., Huebner, J.L., Kraus, W., Huffman, K.M., Baht, G.S., Horvath, S., Parmer, R.J., Miles, L.A., White, J.P. Liver-derived plasminogen mediates muscle stem cell expansion during caloric restriction through the plasminogen receptor, Plg-RKT. *Cell Metabolism*. 23(3).
- 2024** Eisenberg, D.T.A., **Ryan C.P.**, Lee, N.R., Carba D.B., MacIsaac, J.L., Dever K., Atashzay P., Kobor, M.S., Kuzawa C.W. DNA methylation-based estimators of telomere length show low correspondence with paternal age at conception and other measures of external validity of telomere length. *GeroScience*. 1-13.
- 2024** Graf, G.H., Aiello, A.E., Kothari, M., Liu, H., Moffitt, T.E., Muennig, P., **Ryan, C.P.**, Sugden, K., Belsky, D.W. Educational Mobility, Pace of Aging, and Lifespan Among Participants in the Framingham Heart Study. *JAMA Network Open*. 7(3):e240655.
- 2024** Whitman, E.T., **Ryan, C.P.**, Abraham, W.C., Addae, A., Corcoran, D.L., Elliott, M.L., Hogan, S., Ireland, D., Keenan, R., Knodt, A.R., Melzer, T.R., Poulton, R., Ramrakha, S., Sugden, K., Williams, B.S., Zhou, J., Hariri, A.R., Belsky, D.W., Moffitt, T.E., Caspi, A. A blood biomarker of the pace of aging is associated with brain structure: replication across three cohorts. *Neurobiology of Aging*. 136: 22-33.
- 2023** Thomas, A., **Ryan, C.P.**, Caspi, A., Moffitt, T.E., Sugden, K., Zhou, J., Belsky, D.W., Gu, Y. Diet, pace of biological aging, and risk of dementia in the Framingham Heart Study. *Annals of Neurology*. 95: 1069-1079. <https://doi.org/10.1002/ana.26900>.
- 2023** McDade, T.W., **Ryan, C.P.**, Adair, L.S., Lee, N.R., Carba, D.B., MacIsaac, J.L., Dever, K., Atashzay, P., Kobor, M.S., and Kuzawa, C.W. Reply to Nwanaji-Enwerema, 2023, "Exposome and low birthweight selection bias considerations in early life infections and epigenetic age relationships". *American Journal of Human Biology*. 35(11).e23977.
- 2023** McDade, T.W., **Ryan, C.P.**, Adair, L.S., Lee, N.R., Carba, D.B., MacIsaac, J.L., Dever, K., Atashzay, P., Kobor, M.S., and Kuzawa, C.W. Association between infectious exposures in infancy and epigenetic age acceleration in young adulthood in metropolitan Cebu, Philippines. *American Journal of Human Biology*. 35(11). e23948.
- 2023** Waziry, R.<sup>†</sup>, **Ryan, C.P.**<sup>†</sup>, Corcoran, D.L., Huffman, K.M., Kobor, M.S., Kothari, M., Graf, G.H., Kraus, V.B., Kraus, W.E., Lin, D.T.S., Pieper, C.F., Ramaker, M.E., Bhapkar, M., Das, S.K., Ferrucci, L., Hastings, W.J., Kebbe, M., Parker,

D.C., Racette, S.B., Shalev, I., Shilling, B., and Belsky, D.W.. Effect of long-term caloric restriction on DNA methylation measures of biological aging in healthy adults from the CALERIE trial. *Nature Aging*:1–10. doi:10.1038/s43587-022-00357-y.

<sup>†</sup>These authors contributed equally to the manuscript.

