

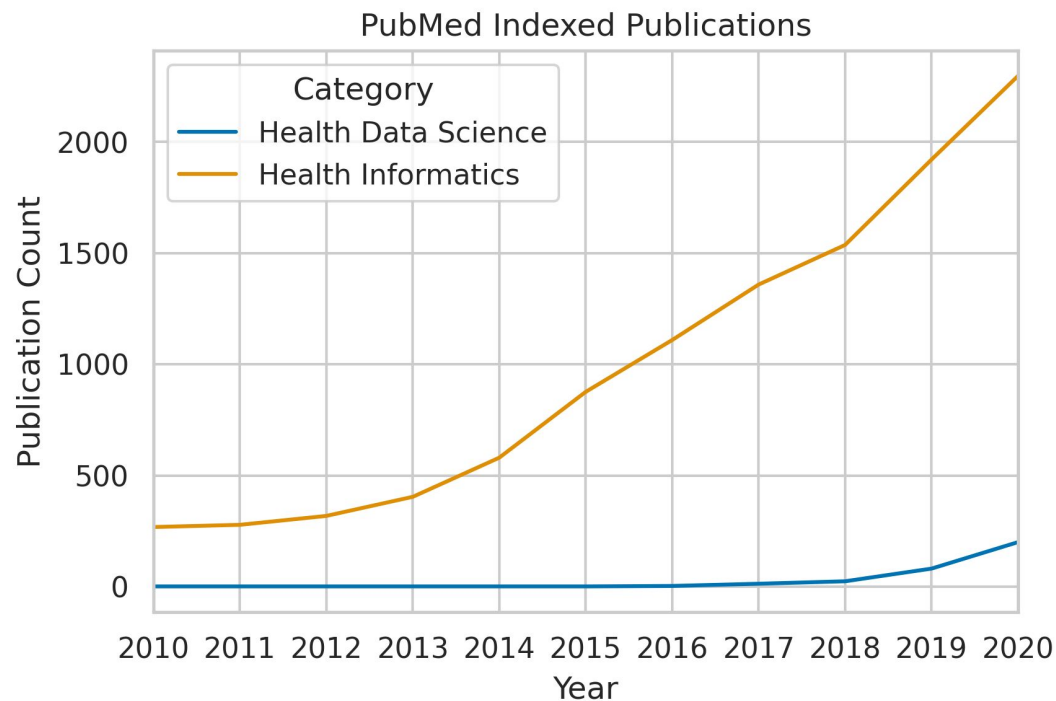
Reading and Critiquing Journal Articles

CSCI6XXX/CHE6XXX/CSCI4148
(CSCI6093)

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Goals of a Journal Club

- Improve understanding of prior research
- Keep up with **newest** research
- Get practice reading research
- Learn how to critically appraise research
- Get practice presenting research



2021: 1k “Health Data Science”
10k “Data Science”
20k “Machine Learning”
48k Health Data Science
101k Data Science

What is a research article?

- Standards differ across fields and subfields (conference vs journal)
- Preprint archives
- Peer review process
- “In-Press”
- Open review
- Archaic identifiers

The screenshot shows a research article page with several elements highlighted by red arrows:

- Publishing house:** Points to the Elsevier logo on the left.
- Journal name:** Points to "Applied Surface Science" in the top right.
- Date year:** Points to "2014" in the citation "Applied Surface Science 302 (2014) 105-108".
- Page numbers:** Points to "105-108" in the citation.
- Journal name:** Points to "Applied Surface Science" in the middle of the page.
- Article name:** Points to "Pulsed laser deposition of Co₃O₄ nanocatalysts for dye degradation and CO oxidation".
- Author surname:** Points to "Edla*" in the author list "R. Edla*, N. Patel, Z. El Koura, R. Fernandes, N. Bazzanella, A. Miotello".

Other visible elements include the ScienceDirect logo, the journal homepage URL (www.elsevier.com/locate/apsusc), a CrossMark logo, and an abstract section titled "ARTICLE INFO" and "ABSTRACT".

Parts of a paper

IMRAD format

- **Abstract** (Summary of key justification, method, results, and take-aways)

~18–68% of medical journal abstracts contain omissions or inaccuracies ([Pitkin, 1999](#)).

