5. Entity roles

5.1 Introduction

Biological components listed in the caption of a figure each play a different role in the experimental design: some components are altered in a controlled manner, other remain untouched by the experimenter, and some are directly or indirectly assayed to perform measurements or observations. Accordingly, the following roles are defined:

- Biological component
- Assayed component
- Intervention
- Reporter component
- Normalizing component
- Experimental variable

5.2 Biological components

A biological component is a generic category for any experimentally relevant component which does not fit any of the other defined roles within SourceData..

5.3 Assayed components

An assayed component is the component that is measured or observed.

> EXAMPLE 7
> The proteins detected on a Western blot are the assayed components with the exception of the loading control, if any, which is a normalizing component (see below).

NOTE

If a molecular marker, for example the protein EEA1, is assayed to visualize a higher order structure, for example endosomal vesicles, the marker (EEA1 in this example) is tagged as an assayed component. The higher order structure (endosomal vesicles in this example) is tagged as assayed component only if it is explicitly highlighted on the image or a property of the entity (such as number/localisation) is mentioned in the text of the legend.

5.4 Interventions

An intervention (or perturbation) is a component that is experimentally altered. An intervention must be targeted and must be controlled. This implies that the experiment must involve the same experimental system across experimental groups and must involve a comparison between several experimental groups to test whether the intervention causes an effect on the assayed component.

EXAMPLE 8

The function of the gene creb1 can be investigated by comparing creb1 wt (control group) to creb1-/- knockout (test group) mice; in this experiment, creb1 is the intervention. If, and only if, it is appropriately controlled, the purpose of such an experiment is to infer a cause-and-effect relationship, whether direct or indirect, between the intervention and the assayed component.

WARNING

If a drug (cycloheximide, for example) is applied across ALL experimental groups, it is NOT considered as an intervention, since there is no control group to compare the effect of the drug across conditions. An intervention must be controlled. Accordingly, in such context, the drug should be tagged as biological component.

Similarly, if a cell strain harboring the same genetic mutation is used across ALL experimental groups, the mutated gene is NOT an intervention but a generic biological component.

NOTE

The target of an experimental manipulation is usually tagged as intervention. Small molecules such as drugs, inhibitors, agonists and other pharmacological compounds are usually considered as the intervention when their effects are compared across experimental groups. An exception is when a small molecule (for example, doxycycline, IPTG, arabinose) is used to manipulate the activity of an engineered circuit controlling the actual entity of interest (for example, a gene whose expression needs to be varied), in which case the entity of interest is considered as the actual intervention.

EXAMPLE 9

If cells are treated with different doses of the PKA inhibitor H89, H89 is tagged as the intervention.

NOTE

In experiments that test the action of an entity over time, the entity is tagged as an intervention only if a control group is tested or if the the time=0 is also shown as point of comparison.

EXAMPLE 10

In a siRNA-mediated knock down experiment, the gene targeted by the siRNA is tagged as an intervention.

NOTE

An intervention must involve controlled experimental conditions. It is therefore common that control experimental groups are treated with a neutral compound, for example the solvent used to dissolve the administered drug. By convention, such components must be assigned the generic role biological component.

5.5 Reporter components

A reporter component is used as a proxy to measure or observe indirectly an assayed component of interest to which it is linked as part of a synthetic or engineered construct.

> EXAMPLE 11
> A RAS-GFP fusion protein includes the RAS protein as an assayed component and GFP as a reporter component.

> EXAMPLE 12
> The luciferase gene can be used a reporter gene to monitor the transcriptional activity of a given gene promoter, which is the actual assayed component of interest.

Linking reporter components or normalizing components to an external identifier is optional.

5.6 Normalizing components

A normalizing component is a component that is assayed for the purpose of providing baseline measurements from each experimental group so that the the data can be normalized across groups.

> EXAMPLE 13
> The proteins beta-actin or GAPDH are often assayed to serve as loading control in Western blots and are then tagged as normalizing component.

Linking normalizing components to an external identifier is optional.

5.7 Experimental variables

When a component is used to compare multiple experimental groups but it is not possible to clearly infer a cause-and-effect relationship between this component and the assayed components of the experiment, the component is said to be an experimental variable.

> EXAMPLE 14
> If the expression of a given gene is measured across tissues and cell lines, including liver, muscle, brain, HEK293 and HeLa cells, the tissues or cell types are tagged as experimental variables.