# How to read a scientific paper

2025-03-27

Mariachiara Grieco

C.G.B.

UNIVERSITÀ DEGLI STUDI DI MILANO

# What is a scientific paper

Scientific papers are scholarly articles written by experts in a field to present original findings, theories, or reviews of existing research.

Crucial to advance knowledge, provide evidence-based insights, and contribute to scientific and academic discussions.

Key features:

- ***Peer-reviewed:*** evaluated by other experts before publication
- ***Data-driven***: includes experiments, analysis, and conclusions
- ***Cited sources***: builds on previous research with proper references
- ***Formal structure:*** typically includes an abstract, introduction, methodology, results, discussion, and references.

# Why read a scientific paper?

- ***Up-to-date information***
  Textbooks may be outdated by the time they are published, while journals provide the latest research and discoveries.

- ***Reproducibility***
  Popular articles and books summarize findings, but scholarly journals provide enough detail for you to replicate experiments and verify results.

- ***Access to raw data***
  Research papers include precise data, uncertainties, and experimental conditions essential for your own work.

- ***Understanding the logic***
  Articles present authors' explanations, assumptions, and conclusions, allowing you to critically assess their reasoning.

# Breaking down scientific papers

| | |
|---|---|
| Original research | Presents new experiments, data, and findings.<br>Contributes new knowledge to the field. |
| Review article | Summarizes and analyzes existing research.<br>Provides an overview of current knowledge. |
| Case report | Examines a specific case or occurrence.<br>Highlights unique or rare phenomena. |
| Methodology paper | Describes new experimental methods or techniques.<br>Helps researchers apply or improve methods. |

# Breaking down scientific papers

| | |
|---|---|
| Conference paper | Shorter research work presented at conferences.<br>Shares preliminary findings or discussions. |
| Commentary | Provides expert opinions on recent studies or topics.<br>Offers insights, critiques, or discussions on published research. |
| Editorials | Written by journal editors or experts, often opinion-based.<br>Highlights key issues, trends, or perspectives in the field. |
| Letter to the editor | Short communication responding to a published paper or current issue.<br>Offers criticism, support, or discussion on a specific topic. |

# Anatomy of a research paper

## Are all apples red?

**By**
**Ida Cortland**

### Abstract:
We examined several apples' color. Although most are red , some are not.

### Introduction:
An Age old question is: are all apples red? Mackintosh (1993) thought so. Smith (1999) begs to differ. We hope to resolve this issue once for all.

### Methods:
We went to the local grocery store and bought one of every apples they had. We took them home and looked at them.

### Results:
We found four red apples, one green apple and two yellow apples

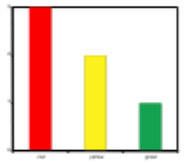


**Figure1**

### Discussion:
Since we found one green apple and two yellow apples. It must be true that not all apples are red. We concur with Smith's findings.

### References:
Machintosh (1993) *Journal of fruit*
*Science* 4(3*):* 121-135.
Smith (1999) *Apple technology Today* 7(3*):* 4-8*

*Pomes and you, volume 4 issue 3 (2003) p. 8*

# Anatomy of a research paper

A research article is structured into **four** main sections following the **IMRaD format**:

- ***Introduction***
- ***Methods***
- ***Results***
- ***Discussion***

The IMRaD format (widely adopted since the 1980s) reflects the **scientific method**.

Some journals prefer variant forms of IMRaD, such as:

- IRDaM – Methods placed at the end
- IM(R+D)nC – Multiple mini-sections of Results & Discussion, followed by a Conclusion

# The scientific method

The **scientific method** is a systematic process for conducting experiments and acquiring knowledge.

The **four key components** of the scientific method are:

- ***Identifying a problem to investigate***
- *Constructing a hypothesis based on observations*
- *Conducting experiments to test the hypothesis*
- *Developing a theory based on the results and analysis*

# The IMRaD format

- ***Introduction***
  Provides background information on the research topic.
  Defines the research question or hypothesis.
  Explains the significance and objectives of the study.

- ***Methods (Materials and Methods)***
  Describes how the research was conducted.
  Includes details about experimental design, data collection, and analysis.
  Ensures reproducibility by providing enough information for others to replicate the study.

- ***Results***
  Presents the findings of the study, often with tables, figures, and graphs.
  Reports data objectively without interpretation.
  Highlights key patterns, trends, and statistical analyses.

- ***Discussion***
  Interprets the results in the context of existing research.
  Explains the implications, limitations, and potential applications of the findings.
  Suggests future research directions.

# Beyond IMRaD

- ***Title***

- ***Abstract***

A brief summary of the entire paper, including objectives, methods, results, and conclusions.

- ***Conclusion***

A final summary of key findings and their broader impact.

- ***References***

A list of all sources cited in the paper, following a specific citation style (e.g., APA, MLA, Chicago).

- ***Acknowledgments***

Recognition of contributors, funding sources, or institutions that supported the research.

- ***Conflict of interest statement***

- ***Authors' roles – authorship and contributorship***

# IMRaD: the hourglass of scientific writing

The IMRaD structure can be visualized as an **hourglass**:

- **Introduction** begins broadly, providing general background information and gradually narrowing down to the specific focus of the study.

- **Methods and Results** sections maintain this narrow focus, detailing the research process and findings.

- **Discussion** starts with the same specific focus but gradually expands, placing the findings in a broader context and exploring their implications.

# The art of title

The ***Title*** serves as a **concise yet comprehensive summary** of the paper's content, providing readers with an immediate understanding of its main focus.

As the first element encountered in a research paper, it **plays a crucial role in bibliographic research** by aiding in its identification, classification, and retrieval in academic databases and search engines.

A well-crafted title should be **clear, specific, and informative**, accurately reflecting the study's objectives, key concepts, and scope.

Incorporating **relevant keywords** enhances its discoverability, ensuring that researchers can efficiently locate the paper in literature searches.

Additionally, a precise and engaging title increases the likelihood of the paper being read and cited, contributing to its **overall impact in the scientific community.**

# The abstract: a gateway to your research

The ***Abstract*** provides a brief yet **comprehensive overview of the paper.**

It explains **why** the authors conducted the study, **how** they carried it out, and **what** they discovered.

Key points:

- It is often the only part of the paper published in conference proceedings.
- It is the only section a potential reviewer sees when invited by an editor to assess a manuscript.
- It is the only part accessible to readers searching through electronic databases such as PubMed.
- It sets the tone for the rest of the paper, making it essential for the author to ensure that it accurately represents the study's content and findings.

# The abstract: under the hood

The typical kinds of information found in most abstracts:

- the **context or background information** for the research: the general topic under study and the specific topic of the research
- the **central questions** or statement of the problem the research addresses
- what is **already known** about this question, what previous research has done or shown
- the **main reasons, the rationale, the goals for the research**
- the research and/or analytical **methods**
- the **main findings**, results, or arguments
- the **significance or implications** of your findings

# Forms of abstracts

The **abstract** comes in three forms:

- ***structured***
- ***semi-structured***
- ***unstructured***

Journals specify which format should be used, so it is essential to check the author guidelines before submission.

# Structured abstracts

Follow the IMRaD format, typically including:
- Introduction
- Methods
- Results
- Conclusions

Some journals use **alternative headings** with similar meanings (e.g., Background instead of Introduction or Findings instead of Results).

**Additional sections,** such as Objectives (between Background and Methods) or Limitations (at the end of the abstract), may also be required.

Key features:
- Help authors summarize their manuscripts precisely and clearly.
- Facilitate the peer-review process by making it easier for reviewers to assess the study.
- Improve computerized literature searches, increasing the paper's visibility.
- Are preferred for medical studies, clinical trials, and meta-analyses.

# Structured abstract at a glance

Precision Medicine and Imaging

Clinical Cancer Research

## Consensus on Molecular Subtypes of High-Grade Serous Ovarian Carcinoma

Gregory M. Chen[1], Lavanya Kannan[2,3], Ludwig Geistlinger[2,3], Victor Kofia[1,4,5], Zhaleh Safikhani[1,4,5], Deena M.A. Gendoo[1,4], Giovanni Parmigiani[6], Michael Birrer[7], Benjamin Haibe-Kains[1,4,5,8], and Levi Waldron[2,3]

### Abstract

**Purpose:** The majority of ovarian carcinomas are of high-grade serous histology, which is associated with poor prognosis. Surgery and chemotherapy are the mainstay of treatment, and molecular characterization is necessary to lead the way to targeted therapeutic options. To this end, various computational methods for gene expression–based subtyping of high-grade serous ovarian carcinoma (HGSOC) have been proposed, but their overlap and robustness remain unknown.