- **Introduction** (why the authors decided to do this research)
 - **Methods** (how they did it, and how they analysed their results)
 - **Results** (what they found)
 - **Discussion** (what the results mean).
-
- **Conclusions** (what they want you to take away)

Presenting a paper to the class

Overview of the paper:

- **Background:**
 - Describe rationale and importance of paper
 - Highlight the previous research that underlie this paper
- **Methodology:**
 - Describe the dataset/collection (and exclusion criteria)
 - Describe the main analysis methods they've selected and their justification
- **Results:**
 - Summarise the key results/figures
 - What didn't they detect?
- **Discussion/Conclusion:**
 - Summarise their discussion points: what limitations/contextualisation did they highlight?
 - What conclusions did they draw?

Presenting a paper to the class

Critique of the paper:

- Main question: relevant/interesting?
- Originality?
- Easy to read?
- Conclusions supported by results?
- Unaccounted for Biases?
- Missing contextualisation?

Conclusion:

- Restate take-homes
- What is the broader implication of this paper?
- What follow-up experiments would this work warrant?
- How would you translate these findings into impact

Let's discuss Alston & Rick 2021

A Beginner's Guide to Conducting Reproducible Research

[Jesse M. Alston](#), [Jessica A. Rick](#) First published: 15 January 2021 <https://doi.org/10.1002/bes2.1801>

- What is the general problem they identify?

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Replication crisis

- What is the specific problem?

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Analyses are not reproducible

- Why do they think people should do reproducible research?

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Benefits researchers:

1. *Documentation*
2. *Easier to update analyses*
3. *Re-use*
4. *Rigour*
5. *Citations*

Benefits community:

1. *Accelerates field*
2. *Improves understanding*
3. *Finding mistakes*

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Why do they think it isn't done?

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Why do they think it isn't done?

1. *Complexity*
2. *Technology change*
3. *Human error*
4. *IP*

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What is their suggested solution?

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What is their suggested solution?

1. *Before analysis: planning/storage/version control/metadata*
2. *During analysis: comments/automation/containers*
3. *After analysis: dynamic/notebook/full release/DOI*

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Why do you think they've missed?

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Why do you think they've missed?

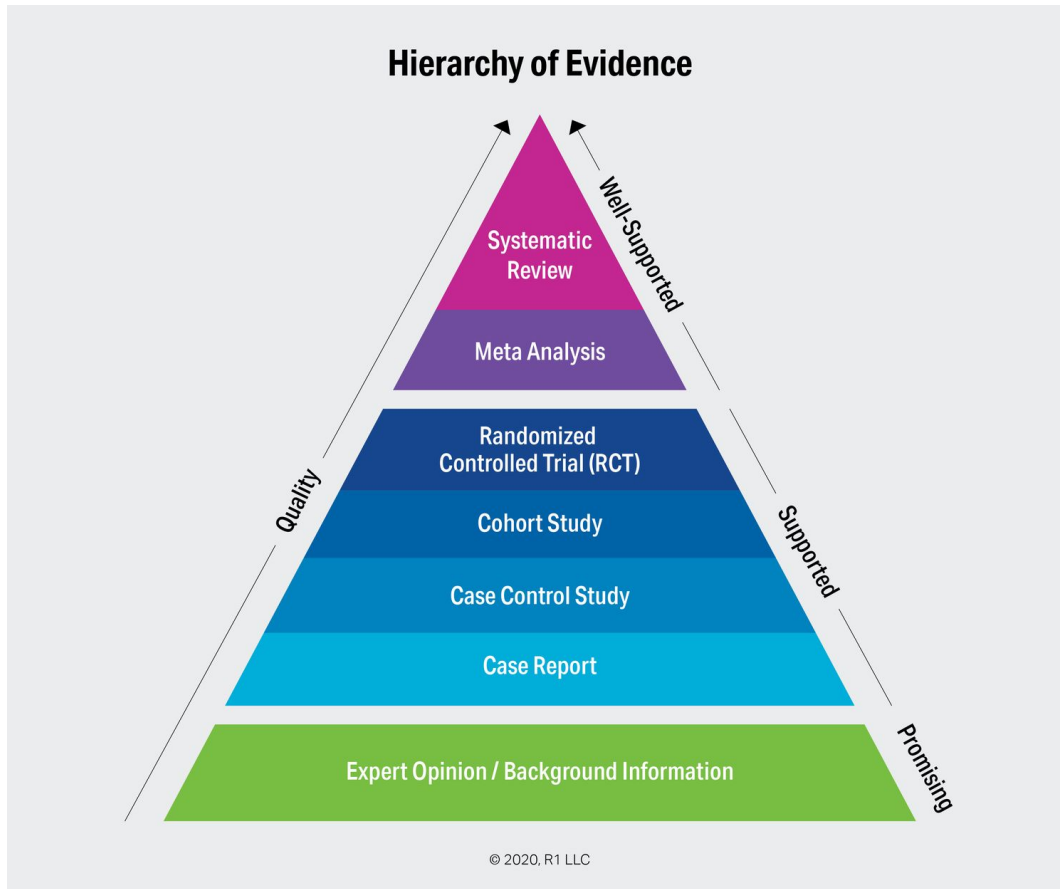
1. *Existence of technical debt suggests stronger incentivisation is needed*
2. *Data ordinality*
3. *Workflow managers (apart from Make)*
4. *Notebooks/markdown*
5. *Typos...*
6. *Gold standard example?*

