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Cell Permeability and Metabolism Data Interpretation

Practical 6 - Software and data-analysis practical

Aim

To calculate apparent permeability and interpret cell-based metabolism observations from a supplied approved dataset.

Principle

A permeability experiment measures transport across a defined barrier under controlled donor and receiver conditions. Apparent permeability reflects the chosen system and requires area, concentration, time, recovery and barrier-integrity information. Disappearance of parent compound alone does not establish metabolism. Keep the supplied data, transformations, software version, analysis settings and complete output together. Record units explicitly and distinguish assumptions from observations.

Materials and Requirements

- Institution-supplied permeability or metabolism dataset
- Membrane or authorised cell-system description, area and donor concentration
- Integrity controls and analytical recovery information
- Spreadsheet or institution-approved analysis software
- Raw-data dictionary and analysis worksheet

Procedure

1. Define the analysis question and the variables, units, identifiers and missing-data conventions in the dataset.
2. Import a working copy and check values against the original file. Inspect ranges, duplicates, timing and unit consistency.
3. Record the barrier system, direction, area, concentrations and sampling and replacement scheme.
4. Verify that the dataset includes appropriate blanks, integrity evidence, donor and receiver measurements and recovery checks.
5. Identify a justified approximately linear transport interval and calculate the transported amount per unit time.
6. Calculate apparent permeability with the correct area and concentration units. Compare reverse-direction or control data only when the design supports it.
7. For metabolism observations, examine parent and metabolite evidence, binding and recovery before attributing loss to enzymatic conversion.
8. Retain diagnostics, intermediate calculations and the selected analysis settings. Explain exclusions and sensitivity checks.
9. Write a conclusion that addresses the stated question and the limitations of the design rather than relying on one fitted statistic.

Observations and Record

Enter actual measurements or the supplied teaching data. Record the method, material identity, conditions and units.

Interval / preparation	Transported amount	Integrity / recovery	Calculated response
Control	Record	Record	Assess
Test interval 1	Record	Record	Calculate
Test interval 2	Record	Record	Calculate
Reverse direction if supplied	Record	Record	Compare

Calculations

- Papp = (dQ/dt) / (A x Cdonor)
- For consistent units, nmol/s divided by cm^2 x nmol/cm^3 gives cm/s.

Worked Example

Illustrative dQ/dt = 0.020 nmol/s, area = 1.00 cm^2 and maintained donor concentration = 100 nmol/cm^3.
Papp = 0.020/(1.00 x 100) = 2.0 x 10^-4 cm/s.
Interpret with barrier integrity, recovery and the interval assumptions. This value does not directly specify human absorption.

Result and Interpretation

- State system-specific limitations and distinguish transport, binding, degradation and metabolism evidence.

Precautions

- Use supplied or institution-approved data and systems.
- Correct sampling and concentration units.
- Avoid biological interpretation when barrier integrity or recovery is inadequate.
- Preserve the original dataset and a reproducible record of the analysis.

Viva Questions and Answers

Why assess barrier integrity?

A damaged barrier can produce misleadingly high transport.

Why measure recovery?

Material can bind, degrade or be lost during handling.

Does parent loss prove metabolism?

No; other processes can also reduce parent concentration.

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