



## Examples of causal questions commonly asked to incubate.bio

incubate.bio has built a computational platform called ALaSCA to rapidly apply Causal Discovery and Causal Inference with biological data and RWD.

1. A company tests the efficacy of drugs on cancer cells *in vitro* by measuring daily omics changes.

**Which component at which level of omics has the largest effect on the drug's efficacy on the cancer phenotype?**

ALaSCA quantifies the relationships between omic and phenotypic metrics to prioritise the effects of the drug on the cancer cells and identifies latent variables that could influence the drug's efficacy.

2. The sleep phenotype of a *Drosophila melanogaster* disease model is representative of an Alzheimer's disease endpoint.

**Which pathways and proteins have the largest causal effect on the observed sleep phenotype?**

ALaSCA can quantify the effects of different pathways and proteins on the sleep phenotype to determine which components have the largest effect.

3. A company has developed a brain-computer-interface treatment device which disrupts cancer cell growth through electrical signals.

**What characteristic of the cancer cells will have the largest effect on the efficacy of the device?**

ALaSCA can determine which characteristic of the cancer cells has the largest effect on the efficacy of the device and identifies latent variables that could influence the device's efficacy.

4. The AMPK pathway has been identified to be highly associated with the progression of type 2 diabetes.

**Which proteins in the AMPK pathway should be targeted to ensure the most effective treatment outcome?**

ALaSCA can quantify the effects of each protein on the outcome of the AMPK pathway in order to prioritise the efficacy of each protein for treatment.

5. Abemaciclib, a kinase inhibitor that is used in the treatment of breast cancer, is affecting several proteins that could form part of the same pathway, but the pathway is unknown.

**What is the order of interaction between proteins targeted by Abemaciclib?**

ALaSCA can predict order of interaction between proteins with high accuracy without prior knowledge of the order of events.

6. Physiological data used for an algorithm to predict the likelihood of atrial fibrillation has inherent bias affecting the prediction.

**Which variables in the data have a large effect on the prediction of atrial fibrillation that were not taken into account?**

**How does the prediction change when a variable with a large causal effect changes?**

ALaSCA can identify which variables could potentially be causing bias in the data and suggest a method of controlling for these variables. It can also simulate the alternative outcomes based on the change of a variable – simulate the “what-if” questions that are not observable.

7. S6-kinase is being validated as a target for its cause in Alzheimer's disease amyloid plaque formation through *in vitro* and *in vivo* models.

**Does S6-kinase have a causal effect on amyloid plaque formation? Are there confounding factors that influence the efficacy of S6-kinase on amyloid plaque formation?**

ALaSCA can give supporting evidence for the causal effect of S6-kinase by using biological data from *in vitro* and *in vivo* experiments. It can also identify potential hidden influences that affect the efficacy of S6-kinase on amyloid plaque formation.

**For more information, contact:**

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