**Experimental Design:** We assess three major subtype classifiers by meta-analysis of publicly available expression data, and assess statistical criteria of subtype robustness and classifier concordance. We develop a consensus classifier that represents the subtype classifications of tumors based on the consensus of multiple methods, and outputs a confidence score. Using our compendium of expression data, we examine the possibility that a subset of tumors is unclassifiable based on currently proposed subtypes.

**Results:** HGSOC subtyping classifiers exhibit moderate pairwise concordance across our data compendium (58.9%–70.9%; $P < 10^{-5}$) and are associated with overall survival in a meta-analysis across datasets ($P < 10^{-5}$). Current subtypes do not meet statistical criteria for robustness to reclustering across multiple datasets (prediction strength < 0.6). A new subtype classifier is trained on concordantly classified samples to yield a consensus classification of patient tumors that correlates with patient age, survival, tumor purity, and lymphocyte infiltration.

**Conclusions:** A new consensus ovarian subtype classifier represents the consensus of methods and demonstrates the importance of classification approaches for cancer that do not require all tumors to be assigned to a distinct subtype.
*Clin Cancer Res; 24(20); 5037–47.* 

# Semi- and unstructured abstracts

Represent the **traditional format**, typically limited to 200-250 words.

Are **written as a single paragraph**, yet still cover the key elements found in structured abstracts.

Some journals calls this paragraph a “**Summary**” rather than an “Abstract”.

Some journals provides **multiple ways** for readers to grasp the content of research articles quickly: graphical abstract, a bulleted list of highlights, and a two-sentence “In Brief” summary.

**Two** common approaches:

- Highlight background, methods, results, and conclusions.
- Provide a brief background statement followed by a summary of key results.

# Unstructured abstracts at a glance

Article | Open access | Published: 05 July 2016

## Patients with genetically heterogeneous synchronous colorectal cancer carry rare damaging germline mutations in immune-related genes

Matteo Cereda, Gennaro Gambardella, Lorena Benedetti, Fabio Iannelli, Dominic Patel, Gianluca Basso, Rosalinda F. Guerra, Thanos P. Mourikis, Ignazio Puccio, Shruti Sinha, Luigi Laghi, Jo Spencer, Manuel Rodriguez-Justo & Francesca D. Ciccarelli

*Nature Communications* **7**, Article number: 12072 (2016) | Cite this article


### Abstract

Synchronous colorectal cancers (syCRCs) are physically separated tumours that develop simultaneously. To understand how the genetic and environmental background influences the development of multiple tumours, here we conduct a comparative analysis of 20 syCRCs from 10 patients. We show that syCRCs have independent genetic origins, acquire dissimilar somatic alterations, and have different clone composition. This inter- and intratumour heterogeneity must be considered in the selection of therapy and in the monitoring of resistance. SyCRC patients show a higher occurrence of inherited damaging mutations in immune-related genes compared to patients with solitary colorectal cancer and to healthy individuals from the 1,000 Genomes Project. Moreover, they have a different composition of immune cell populations in tumour and normal mucosa, and transcriptional differences in immune-related biological processes. This suggests an environmental field effect that promotes multiple tumours likely in the background of inflammation.


*1730–1747* *Nucleic Acids Research, 2020, Vol. 48, No. 4* *Published online 31 December 2019*
*doi: 10.1093/nar/gkz1208*

## Identification of altered biological processes in heterogeneous RNA-sequencing data by discretization of expression profiles

**Andrea Lauria[1,2,†], Serena Peirone[2,3,†], Marco Del Giudice[2,4,†], Francesca Priante[2,4], Prabhakar Rajan[5,6], Michele Caselle[3], Salvatore Oliviero[1,2,*] and Matteo Cereda[2,4,*]**


### ABSTRACT

**Heterogeneity is a fundamental feature of complex phenotypes. So far, genomic screenings have profiled thousands of samples providing insights into the transcriptome of the cell. However, disentangling the heterogeneity of these transcriptomic Big Data to identify defective biological processes remains challenging. Here we present GSECA, a method exploiting the bimodal behavior of RNA-sequencing gene expression profiles to identify altered gene sets in heterogeneous patient cohorts. Using simulated and experimental RNA-sequencing data sets, we show that GSECA provides higher performances than other available algorithms in detecting truly altered biological processes in large cohorts. Applied to 5941 samples from 14 different cancer types, GSECA correctly identified the alteration of the PI3K/AKT signaling pathway driven by the somatic loss of PTEN and verified the emerging role of PTEN in modulating immune-related processes. In particular, we showed that, in prostate cancer, PTEN loss appears to establish an immunosuppressive tumor microenvironment through the activation of STAT3, and low PTEN expression levels have a detrimental impact on patient disease-free survival. GSECA is available at https://github.com/matteocereda/GSECA.**

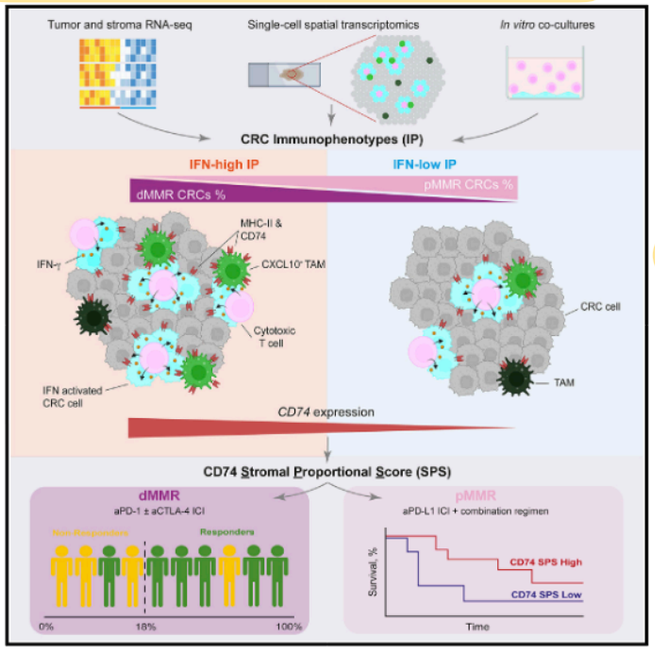
# Semi-structured abstracts at a glance

Article

## Cancer Cell

### A constitutive interferon-high immunophenotype defines response to immunotherapy in colorectal cancer

**Graphical abstract**




**Highlights**

- CRCs can be grouped into IFN-high or low immunophenotype based on 7 gene signatures
- CRC patients responding to immunotherapy have IFN-high immunophenotype
- IFN-high CRCs show high T cell-induced *CD74* expression in TAMs and cancer cells
- CD74 abundance predicts clinical benefit in ICI-treated dMMR and pMMR CRCs


**Authors**

Amelia Acha-Sagredo, Pietro Andrei, Kalum Clayton, ..., Elisa Fontana, Manuel Rodriguez-Justo, Francesca D. Ciccarelli

**Correspondence**

f.ciccarelli@qmul.ac.uk


**In brief**

Acha-Sagredo et al. stratify colorectal cancers using features of an immune-reactive tumor microenvironment. This microenvironment, locally abundant in cytotoxic lymphocytes and antigen-presenting macrophages, facilitates immunotherapy response and is characterized by *CD74* abundance. Using standard IHC, high CD74 identifies patients benefitting from immune-checkpoint inhibition therapies, independently of TMB or microsatellite status.

