- What would be your answer to the connectome debate? “Is mapping the mind of a worm worth it?”
- What are some of the challenges in mapping these connectomes?
- What do you think we could learn from these connectomes?
- How can connectome mapping help in clinical applications?

There is a huge scaling factor going from a worm brain to a human brain in term of number of neurons, synapses and complexity of the “map” or the connectome. Simplicity of the worm brain helps to validate tools, processes and technologies, that you can then apply to brains of increasing complexity (extrapolation step: https://www.youtube.com/watch?v=LBKEyGaPamY).
Theories or research in defining brain regions or functional areas in a worm brain can be easily verified, validated until you apply them to the human brain. To some extent the nematode brain has a limited interest in term of research but for, example, mouse and humans have very similar brain architecture made up of similar types of brain cells, thus making them an ideal test subjects for neuroscience and connectome studies.

Establishing a connectome has to face many challenges:

- As one of the YouTube videos emphasized: “1mm^3 of brain tissues contains 50K neurons and 1 billion synapses, the cerebral cortex has 16 billion neurons, 150 trillion synapses and 160K km axons in white matter, the brain has an average of 90 billion neurons”, the immediate challenge for a project like this, the HCP, is facing: is the sheer amount of data to process, which requires specific computing resources, sophisticated engineering equipment (in term of distributed computing, big data storage facilities, simulation facilities), and analysis and visualization tools which scale linearly and can handle a huge amount of data efficiently
- The mathematical methodologies have to deal with multi-dimensions data which is multi-modal, has unique features, and complex correlations.
- Communication between experts of different scientific fields
- Breaking down the human connectome in various projects seems a reasonable choice to make but then you have to provide a way to coordinate the projects, create collaborative platforms, systems of reference, dedicated information retrieval systems and suitable validation frameworks. Additionally, you need then to build theories which can pull together the different subsystems into the overall and overarching connectome of the human brain.
- One aspect people often mention about the connectome is how to address individual variability

(See this video around 44:00 which describes how to deal with this issue using connectome thresholding: https://www.youtube.com/watch?v=gR6iMuMSuYU)

A connectome is a neuronal anatomic and functional connectivity map which is necessary but not sufficient to help research to find therapies for brain disorders such as dyslexia, autism, Alzheimer’s disease, schizophrenia, and also will enable to link together gene expression to aspect of connectivity.
One output of fMRI is a functional connectivity matrix which helps to visually compare healthy and diseased people, and can give an immediate fine granular understanding of brain areas affected and by implication functional activities impacted. If you average these matrices cross individuals which are organized in populations with specific characteristics, then you link brain network areas, cortical folding patterns, myelin maps, with their intelligence, medical conditions, clinical treatments and other traits under which these people were clustered (https://www.youtube.com/watch?v=i2W570VgV6I).
But beyond these aspects, HCP can:

- Help to develop “Brain fingerprinting” to identify uniquely individuals.
- Help not only to find cure for humans but other types of life, grow better plants, create healthier animals.

- Having identify functional neuronal connectivity, we may also be able to better understand social behaviors and “redefine or rewire” them.
- Incidentally spurs research and with its applications triggers a positive economic impact

In regard to application of connectome mappings to clinical studies, I found this company which provides tools to compare connectomes of patients to monitor biomarkers or phenotypes of diseases: https://www.biomax.com/product/nicara/.