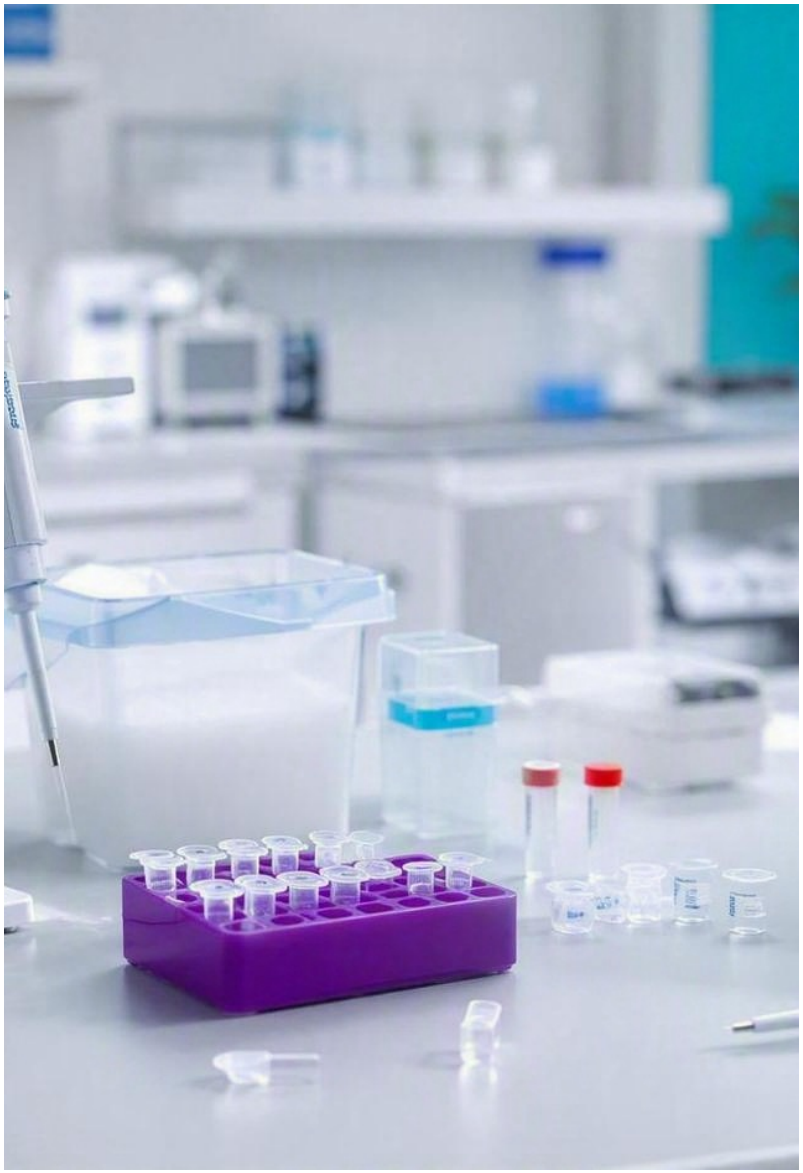
LABORATORY WORKFLOW GUIDE

Running a Molecular Biology Experiment at LIBM

From hypothesis and protocol approval by the head professor through bench work, controls, and data reporting.

9 steps · Principal Investigator sign-off included



The nine-step workflow

01 Define the question

02 Design the experiment

03 Draft the protocol

04 Professor approval

05 Prepare reagents

06 Run the bench work

07 Controls & QC

08 Analyze the data

09 Document & report

Steps 1–4 are planning and governance; steps 5–9 are execution and reporting.