Reproducibility in machine learning for health research: Still a ways to go

[Matthew B. A. McDermott](#) [Shirly Wang](#) [Nikki Marinsek](#) [Rajesh Ranganath](#) [Luca Foschini](#) [Marzyeh Ghassemi](#)

Science Translational Medicine • 24 Mar 2021 • Vol 13, Issue 586 • [DOI: 10.1126/scitranslmed.abb1655](https://doi.org/10.1126/scitranslmed.abb1655)

Evidence in Medicine



<https://r1learning.com/blog/2020/02/upon-what-evidence-are-evidence-based-practices-based-4pjtt>

Evidence in Medicine

Research

Artificial Intelligence versus clinicians: systematic review of design, reporting standards, and claims of deep learning studies

BMJ 2020 ; 368 doi: <https://doi.org/10.1136/bmj.m689> (Published 25 March 2020)

Cite this as: *BMJ* 2020;368:m689

Linked Editorial

Artificial intelligence versus clinicians


Article

Related content

Metrics

Responses

Peer review

Myura Nagendran , academic clinical fellow¹, Yang Chen, academic clinical fellow², Christopher A Lovejoy, physician³, Anthony C Gordon, professor^{1 4}, Matthieu Komorowski, clinical lecturer⁵, Hugh Harvey, director⁶, Eric J Topol, professor⁷, John P A Ioannidis, professor⁸, Gary S Collins, professor^{9 10}, Mahiben Maruthappu, chief executive officer³

<https://r1learning.com/blog/2020/02/upon-what-evidence-are-evidence-based-practices-based-4pjtt>

Only 10 RCTs (2 published with no blinding), 81 non-randomised (6 actually tested in real clinical setting), median of 4 experts comparison but 61/81 stated comparable to human performance

Figure 1

Evaluation metrics

- A** Technical reproducibility
 - 1 Code available
 - 2 Public dataset
- B** Statistical reproducibility
 - 1 Variance reported
- C** Conceptual reproducibility (replicability)
 - 1 Multiple datasets

