Introduction to Scientific Bibliography

Parcours Recherche

Adrien Merlini

IMT Atlantique

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Programme de la séance

1

[1] The beamer code for the slides was generated in part from a detailed outline by a LLM.

Introduction: The Scientific Paper

What is a Scientific Paper?

Definition

A formal document that presents original research, methodology, results, and conclusions in a structured format, subject to peer review.

Key Characteristics:

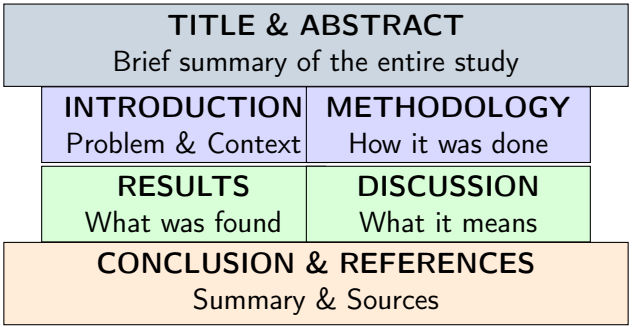
- Peer-reviewed
- Structured format
- Reproducible methodology
- Evidence-based conclusions
- Builds on existing knowledge

For Engineers

Scientific papers are your foundation for:

- Problem-solving
- Innovation
- Safety standards
- Best practices

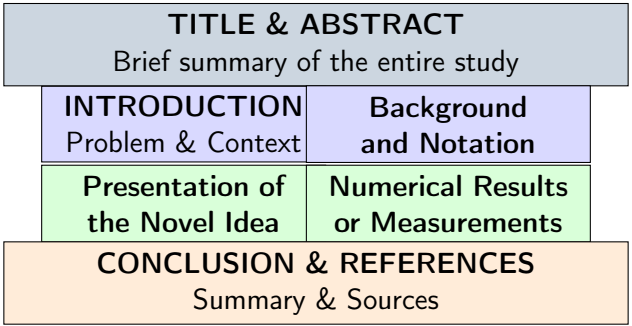
Structure of a Scientific Paper: Life Sciences



Aspirin & Cardiovascular Health

`https://www.nejm.org/doi/full/10.1056/NEJMoa1805819`

Structure of a Scientific Paper: Engineering



Electromagnetic Brain Models

`https://ieeexplore.ieee.org/abstract/document/8957159`

Math: Not Even Once

`https://link.springer.com/article/10.1007/s00211-002-0407-z`

Reading Strategy: The Engineering Approach

Step 1: Quick Scan (3-5 minutes)

The abstract is free, not necessarily the rest

1. Read title and abstract
2. Check figures and tables
3. Read conclusion
4. Scan references

Step 2: Focused Reading

1. Introduction (context)
2. Methodology (approach)
3. Results (findings)
4. Discussion (interpretation)

Time Management

- Abstract: 30 seconds
- Full paper: 15-30 minutes
- Deep analysis: 1-2 hours

Engineering Tip

Focus on methodology and results - these sections contain the technical details you need for applications.

Disciplinary Differences

Aspect	Engineering	Life Sciences	Mathematics
Structure	IMRaD + Applications	IMRaD + Clinical relevance	Theorem-Proof format
Methodology	Experimental design, simulations	Laboratory protocols, statistical analysis	Theoretical proofs, algorithms
Results	Performance metrics, efficiency	Statistical significance, p-values	Proofs, examples
Language	Technical specifications	Medical/biological terminology	Mathematical notation
Focus	Practical applications	Biological mechanisms	Theoretical foundations

Key Takeaway

Adapt your reading strategy based on the discipline, but the core principles remain the same.

Why Check Scientific Papers?

Technical Applications in Engineering

Case Study: Antenna Design

Problem: Designing a new wireless communication antenna

Without Scientific Literature:

- Trial and error approach
- Reinventing existing solutions
- Potential safety issues
- Inefficient designs

With Scientific Literature:

- State-of-the-art techniques
- Validated methodologies
- Performance benchmarks
- Safety standards compliance

Everyday Life Applications

Medical Decisions

Scenario: Should you take daily aspirin for heart health?
News headlines: "Aspirin prevents heart attacks!"
Scientific reality: Benefits vary by age, gender, and risk factors. Side effects include bleeding risk.