- 2022** **Ryan, C.P.**, Rege, R.J., Lee, N.R., Carba, D.B., Kobor, M.S., MacIsaac, J.L., Lin, D.S., Atashzay, P., and Kuzawa, C.W. Maternal epigenetic clocks measured during pregnancy do not predict gestational age at delivery or offspring birth outcomes: a replication study in metropolitan Cebu, Philippines. *Clinical Epigenetics*. 14(1):1-9.
- 2022** **Ryan, C.P.**, Jones, M.J., Edgar, R.D., Lee, N.R., Kobor M.S., McDade, T.W., Kuzawa C.W. Immune cell type and DNA methylation vary with reproductive status in women: possible pathways for costs of reproduction. *Evolution, Medicine, and Public Health*. 10(1):47-58.
- 2022** Kuzawa C.W., **Ryan, C.P.**, Adair, L.S., Lee, N.R., Carba, D.B., Kobor, M.S., MacIsaac, J.L., Dever, K., Atashzay, P., McDade, T.W. Birth weight and maternal energy status during pregnancy as predictors of epigenetic age acceleration in young adults from metropolitan Cebu, Philippines. *Epigenetics*. 1-11.
- 2022** Johnson, A.P., **Ryan, C.P.**, Wallman, J.F. Climatic and biotic influences on the distributions of *Calliphora augur* and *Calliphora dubia* (Diptera: Calliphoridae). *Austral Entomology*. 61:370-377.
- 2020** **Ryan, C.P.** Epigenetic clocks: Theory and application in Human Biology. *American Journal of Human Biology*. e23488
- 2020** Shirazi, T.N., Hastings, W.J., Rosinger, A.Y. **Ryan, C.P.** Parity predicts biological age acceleration in post-menopausal, but not pre-menopausal, women. *Scientific Reports*. 10(1):20522
- 2020** **Ryan, C.P.** and Kuzawa, C.K. Germline epigenetic inheritance: Challenges and opportunities for linking human paternal experience with offspring biology and health. *Evolutionary Anthropology*. 1–21.
- 2020** Kuzawa, C.K., Bechayda, S.A., Borja, J.R.B., Carba, D.B., Duazo, P.L., Eisenberg, D.T.A., Georgiev, A.V., Gettler, L.T., Lee, N.R., Quinn, E.A., Rosenbaum, S. , Rutherford, J., **Ryan, C.P.**, McDade, T.W. Evolutionary life history theory as an organizing framework for cohort studies: Insights from the Cebu Longitudinal Health and Nutrition Survey. *Annals of Human Biology*. 47(2): 94-105.
- 2019** **Ryan, C.P.** Tandem Repeat Disorders. *Evolution, Medicine, and Public Health*. 1:17-17.
- 2019** McDade, T.W., **Ryan, C.P.**, Jones M.J., Hoke, M.K., Borja, J., Miller, G.E.,

- Kuzawa C.W., Kobor M.S. Epigenetic signatures of socioeconomic status during development and early adulthood - *American Journal of Physical Anthropology*. 169(1):3-11.
- 2018** **Ryan, C.P.**, Hayes, M.G., Lee, N.R., McDade, T.W., Jones M.J., Kobor M.S., Kuzawa C.W., Eisenberg D.T.A. Reproduction predicts shorter telomeres and epigenetic age acceleration among young adult women. *Scientific Reports*. 8(1): 11100.
- 2017** Georgiev, A.V., **Ryan, C.P.**, Borja, J.B., Kuzawa, C.W. Does growth during early postnatal “minipuberty” predict adult second-to-fourth digit ratio (2D:4D)? Evidence from Cebu, The Philippines. *American Journal of Human Biology*. 23(7): e23047.
- 2017** McDade, T.W., **Ryan, C.P.**, Jones, M.J., MacIsaac, J.L., Morin, A.M., Meyer, J.M., Borja, J.B., Miller, G.E., Kobor, M.S., Kuzawa, C.W. Social and physical environments early in development predict DNA methylation of inflammatory genes in young adulthood. *Proceedings of the National Academy of Sciences of the United States of America*. 114: 7611-7616.
- 2017** Georgiev, A.V., **Ryan, C.P.**, Gettler, L.T., McDade, T.W., Kuzawa, C.W. Second-to-fourth digit ratio (2D:4D) is unrelated to measures of somatic reproductive effort among young men from Cebu, The Philippines. *American Journal of Physical Anthropology*. 163(3):437–445.
- 2017** **Ryan, C.P.**, Georgiev, A.V., Bechayda, S.A., McDade, T.W., Gettler, L.T., Eisenberg, D.T.A., Rzhetskaya, M., Hayes, M.G., Kuzawa, C.W. Androgen receptor polyglutamine repeat length (AR-CAGn) modulates the effect of testosterone on androgen- dependent somatic traits in Filipino young adult men. *American Journal of Physical Anthropology*. 163(2): 317–327.
- 2017** Bairos-Novak, K.R., **Ryan, C.P.**, Freeman, A.R., Anderson, W.G., Hare, J.F. Like mother, like daughter: heritability of female Richardson’s ground squirrel (*Urocitellus richardsonii*) cortisol stress responses. *Current Zoology*. zox014. doi: 10.1093/cz/zox014
- 2017** Gettler, L.T., **Ryan, C.P.**, Eisenberg, D.T.A., Rzhetskaya, M., Hayes, M.G., Feranil AB, Bechayda SA, Kuzawa, C.W. The role of testosterone in coordinating male life history strategies: The moderating effects of the androgen receptor CAG repeat polymorphism. *Hormones and Behavior*. 87: 164-175.
- 2017** **Ryan, C.P.**, McDade, T.W., Gettler, L.T., Eisenberg, D.T.A., Rzhetskaya, M., Hayes, M.G., Kuzawa, C.W. Androgen receptor CAG repeat polymorphism and hypothalamic-pituitary-gonadal function in Filipino young adult males. *American Journal of Human Biology*. 29(1): e22897
- 2016** **Ryan, C.P.**, Brownlie, J.C., and Whyard, S. Hsp90 and physiological stress are linked to autonomous transposon mobility in nematodes. *Genome Biology and*