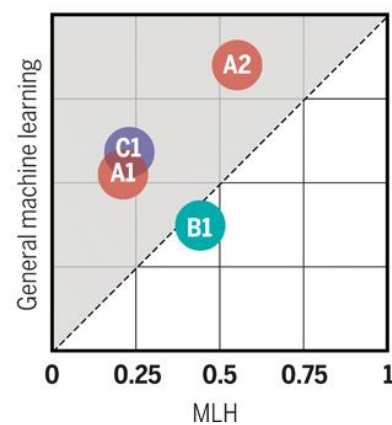
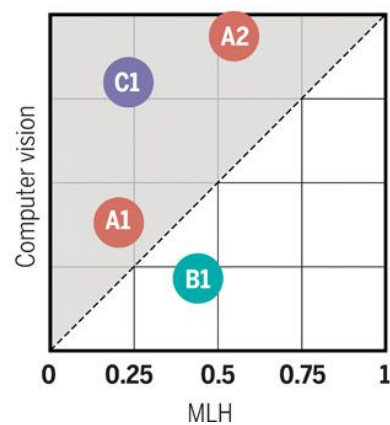
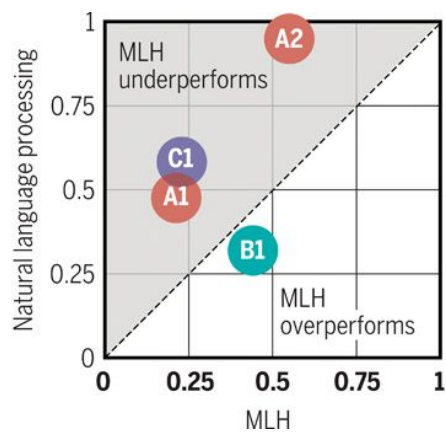
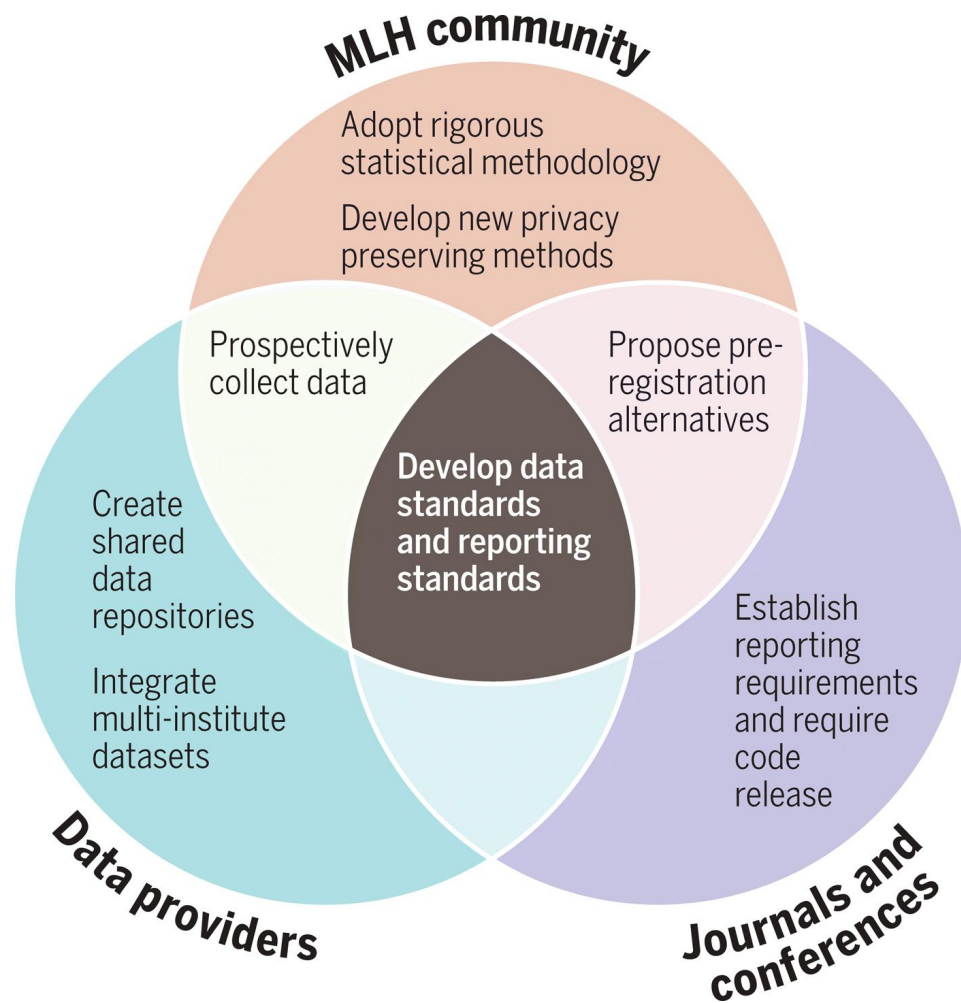


Figure 2



Proposal Class

Developing a question

Learning objectives

1. Understand the components of a research proposal
2. List the basic criteria in selection a health data science research question
3. Describe methods for developing a research question
4. List potential sources for research questions

What goes into a research proposal?

Components of a written research proposal

- **Research Question:** *clearly defined research question related to solving an important problem*

Components of a written research proposal

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- **Abstract:** *concise & informative expert overview*
- **Lay Summary:** *clear general public summary of problem, solution, and relevance*
- **Introduction:** *problem/knowledge gap justification/explanation of relevant methods*
- **Literature Review:** *critical appraisal of broad relevant literature that supports method and question*
- **Methodology:** *appropriate method, data gathering/access, that solves the research question and is justified by literature review*
- **Budget:** *reasonable/appropriate timeline and cost estimates*
- **Ethics:** *explores hurdles/risks/benefits and impact of question, method and KT*
- **Discussion:** *addresses limitations, implications, and future directions/extensions.*
- **Knowledge Translation:** *robust/impactful plan to mobile results across a range of settings.*

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- **Discussion:** *addresses limitations, implications, and future directions/extensions.*
- **Knowledge Translation:** *robust/impactful plan to mobile results across a range of settings.* June 10th

June 3rd: Intermediate Check-in and Troubleshooting!

Proposal Presentation Structure (June 15th)

15 minutes + 5 minutes Q&A

- Title Slide (1)
- Team Background and Conflicts of Interest (1)
- Background/Literature Review (3)
- Research Objectives/Question/Hypothesis (1)
- Methodology (3)
- Budgeting (1)
- Knowledge Translation Plan (1)
- Future Work (1)
- Q&A

- **Chance for feedback -> incorporate into final submission**

What makes a good research question?