Steps 1–2: Question and experimental design

01 Define the question

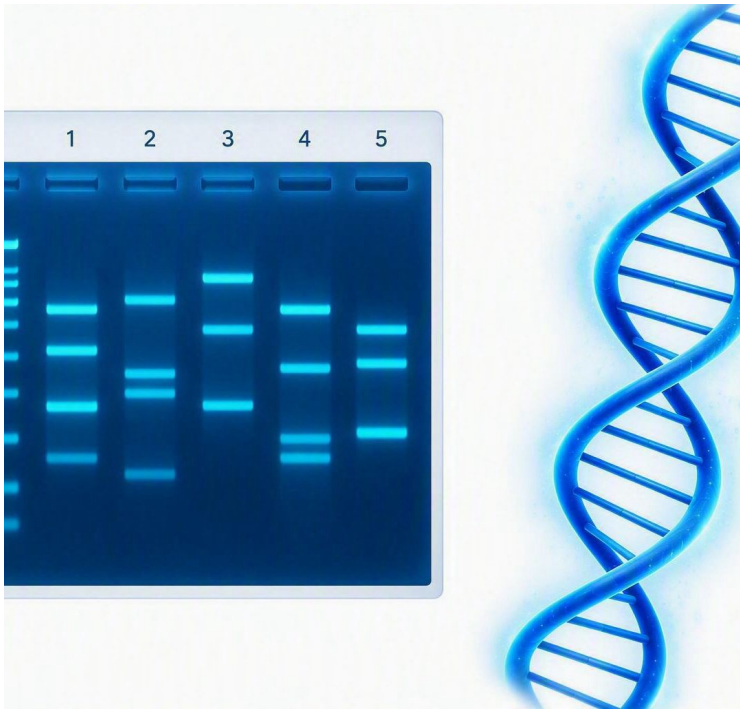
State a falsifiable hypothesis and the exact readout that would confirm or reject it.

02 Design the experiment

Choose the technique (PCR, qPCR, cloning, Western blot), define variables, controls, replicates, and statistical power.

Search the literature

Review published protocols and prior lab results, so the design builds on what already works.



Step 3: Draft the written protocol

Materials & reagents

Full list with catalog numbers, concentrations, lot tracking, and storage conditions.

Step-by-step method

Volumes, incubation times, temperatures, and instrument settings written so another student can repeat it.

Safety & compliance

Risk assessment for hazardous reagents, biosafety level, waste handling, and any ethics or GMO permits.

Timeline & budget

Bench hours, **shared-instrument booking**, consumable costs, and the grant line that funds them.

Where can I check the information?

