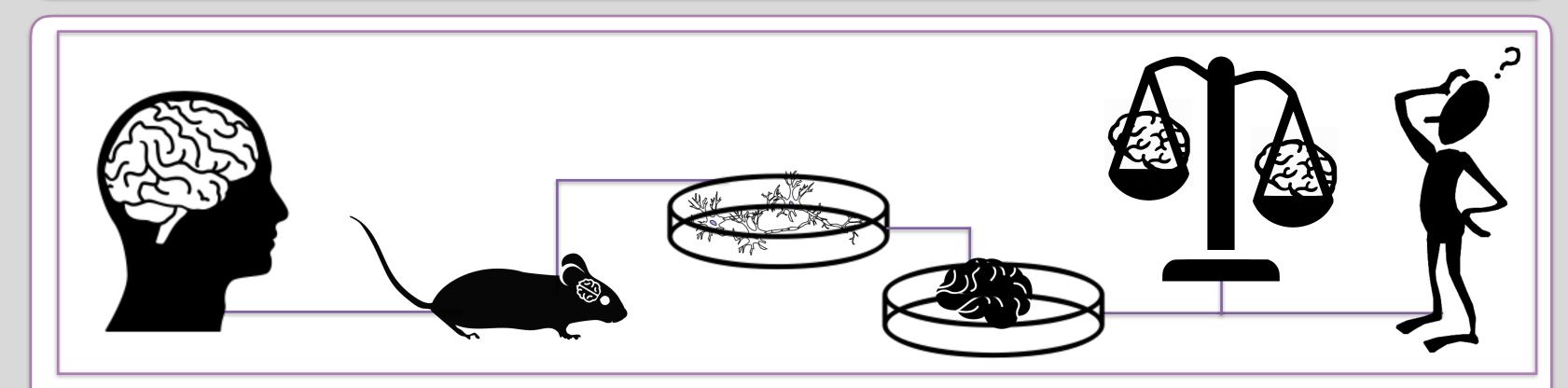
## Mapping Ethical Aspects of Recent Advances in Human Neural Cell Modeling.

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#### Introduction



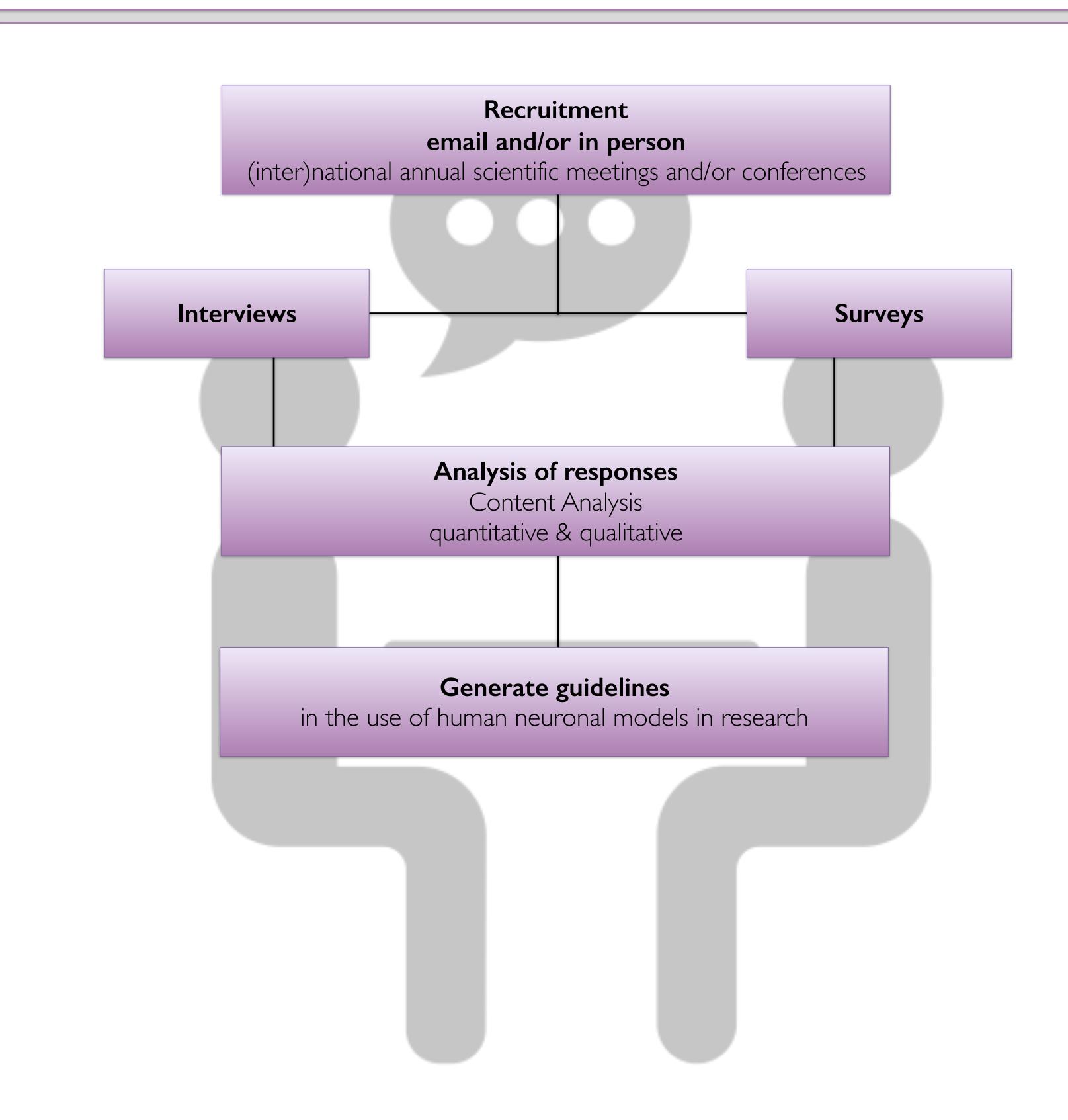
The modeling of mental disorder-, brain-related molecular, cellular and physiological phenotypes of humans in the lab has been revolutionized by methodological developments in the use of embryonic and inducible pluripotent stem cells as well as organoids comprising of neural cell types<sup>1</sup>. Brain organoids are three-dimensional (3D) entities composed of different types of human neural cells found in the developing brain<sup>2</sup>. While the developments in this field are yet in an early phase, they are expected to grow significantly in the nearby future, thereby triggering a series of ethical questions<sup>3,4</sup>.