*Evolution*. 8 (12): 3794:3805. DOI: 10.1093/gbe/evw284

- 2015** Ryan, C.P., Dawson, A.S., Sharp, P.J. and Williams, T.D. Uncoupling clutch size, prolactin, and luteinizing hormone using experimental egg removal. *General and Comparative Endocrinology*. 213: 1-8.
- 2014** Ryan, C.P., Anderson, W.G., and Hare, J.F. Maternal gestational cortisol and testosterone are associated with trade offs in offspring sex and number in a free-living rodent (*Uroditellus richardsonii*). *PLoS One*. 9 (10): e111052.
- 2014** Clary, D., Skyner, L.J., Ryan, C.P., Gardiner, L.E., Anderson, W.G., and Hare, J.F. Shyness boldness, but not exploration, predicts glucocorticoid stress response in Richardson's ground squirrels (*Uroditellus richardsonii*). *Ethology*. 120: 1101-1109.
- 2014** Hare, J.F., Ryan, C.P., Enright, C., Gardiner, L.E., Skyner, L.J., and Anderson, W.G., Validation of a radioimmunoassay-based fecal corticosteroid assay for Richardson's ground squirrels (*Uroditellus richardsonii*) and behavioural correlates of stress. *Current Zoology*. 60 (5): 591-601
- 2014** Ryan, C.P., Dawson, A.S., Sharp, P.J. and Williams, T.D. Circulating breeding and pre-breeding prolactin and LH are not associated clutch size in the Zebra Finch (*Taeniopygia guttata*) *General and Comparative Endocrinology*. 202: 26-34.
- 2013** Ryan, C.P., and Crespi, B.J. Androgen receptor polyglutamine repeat tract length: models of selection and disease susceptibility. *Evolutionary Applications*. 6:180-196.
- 2013** Singh, A.D., Wong, S., Ryan, C.P., Whyard, S. Oral delivery of double-stranded RNA in larvae of the yellow fever mosquito, *Aedes aegypti*; implications for pest mosquito control. *Journal of Insect Science*. 13:69.
- 2012** Ryan, C.P., Anderson, W.G., Gardiner, L.E. and Hare, J.F. Stress-induced sex ratios in ground squirrels: support for a mechanistic hypothesis. *Behavioral Ecology*. 23:160-167
- 2010** Anderson, W.G., Dasiewicz, P.J., Liba, S., Ryan, C.P., Taylor, J.R., Grosell, M., and Weihrauch, D. Gastro-intestinal handling of water and solutes in three species of elasmobranch fish, the white-spotted bamboo shark, *Chiloscyllium plagiosum*, little skate, *Leucoraja erinacea*, and the clear-nose skate *Raja eglanteria*. *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology*. 155: 493-502.

#### Book chapters and other publications

- 2021** Ryan, C.P. and Kuzawa, C.K. Aging: The temporary cost of dominance. *ELife*. 10. e68790. <https://doi.org/10.7554/eLife.68790>

- 2017**      **Ryan, C.P.** Simple Sequence Repeats. In Vonk, J. and Shackelford, T.K. (eds.) *Encyclopedia of Animal Cognition and Behavior*. Springer International Publishing.

