

EDITORIAL

Open Access



# 'Epigenetics and Society': a forum for the theoretical, ethical and societal appraisal of a burgeoning science

Luca Chiapperino<sup>1\*</sup>, Eline Bunnik<sup>2</sup> and Gerard J. van den Berg<sup>3</sup>

**Keywords:** Epigenetics, Biosocial, ELSA-Ethical, Legal and Social Aspects, Philosophy of biology, Science and Technology Studies, Science in Society, Interdisciplinarity, Transdisciplinarity

*Epigenetics Communications* is proud to announce the introduction of a new section entitled 'Epigenetics and Society' (EaS). EaS offers a forum for researcher from various disciplines to engage with the theoretical, interdisciplinary, ethical, social and political dimensions of epigenetics. Authors, within and beyond academia, are invited to submit manuscripts of original research, reviews or perspectives/correspondences dealing with these different facets of epigenetics. The EaS section is meant to provide an opportunity for sharing work across disciplinary borders in ways that both illuminate the science-society intersections around epigenetics and promote their operationalization in multidisciplinary and collaborative scientific practices.

The EaS section provides a forum for novel contributions on a number of key dimensions of epigenetic research. First, this concerns studies of the Ethical, Legal and Social Aspects (ELSA) of epigenetics. The EaS section aims to bring this body of scholarship closer to a life-sciences readership and to offer life scientists a unique opportunity to share their experiences and perspectives on the ELSA of their research. The ELSA literature on epigenetics has still not found a definitive answer to some major questions [1–3]. A notable example is the use of epigenetics in public health promotion: is epigenetics

a science of the social determinants of health and their molecular effects over disease predispositions [4, 5]? What role should epigenetics play with regard to the unfair distribution of environmental and transgenerational risks in our societies [6, 7]? To what extent should public representations of this knowledge insist on positive lifestyles changes, instead of social and community interventions, when it comes to modifiable epigenetic predispositions to diseases? [8–12]. We invite researchers from all fields and backgrounds to advance the reflection on the ethical and legal dimensions of the latest developments in epigenetic research, with specific attention to techniques such as CRISPR-Cas-mediated epigenetic editing. The transient and reversible nature of epigenetic editing systems challenges the ethical intuitions crystallized by ten years of debate around genomic sequence editing. Beyond assessments of epigenetic editing as safer and less controversial option than its genetic counterpart lies the task of dissecting the specific concerns and opportunities of this technology as it approaches clinical translation [13]. We also invite contributions on best practices of study design and rules of engagement of participants in epigenetic research, especially when these fall into the category of vulnerable populations [14–17]. Finally, the EaS section welcomes ELSA assessments of understudied issues such as the societal concerns attached to the epigenetic engineering of plants.

As a second key dimension of the EaS section, we are interested in work on the utility and limitations of existing and future applications of epigenetic technologies in

\*Correspondence: [Luca.Chiapperino@unil.ch](mailto:Luca.Chiapperino@unil.ch)

<sup>1</sup> STS Lab, Institute of Social Sciences, Faculty of Social and Political Sciences, University of Lausanne, CH-1015 Lausanne, Switzerland  
Full list of author information is available at the end of the article



© The Author(s) 2022. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

the diagnosis, stratification and prognosis of diseases. We encourage assessments of their risks and implications, as well as the development of models for responsible clinical implementation [18]. On a deeper level, we encourage submissions of work uncovering epigenetic mechanisms and pathways guiding the effects of socio-economic conditions and events on subsequent health outcomes. Such studies improve our understanding of the role of epigenetics in the long-run implications of social, economic and psychological factors on health outcomes and on societal inequality.

As a third key dimension, we envisage contributions addressing the agendas, questions and research practices of epigenetics, including discussions of how these affect the societal circulation of this knowledge. A substantive body of empirical research in the domain of Science and Technology Studies has dealt with intrinsic biases and limitations of research practices of epigenetics that may produce a controversial uptake of this science in society [19–25]. This body of work is seldomly brought to the attention of life scientists and rarely finds recognition in interdisciplinary circles, or beyond networks of social sciences collaboration. We hope that the EaS section will offer a venue for the dissemination of this work within the life sciences community. Specifically, we encourage Science and Technology Studies scholars to condense thick socio-anthropological analyses into short perspectives and/or correspondence articles. The objective of such contributions is to retain their critical and empirical outlook on practices of epigenetic research all while making this content suitable to a life sciences journal and audience. Our hope is that making this work amenable to reading and debating within a life-sciences setting will ultimately promote an interdisciplinary dialogue around epigenetics and improve those methods, biases, designs and configurations of research that Science and Technology Studies critics find wanting.