Article

## A constitutive interferon-high immunophenotype defines response to immunotherapy in colorectal cancer


Amelia Acha-Sagredo,[1,2,16] Pietro Andrei,[1,2,16] Kalum Clayton,[1,2,16] Emma Taggart,[1,2] Carlotta Antoniotti,[3] Chloé A. Woodman,[4] Hassnae Afrache,[5,6] Constance Fourny,[5,6] Maria Armero,[1,2] Hafsa Kaja Moinudeen,[1] Mary Green,[7] Nisha Bhardwaj,[7] Anna Mikolajczak,[7] Maria Rodriguez-Lopez,[8] Marg Crawford,[8] Emma Connick,[8] Steven Lim,[9] Philip Hobson,[9] Josep Linares,[10] Ekaterina Ignatova,[11] Diana Pelka,[11] Elizabeth C. Smyth,[12] Nikolaos Diamantis,[13] Dominika Sosnowska,[4] Martina Carullo,[3] Paolo Ciraci,[3] Francesca Bergamo,[14] Rossana Intini,[14] Emma Nye,[7] Patricia Barral,[5,15] Michele Mishto,[5,6] James N. Arnold,[4] Sara Lonardi,[14] Chiara Cremolini,[3] Elisa Fontana,[11,17] Manuel Rodriguez-Justo,[10,17] and Francesca D. Ciccarelli[1,2,18,*]

[1]Cancer Systems Biology Laboratory, The Francis Crick Institute, London NW1 1AT, UK
[2]Centre for Cancer Evolution, Bart's Cancer Institute, Queen Mary University London, London EC1M 6AU, UK
[3]Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy
[4]School of Cancer and Pharmaceutical Sciences, King's College London, London SE1 1UL, UK
[5]Centre for Inflammation Biology and Cancer Immunology, King's College London, London SE1 1UL, UK
[6]Molecular Immunology Laboratory, Francis Crick Institute, London NW1 1AT, UK
[7]Experimental Histopathology, The Francis Crick Institute, London NW1 1AT, UK
[8]Advanced Sequencing Facility, The Francis Crick Institute, London NW1 1AT, UK
[9]Flow Cytometry Facility, The Francis Crick Institute, London NW1 1AT, UK
[10]Department of Histopathology, University College London Cancer Institute, London, UK
[11]Drug Development Unit, Sarah Cannon Research Institute UK, London, UK
[12]Oxford NIHR Biomedical Research Centre, Churchill Hospital, Oxford OX3 7LE, UK
[13]Department of Medical Oncology, Royal Free London NHS Foundation Trust, London WC1E 6BT, UK
[14]Oncology Unit 1, Department of Oncology Veneto Institute of Oncology IOV–IRCCS, Padova, Italy
[15]Immune Responses to Lipids Laboratory, The Francis Crick Institute, London NW1 1AT, UK
[16]These authors contributed equally
[17]These authors contributed equally
[18]Lead contact
*Correspondence: f.ciccarelli@qmul.ac.uk


https://doi.org/10.1016/j.ccell.2024.12.008



**SUMMARY**

Fewer than 50% of metastatic deficient mismatch repair (dMMR) colorectal cancer (CRC) patients respond to immune checkpoint inhibition (ICI). Identifying and expanding this patient population remains a pressing clinical need. Here, we report that an interferon-high immunophenotype locally enriched in cytotoxic lymphocytes and antigen-presenting macrophages is required for response. This immunophenotype is not exclusive to dMMR CRCs but comprises a subset of MMR proficient (pMMR) CRCs. Single-cell spatial analysis and *in vitro* cell co-cultures indicate that interferon-producing cytotoxic T cells induce overexpression of antigen presentation in adjacent macrophages and tumor cells, including MHC class II invariant chain *CD74*. dMMR CRCs expressing high levels of CD74 respond to ICI and a subset of CD74 high pMMR CRC patients show better progression free survival when treated with ICI. Therefore, CD74 abundance can identify the constitutive interferon-high immunophenotype determining clinical benefit in CRC, independently of tumor mutational burden or MMR status.

# The Introduction: setting the stage

The ***Introduction*** provides a **brief overview** of the existing knowledge on the subject, specifically in relation to the research paper.

It highlights:
- what is **already known**
- identifies **gaps** in the current understanding
- **establishes** what is not yet known

This section **sets the stage** for the study by clearly stating its purpose, research question, or hypothesis.

It explains **why** the investigation is necessary and outlining its **significance** within the broader scientific context.

A well-written introduction not only engages the reader but also justifies the study's relevance and contribution to the field.

# The Methods: blueprints for research

The ***Methods*** section provides a detailed account of how the experiment was designed, conducted, and analyzed.

A well-structured methods section ensures **transparency, reproducibility, and reliability** in scientific research, allowing other researchers to replicate the experiment accurately.

This section must include sufficient information for the reader to understand:

- **What** was done: a clear description of the experimental procedures, study design, and protocols.
- **How** it was done: the materials, techniques, tools and parameters used.
- **Why** it was done this way: the rationale behind methodological choices.

**Key questions** addressed in the methods section:

- What materials, tools, or technologies were used?
- What were the experimental conditions and parameters?
- How was data collected and analyzed?
- Were there any controls or variables?
- What statistical methods were applied?

# The Results: show, do not tell

The ***Results*** section presents the **raw data obtained from the experiment**, highlighting the rationale and experimental design behind the findings.

This section serves as the foundation for the study's conclusions, providing a clear and objective account of what was observed **without interpretation or discussion.**

**Key elements** of the Results section:

- **Presentation of data**: the core findings are reported in an organized manner, often grouped thematically or by research question.

- **Use of figures and tables:**
  - *Figures* (graphs, charts, images, etc.) provide a visual summary of key findings
  - *Tables* present numerical data in a structured format, allowing for quick comparison and reference.
  - Proper labeling and clear captions ensure that figures and tables are self-explanatory and meaningful without excessive text.

- **Logical flow:** the results should be structured in a way that clearly supports the study's objectives, guiding the reader through the evidence step by step.

# Discussion and Conclusions: connecting the dots

The ***Discussion and Conclusion*** section is where the authors **interpret their findings, connect them to existing knowledge, and explain their broader significance.**

**Key elements** of the Discussion section:

- *Primary Take-Home message*: the main conclusion drawn from the study, directly addressing the research question or hypothesis.
- *Additional important findings:* any secondary insights, unexpected observations, or novel discoveries that contribute to the field.
- *Perspective and implications:* how the study fits into the larger scientific landscape, potential applications, and directions for future research.

**Guidelines** for writing a strong discussion and conclusion:

- **Be objective** – Conclusions should be honest, accurately reflecting the data
- **Stay within the data** - Authors should avoid overstating their claims or drawing conclusions beyond what the results directly support.
- **Acknowledge limitations** – Recognizing the study's limitations and areas for improvement enhances credibility.
- **Relate to existing research** – Discussing how the findings align or contrast with previous studies adds context and depth.

# The References: back to the source

The ***References/Bibliography*** section provides a **comprehensive list of sources** cited or referenced by the authors throughout the paper.

This section serves **multiple purposes:** it credits original authors, demonstrates the foundation of the research, and allows readers to trace back sources to verify their accuracy, relevance, and reliability.

Formatting considerations:

- The format of references varies between journals, following specific citation styles such as APA, MLA, Chicago, or Vancouver.
- Many academic journals provide detailed author guidelines on how references should be formatted.
- Proper reference formatting ensures consistency and professionalism, making it easier for other researchers to locate sources.

# How to read a scientific paper


Approach a scientific article like a textbook:
from beginning to end of the chapter or book without pause for reflection or criticism

1. Abstract
2. Discussion
3. Introduction
4. Results
5. Methods

+ Be skeptical

# Roadtrip to read a scientific paper (1)

1. The ***Abstract***
   Provides a brief summary of the experiment, including what was done and what was found.

   Abstracts are widely available in journal indexes and electronic databases, allowing readers to determine whether an article is relevant without needing to access the full paper.

**Key questions** to consider:

- What specific results are mentioned?

- Are the findings relevant to your research question?

# Roadtrip to read a scientific paper (2)

2. The ***Discussion*** section summarizes key results and explains their significance.
   It provides the reasoning behind the conclusions, connecting the findings to the study's objectives and the broader scientific context.

   Key questions to consider:
   - Are these results useful to you?
     Do they align with your research interests or objectives?

   - Do you agree with the authors' interpretation?
     Compare your own conclusions about the data with their analysis.

   - Is the logic sound?
     Are the conclusions well-supported by the results, or are there gaps in reasoning?

# Roadtrip to read a scientific paper (3)

3. The ***Introduction*** explains the motivation behind the research and its importance within the broader scientific context.

   It provides essential background information, helping readers understand the study's foundation and objectives.

   Key questions to consider:

   - Do you understand the background information?
     Is the study's context clear, or do you need additional knowledge?

   - Do you need to look up references for more details?
     Are there cited sources you should explore to deepen your understanding?

# Roadtrip to read a scientific paper (4)

4. The ***Results*** section provides the raw data that may be useful for your own research.

   It presents findings in a clear, structured manner, often using figures and tables to make complex data more accessible.