## **Professional presentations with published abstracts**

### **Podium Presentations**

- 2023**      **Ryan, C.P.**, Lee, N.R., Carba, D.B., MacIsaac, J.L., Lin, D.S., Atashzay, P., Belsky, D.W., Kobor, M.S., McDade, T.W., Kuzawa, C.W. Cross-sectional and longitudinal changes in gravidity are associated with accelerated epigenetic age in young and middle-aged women in the Philippines. 48th Annual Meeting of the Human Biology Association. Reno, Nevada, U.S.A.
- 2021**      **Ryan, C.P.**, Rej, P.H., Holman, D.J., Lee, N.R., Hayes, M.G., Kuzawa, C.K., Eisenberg, D.T.A. Exploring the links between ovarian aging and somatic aging in humans: A study of leukocyte telomere length across the menopausal transition in a Philippine cohort. Telomere Research Network Annual Meeting, New Orleans, Louisiana, U.S.A.
- 2020**      **Ryan, C.P.**, Jones, M.J., Borja, J.B., McDade, T.W., Kuzawa, C.W. Testing for costs of reproduction using a new ‘epigenetic clock’ of all-cause mortality in a cohort of young women in the Philippines. Human Biology Association 45th Annual Meeting, Los Angeles, California, U.S.A. (Conference cancelled due to COVID-19)
- 2019**      **Ryan, C.P.**, Kuzawa, C.W. Germline epigenetic inheritance: Challenges and opportunities of linking paternal experience with offspring biology and health. American Association of Physical Anthropologists and American Association of Anthropological Genetics, 44nd Annual Meeting, Cleveland, Ohio, U.S.A
- 2018**      **Ryan, C.P.**, Edgar, R.D., Jones, M.J., Kobor, M.S., Borja, J.B., McDade, T.W., and Kuzawa C.W. Genome-wide DNA-methylation varies with reproductive status and supports costs of reproduction in a cohort of young Filipino women. International Society for Evolution, Medicine, and Public Health, 4th Annual Meeting, Park City, Utah, U.S.A.
- 2018**      Kim, A.W., **Ryan, C.P.**, Bechayda, S.A, McDade, T.W., Kuzawa, C.W. Early life social experiences as predictors of depression in Cebu, Philippines: Investigating the mediating roles of the HPA axis and DNA methylation. Developmental Origins of Disease: Biocultural and Evolutionary Insights from Working with Vulnerable Human and Non-Human Populations. 46th Annual Meeting of the Canadian Association for Physical Anthropology. London, Ontario, Canada.
- 2018**      Kim, A.W., **Ryan, C.P.**, Borja, J., McDade, T.W., Kuzawa, C.W. Early life social experiences as predictors of depression in Cebu, Philippines: Investigat-



ing the mediating roles of the HPA axis and DNA methylation. 43rd Annual Meeting of the Human Biology Association. Austin, Texas, U.S.A.