Here, we aim to start mapping and reflecting on the potential ethical implications of these methodologies. In order to map the field, it is important to combine theoretical ethical reflection with stakeholder analysis, such that the suitable normative analysis is well-informed by relevant views and perspectives in the field. The current project (yet to be started) will therefore conduct a thorough examination of professional opinions. We plan to approach and interview scientists and other practitioners currently working with human neuronal models, including brain organoids, via interviews and surveys. An inventory of ethical questions like problems and advantages that might arise in the context of human brain model systems will be generated in the form of scenarios. This and future projects will help define the ethical issues that accompany one of the fastest growing biotechnologies, in order to guide it in a direction that benefits all and harms none.

### Objectives

- Generate ethical questions and scenarios relevant to human neuronal cell modeling to be used during interviews and surveys.
- Generate research questions based on responses during interviews with experts in the field (neuroscientists, ethicists, and philosophers).
- Generate guidelines for the use of human neuronal models in research.

#### Methods



#### List of example questions to be asked during interviews

- O Does research with 3D brain organoids derived from human stem cells resemble biobank research or research with cell lines?
- O Given the possibility of sentience in neurons with growing complexities<sup>5</sup>, is there a conceivable stage in which research with brain organoids begins to resemble research with human beings? What would reasonably count as such a stage?
- Accordingly, is there any normative framework available that should apply to research in this area?
- Alternatively, is it necessary to develop a different kind of normative framework, that apply in particular to research with human brain organoids, existing somewhere on a continuum between mere cell-lines and a fully-developed human organ?

#### Discussion & Conclusion

The increasing complexity of human neural cell models, including brain organoids has called for ethical considerations<sup>3</sup>. This study will focus on the ethical aspects of these applications in a research context, including notions such as sentience, chimerism, ownership, consent, data, death, handling and more. A thorough assessment of responses to ethical questions from experts in the field will set the stage for the way the methodologies and practices should be perceived and used in both ongoing and future research. Both issues and advantages will be highlighted and discussed. By doing so, the envisaged project will provide a first basis for generating research questions, ultimately aimed to generate guidelines in the use of human neuronal models in research.

### Future Directions



## References & Acknowledgements

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