Consumer Choices

Scenario: Choosing ergonomic office equipment
Marketing claims: "Scientifically proven to reduce back pain!"
Research shows: Limited evidence for most products. Proper posture and regular movement more important.

Critical Thinking

Scientific literacy helps you make informed decisions in all aspects of life.

News vs. Research: The Gap

Case Study: "Chocolate turns you into a genius"

News Report

"Eating chocolate 'improves brain function' - study"

Typical news distortions:

- Sensationalized headlines
- Missing context
- Oversimplified explanations
- Ignored limitations

Actual Research

"Chocolate intake is associated with better cognitive function: The Maine-Syracuse Longitudinal Study"

Research reality:

- Early-stage research
- Laboratory conditions only
- Significant technical challenges
- Years from commercialization

Search Strategies

Effective Keyword Selection

Strategy 1: Start Broad, Then Narrow

1. Identify main concepts
2. Find synonyms and related terms
3. Use discipline-specific terminology
4. Check subject headings/tags

Example: Solar Panel Efficiency

- "solar panel" OR "photovoltaic"
- "efficiency" OR "performance"
- "optimization" OR "improvement"

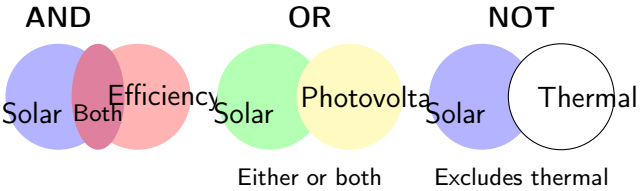
Strategy 2: Learn from Good Papers

- Check keywords in relevant papers
- Look at subject headings
- Note terminology variations
- Build your vocabulary

Pro Tip

Keep a personal glossary of technical terms in your field!

Boolean Operators: Your Search Power Tools



Complex Search Example

```
(solar OR photovoltaic) AND efficiency AND (silicon OR perovskite) NOT
review
```

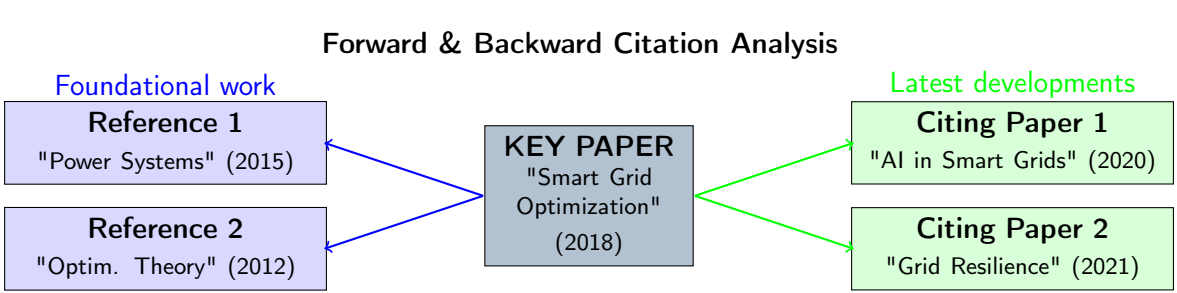
Database Navigation: Where to Look

Database	Strengths	Best For
IEEE Xplore	Electrical/Computer engineering focus	Electronics, telecommunications, computing
Web of Science	High-impact journals, citation tracking	Multidisciplinary research, impact analysis
Scopus	Broad coverage, author profiles	Engineering + sciences, collaboration analysis
Google Scholar	Free access, broad coverage	Quick searches, finding open access
arXiv	Preprints, cutting-edge research	Latest developments, conference papers

University Resources

Your library provides access to multiple databases. Always start with institutional access!