- 2017** **Ryan, C.P.**, Jones, M.J., MacIsaac, J.L., Morin, A., Borja, J.B., Kobor, M.S., Kuzawa, C.W., McDade, T.W. Epigenetic pathways of intergenerational phenotypic inertia in birth weight: Evidence from mothers in Cebu, Philippines. American Association of Physical Anthropologists and American Association of Anthropological Genetics, 42nd Annual Meeting, New Orleans, Louisiana, U.S.A.
- 2017** Eisenberg, D.T.A., Hayes, M.G., McDade, T.W., **Ryan, C.P.**, Georgiev, A.V., Jones, M.J., Kobor, M.S., Kuzawa, C.W., Costs of reproduction assessed via telomere length and epigenetic age measures of biological senescence in young adult women from Cebu, the Philippines. American Association of Physical Anthropologists, 86th Annual Meeting, April 22nd, New Orleans, Louisiana, U.S.A.
- 2016** **Ryan, C.P.**, Georgiev, A.V., McDade, T.W., Gettler L.T., Eisenberg, D.T.A., Hayes, M.G., Kuzawa, C.W. Variation in the androgen receptor modulates the relationship between testosterone and sexually dimorphic traits in adult males. Human Biology Association, 41st Annual Meeting, April 13-14, Atlanta, Georgia, U.S.A.
- 2016** McDade, T.W., **Ryan, C.P.**, Fried, R., Jones M., Kobor, M., Kuzawa, C.K. Early origins of inflammation: Does DNA methylation mediate the association between nutritional and microbial environments in infancy and the regulation of inflammation in young adulthood? Human Biology Association, 41st Annual Meeting, April 13-14, Atlanta, Georgia, U.S.A.
- 2016** Georgiev, A.V., **Ryan, C.P.**, Gettler L.T., McDade, T.W., Kuzawa, C.W. Prenatal androgen exposure (2D:4D) and its relationship to early growth and adult reproductive effort in men from Cebu, The Philippines. American Association of Physical Anthropologists, 85th Annual Meeting, April 12-16, Atlanta, Georgia, U.S.A.
- 2016** Bairos-Novak, K.R., Anderson, W.G., Freeman, A.R., **Ryan, C.P.**, Hare, J.F. Like mother, like matriline: quantification and inheritance of Richardson's ground squirrel (*Urocitellus richardsonii*) stress responses. Prairie University Biology Symposium, Lethbridge, AB, Canada.
- 2013** **Ryan, C.P.**, Dawson, A.S., Sharp, P.J. and Williams, T.D. Hormone-trait relationships for experimentally enlarged clutches continue to challenge the prolactin-based model for clutch-size determination. Society for Integrative and Comparative Biology, Annual meeting and exhibition, Jan. 3-7, San Francisco, California, U.S.A.
- 2012** **Ryan, C.P.**, Dawson, A.S., Sharp, P.J. and Williams, T.D. Testing the prolactin-based mechanism for avian clutch-size determination in captive Ze-

bra finches: Individual variability in hormone-trait relationships. North American Ornithological Conference, August 15-18, Vancouver, British-Columbia, Canada

- 2012**     **Ryan, C.P.**, Dawson, A.S., Sharp, P.J. and Williams, T.D. Experimental evidence for a role of prolactin in modulating avian clutch-size. Society for Integrative and Comparative Biology, Annual meeting and exhibition Jan. 3-7, Charleston, South Carolina, U.S.A.
- 2011**     **Ryan, C.P.**, Anderson, W.G., and Hare, J.F. Glucocorticoids, litter size optimization and sex allocation in *Urocitellus richardsonii*. Society for Integrative and Comparative Biology, Annual meeting and exhibition, Jan. 3-8, Salt Lake City, Utah, U.S.A.
- 2010**     **Ryan, C.P.**, Anderson, W.G., and Hare, J.F. Struggling mothers, strong sons: optimization and adaptive sex allocation in Richardson's ground squirrels (*Spermophilus richardsonii*). Annual meeting for the Canadian Society of Zoologists, May 17-21, Vancouver, British Columbia, Canada

#### **Poster Presentations**

- 2024**     **Ryan, C.P.**, Bose, P., Eckstein Indik, C., Belsky, D.W. The Columbia Aging Center Geroscience Computational Core (GCC). Healthspan Extension Summit. April 19th. New York, NY.
- 2024**     **Ryan, C.P.**, Lee, N.R., Carba, D.B., MacIsaac, J.L., Lin, D.S., Atashzay, P., Belsky, D.W., Kobor, M.S., and Kuzawa, C.W. Pregnancy number is linked to faster epigenetic aging in young women, but not same-aged cohort men in the Cebu Longitudinal Health and Nutrition Survey (CLHNS). Healthspan Extension Summit. April 19th. New York, NY.
- 2023**     <sup>†</sup>**Ryan, C.P.**, Lee, N.R., Carba, D.B., MacIsaac, J.L., Lin, D.S., Atashzay, P., Belsky, D.W., Kobor, M.S., and Kuzawa, C.W. Cross sectional and longitudinal changes in gravidity are associated with accelerated epigenetic clock age in young and middle-aged women in the Philippines. International Workshop on Statistical Genetics, March 6-10th, Boulder, CO. U.S.A.  
  