Inventory

Primers

Booking

Kardex

Webtools

PrimerBLAST

https://www.ncbi.nlm.nih.gov/tools/primer-blast/

Oligoanalyzer

https://www.idtdna.com/pages/tools/oligoanalyzer

RAOSOFT Sample Size Calculator

https://raosoftcalculator.com

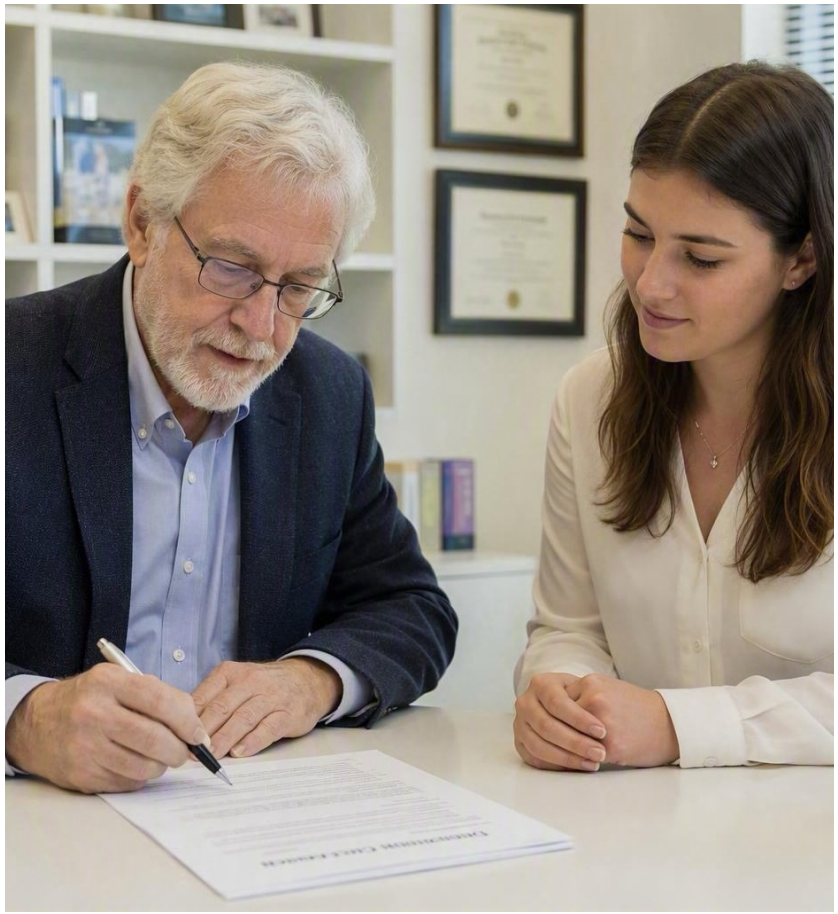
CHS Protocols

https://cshprotocols.cshlp.org

LIBM webpage

https://poultryimmunopathogenesis.com

Step 4: Approval by the head professor



No experiment starts at the bench until the principal investigator signs off on the protocol.

- **Submit**

  Send the protocol, risk assessment, and budget ahead of the lab meeting.

- **Present & defend**

  Walk the group through the hypothesis, controls, and expected outcomes.

- **Revise**

  Incorporate the professor's feedback on design, safety, and feasibility.

- **Formal sign-off**

  Written or electronic approval is recorded, plus biosafety or ethics clearance where required.

Step 5: Prepare reagents, samples, and workspace

Order and log	Order approved consumables; log lot numbers and expiry dates on arrival.
Prepare buffers	Make fresh stocks and working dilutions; label with contents, concentration, date, and initials.
Prepare samples	Extract and quantify nucleic acids or protein; check purity before committing to the assay.
Set up the bench	Decontaminate surfaces, use dedicated pre- and post-PCR areas, and book instrument time.

Step 6: Run the experiment at the bench

- Follow the approved protocol exactly — deviations are recorded, not improvised.
- Work in defined blocks: extraction, reaction setup, amplification, detection.
- Include every control in the same run as the samples they validate.
- Time-stamp each step in the lab notebook while at the bench, not afterwards.
- Photograph gels, save raw instrument files, and back them up the same day.

If something goes wrong, stop and consult the professor before repeating.

Step 7: Controls and quality checks

Control	What it is	What it proves
Positive control	Sample known to give the expected result	The assay and reagents are working
Negative control	Reaction without template or target	No contamination or non-specific signal
No-template control	Master mix with water instead of DNA	Reagents are free of carry-over amplicon
Loading / reference	Housekeeping gene or protein	Equal input across lanes or wells
Replicates	Technical and biological repeats	The result is reproducible, not chance

Uncontrolled results are not results — the professor will ask for the controls first.

Step 8: Analyze and interpret the data

01

Clean the raw data

Check instrument QC flags, exclude failed wells with a documented reason, and normalize to the reference.

02

Quantify

Apply the right model — standard curve, ΔΔCt, densitometry — and report values with error bars.

03

Test the hypothesis

Choose the statistical test before looking at results; report effect size and n, not just p-values.

04

Interpret honestly

Distinguish what the data show from what you expected; flag anomalies for the professor.

> Agree the analysis plan with the professor before the data come in — deciding how to test after seeing results invites bias.

Step 9: Document, review, and report

1

Lab notebook

Complete, dated, and signed entries that let anyone reconstruct the experiment.

2

Data archive

Raw files, analysis scripts, and figures stored on the lab server with clear naming.

3

Group meeting

Present results and interpretation; the professor reviews conclusions and next steps.

4

Next iteration

Approved follow-up experiments, or write-up for a thesis chapter, poster, or manuscript.

Good documentation is what turns a successful run into a result the lab can publish and defend.

Key takeaways

Plan on paper first	A written, costed protocol prevents most wasted bench time.
Get the sign-off	Professor approval — plus biosafety or ethics clearance — precedes any bench work.
Control everything	Positive, negative, and no-template controls run alongside every experiment.
Record as you go	Contemporaneous notes and archived raw data make results defensible.

Reproducibility is the product — the result is just the evidence.

Thanks

Any inquiry or question

libm@ut.edu.co
isrondon@ut.edu.co
(head professor)