

Date	Day (week)	Topic	To do
20.2	Tue (1)	Introductions / syllabus review	Review course content, ask questions
22.2	Thu (GT)	Structure of a scientific paper, critical reading	Look over worksheet, ask questions
27.2	Tue (2)	Introductory unit: Structure	Read PBoC 1.1, 1.2, 8.1, 8.4
29.2	Thu (GT)	Open discussion, Q&A	Ask questions
5.3	Tue (3)*	George Feher, Roderick Clayton	Read paper
7.3	Thu (WS)	Discuss paper analysis	Bring completed worksheet
12.3	Tue (4)	Peter Wolynes	Read paper
14.3	Thu (WS)	Discuss paper analysis	Bring completed worksheet
19.3	Tue (5)	Jose Onuchic, Ken Dill	Read paper
21.3	Thu (WS)	Discuss paper analysis	Bring completed worksheet
26.3	Tue (6)	Discussion, outlook: Structure Introductory unit: Single molecule mechanics	Read PBoC 8.3
28.3	Thu (GT)	Open discussion, Q&A	Ask questions





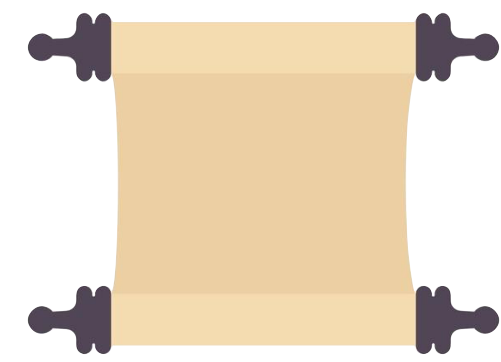
# Structure of a scientific paper

Giorgio Tortarolo

Topics in biophysics and physical biology | PHYS-466 | 22.02.2024



Attributes	Primary literature	Journalistic versions	Textbooks
Authors	Scientists	Journalists	Educators
Audience	Scientists	General public	Students
Genre	Argumentative	Various (expository, narrative, argumentative)	Expository
Content	Evidence to support conclusions	Facts with minimum evidence	Facts
Structure	Canonical	Non-canonical	Non-canonical, reflects knowledge structure of discipline
Presentation of science	Uncertain	Various degrees of certainty	Certain



# Scientific Papers



Motivations to Read



Structure



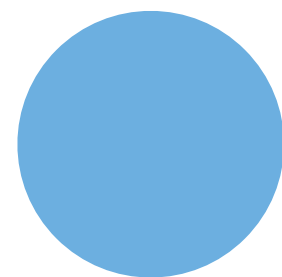
Reading Tips



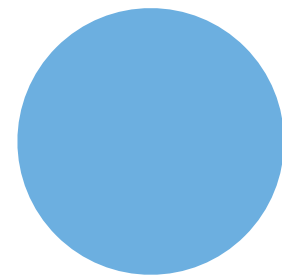
Common Problems



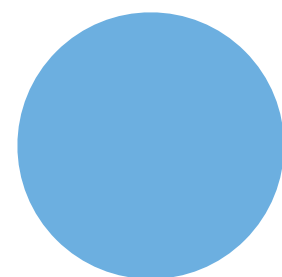
## Motivations to Read?



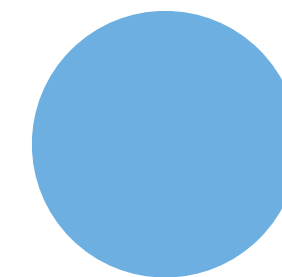
Be exposed to the true boundaries of a field



