SCIENCE FOUNDATIONS

Scientific interpretation of biological data

Difficulty level: Advanced

Science Foundations

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Overview of the concept

This is how you read a study about a new diet or a vaccine trial and judge whether the results are solid, by checking the pattern, the sample size, and the controls. A headline claiming a food doubles your lifespan needs a closer look at how many people were studied and whether the comparison group was fair. A doctor deciding whether to trust a trial checks the same things before changing a treatment. Knowing how to interpret biological data tells you how to tell a strong result from a shaky one.



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Worked examples

EXAMPLE 1

Q Interpret: a drug trial with 1000 patients, control group included, shows faster recovery. Claim?

SOLUTION

Check the design: large sample and a control group are strengths.

Describe the pattern: treated patients recovered faster than controls.

Claim carefully: the drug appears to speed recovery in this trial.

The result is drug appears to speed recovery in this trial.

EXAMPLE 2

Q Interpret: two plants, one tall, one short, different soils. Claim?

SOLUTION

Check the design: sample size is tiny and soils differ.

Confounding: soil, not just the factor of interest, differs.

Claim: almost nothing can be concluded from this test.

The result is no reliable conclusion from two plants in different soils.

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Practice questions

1 **A trial of a new cough medicine with 800 patients and a control group shows treated patients recovering faster than controls. What can be claimed, and why is the design strong?**

- **A** The medicine appears to speed recovery in this trial; the large sample and control group are strengths
- **B** The medicine definitely cures the illness for everyone
- **C** Almost nothing can be concluded; the sample is too small
- **D** The medicine appears to slow recovery; the control group proves it

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2

A study finds that people who eat breakfast have better grades. What can be claimed?

A. Breakfast is linked to better grades, but the study does not prove cause

B. Breakfast causes better grades

C. Breakfast has no effect on grades

D. The study proves breakfast is the only cause

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3 **Two goldfish, one large and one small, are kept in tanks at different temperatures. What can be claimed, and what is wrong with the test?**

- **A** Almost nothing can be concluded; the sample is tiny and the temperatures differ, so temperature confounds the result
- **B** The larger fish must be healthier; the test proves temperature makes fish grow
- **C** The test is strong because it uses two different temperatures
- **D** The smaller fish is unhealthy because of its size alone

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4

Three mice are fed a new food and gain weight, with no control group. What can be claimed, and what is wrong with the test?

A. The food definitely makes mice gain weight

B. Almost nothing can be concluded; the sample is tiny and there is no control group

C. The mice gained weight because they ate more than usual

D. A control group would make the result weaker

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5 After checking the design, what do you do next when interpreting data?

- A Describe the pattern
- B Check the design
- C Claim the result is proven
- D Ignore the sample size

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6 Why check sample size?

- A Small samples can mislead
- B Large samples always prove cause
- C Sample size does not affect a result
- D Small samples are always more reliable

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7 Does correlation (two things changing together) prove cause?

- A Yes
- B No

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8 What is a confounding factor?

- A An extra factor that differs between groups
- B A factor that is kept the same for all groups
- C The factor the experimenter changes on purpose
- D The result measured at the end of a test

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9 Is a large sample more or less reliable than a small one?

- A Less reliable
- B Just as reliable
- C More reliable
- D Reliability does not depend on sample size.

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10 State a claim only as far as what?

- A As far as you hope
- B As far as the data support
- C As far as the headline claims
- D As far as one patient shows

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ANSWER KEY

1. The medicine appears to speed recovery in this trial; the large sample and control group are strengths
2. Breakfast is linked to better grades, but the study does not prove cause
3. Almost nothing can be concluded; the sample is tiny and the temperatures differ, so temperature confounds the result
4. Almost nothing can be concluded; the sample is tiny and there is no control group
5. Describe the pattern
6. Small samples can mislead
7. No
8. An extra factor that differs between groups
9. More reliable
10. As far as the data support

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