   Key questions to consider for figures:

- Do you understand what the axes represent? What variables are plotted?
- What units are used? Are they consistent and appropriate for the study?
- Does the trend or curve make sense?
  Do the results align with expectations or previous research?

# Roadtrip to read a scientific paper (5)

5. The ***Methods*** section provides a detailed account of how the experiment was designed and conducted.

   It outlines the materials, techniques, and procedures used, ensuring that the study can be replicated by other researchers.

   How to approach the methods section:

   - Skim for the basic methodology
     Focus on the overall approach rather than getting lost in complex details.

   - Identify key techniques
     Recognize commonly used methods that might be relevant to your own research.

   - Seek clarification when needed
     If a technique is unfamiliar, ask an expert or refer to a scientific textbook or encyclopedia for a deeper understanding.

## 1 SKIM

First get the "big picture" by reading the title, key words and abstract carefully; this will tell you the major findings and why they matter.

- Quickly scan the article without taking notes; focus on headings and subheadings.
- Note the publishing date; for many areas, current research is more relevant.
- Note any terms and parts you don't understand for further reading.

## 2 RE-READ

Read the article again, asking yourself questions such as:

- What problem is the study trying to solve?
- Are the findings well supported by evidence?
- Are the findings unique and supported by other work in the field?
- What was the sample size? Is it representative of the larger population?
- Is the study repeatable?
- What factors might affect the results?

If you are unfamiliar with key concepts, look for them in the literature.

## 3 INTERPRET

- Examine graphs and tables carefully.
- Try to interpret data first before looking at captions.

- When reading the discussion and results, look for key issues and new findings.
- Make sure you have distinguished the main points. If not, go over the text again.

## 4 SUMMARIZE

- Take notes; it improves reading comprehension and helps you remember key points.
- If you have a printed version, highlight key points and write on the article. If it's on screen, make use of markers and comments.

# Paper hunt: how to select valuable papers

Given the sheer volume of research papers available, what criteria should you use to find the most relevant and credible work?

***A) Journal reputation***

***B) Publication date***

***C) Author recognition***

***D) Relevance to your topic***

# Paper hunt: how to select valuable papers

Given the sheer volume of research papers available, what criteria should you use to find the most relevant and credible work?

***A) Journal reputation:***

- High Impact Factor (IF) journals
  The Impact Factor (IF) is a **scientometric index:** measures the average number of citations received per article published in a specific journal over the past two years. It is widely used as a proxy for a journal's influence and prestige within the scientific community.

  For the latest rankings of journals by Impact Factor, visit here.

  Highly recommended High-Impact Journals: *Nature, Science, Cell, The Lancet*
  These journals are highly selective and publish groundbreaking research across various disciplines, making them some of the most cited and influential sources in academia.

- Highly specific journals: these provide in-depth, niche research in specialized fields.

- Avoid predatory journals (check *Beall's List*)

# Paper hunt: how to select valuable papers

Given the sheer volume of research papers available, what criteria should you use to find the most relevant and credible work?

*A) Journal reputation*

***B) Publication date:***

- Recent papers ensure you are working with the latest advancements in the field.
- However, foundational older papers may still be crucial for background knowledge.

# Paper hunt: how to select valuable papers

Given the sheer volume of research papers available, what criteria should you use to find the most relevant and credible work?

*A) Journal reputation*

*B) Publication date*

***C) Author recognition:***

- Look for papers by researchers whose work you trust
- Well-established authors and groups often produce high-quality studies.

# Paper hunt: how to select valuable papers

Given the sheer volume of research papers available, what criteria should you use to find the most relevant and credible work?

*A) Journal reputation*

*B) Publication date*

*C) Author recognition*

***D) Relevance to your topic:***

- Does the paper directly address your research question?
- Is it cited frequently by other researchers?

# Hack your research: where to find papers

**1. PubMed**

- The most widely used database for biomedical and life sciences research, maintained by the U.S. National Library of Medicine (NLM).
- Contains millions of peer-reviewed articles, clinical studies, systematic reviews, and more.

**2. Google Scholar**

- A broad academic search engine that indexes a wide range of scientific literature.
- Contains scientific articles, theses, books, conference papers, and patents.
- Caution: Some results may include non-peer-reviewed sources.

**3. Scopus & Web of Science**

- Two high-level academic search databases used for advanced research.
- Contain indexed articles, citation metrics, journal impact factors, and research trends.

# Hack your research: where to find papers

**4. DOAJ (Directory of Open Access Journals)**

- A directory of peer-reviewed, open-access journals.
- Contains free full-text articles from various disciplines.
- Ideal for finding freely available papers without paywalls, always verify journal credibility.

**5. Preprint Servers (Unpublished research)**

- Preprints are early versions of research papers that haven't been peer-reviewed yet.
  Useful for accessing cutting-edge studies before official publication.
  - bioRxiv – Biology and life sciences.
  - medRxiv – Clinical and medical research.
  - arXiv – Physics, bioinformatics, and computational biology.
- Since these papers are not peer-reviewed, they should be interpreted critically.

**6. Institutional Repositories**

- Many universities and institutions provide open-access papers through their archives:
  - PubMed Central (PMC) – Free archive of biomedical articles.
  - Europe PMC – European version of PMC with additional open-access content.
  - HAL – Open-access repository of French research.

# Hack your research: where to find papers

**7. ResearchGate & Academia.edu**

- Academic social networks where researchers share publications.
- You can request full-text articles from authors if they are not openly available.

**8. Dimensions & AI-Powered search engines**

AI-driven platforms enhance research by offering advanced search functionalities.

- Dimensions – Analyzes research trends, citations, and funding.
- Semantic Scholar – Uses AI to suggest relevant papers.
- Elicit – AI assistant for finding and summarizing research papers.

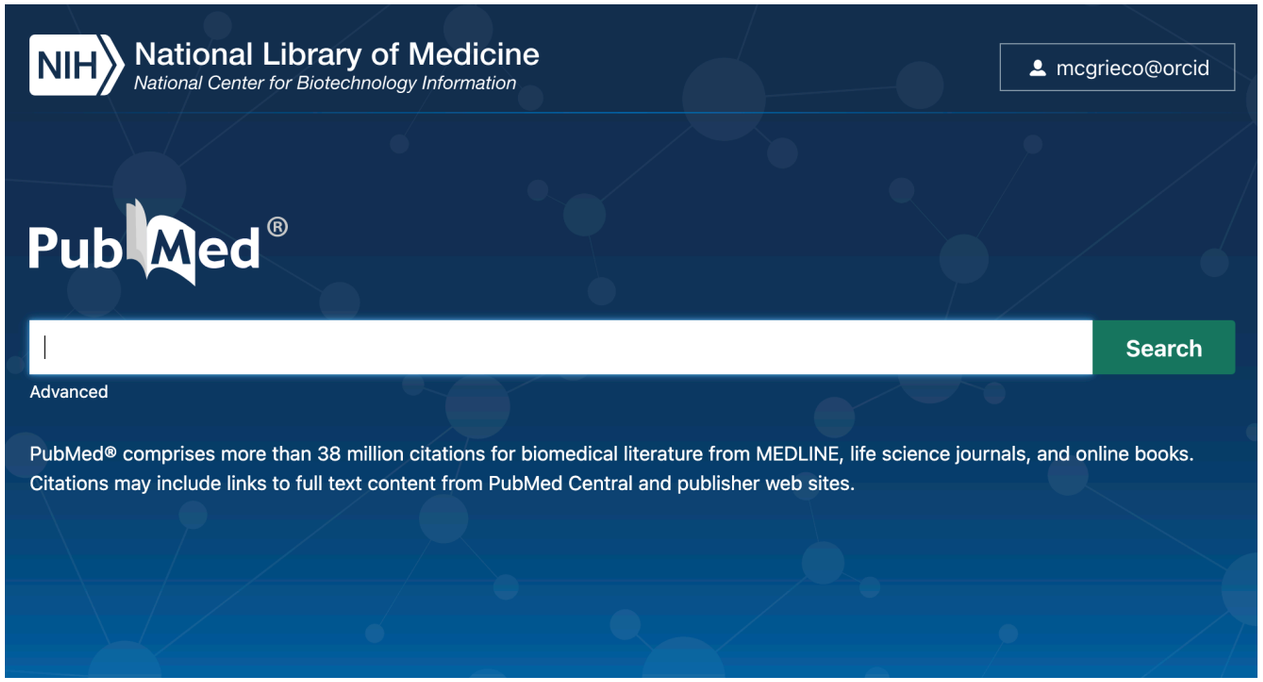
**9. Systematic reviews & meta-analysis databases**

If you're looking for high-quality systematic reviews and meta-analyses:

- Cochrane Library – Evidence-based reviews in healthcare.
- Epistemonikos – Global database of systematic reviews.

