

Removable Discontinuity: CRISPR, Gene Drives, and Bioethics

Emily Dunnahoe

Faculty Advisor: Betsy Ott

Abstract

This paper questions whether bioethical scrutiny has been devoted to the ethical dilemmas that have arisen with advancements of CRISPR-Cas 9 gene editing techniques, particularly its use in conjunction with gene drive applications. The tabulation of all articles from 2012 to 2015 from selected genetic journals yielded a significant increase in articles relating to CRISPR, while no articles were found in their selected bioethical counterparts for the same period. Similarly, no significant CRISPR/gene drive research was reported in selected journals during the specified period in either field of study.

To demonstrate trends outside of bioethical scholarship, a secondary keyword analysis detailed an increase in articles devoted to exploring the ethical implications of CRISPR in all fields, yet without additional research outside of the scope of this paper, no conclusions can be made.

Methods

Original Methodology

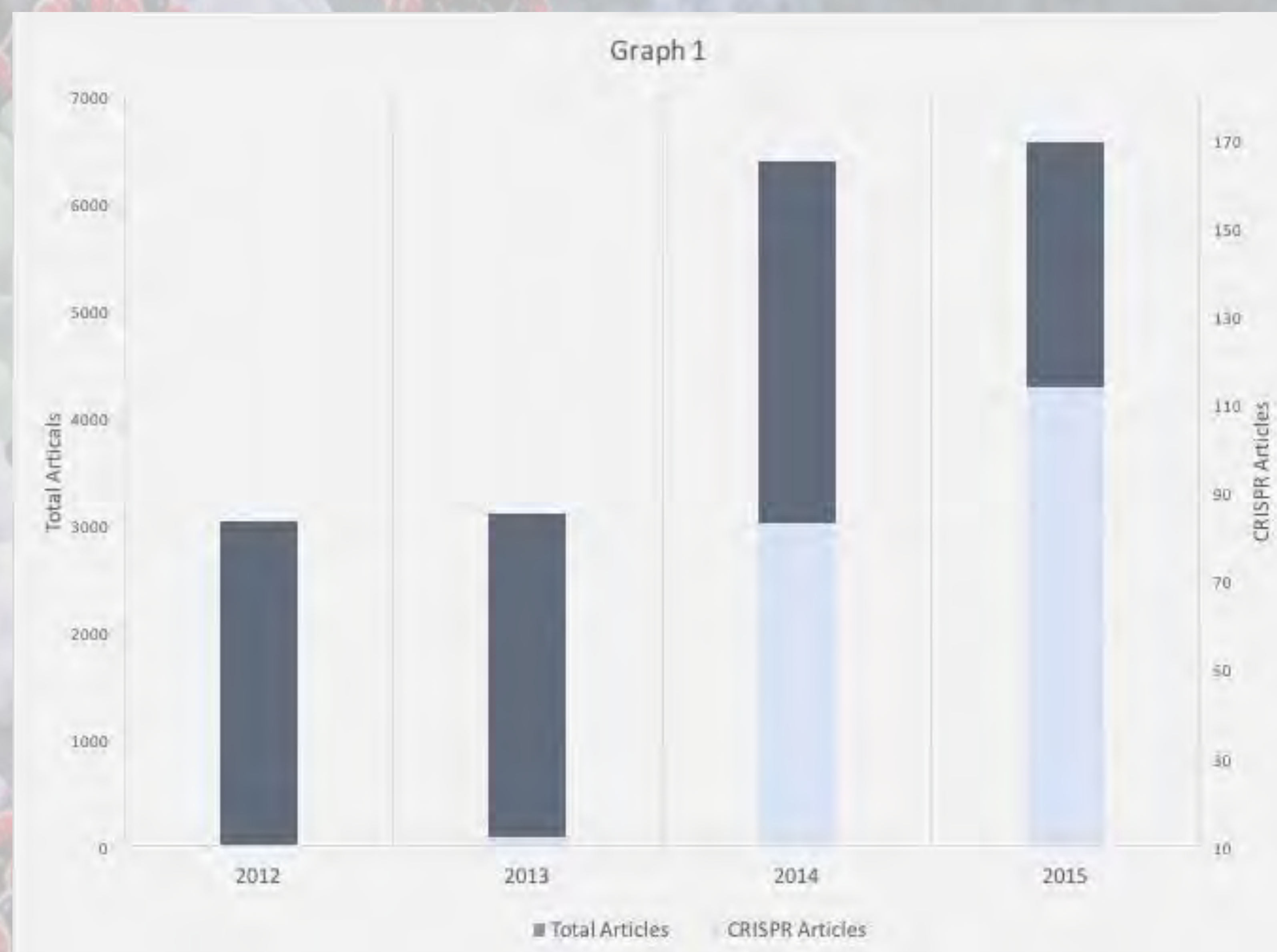
- Use of SNIP indicator in journal selection, which is powered by the SCOPUS database.
- Analysis of top 5 journals 2012 to 2015 within appropriate subject filters and exclusionary perimeters.
- Further dissection of each journal on a per year basis through manual review and keyword searches (i.e. CRISPR-Cas Systems, gene drives)

Additional Methodology

- Used a simple key phrase search (i.e. ethical implications + CRISPR) within the previously selected time period using Google Scholar database
- Tabulated the trend over time via total query results.