Citation Tracing: Building Your Research Network



Backward Tracing

Purpose: Find foundational work

- Follow reference lists
- Discover seminal papers
- Understand historical development
- Find established methodologies

Forward Tracing

Purpose: Find recent developments

- Use "Cited by" links
- Discover applications
- Find improvements/critiques
- Track current research trends

Advanced Citation Tracing Tips

Quality Indicators:

- **High citation count** = influential work
- **Recent citations** = current relevance
- **Author reputation** = credible source
- **Journal quality** = rigorous review

Red Flags:

- Self-citations only
- No recent citations
- Negative citation contexts
- Retracted papers in chain

Efficient Strategies:

- Start with review papers
- Follow highly-cited authors
- Use "Related articles" feature

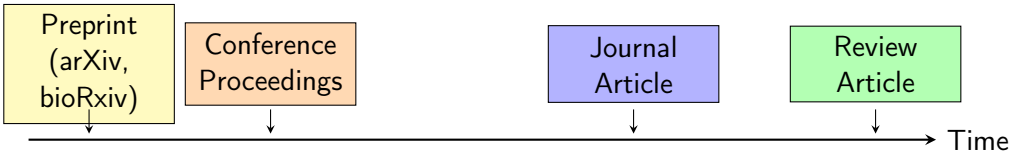
Stop Criteria

Know when to stop:

- Diminishing returns
- Repetitive findings
- Off-topic drift
- Time constraints

Publication Types

The Publishing Ecosystem



Key Insight

Different publication types serve different purposes and have different levels of validation.

Journal Articles vs. Conference Proceedings

Journal Articles

- \+ Rigorous peer review
- \+ Detailed methodology
- \+ Comprehensive results
- \+ High credibility
- – Slow publication (1-2 years)
- – May be outdated

When to Use

For established, validated knowledge and comprehensive understanding

Conference Proceedings

- \+ Recent developments
- \+ Cutting-edge research
- \+ Fast publication
- \+ Networking opportunities
- – Limited peer review
- – Preliminary results

When to Use

For latest trends and emerging technologies

Standards, Patents, and Technical Reports

Type	Purpose	Where to Find
Standards	Technical specifications, safety requirements, interoperability	ISO, IEEE, ANSI, AFNOR (France)
Patents	Intellectual property protection, technical innovations	Google Patents, Espacenet, USPTO
Technical Reports	Government research, industry studies, detailed analyses	Government agencies, NASA, NIST
Theses	In-depth research, novel approaches, detailed methodologies	HAL (France), ProQuest, university repositories

For French Engineers

Don't forget French-specific resources like HAL (Hyper Articles en Ligne) and AFNOR standards!

Quality Assessment

Journal Reputation: What to Look For

Quality Indicators:

- **Impact Factor:** Citations per article
- **Peer Review:** Editorial process quality
- **Publisher:** Reputable academic publishers
- **Indexing:** Inclusion in major databases
- **Editorial Board:** Recognized experts

High-Quality Engineering Journals

- Nature, Science (multidisciplinary)
- IEEE Transactions series
- Journal of Engineering Mechanics
- Applied Energy

Red Flags

- Promises rapid publication
- Asks for payment upfront
- Spam email invitations
- Poor English/grammar
- No clear peer review
- Unknown editorial board

The Predatory Publishing Problem

What are Predatory Journals?

Publications that prioritize profit over scientific rigor, often with minimal or fake peer review.

How to Identify Them:

- Aggressive email solicitation
- No clear contact information
- Promises unrealistic publication speed
- Minimal or no peer review
- Pay-to-publish with no quality control

Protection Strategies:

- Check journal databases
- Verify publisher reputation
- Look for clear editorial process
- Ask your supervisor/librarian
- Use Think-Check-Submit checklist

Impact on Engineering

Poor quality research can lead to safety failures, design flaws, and public mistrust in engineering solutions.

The Wakefield Study: Vaccines and Autism

Case Study: When Science Goes Wrong

In 1998, Andrew Wakefield published a study in The Lancet claiming a link between MMR vaccines and autism.[a]

[a] A. J. Wakefield et al., "Retracted: ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children," *The lancet*, vol. 351, no. 9103, pp. 637–641, 1998 .