# Mastering PubMed

Type your **keywords**, and PubMed will display all relevant papers for your research.



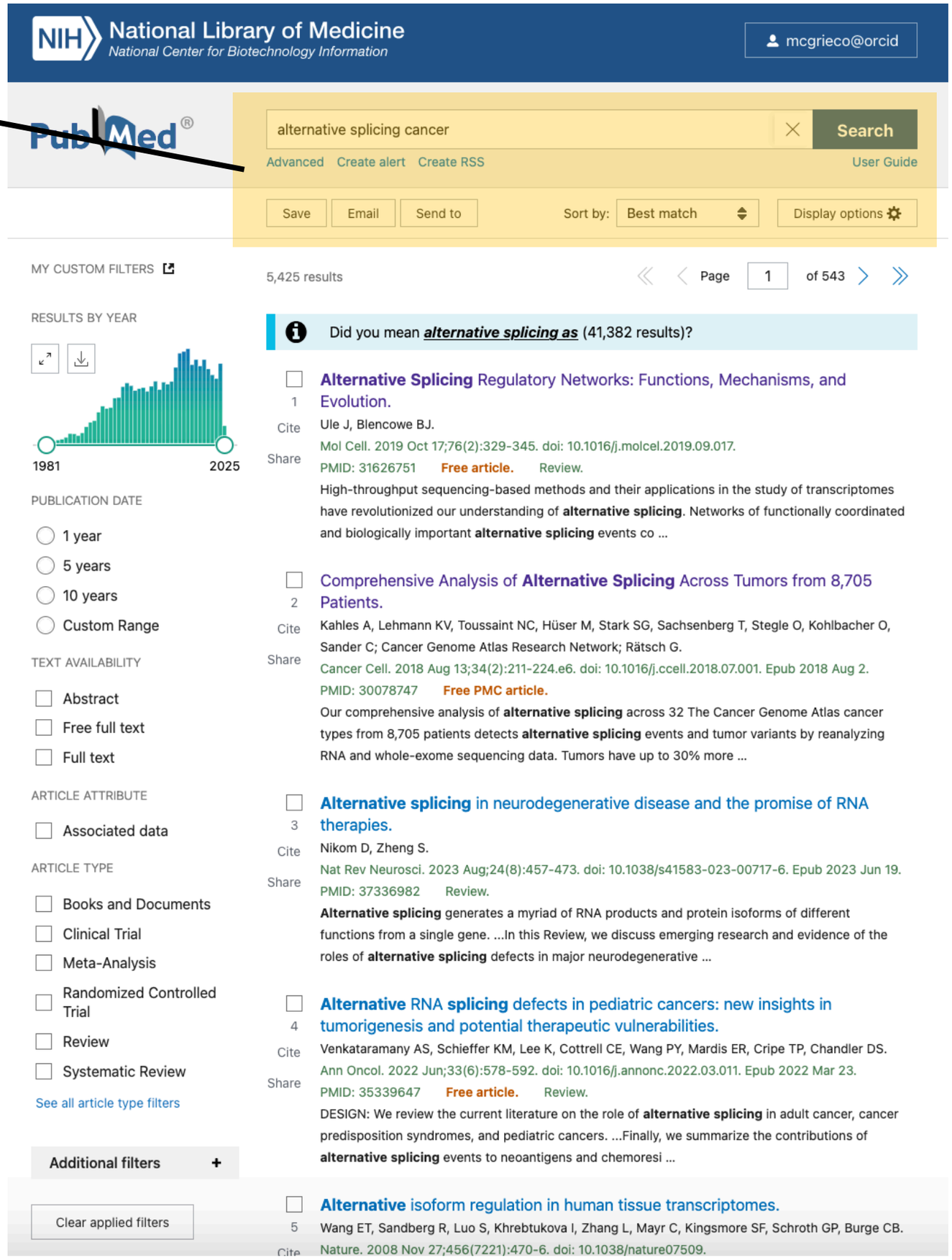

To **refine your search**, you can:

- Use *MeSH* (Medical Subject Headings) terms for more precise results (e.g., Prostatic Neoplasms instead of prostate cancer).
- Apply *filters* to narrow results by publication date, article type (e.g., clinical trials, reviews), free full text, and more.
- Check *PubMed Central* (PMC) for open-access articles.
- Use the *"Cited by"* feature to find newer studies that reference a specific paper.

**Search bar**
Located at the top, this is where you **type your keywords** (e.g., alternative splicing cancer).

You can refine your search by using:

- MeSH terms
- Boolean operators (AND, OR, NOT)
- advanced search options.

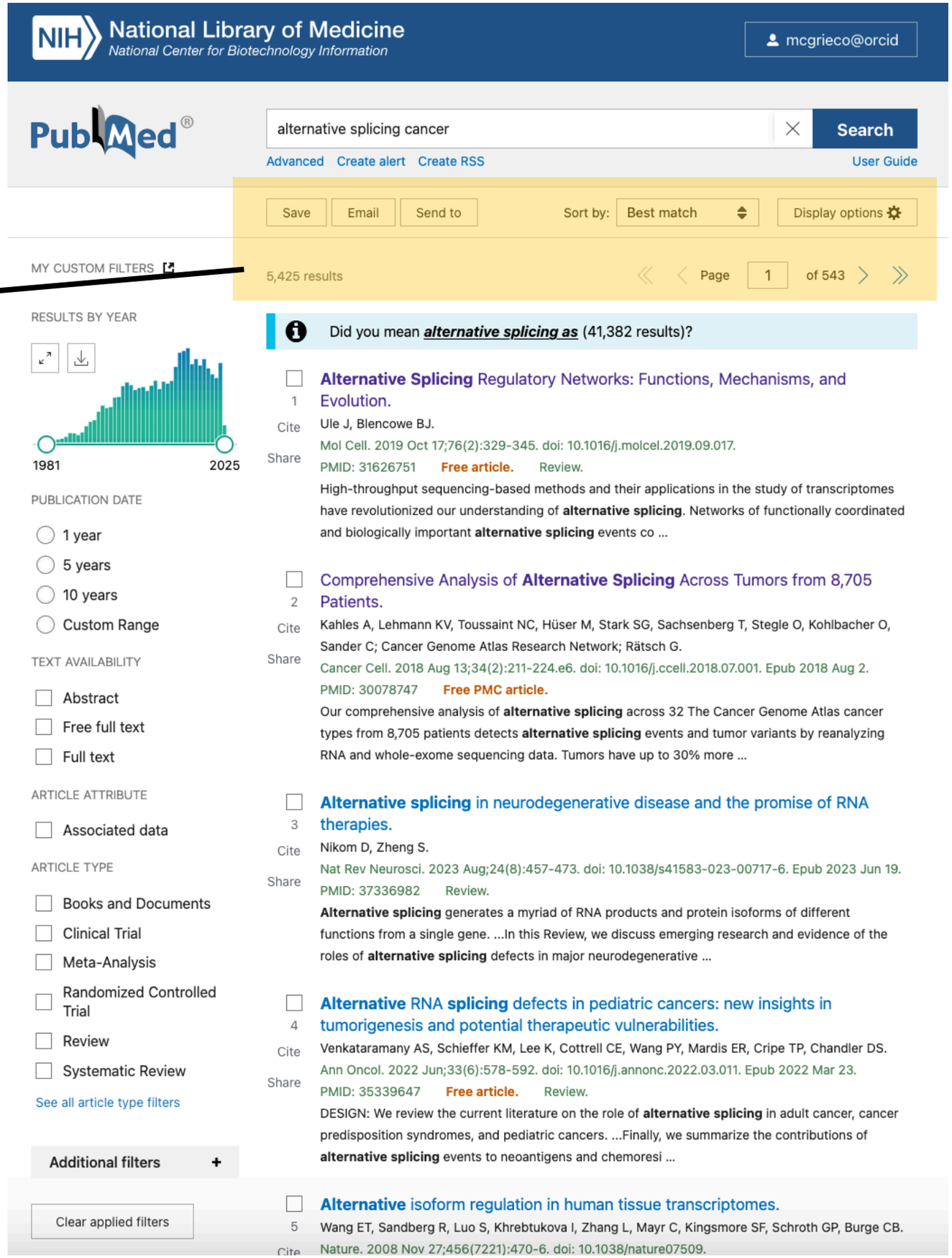


The number of papers found.