Components of a good research question

- **Focused:** single problem or issue
- **Novel:** hasn't already been done
- **Answerable:** ideally quantitatively
- **Feasible:** to answer within the timeframe and practical constraints
- **Specific:** can be thoroughly addressed
- **Interesting:** to you & your collaborators
- **Relevant:** implications for broader field/society (KT)

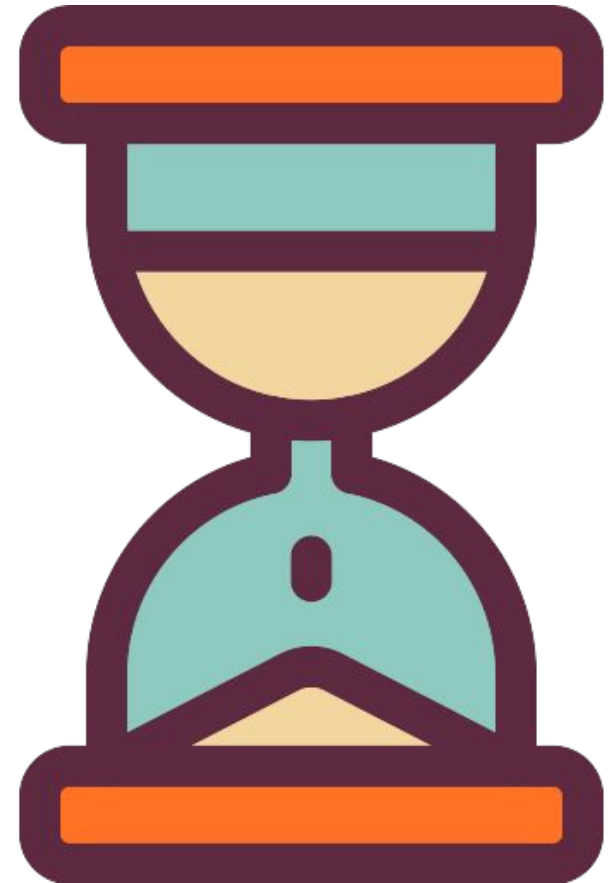
Additional:

- **(?)Complex:** not too trivial



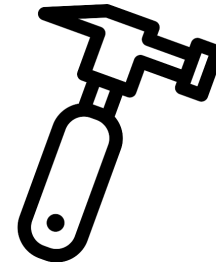
The Research “Hourglass”

- General question (broad)
- Specific question (narrow)
- Data (collection/curation/gathering)
- Analyse Data
- Contextualise Results (discuss limitations/differences in outcome to other studies)
- Generalise Conclusions (broader relevance)



3 ways to identify a general area

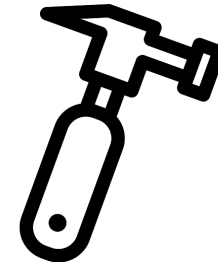
- **Method**
 - new algorithm, new statistical approach, new ML workflow



3 ways to identify a general area

- **Method**

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- **Data**

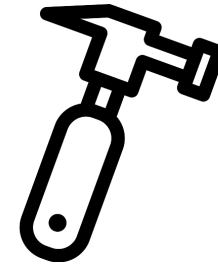
- new/expanded/linked dataset e.g., controlled workplace proximity infectivity data



3 ways to identify a general area

- **Method**

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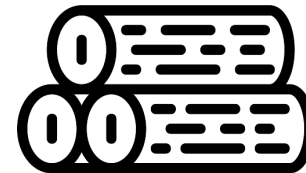
- **Data**

- new/expanded/linked dataset e.g., controlled workplace proximity infectivity data



- **Problem**

- Emergent disease/health/social crisis, long existing/unresolved crisis



Formulating a research question

Research aims	Research question formulations
Describing and exploring	<ul style="list-style-type: none">• What are the characteristics of X?• How has X changed over time?• What are the main factors in X?• How does X experience Y?• How has X dealt with Y?
Explaining and testing	<ul style="list-style-type: none">• What is the relationship between X and Y?• What is the role of X in Y?• What is the impact of X on Y?• How does X influence Y?• What are the causes of X?
Evaluating and acting	<ul style="list-style-type: none">• What are the advantages and disadvantages of X?• How effective is X?• How can X be achieved?• What are the most effective strategies to improve X?• How can X be used in Y?

Let's brainstorm some research ideas!

What about the other components?