Fourth, STS and humanities scholars may consider the EaS section as an outlet for their philosophical, historical and/or socio-anthropological work on the theoretical, methodological and experimental foundations of epigenetics [26–31]. This strand of literature has interrogated how epigenetics re-iterates fundamental questions on life and biology, as well as how it challenges established conceptions of the body as self-contained entity [32, 33]. In this light, epigenetics straddles disciplinary divides (e.g. the one separating the life and social sciences) as well as research traditions in biology oscillating between mechanism and organicism, reduction and emergence, linearity and complexity, pre-determination and plasticity. While at first glance these issues may seem abstract or ‘philosophical’, they could also offer invaluable insights to the ongoing debates on the definitional and

methodological disagreements in epigenetics [34–38]. These controversies are not simply ambiguities and misconceptions that, if settled, may lay the foundations of a better ordered scientific field. Rather, they offer a unique opportunity and a prolific terrain for any empirical or conceptual inquiry into foundational questions in biology—which touch upon notions such as ‘genes’, ‘genomes’ and ‘organisms’ [39–41]. We therefore invite scientists inquiring into the theoretical stability of epigenetics and scholars working on the historicity and foundations of this question, to view EaS as a trading zone where intellectual guidance and pragmatic relevance of theoretical analysis can productively engage with one another. Through EaS we wish to offer a stable forum to bring decades of philosophical, historical and socio-anthropological work on the theoretical foundations of biological thinking into the research practices of epigenetics.

By doing so, we hope that, at a later stage of development of the EaS section, the research community will reap the benefits of a well-developed theoretical, ethical and social reflexivity with and within epigenetics. Many scholars have recognized the opportunities epigenetics offers to an integrative approach to human health in our societies [42, 43]. There exist calls for a shared theoretical, empirical or even political approach in multidisciplinary engagements around epigenetics, which often go by the qualifying adjective of *biosocial* [44]. This term is used to describe a more or less contested experimental space at the crossroad of the social and life sciences, which captures complex, non-linear social-biological transitions in the shaping of the epigenome and situates biology in its material, social and ecological environments [45]. The EaS section welcomes reports on the challenges of interdisciplinary work towards a biosocial science of health built on epigenetics, its questions, methods and approaches [46, 47]. Collaboration and interdisciplinarity are loaded practices: the encounter of cultures and traditions of research is an intricate, power-driven, often-frustrating and risky endeavour [48]. The stated objective of *Epigenetics Communications* to explore alternative conclusions/interpretations of well-established epigenetic phenomena (“negative data”) should therefore not be confined to molecular biology research. The EaS section rather wishes to extend this opportunity to those involved in more or less successful interdisciplinary experimentations.

*Epigenetics Communications* has taken up the ambitious mission of promoting the critical reflexivity internal to the field of epigenetics. With the launch of the EaS section, this invitation is formally extended to researchers from any disciplinary background, investigating the theoretical, ethical, social, interdisciplinary and empirical dimensions of this science. We believe that this is another

much needed development in the editorial landscape of the field: a venue for connecting and integrating different communities of researchers and distinct analytical perspectives may be a major enabler of a thriving epigenetic science. The time is ripe for the implementation of collaborative approaches that, by transcending disciplinary divides and combining different analytical sensibilities, can structure an effective contribution of epigenetics to societal flourishing.

#### Authors' contributions

LC took the lead in conceiving and writing the manuscript, as well as in coordination of this work. EB and GvdB participated in its conception and multiple rounds of revision. All authors read and approved this version of the manuscript.

#### Funding

LC contributed to this work thanks to funding from the Swiss National Science Foundation (SNSF) Ambizione project "Constructing the Biosocial: an engaged inquiry into epigenetics and post-genomic biosciences" (N. 185822).

#### Availability of data and materials

Data sharing not applicable to this article as no datasets were generated during the current study.

#### Declarations

#### Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

#### Author details

<sup>1</sup>STS Lab, Institute of Social Sciences, Faculty of Social and Political Sciences, University of Lausanne, CH-1015 Lausanne, Switzerland. <sup>2</sup>Department of Medical Ethics, Philosophy and History of Medicine, Erasmus MC, University Medical Centre Rotterdam, Rotterdam 3000 CA, The Netherlands. <sup>3</sup>Department of Economics and Department of Epidemiology, University of Groningen and University Medical Center Groningen, Groningen 9700 AB, The Netherlands.