You can sort results by

- most recent
- best match
- publication date

to prioritize the most relevant studies.



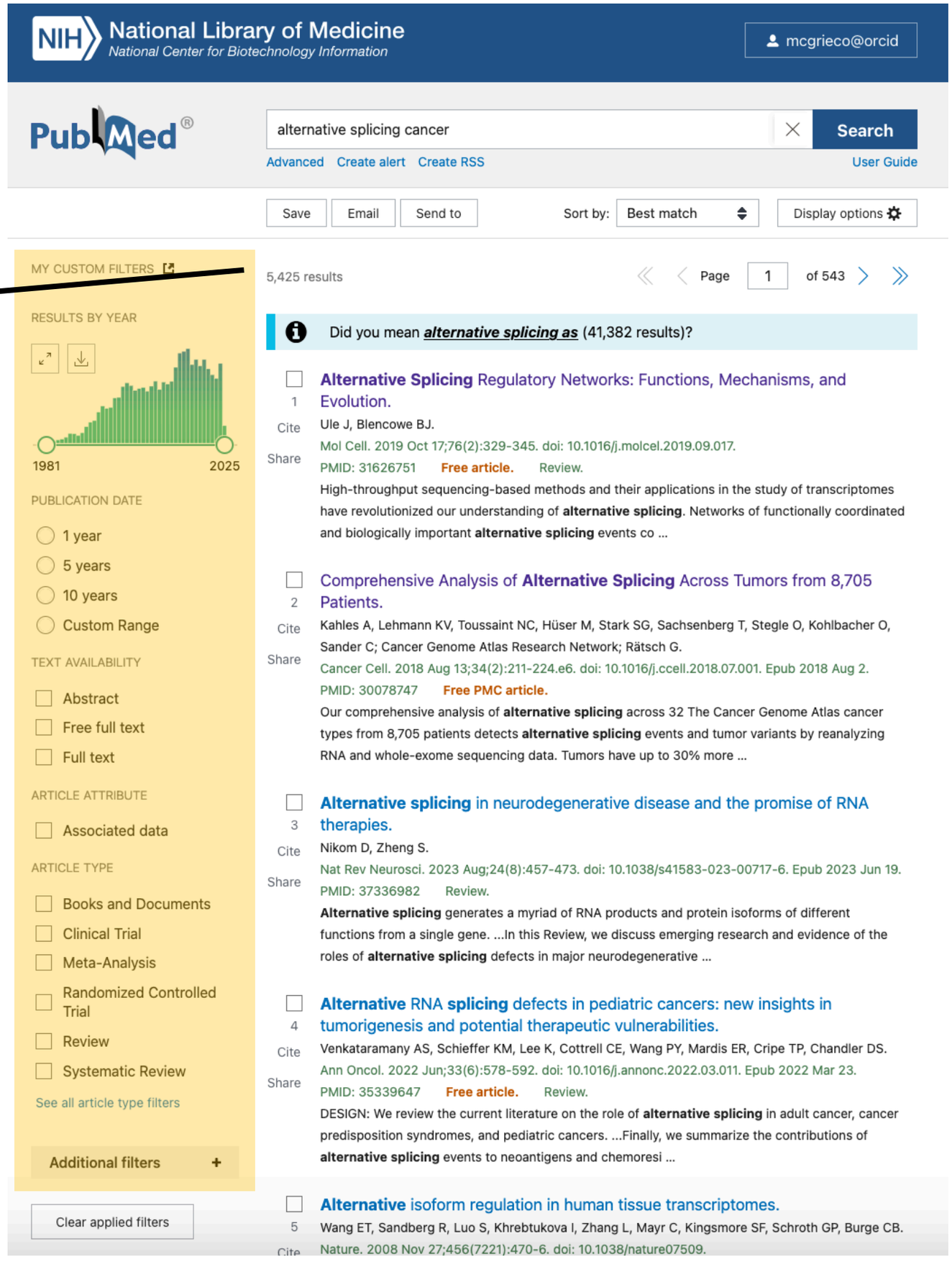

C.G.B.

UNIVERSITÀ DEGLI STUDI DI MILANO

## Filters panel

Allows you to refine results based on:

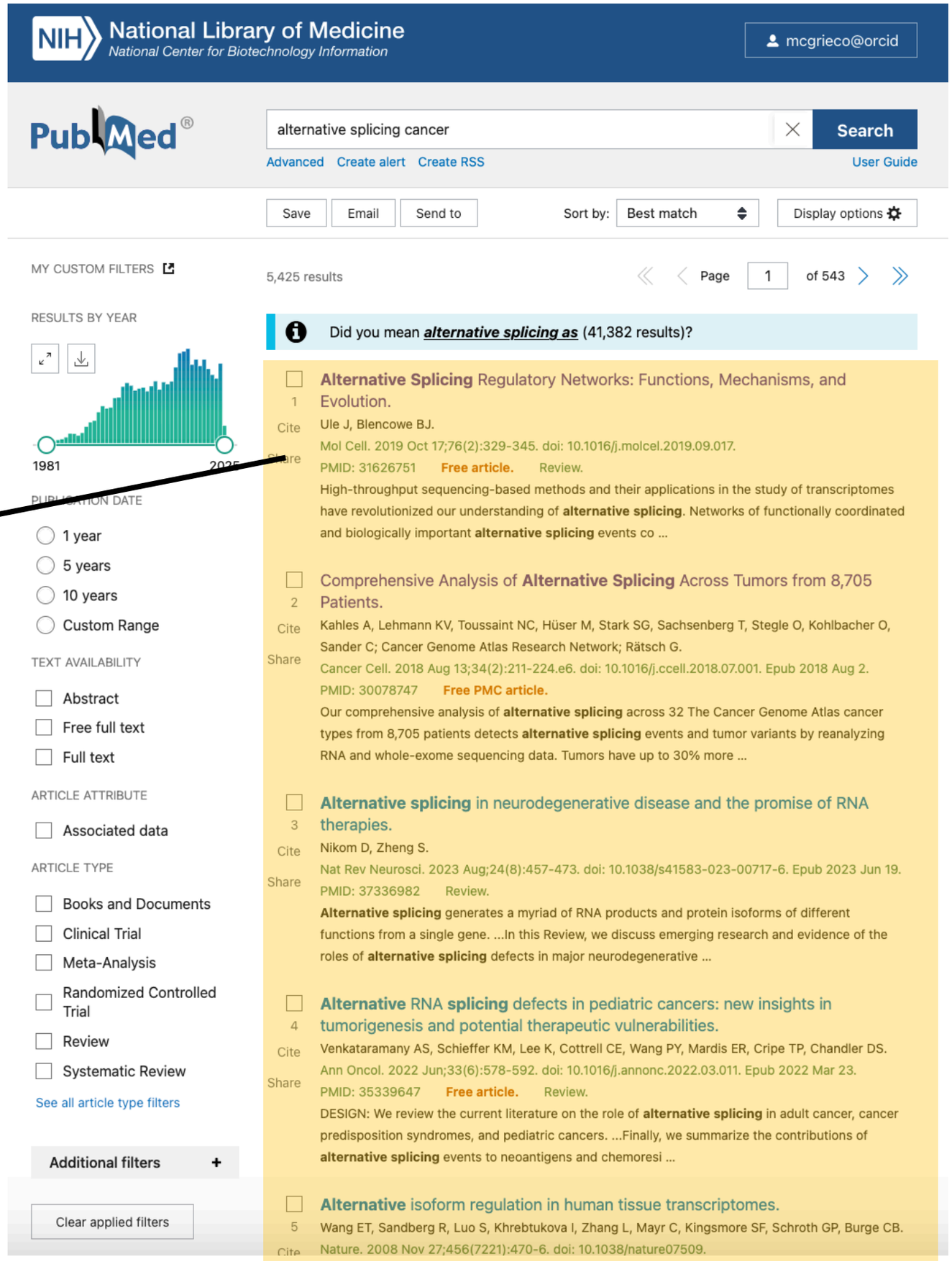
- Article type (e.g., clinical trials, reviews, meta-analyses)
- Publication date (e.g., last 5 years)
- Text availability (Free full-text, Abstract only)
- Study species (Humans, Animals)