Components of a research proposal

- ~~**Research Question:** *clearly defined research question related to solving an important problem*~~
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Abstract

“Several studies have reported reprogramming of fibroblasts into induced cardiomyocytes; however, reprogramming into proliferative induced cardiac progenitor cells (iCPCs) remains to be accomplished. Here we report that a combination of 11 or 5 cardiac factors along with canonical Wnt and JAK/STAT signaling reprogrammed adult mouse cardiac, lung, and tail tip fibroblasts into iCPCs. The iCPCs were cardiac mesoderm-restricted progenitors that could be expanded extensively while maintaining multipotency to differentiate into cardiomyocytes, smooth muscle cells, and endothelial cells in vitro. Moreover, iCPCs injected into the cardiac crescent of mouse embryos differentiated into cardiomyocytes. iCPCs transplanted into the post-myocardial infarction mouse heart improved survival and differentiated into cardiomyocytes, smooth muscle cells, and endothelial cells. Lineage reprogramming of adult somatic cells into iCPCs provides a scalable cell source for drug discovery, disease modeling, and cardiac regenerative therapy.” (p. 354)

The first sentence announces the **topic** under study, summarizes what’s **already known** or been accomplished in **previous research**, and signals the **rationale and goals are for the new research and the problem** that the new research solves: How can researchers reprogram fibroblasts into iCPCs?

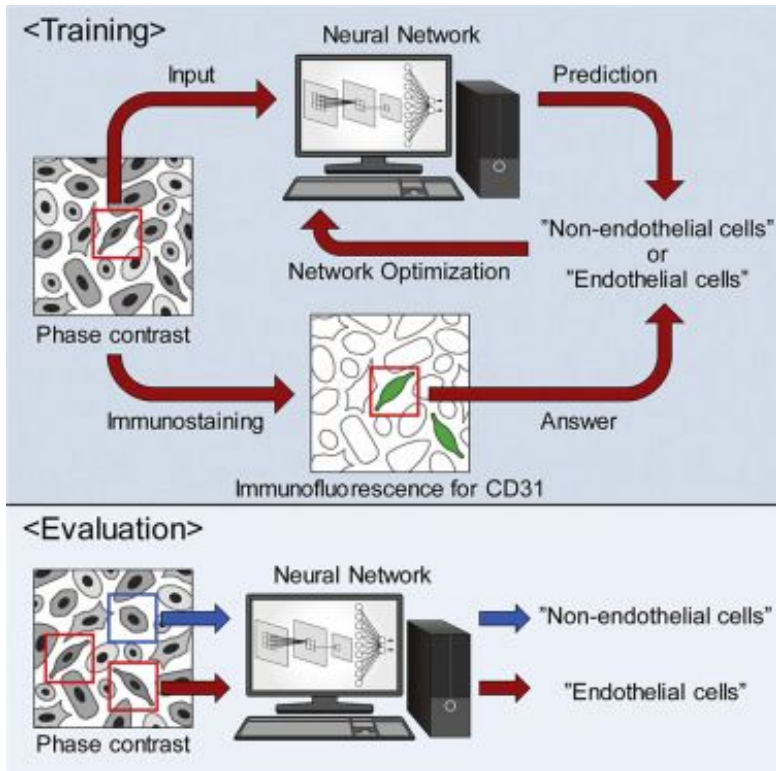
The **methods** the researchers developed to achieve their goal and a description of the **results**.

The **significance or implications**—for drug discovery, disease modeling, and therapy—of this reprogramming of adult somatic cells into iCPCs.

<https://writing.wisc.edu/handbook/assignments/writing-an-abstract-for-your-research-paper/>