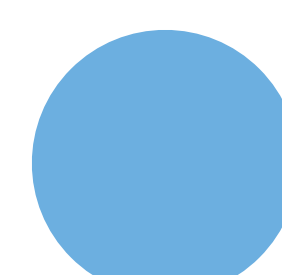
Access knowledge not yet in textbooks



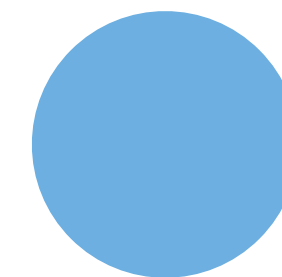
Scout for new research ideas



Learn how great papers are written



Replicate existing results, and build on them



Find solutions to your problems



# Structure?



Introduction



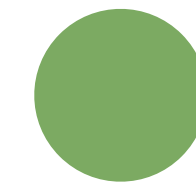
Material and Methods



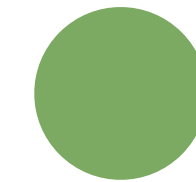
Results



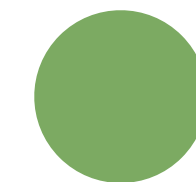
Discussion, Conclusions



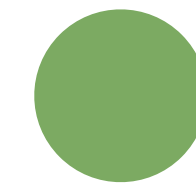
Abstract



Figures and captions



Supplementary material



Code



# Structure

## Aim

I

Introduction

M

Material and Methods

R

Results

D

Discussion, Conclusions

- Recapitulate the relevant state of the art prior to the work
- Clearly identify the gap in knowledge that the work aims to fill, and anticipate how it is done
- Anticipate the interpretation of the results

*“The protein P1 has been shown to be over expressed in cancer cells with high proliferation levels, **BUT** its precise role in cancer progression is not yet understood. **HERE** we employ super resolution fluorescence microscopy and biochemical assays to show that P1 binds with protein P2, an important actor in the signalling pathway X.”*



# Structure

I

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Discussion, Conclusions

## Aim

- Explain in great detail the strategies that the authors employed to reach the conclusions of the work
- Ensure the work to be reproducible!

*“This is the protocol for cell preparation, data collection and image analysis: ...”*





# Structure

I

Introduction

M

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Discussion, Conclusions

## Aim

- Present all the results of the work

*“Protein P1 is expressed 78% more in cell lines with high proliferation level, with respect of with normal-like cells (fig2a). Super resolution, two color imaging of P1 and P2 show co-localisation at 57%. Western blot analysis show that P1 and P2 are binding to form a macromolecule. We monitored the amount of the compound C1, a result of the pathway X, in absence of the protein P1, and we measured reduction in the concentration of the compound C1 of 98% (fig1b). Further analysis suggest a linear correlation between the concentration of P1 and C1 in the cells (fig2).”*



# Structure

I

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Discussion, Conclusions

## Aim

- Provide an interpretation of the results
- To present the outcome of the work by interpreting the findings at a higher level of abstraction
- To relate these findings to the motivation stated in the introduction