## Search results list

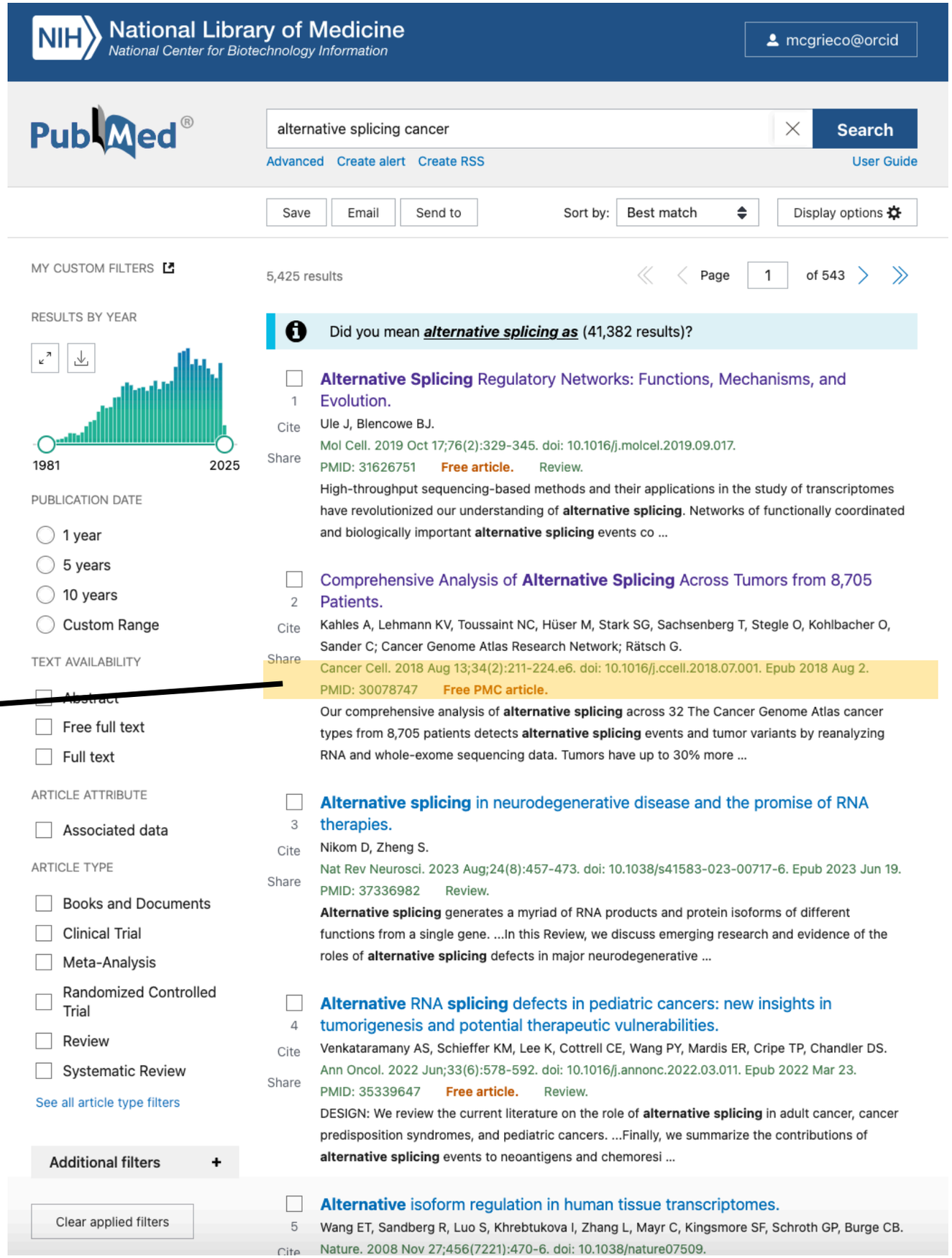
Displays article titles, authors, journal names, and publication dates.

Clicking on a title opens the full article page with an abstract and access options.




C.G.B.

UNIVERSITÀ DEGLI STUDI DI MILANO




## Access & full-text links

Some papers are freely available through PubMed Central (PMC), while others may require university access or a request from the author.

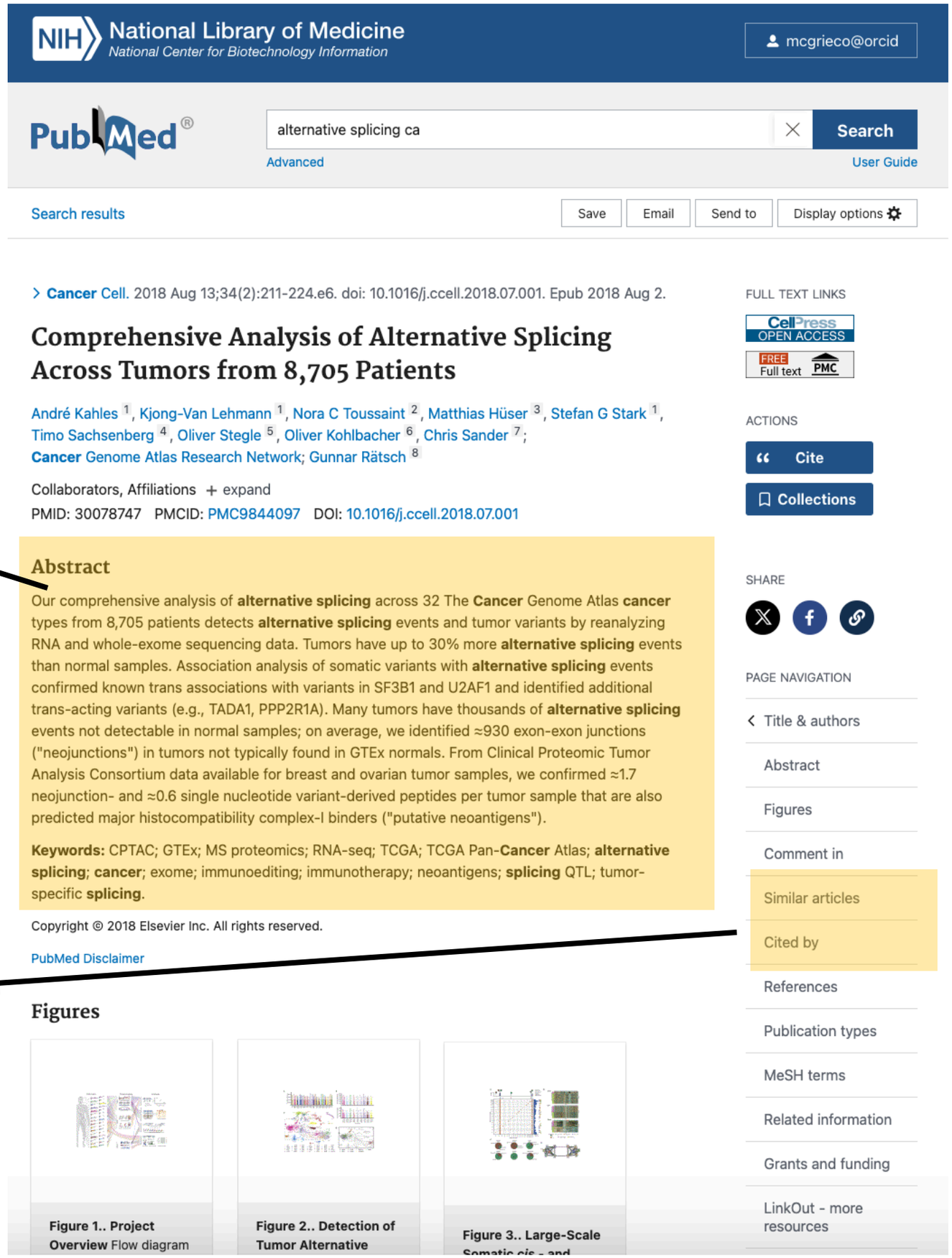
C.G.B.

UNIVERSITÀ DEGLI STUDI DI MILANO

Abstract and keywords

Some articles include a **“Cited by”** section, showing newer papers that reference them.