Published online: 19 October 2022

#### References

- Rothstein MA. Legal and Ethical Implications of Epigenetics. In: Jirtle RL, Tyson FL, editors. *Environmental Epigenomics in Health and Disease*. Springer Berlin Heidelberg; 2013. p. 297–308. Available from: [https://doi.org/10.1007/978-3-642-36827-1\\_14](https://doi.org/10.1007/978-3-642-36827-1_14). [cited 2016 Jan 13]
- Chiapperino L. Epigenetics: ethics, politics, biosociality. *Br Med Bull*. 2018;128:49–60.
- Dupras C, Saulnier KM, Joly Y. Epigenetics, ethics, law and society: A multidisciplinary review of descriptive, instrumental, dialectical and reflexive analyses. *Soc Stud Sci*. 2019;49:785–810.
- Loi M, Savio LD, Stupka E. Social Epigenetics and Equality of Opportunity. *Public Health Ethics*. 2013;6:142–53.
- Huang JY, King NB. Epigenetics Changes Nothing: What a New Scientific Field Does and Does Not Mean for Ethics and Social Justice. *Public Health Ethics*. 2018;11:69–81.
- Guibet LC. Quelle théorie de la justice pour l'épigénétique? *Dialogue*. 2015;54:489–517.
- Rothstein MA, Harrell HL, Marchant GE. Transgenerational epigenetics and environmental justice. *Environ Epigenet*. 2017;3. Available from: <https://academic.oup.com/eep/article/3/3/dvx011/4061580>. [cited 2018 May 2]
- Hedlund M. Epigenetic Responsibility. *Med Stud*. 2012;3:171–83.
- Dupras C, Ravitsky V. The ambiguous nature of epigenetic responsibility. *J Med Ethics*. 2016;42:534–41.
- M'hamedi H, de Beaufort I, Jack B, Steegers EAP. Responsibility in the age of Developmental Origins of Health and Disease (DOHaD) and epigenetics. *J Dev Orig Health Dis*. 2018;9:58–62.
- Bolt I, Bunnik EM, Tromp K, Pashayan N, Widschwendter M, de Beaufort I. Prevention in the age of personal responsibility: epigenetic risk-predictive screening for female cancers as a case study. *J Med Ethics*. 2021;47:e46.
- Chiapperino L. Luck and the responsibilities to protect one's epigenome. *J Responsible Innov*. 2020;7(sup2):S86–106.
- Huerne K, Palmour N, Wu AR, Beck S, Berner A, Siebert R, et al. Auditing the Editor: A Review of Key Translational Issues in Epigenetic Editing. *The CRISPR J*. 2022;5:203–12.
- Joly Y, Dyke SO, Cheung WA, Rothstein MA, Pastinen T. Risk of re-identification of epigenetic methylation data: a more nuanced response is needed. *Clin Epigenetics*. 2015;7. Available from: <http://www.clinicalepigeneticsjournal.com/content/7/1/45>. [cited 2018 Apr 16]
- Bunnik EM, Bolt IL. Exploring the Ethics of Implementation of Epigenomics Technologies in Cancer Screening: A Focus Group Study. *Genet Epigenet*. 2021;14:25168657211063616 (SAGE Publications Ltd STM).
- Taki F, de Melo-Martin I. Conducting epigenetics research with refugees and asylum seekers: attending to the ethical challenges. *Clin Epigenetics*. 2021;13:105.
- Santaló J, Berdasco M. Ethical implications of epigenetics in the era of personalized medicine. *Clin Epigenetics*. 2022;14:44.
- Chadwick R, O'Connor A. Epigenetics and personalized medicine: prospects and ethical issues. *Pers Med*. 2013;10:463–71.
- Niewöhner J. Epigenetics: Embedded bodies and the molecularisation of biography and milieu. *BioSocieties*. 2011;6:279–98.
- Warin M, Moore V, Davies M, Uljaszek S. Epigenetics and Obesity: The Reproduction of Habitus through Intracellular and Social Environments. *Body Soc*. 2015. <https://doi.org/10.1177/1357034X15590485>. [cited 2016 Sep 6]
- Kenney M, Müller R. Of rats and women: Narratives of motherhood in environmental epigenetics. *BioSocieties*. 2017;12:23–46.
- Chiapperino L, Panese F. Gendered imaginaries: situating knowledge of epigenetic programming of health. *Sociol Health Illn*. 2018;40:1233–49.
- Lappé M. The paradox of care in behavioral epigenetics: Constructing early-life adversity in the lab. *BioSocieties*. 2018;13:698–714.
- Sharp GC, Lawlor DA, Richardson SS. It's the mother!: How assumptions about the causal primacy of maternal effects influence research on the developmental origins of health and disease. *Soc Sci Med*. 2018;213:20–7.
- Chiapperino L. Environmental enrichment: an experiment in biosocial intervention. *BioSocieties*. 2021;16:41–69.
- Lock M. Comprehending the Body in the Era of the Epigenome. *Curr Anthropol*. 2015;56:151–77.
- Deichmann U. Epigenetics: The origins and evolution of a fashionable topic. *Dev Biol*. 2016;416:249–54.
- Meloni M. *Political Biology*. 1st ed. 2016 edition. Basingstoke; New York: Palgrave Macmillan; 2016.
- Nicoglou A, Merlin F. Epigenetics: A way to bridge the gap between biological fields. *Stud Hist Philos Sci C Stud Hist Philos Biol Biomed Sci*. 2017; Available from: <http://www.sciencedirect.com/science/article/pii/S1369848617300444>
- Baedke J. Above the Gene, Beyond Biology: Toward a Philosophy of Epigenetics. In: *Above the Gene, Beyond Biology: Toward a Philosophy of Epigenetics*. 2018.
- Buklijas T. Histories and Meanings of Epigenetics. In: Meloni M, Cromby J, Fitzgerald D, Lloyd S, editors. *The Palgrave Handbook of Biology and Society*. London: Palgrave Macmillan UK; 2018. p. 167–87. Available from: [https://doi.org/10.1057/978-1-137-52879-7\\_8](https://doi.org/10.1057/978-1-137-52879-7_8) [cited 2018 Oct 4]
- Peterson EL. *The Life Organic: The Theoretical Biology Club and the Roots of Epigenetics*. 1st ed. Pittsburgh: University of Pittsburgh Press; 2017.
- Squier SM. *Epigenetic Landscapes: Drawings as Metaphor*. Durham: Duke University Press Books; 2017.
- Campagna MP, Xavier A, Lechner-Scott J, et al. Epigenome-wide association studies: current knowledge, strategies and recommendations. *Clin Epigenet*. 2021;13:214. <https://doi.org/10.1186/s13148-021-01200-8>.
- Cerutti J, Lussier AA, Zhu Y, et al. Associations between indicators of socioeconomic position and DNA methylation: a scoping review. *Clin Epigenet*. 2021;13:221. <https://doi.org/10.1186/s13148-021-01189-0>.