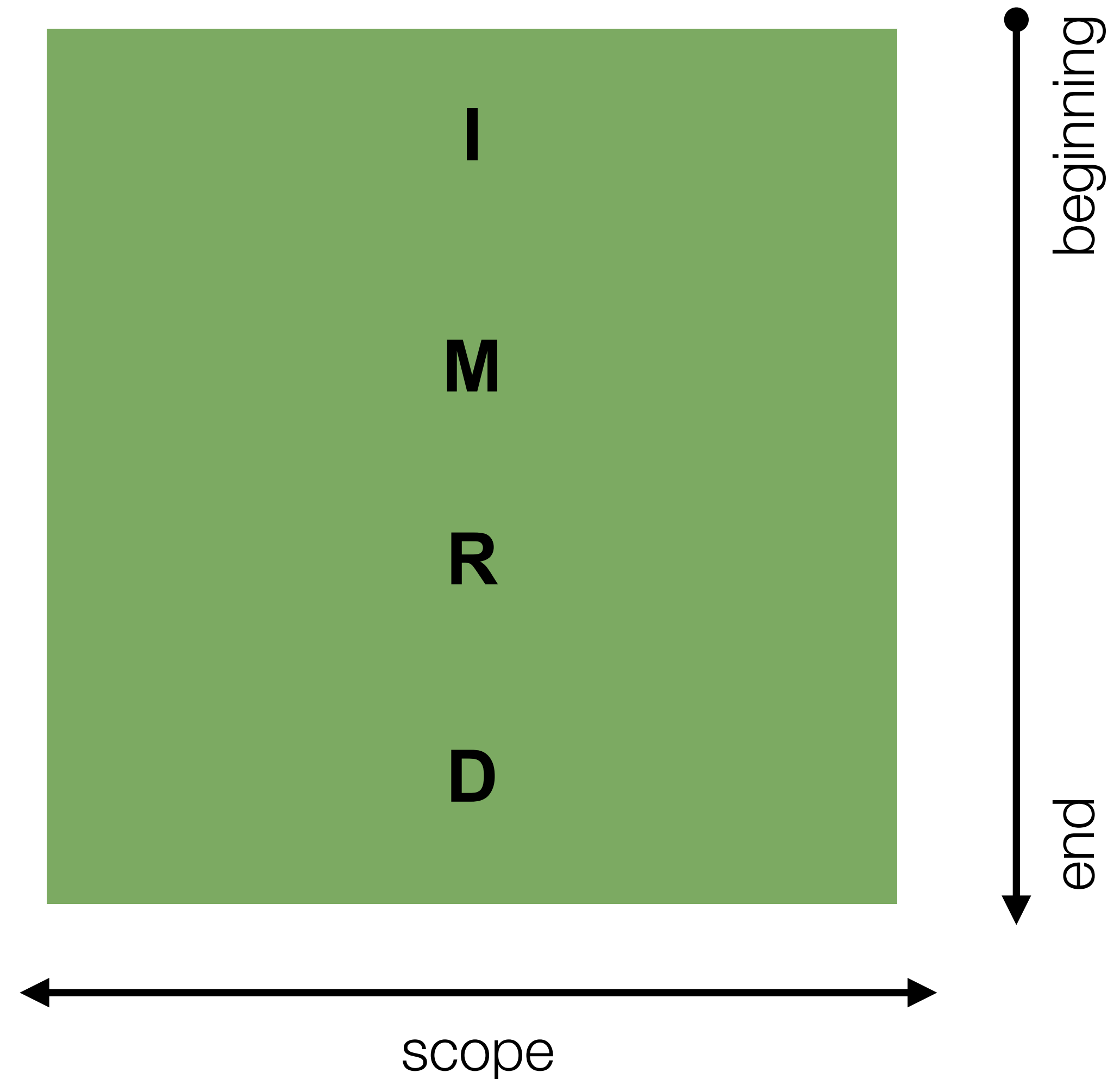
*Results show that protein P1 is necessary for the signalling pathway X by binding the protein P2. This finding may provide a novel tool to mitigate cell proliferation during cancer.*



# Structure

- I** Introduction
- M** Material and Methods
- R** Results
- D** Discussion, Conclusions

How would you shape it?