<sup>†</sup>Awarded Best Poster at the International Workshop on Statistical Genetics, 2023.
- 2022**     **Ryan, C.P.**, Lee, N.R., Carba, D.B., MacIsaac, J.L., Lin, D.S., Atashzay, P., Belsky, D.W., Kobor, M.S., and Kuzawa, C.W. Cross sectional and longitudinal changes in gravidity are associated with accelerated epigenetic clock age in young and middle-aged women in the Philippines. New York City Epidemiology Forum, New York, NY, U.S.A.
- 2020**     **Ryan, C.P.**, Lin, D.S., Kobor, M.S., McDade, T.W., Kuzawa, C.W. DNA

methylation measurements using dried blood spots on the Illumina EPIC array yield high quality data comparable to whole blood measured using the 450k array. American Association of Physical Anthropologists, 45th Annual Meeting, Los Angeles, California, U.S.A. (Conference cancelled due to COVID-19)

- 2018**     **Ryan, C.P.**, Edgar, R.D., Jones, M.J., Kobor, M.S., Borja, J.B., McDade, T.W., Kuzawa, C.W. Genome-wide DNA-methylation in pregnancy and breastfeeding mark a ‘landscape of adaptive immunity’ and novel biological networks. Human Biology Association, 43rd Annual Meeting, Austin, Texas, U.S.A.

## **Selected Media Coverage**

**Pregnancy and Biological Aging:** [The Washington Post \(2018\)](#), [The Washington Post \(2024\)](#), [National Geographic](#), [Time Magazine](#), [NBC Healthline](#), [The Sun](#), [Scientias](#), [CBS Chicago](#), [US News and World Report](#) [ABC News](#) **Caloric Restriction and Biological Aging:** [Time Magazine](#), [The Washington Post](#), [CNN](#), [Medium.com](#) **Socioeconomic Status, Early Life Environments and DNA Methylation:** [BBC-Russia](#), [Smithsonian Magazine](#), [US News and World Report](#), [European Scientist](#), [Chicago Tribune](#)

## Honors and Awards

### External

2016-	NSERC Postgraduate Scholarship	Northwestern University
2018	Natural Sciences and Engineering Research Council of Canada (NSERC)	
2016	Alexander Graham Bell Canada Graduate Scholarship NSERC <i>Declined - ineligible outside Canada</i>	Northwestern University
2011	Michael Smith Foreign Study Supplement NSERC - <i>Research conducted at The Roslin Institute, University of Edinburgh, UK</i>	Simon Fraser University
2010- 2011	Alexander Graham Bell Canada Graduate Scholarship NSERC	Simon Fraser University
2009	IDP Student Mobility Scholarship IDP Education, Australia	University of Wollongong
2008	Undergraduate Summer Research Award NSERC	University of Manitoba
2008	W.B. Scott Scholarship in Ichthyology	Huntsman Marine Science Centre
2007	Undergraduate Summer Research Award NSERC	University of Manitoba

## Internal

- 2010- Provost Prize of Distinction Simon Fraser University  
2011 Dean of Graduate Studies
- 2010 Harold E. Welch Award University of Manitoba  
Faculty of Science  
*Awarded for highest academic standing in B.Sc. Honours degree program*
- 2010 David Ian Mackenzie Medal University of Manitoba  
Department of Zoology  
*Awarded for highest academic standing in Zoology degree program*
- 2009- UMSU Scholarship for Excellence in Academic Achievement University of Manitoba  
2010 University of Manitoba Students Union
- 2006- UMSU Scholarship for Excellence in Academic Achievement University of Manitoba  
2007 University of Manitoba Students Union
- 2006- Isbister Scholarship University of Manitoba  
2007 Manitoba Scholarship and Bursary Initiative  
*Awarded to 10 University 1 students attaining highest academic standing*

## Invited Talks

- 2024** Effect of long-term caloric restriction on DNA methylation measures of biological aging in healthy adults from the CALERIE trial. Foresight Institute: Biotech and Health Extension Group. International Zoom. January 9th, 2024.
- 2023** The Long-Term Effects of Pregnancy on Aging. National Institute on Aging (NIA). Bethesda, MD, USA. November 1st, 2023.
- 2023** Cross-sectional and longitudinal changes in gravidity are associated with accelerated epigenetic clock age in young and middle-aged women in the Philippines. National Bureau of Economic Research, Cohort Studies Meeting. Los Angeles, CA, USA. January 19-21, 2023
- 2021** ‘Epigenetic Clocks’ in Primates and Other Species. Primate-omics Journal Club, International Zoom, August 4th, 2021.
- 2021** Département d’Anthropologie, Université de Montréal. International Zoom, March 19th, 2021.
- 2020** Department of Anthropology, Emory University, Atlanta, Georgia, USA. February 3rd, 2020.
- 2020** Department of Anthropology, University of Minnesota - Twin Cities, Minneapolis, Minnesota, USA. January 27th, 2020.