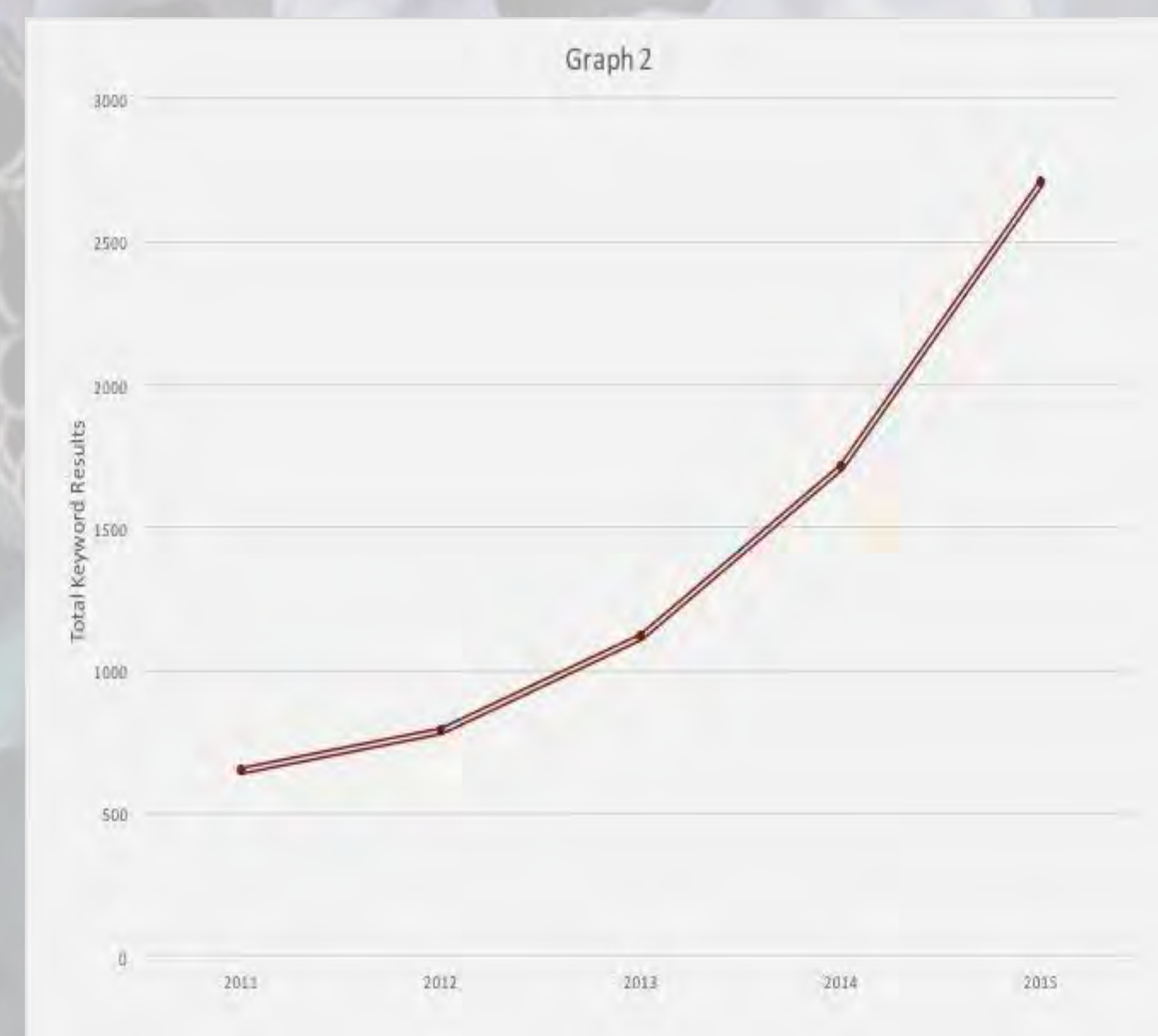
Results

Original Methods



Graph 1. Depicts the upward trend of all articles that are CRISPR-Cas system related. No articles could be found that address CRISPR in bioethical scholarly works within the selected time period for journals with a high SNIP indicator designation.

Additional Methods



Graph 2. Is a representation of the trend of total articles examining both ethical implications and CRISPR-Cas 9, without field of study filtration or impact citation metric.

Conclusion

These findings are an indication of bioethical focus on CRISPR for a snapshot in time under tightly controlled circumstances. Yet, they clearly indicate that scholarly bioethical scrutiny was not being allotted for the consideration of CRISPR research within this methodological purview.

Further Comments

The insights that the inclusion of additional methodology gives are simple. People were considering the ethical implications of CRISPR; they just were not publishing in the most impactful bioethical journals and they may not have been bioethical scholars.

Glossary

CRISPR-Cas Systems- (or Clustered Regularly Interspaced Short Palindromic Repeats-CRISPR Associated Proteins) a bacterial and archaeal defense mechanism, which is conceptually analogous to our own adaptive immune system. This process is being cleverly co-opted for use in genetic engineering labs (Oost et al. 2014).

Gene Drive- a naturally occurring processes in which selfish genetic elements increase chances of heritability. In the context of bioengineering, it is a co-opted process that “drives” a gene and biases inheritance to greater than 50%, despite relative fitness (Burt, 2003).

Bioethics- The study of ethical quandaries that arise from developments and emerging technologies in the biological sciences. Serves a translator and conduit between researchers and the general public.

SNIP Indicator- measures the average citation impact, or impact factor, of a journal, while also normalizing any publication differences between fields of study (Moed, 2010).