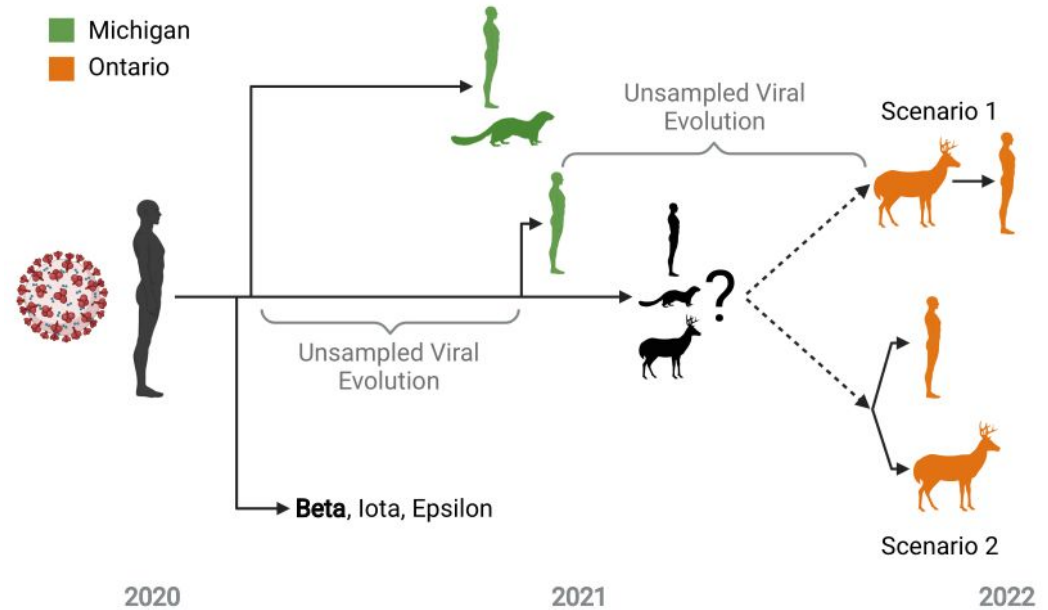
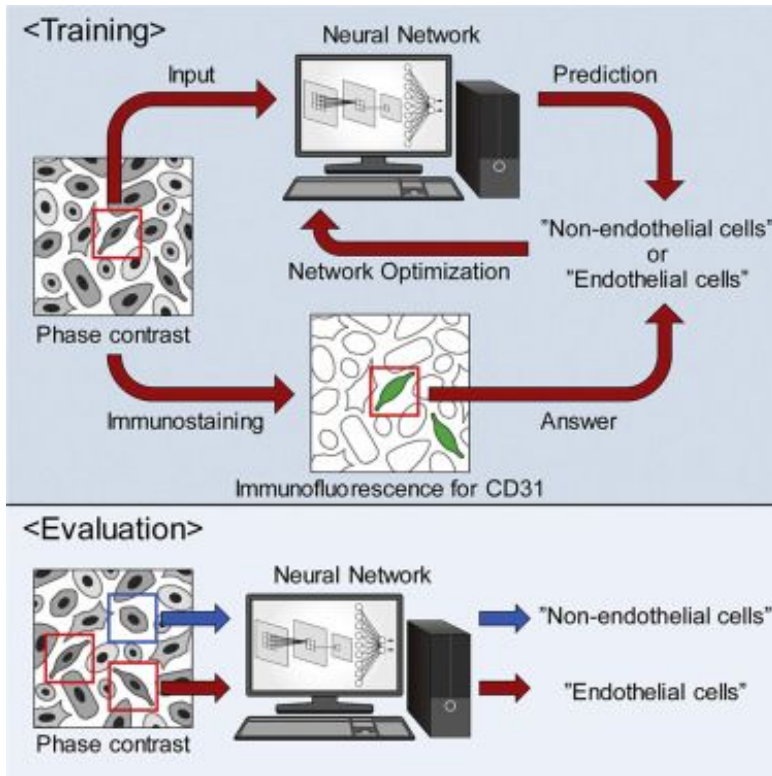
Structured is common in medicine: Objective/Method/Results/Discussion

