

# Guide: Writing the Perfect Results Section of a Scientific Paper

In top-tier journals, the **Results** section is not just a data dump; it is a **visual argument**. You are taking the reader by the hand and showing them the "Proof" for the claims you made in the introduction.

Taking an example of the **PRL (Ice)** and **Acta Materialia (Metallic Glass)** papers, let's analyze these papers and look at how to structure these results.

## The Executive Comparison: Results Sections

Feature	The Letter (e.g., PRL)	Full-Length Article (e.g., Acta Mater)
Philosophy	<b>"The Evidence"</b> : Every figure must directly answer the "Mystery" posed in the intro.	<b>"The Investigation"</b> : Systematic exploration of variables and correlations.
Structure	Combined Results/Discussion is common. Linear and fast.	Divided into sub-headings by phenomenon (e.g., "Hardness," "Shear Bands").
Tone	Assertive. "Figure 1 proves that..."	Analytical. "We observe a trend where..."

## Part 1: The "Letter" Results (The Evidence)

**Example:** *Cold Self-Lubrication of Sliding Ice*

In a Letter, you have very little space. You cannot show every graph you made. You only show the "Killer Plots."

1. **Lead with the Visualization:** The ice paper uses a cross-section of the interface. This allows the reader to see the amorphous water layer.
2. **Quantify the Breakthrough:** They don't just say it's slippery; they show a graph of the friction coefficient vs. velocity.
3. **Address the Paradox:** They show that amorphization happens even at 10 K. This is the "mic drop" result that destroys the "frictional heating" theory.

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**Student Tip:** For a Letter, Figure 1 should be the "Executive Summary" of your entire discovery. If the reader only looks at Figure 1, they should still get the main point.

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## Part 2: The Full-Length Results (The Investigation)

**Example:** *Plasticity of metallic glasses...*

In a full-length article, you are building a narrative of discovery. You move from the general to the specific.

1. **Establish the Baseline:** The authors start by showing the "quench" data. They prove they have two distinct types of glass: fragile and strong.
  2. **The Main Event:** They move to Nanoindentation. They show the load-depth curves.
  3. **The Deep Dive (Mechanism):** They use "shear strain maps" to show *why* the fragile glass is more ductile. They show the physical formation of shear bands.
  4. **The Correlation:** They end with a summary plot that directly links the state from which the melt was cooled to the mechanical properties.
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## Part 3: The "Perfect Results Section" Guide

### 1. The "Result-Reason" Sentence Structure

Never just describe a graph. Tell the reader what the graph means.

- **Weak:** "Figure 2 shows the friction as a function of temperature."
- **Strong:** "To determine if melting is purely thermal, we plotted friction against temperature (Fig. 2), which reveals a non-linear drop that contradicts standard melting models."

### 2. Visual Hierarchy

A top-tier paper is often "read" by looking at the figures first.

- **A-Figures:** The main discovery (e.g., a new phase or mechanism).
- **B-Figures:** The supporting data (e.g., temperature dependence, error analysis).
- **C-Figures:** The "sanity checks" (move these to the Supplement).

### 3. The "Storytelling" Sub-headings

Instead of "Friction Results," use "Displacement-driven amorphization at low temperatures." Make the heading a summary of the finding.

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## Part 4: Grammar & Syntax for Results

### 1. The "Tense Transition" Rule

Results sections often fail because they oscillate awkwardly between past and present tense. Follow this standard:

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- **Past Tense:** Use for the *actions* you took and the *specific data* gathered.
  - *"We measured a 20% increase in shear band density."*
- **Present Tense:** Use for *eternal truths* shown in your figures or established theory.
  - *"Figure 3 shows that the amorphous layer remains stable at 10 K."*

## 2. Eliminating "Empty" Subjects

Avoid starting sentences with "There is" or "It was found that." These are wordy and hide the "hero" of your sentence (the data).

- **Weak:** "There was a significant correlation observed between cooling rate and hardness."
- **Strong:** "Cooling rate correlated significantly with hardness ( $R^2 = 0.98$ )."

## 3. Hedging vs. Asserting

In high-impact journals, you must distinguish between what the data **proves** and what it **suggests**.

- **For Direct Observations:** Use "indicates," "demonstrates," or "reveals."
- **For Inferences:** Use "suggests," "implies," or "is consistent with."

**Note:** Over-hedging (using "may" or "could" too often) makes your discovery look weak. Only hedge when the mechanism isn't directly captured by the plot.

## 4. Precision Adverbs

Avoid "very," "extremely," or "clearly." If a result is "clear," the data should speak for itself. Use quantitative descriptors instead:

- Instead of "The friction was **very** low," use "The friction coefficient dropped by **an order of magnitude**."

# Part 5: The "Perfect Results" Checklist

Use this list as a final pass before sending a draft to your PI or co-authors.

## Structural Integrity

- **The "Flip Test":** If I look only at the Figures and read only the Sub-headings, do I understand the entire discovery?
- **No Discussion:** Have I removed all "Why" explanations? (Save the "Why" for the Discussion section unless it's a Combined Results/Discussion Letter).
- **Figure Order:** Are the figures mentioned in the text in chronological order (Fig 1, then Fig 2)?

## Data & Logic

- **The "So What?":** Does every paragraph start with a sentence explaining *why* a specific experiment was done? (e.g., *"To verify the crystallinity of the interface..."*)

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- [ ] **Statistical Rigor:** Are all P-values, error bars (SD vs. SEM), and sample sizes (n) explicitly stated in the text or captions?
- [ ] **Sanity Checks:** Have I moved "boring" characterization data (XRD patterns of starting materials, etc.) to the Supplementary Information?

### Writing & Tone

- [ ] **Active Voice:** Did I use "We observed..." or "The data shows..." instead of "It was observed by us..."?
- [ ] **No "Figure-Talk":** Did I avoid sentences that only say a figure exists? (e.g., "*Figure 4 is a graph of X.*" → **Delete.**)
- [ ] **Consistent Terminology:** If I call it a "shear band" in Figure 1, am I still calling it a "shear band" (not a "deformation zone") in Figure 4?