36. Rauschert S, Raubenheimer K, Melton PE, Huang RC. Machine learning and clinical epigenetics: a review of challenges for diagnosis and classification. *Clin Epigenetics*. 2020;12:51.
37. Topart C, Werner E, Arimondo PB. Wandering along the epigenetic timeline. *Clin Epigenetics*. 2020;12:97.
38. Vryer R, Saffery R. What's in a name? Context-dependent significance of 'global' methylation measures in human health and disease. *Clin Epigenetics*. 2017;9:2.
39. Morange M. Post-genomics, between reduction and emergence. *Synthese*. 2006;151:355–60.
40. Fox Keller E. The Postgenomic Genome. In: Richardson SS, Stevens H, editors. *Postgenomics: Perspectives on Biology after the Genome*. Duke University Press; 2015. Available from: <https://doi.org/10.1215/9780822375449-002>. [cited 2018 Jul 12]
41. Rheinberger H-J, Müller-Wille S. The Gene: From Genetics to Postgenomics. In: Expanded, Revised edizione. Chicago: University of Chicago Press; 2018.
42. Rose N. The Human Sciences in a Biological Age. *Theory Cult Soc*. 2013;30:3–34.
43. Niewöhner J. Epigenetics: localizing biology through co-laboration. *New Genet Soc*. 2015;34:219–42.
44. Meloni M, Cromby J, Fitzgerald D, Lloyd S. Introducing the New Biosocial Landscape. *The Palgrave Handbook of Biology and Society*. Springer; 2018. p. 1–22.
45. Niewöhner J, Lock M. Situating local biologies: Anthropological perspectives on environment/human entanglements. *BioSocieties*. 2018;1–17.
46. Evans L, Engelman M, Mikulas A, Malecki K. How are social determinants of health integrated into epigenetic research? A systematic review. *Soc Sci Med*. 2021;273:113738.
47. van den Berg GJ, Pinger PR. Transgenerational effects of childhood conditions on third generation health and education outcomes. *Econ Hum Biol*. 2016;23:103–20.
48. Callard F, Fitzgerald D. *Rethinking Interdisciplinarity across the Social Sciences and Neurosciences*. Basingstoke; New York: Palgrave Macmillan UK; 2015. Available from: (<https://www.palgrave.com/gp/book/9781137407955>. [cited 2019 Sep 17]).

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more [biomedcentral.com/submissions](https://biomedcentral.com/submissions)