Graphical Abstracts



<https://www.sciencedirect.com/science/article/pii/S2213671118301759>

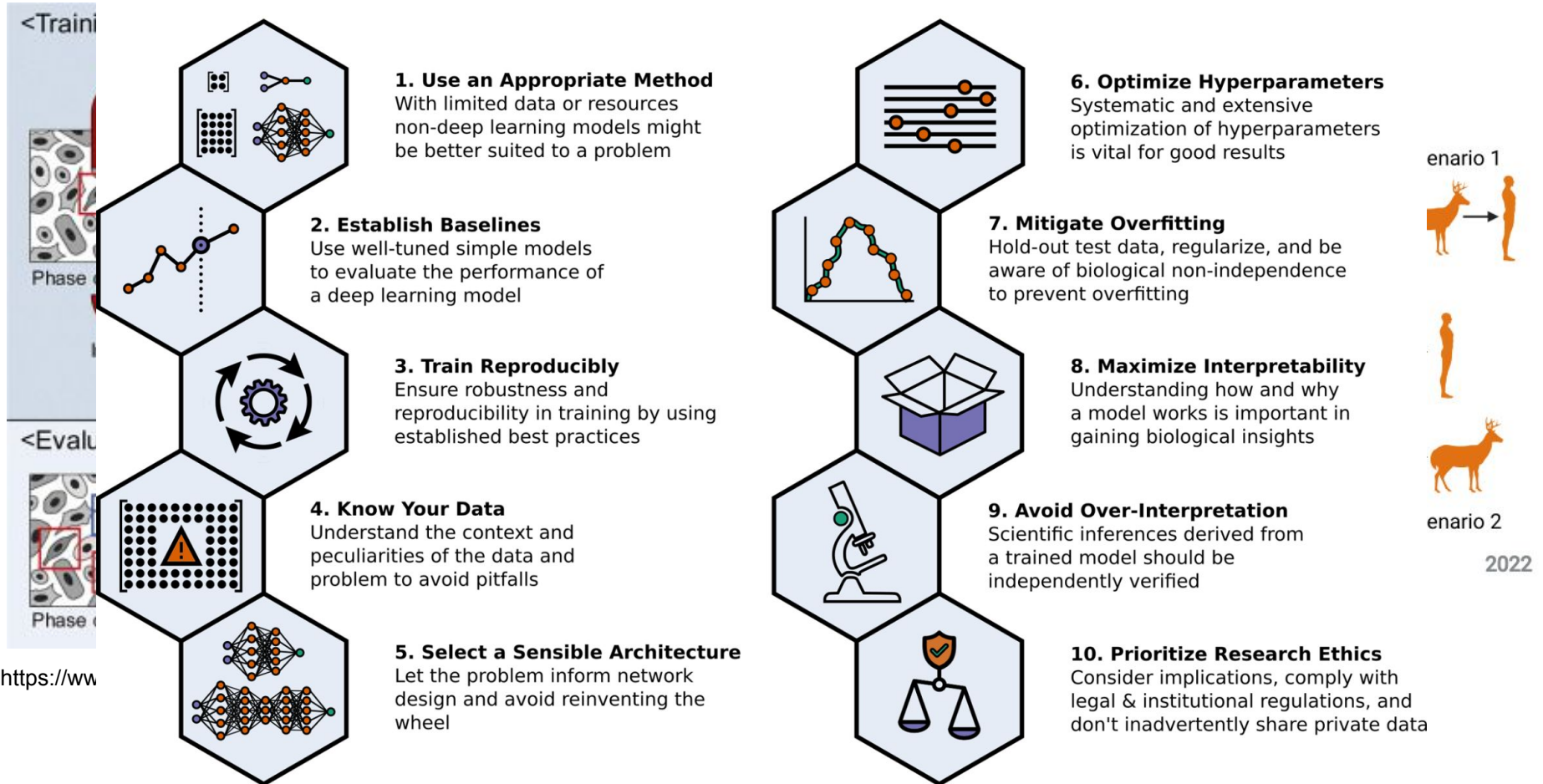
Graphical Abstracts



<https://www.sciencedirect.com/science/article/pii/S2213671118301759>

Graphical Abstracts

Ten Quick Tips for Deep Learning in Biology



Lay Summary

How to write a Lay Summary for your website

Parents of autistic children in Europe have positive attitudes towards research involving babies who might be autistic.

We asked 1040 parents who have a child on the autism spectrum about their attitudes to research. Specifically we asked them about research with babies who don't yet have a diagnosis of autism, but who are more likely to be autistic because they have an older, autistic brother or sister.

Parents with an autistic child are central to these studies, because they decide whether to get involved. It's important to find out their opinions on this work, so we can make it easy to take part, ethical, and useful.

In our sample, from 11 European countries, attitudes were positive overall, and parents valued the scientific goals of research. We also learned about what parents want when it comes to the types of research they would be happy to take part in.

The findings of this work can influence how researchers design their studies, and also provide an example of how to involve the community in research.

Start by stating your main finding clearly. This is the key thing most people want to know about your study

Describe the method that underpinned that key finding, ideally in a single sentence

Now you can add a bit more methodological detail, to help readers understand more about what you did.

This is where I would describe why you were interested in this question. It comes in the middle – much later than a normal abstract

Repeat your main finding and add a bit more info. It is OK to leave out some of the detail, especially if you're worried about mis-representing what you found.

Finish by stating why your research is important and how it will contribute to changing things in the future.

Created by Sue Fletcher-Watson, @SueReviews, www.dart.ed.ac.uk
Based on this original article: <https://journals.sagepub.com/doi/full/10.1177/1362361317728436>
Inspired by Nature: <https://www.nature.com/documents/nature-summary-paragraph.pdf>

Check your readability here:
<https://www.webfx.com/tools/read-able/check.php>

Introduction and Literature Review

Finding good non-predatory publications (pubmed, google scholar):

- <https://pubmed.ncbi.nlm.nih.gov/>
- <https://scholar.google.ca/>

Preprint Archives (arXiv, medrXiv, biorXiv...)

Conference proceedings (CS/ML especially)