- 2019** Department of Anthropology, Baylor University, Waco, Texas, USA. November 20th, 2019.
- 2019** Evolution in Medicine, Human Reproduction, and Health. 22nd annual Britton C. and Lucille McCabe Lecture, Springfield College, Springfield, Massachusetts, USA. April 11th, 2019.
- 2019** Using whole genome DNA methylation to study the costs of reproduction in a cohort of young Filipino women. Department of Biochemistry and Medical Genetics, University of Manitoba, Winnipeg, Manitoba. January 24th, 2019.
- 2013** Evolution and Disease in the Human Androgen Receptor. Department of Biological Sciences Seminar Series, University of Manitoba, Winnipeg, Manitoba. November 29th, 2013.

## Research Fellowships and Grants

- |               |  |                         |
|---------------|--|-------------------------|
| 2019          | Data Science Development Grant: Data Scientist<br>Data Science for the Social Sciences Initiative                            | Northwestern University |
| 2018          | Le Cron Foster and Friends of Anthropology Research Grant  | Northwestern university |
| 2018          | Leadership Coaching Program<br>Northwestern Center for Leadership and McCormick School of<br>Engineering and Applied Science | Northwestern University |
| 2018          | Computational Essentials for Social Scientists<br>Data Science for the Social Sciences Initiative                            | Northwestern University |
| 2018          | Intensive in Computational Evolutionary Medicine<br>Evolutionary Medicine Summer Institute (EMSI)                            | Duke University         |
| 2015-<br>2016 | Graduate Research Assistant<br>Institute for Policy Research   | Northwestern University |
| 2012          | Dean of Graduate Studies Fellowship  | Simon Fraser University |
| 2011          | Dean of Graduate Studies Fellowship  | Simon Fraser University |

## Campus/Departmental Talks

- |      |   |  |
|------|---|--|
| 2017 | Epigenetic Change as Biological ‘Memory’: Potential Pathways for Lifecourse Health Determinants in the Philippines.<br>Department of Anthropology Graduate Student Colloquium | Northwestern University                |
| 2011 | Endocrine control of clutch-size determination in <i>Taeniopygia guttata</i> - Linnaeusborg Centre for Life Sciences  | Groningen University                   |
| 2011 | Physiological orchestration of life history traits: Why do mechanisms matter?   | Centre for Ecology and Hydrology, U.K. |

## Teaching

2024	Guest Lecturer Environmental Epigenetics	University of Texas at Austin Department of Anthrtpology
2023- 2024	Invited Speaker Children's Hospital Summer Internship Program	University of Colorado An- schutz Medical Campus
2022- 2024	Guest Lecturer Epigenetics in Epidemiology	Columbia University Mailman School of Public Health
2021	Guest Lecturer Evolutionary Medicine	Northwestern University
2020	Class Podcast Guest Author Early Life Origins of Health and Wellbeing	Department of Anthropology Emory University
2018- 2020	Virtual Science Mentor Mentor Matching Program	Illinois Science and Technology Institute
2019	Assistant Lecturer/Teaching Assistant Evolutionary Medicine	Northwestern University
2019	Workshop Assistant Intro to R, R for Stata Users	Northwestern University Research Computing Services
2018	Teaching Assistant: Human Population Biology	Northwestern University
2017	Guest Lecturer: Epigenetic Processes in Health and Evolution Evolution of Life Histories	Northwestern University
2016	Teaching Assistant/Guest Lecturer: Genomic Imprinting Evolutionary Medicine	Northwestern University
2012	Guest Lecturer: Endocrine Control of Life History Traits, States, and Trade-offs Endocrinology	Simon Fraser University
2008	Lab Demonstrator Principles and Themes in Biology	University of Manitoba
2006- 2009	Tutor Biological Diversity, Function and Interactions Cell Biology	University of Manitoba, Disability Services



## Training

### Computational and Analytic Training

#### *Programming Languages:*

R (proficient), Python (basic), UNIX/Linux (basic), Perl (basic), SQL (basic), Git/Github (basic), L<sup>A</sup>T<sub>E</sub>X (basic)

#### *Statistical Methods:*

Descriptive statistics and data visualization linear regression; linear mixed-effects models; generalized linear and generalized linear mixed-effects models; principle component analysis; power calculations; model diagnostics; Monte Carlo simulations; model selection (information theoretic approaches, lasso, ridge, elastic net regression); other methods for statistical learning.

