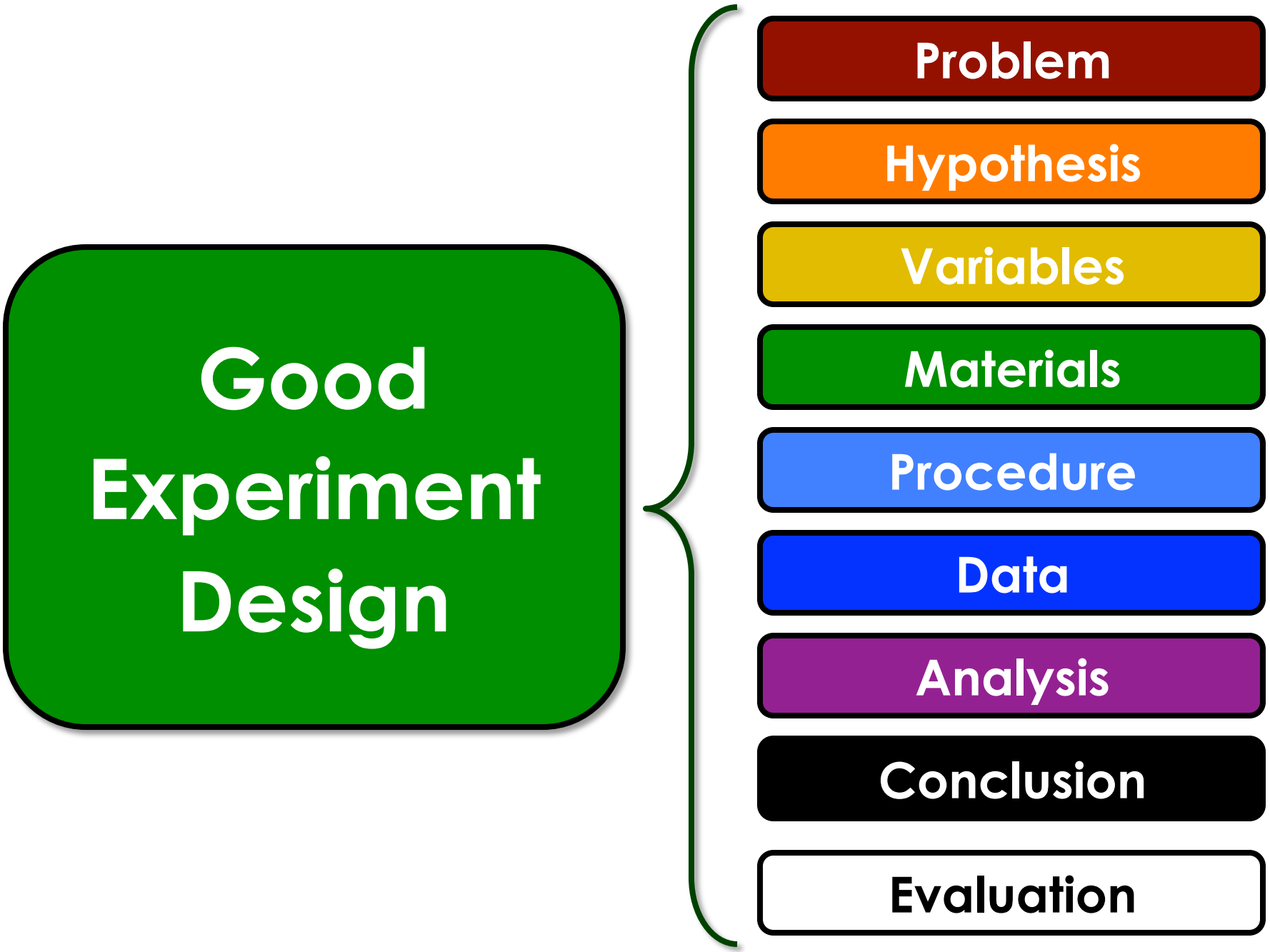
The Scientific Method
Experimental Design

REVIEW

Basic Scientific Method

1. State a Problem
2. Form a Hypothesis
3. Perform an Experiment
4. Analyze the Data
5. Write a Conclusion


Good Experiment Design
Problem
Hypothesis
Variables
Materials
Procedure
Data
Analysis
Conclusion
Evaluation

PROBLEM

A statement that describes the main topic of the experiment

A good problem should…

- Be **detailed**
- Be answered by a simple **yes** or **no**
- Be about something that can be measured **quantifiably**

HYPOTHESIS

A prediction about the outcome of an experiment.

A good hypothesis…

- Is written as an "If… then…" statement
- Can be tested by the experiment
- Includes a detailed explanation why

VARIABLES

A variable is a factor in an experiment that can change.

There are 3 types:

1. **Independent**
2. **Dependent**
3. **Constant**

Independent Variable	The one factor you change on purpose.
Dependent Variable	The one factor you measure.
Constants	The multiple factors that must not change in the experiment

EXPERIMENTAL CONTROL

A trial performed within the experiment where the independent variable is NOT changed at all.

A control is used to…

- **Check that all constants are working**
- **The independent variable is actually causing a change to the dependent**

MATERIALS

Specific information about the items that you will use.

A good materials section should:

1. Be in **list** or **table** form
2. Include **exact** amounts, sizes or volumes (e.g. 35 mL of water)
3. Include **safety equipment**

PROCEDURE

Step by step instructions on how the experiment is to be performed.

A good procedure should:

1. Be listed in numerical steps
2. Have each step start with a verb
3. Avoid personal pronouns (I, We)
4. Include steps for multiple trials

DATA

Observations collected by the senses or measurement tools.

There are 2 types of data:

1. **Quantitative**
2. **Qualitative**

Quantitative Data	Data represented by **numbers** (e.g. the flower grew 2.5 cm in a week)
Qualitative Data	Data represented by **opinions** (e.g. the flower looked healthy)

DATA TABLE

Experimental data is usually recorded in data tables.

A good data table should…

1. Be drawn neatly with a ruler
2. Have independent variable in left column
3. Have dependent variable in the right
4. Include the units in the header only

ANALYSIS

The analysis explains the patterns in the data that you recorded.

A good analysis should…

1. Describe the relationship between the independent and dependent variables
2. Identify other patterns in the data
3. Describe what was learned

CONCLUSION

A conclusion is a simple summary of what was found in the experiment.

A good conclusion...

1. Answers the original **Problem**
2. States whether the **Hypothesis** was supported by the data or not supported
3. Is **simple and clear**

EVALUATION

In your evaluation, you must honestly critique the experiment.

A good evaluation should…

1. State if the experiment was successful or not
2. State if the data is reliable or not
3. Identifies weaknesses in the procedure
4. Suggests reasonable improvements

Any Questions?