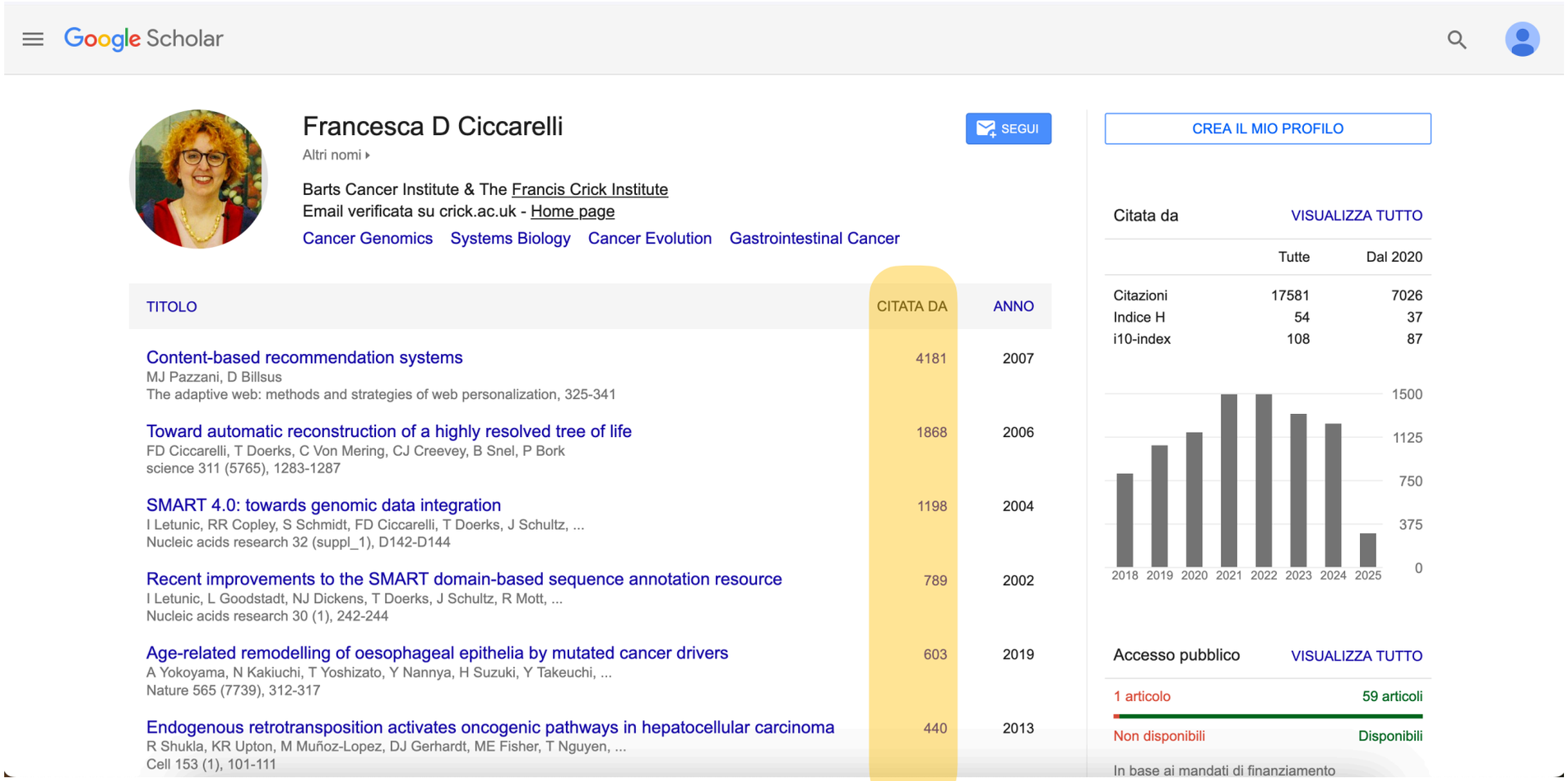
The **“Similar articles”** section suggests related research based on your query.



# Tracking a researcher's work

If you are looking for all the published work of a **specific researcher**, one of the best tools to use is **Google Scholar.**

Let's try searching for "**Francesca Ciccarelli**" as an example. This will display a list of her published articles, citations, and co-authors.




Check the "Cited by" feature to see how her work has influenced other studies.

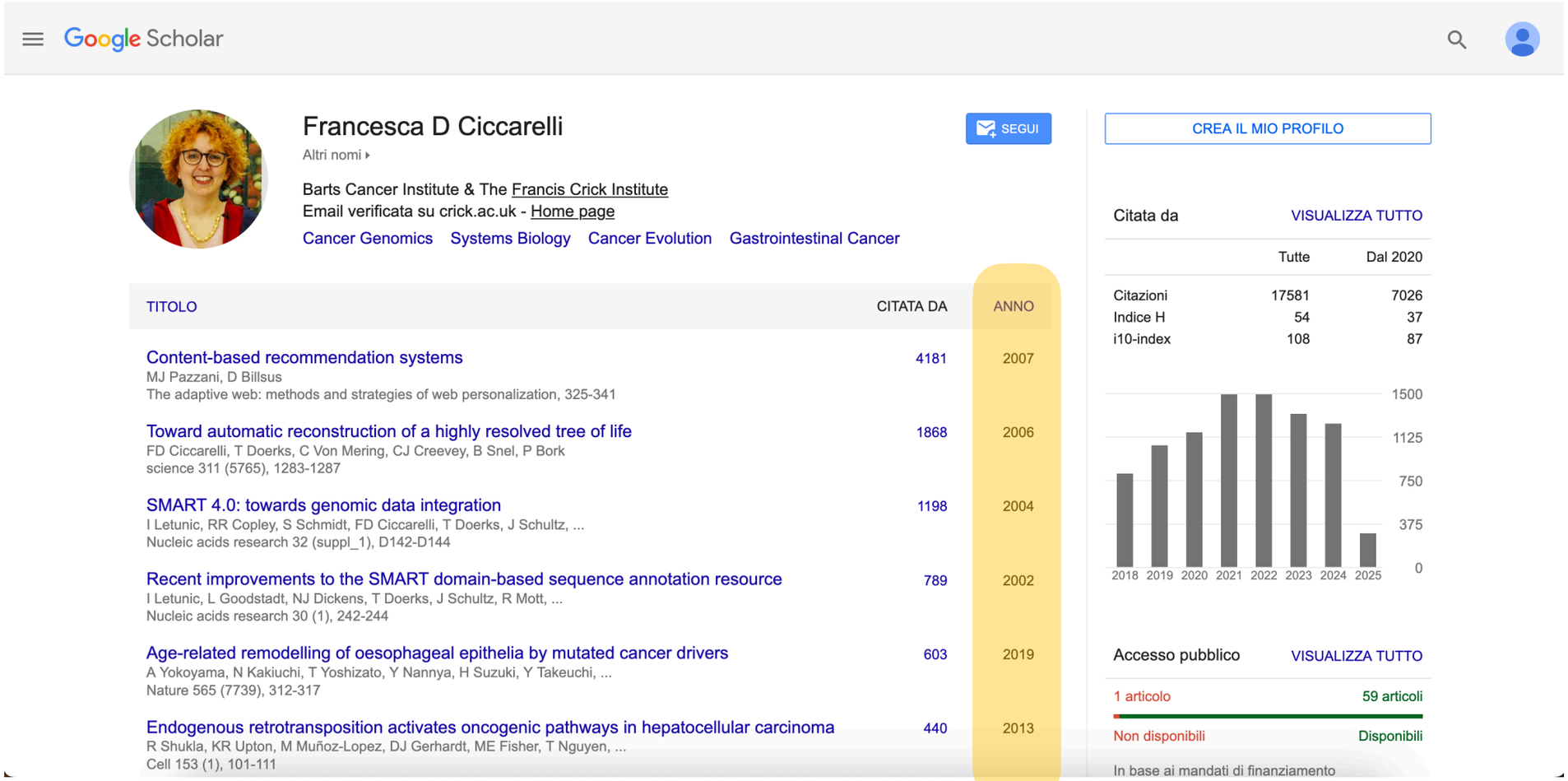
C.G.B.

UNIVERSITÀ DEGLI STUDI DI MILANO

# Tracking a researcher's work

If you are looking for all the published work of a **specific researcher**, one of the best tools to use is **Google Scholar.**

Let's try searching for "**Francesca Ciccarelli**" as an example. This will display a list of her published articles, citations, and co-authors.




Sort by date to find the most recent papers