Red Flags That Were Missed:

- Tiny sample size (12 children)
- Financial conflicts of interest
- Unreproducible results

Consequences:

- Vaccination rates dropped
- Disease outbreaks returned
- Public health crisis

The Resolution:

- Multiple large studies found no link
- Paper retracted in 2010
- Wakefield lost medical license
- Scientific consensus: vaccines are safe

Retractions

It's not the only one...

https://retractionwatch.com/the-retraction-watch-leaderboard/top-10-most-highly-cited-retracted-papers/

Access Methods

Legitimate Access: Your University Resources

Your University Library is Your Best Friend

What Your Library Provides:

- Database subscriptions
- Full-text access to journals
- Interlibrary loan services
- Research support and training
- VPN access for off-campus use

French Academic Resources:

- **HAL:** Open archive for French research
- **Cairn.info:** French academic publications
- **Persée:** Digital library of French journals
- **OpenEdition:** Humanities and social sciences

Pro Tips

- Set up VPN for home access
- Use library proxy URLs
- Contact librarians for help

Remember

Most universities have agreements that provide free access to thousands of journals!

Open Access: Free and Legal

Types of Open Access:

- **Gold OA:** Freely available immediately upon publication
- **Green OA:** Author self-archives in repositories
- **Bronze OA:** Free to read but limited rights
- **Hybrid OA:** Individual articles in subscription journals

Major OA Repositories:

- arXiv (physics, mathematics, engineering)
- PubMed Central (life sciences)
- HAL (French research)
- ResearchGate (academic networking)

Benefits of Open Access

- Free for everyone
- Faster dissemination
- Higher citation rates
- Global accessibility

Quality Check

Open Access $\neq$ Lower Quality Many top journals are now OA!

Problematic Access Methods: Why to Avoid Them

The Temptation: "Free" Illegal Sites

Sites like Sci-Hub promise free access to all papers, but come with serious risks.

Legal Risks:

- Copyright infringement
- Institutional policy violations
- Potential legal action
- Academic misconduct charges

Bibliography Management Tools

What Are Bibliography Management Tools?

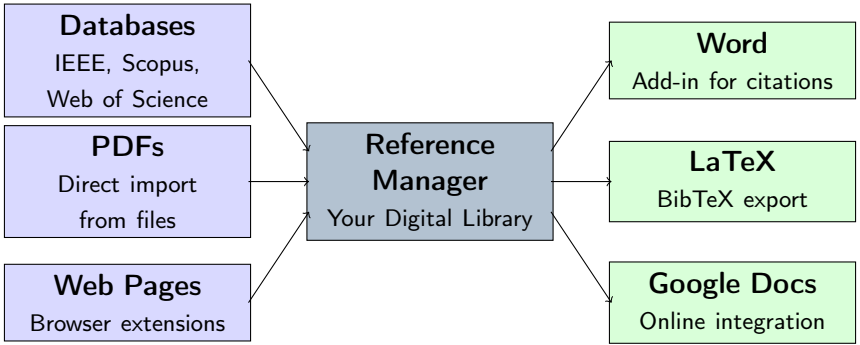
Definition

Software applications that help you collect, organize, and cite scholarly references efficiently and consistently.

What They Do:

- Store and organize references
- Import citations from databases
- Generate bibliographies automatically
- Insert citations while writing
- Sync across devices
- Share libraries with collaborators

The Reference Management Ecosystem



Key Insight

Reference managers sit at the center of your research workflow, connecting sources to your writing.

Zotero: The Open Source Champion

Strengths:

+ Completely free and open source
+ Excellent browser integration
+ Automatic PDF metadata extraction
+ Strong community support
+ Works offline
+ No storage limits for references

Limitations:

– Limited free cloud storage (300MB)
– Fewer social features
– Learning curve for advanced features

Perfect for Engineering Students

- Technical documentation
- IEEE standards
- Patent research
- Conference proceedings
- LaTeX integration

Getting Started

1. Download from zotero.org
2. Install browser connector
3. Create account for sync
4. Install Word plugin

Your Turn