#### *Bioinformatics:*

DNA methylation microarray processing and quality control pipelines (Illumina BeadChip 450k and EPIC arrays); Epigenome-wide association studies (EWAS); Cell-type deconvolution methods; Epigenetic Age estimation methods; ErmineJ (Functional Enrichment); Cytoscape (Network Construction); RNA-Seq (alignment, quantification, and analysis); GWAS (Genomics for Social Scientists Workshop, University of Michigan, June 2021; International Workshop on Statistical Genetics, Boulder, CO, 2023)

### Lab Management and Leadership

2021	Academic lab management and leadership symposium	Torrey Pines Training Consortium
2021	Maintaining communication and aligning expectations Mentoring up and down: Enacting equity and inclusion Building self-efficacy and developing professionally	Office of Postdoctoral Affairs Northwestern University

### Diversity, Inclusion, Equity, and Accessibility

2021	Hearing One Another	University of Chicago Diversity and Inclusion
2021	Social justice: key concepts Principles of inclusive teaching The impact of microaggressions on building inclusive environments	Searle Center for Advancing Learning and Teaching Northwestern University
2020	Diversity, inclusion, equity and accessibility in science mentorship	Illinois Science and Technology Institute

## Languages

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Portuguese [black,fill=black] (0,0) circle (.5ex); [black,fill=white] (0,0) circle (.5ex); [black,fill=white] (0,0) circle (.5ex); [black,fill=white] (0,0) circle (.5ex); [black,fill=white] (0,0) circle (.5ex);

## Professional Activities

### Editorial Board

*Epigenetics Reports*

### Ad-hoc Peer-Reviewer

*Advances in Geriatric Medicine and Research; Aging; Aging Cell; American Journal of Human Biology; Annals of Human Biology; Archives of Gynecology and Obstetrics; Behavioral Ecology; Behavioral Ecology and Sociobiology; Bioessays; BMC Bioinformatics; The BMJ; Clinical Epigenetics; Current Zoology; Demography; Diabetes Metabolism Research and Reviews; Environmental Research; Epigenetics; Evolution, Medicine, and Public Health; Evolutionary Applications; Frontiers in Genetics; Frontiers in Zoology; GeroScience; Genome Medicine; Human Reproduction; Journal of Mammology; Journal of Molecular Evolution; Molecular Biology*

*Reports; National Science Foundation; Oncotarget; Scientific Reports; The Israeli Science Foundation; Women's Health Report*

**Professional Memberships and Affiliations (Active)**

American Association of Anthropological Genetics  
American Association of Physical Anthropologists  
Human Biology Association  
International Society for Evolution, Medicine, and Public Health  
The Gerontological Society of America

## Service and Community Building

2023	Invited Scholar The Long-Term Effects of Pregnancy on Aging	National Institute on Aging Bethesda, Maryland, USA
2023	Invited Scholar Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS)	Early Health Disparities and Late Life Outcomes Amsterdam, Netherlands
2022	Meeting Reporter Canadian Institute for Advanced Research (CIFAR)	Child and Brain Development Vancouver, Canada
2021	Subcommittee on Aging Telomere Research Network	Tulane University NIA and NIEHS (NIH)
2018- 2021	Virtual Science Project Mentor to Illinois High School Students Mentor Matching Program	Illinois Science and Technology Institute, Illinois
2019- 2020	Meeting Co-organizer Northwestern R User Group	Northwestern University Evanston, Illinois
2012- 2013	Biology Tutor: Introductory Biology	Native Education Centre Vancouver, Canada
2005	Note-Taker Disability Services (now Student Accessibility Services)	University of Manitoba, Winnipeg, Canada