Scientific Methodology

Scientific methodology refers to the **systematic, logical, and empirical framework** used to investigate questions, generate knowledge, and validate findings through **observation, experimentation, and analysis**.

Core Components

- **Observation**: Careful identification of phenomena or patterns.
- **Hypothesis formulation**: Testable and falsifiable propositions.
- **Experimental design**: Controlled methods to test hypotheses.
- **Data collection**: Accurate and objective gathering of information.
- **Analysis**: Use of statistical or computational tools to interpret results.
- **Validation**: Reproducibility, peer review, and external confirmation.
- **Conclusion**: Interpretation of findings in context, acknowledging limitations.

Principles

- **Objectivity**: Avoiding bias in design, interpretation, and reporting.
- **Reproducibility**: Methods and results should be repeatable by others.
- **Transparency**: Clear documentation of procedures and assumptions.
- **Falsifiability**: Theories must be disprovable by evidence.

Misuse Warning

Use of the term “scientific methodology” without adherence to these principles can be misleading, especially in:

- Poorly validated AI models
- Overinterpreted tractography results
- Flashy but untested clinical tools