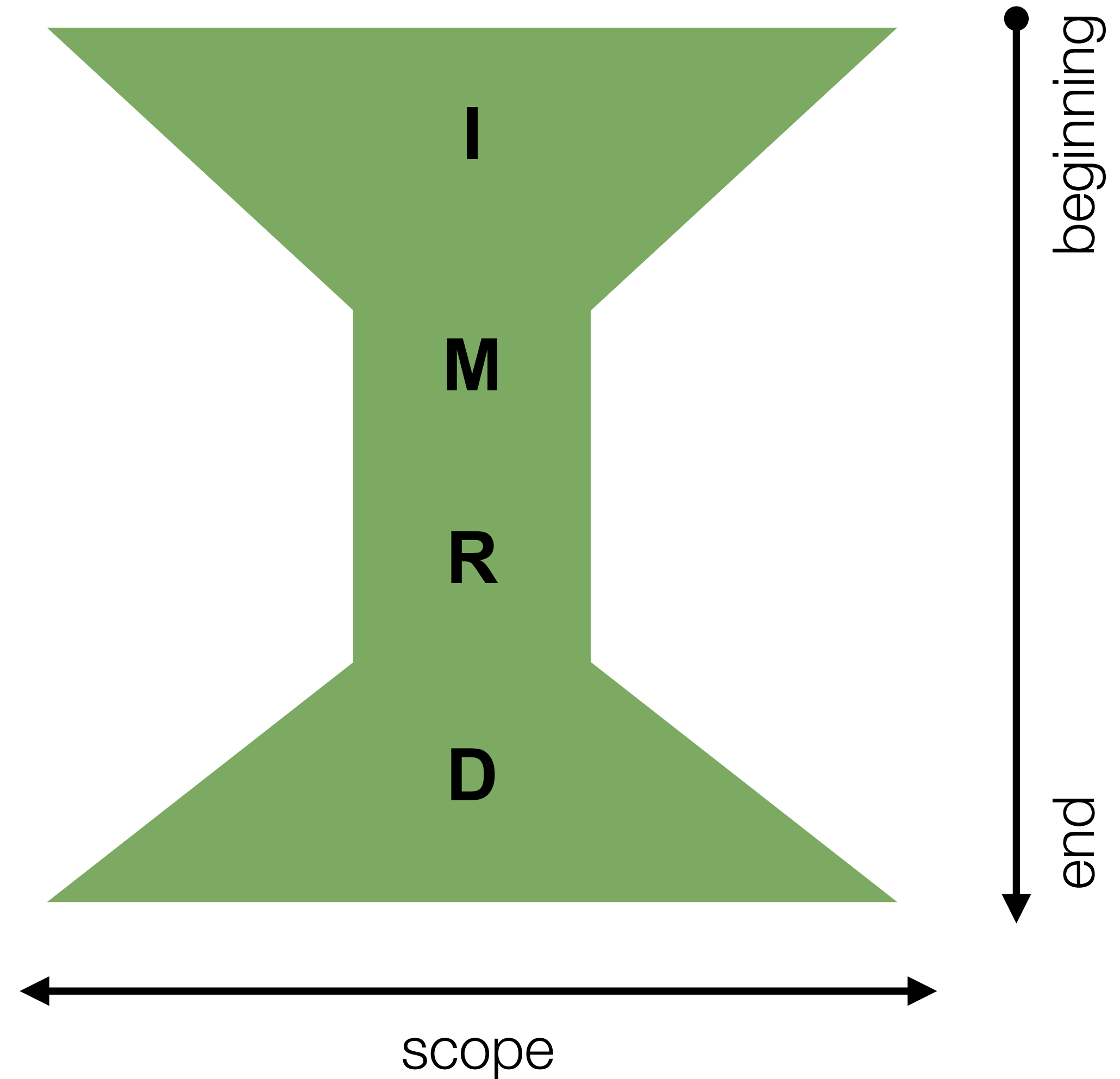




# Structure

EPFL

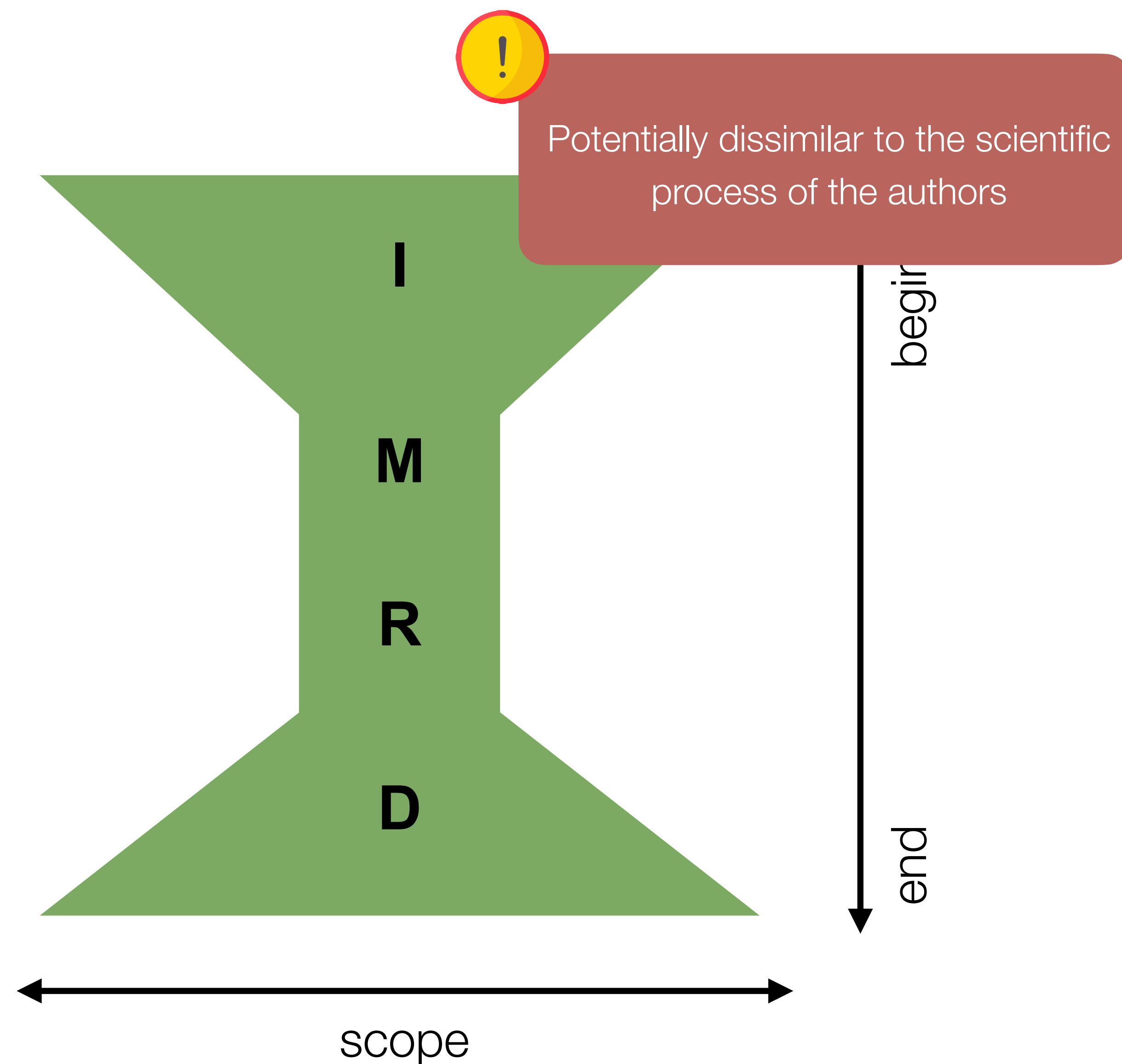
- I** Introduction
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# The structure of a scientific paper: IMRD

- I** Introduction
- M** Material and Methods
- R** Results
- D** Discussion, Conclusions





# Reading Tips

1

Read and digest the title

2

Read the abstract carefully

3

Go through all the figures in the paper,  
and read the captions

4

Read the Introduction and understand  
where the work fits into the puzzle

5

Read the Discussion



- Don't read word for word
- Look up words you are not familiar with
- Check cited/related literature
- Ask question to informed people





# Reading Tips

*What is your motivation?*

Get the basics, is this paper worth reading or passing along?  
Understand if the researcher's work is relevant to your project

Understand the significance and broader impacts of the work

Read the paper for a class discussion  
Present the paper at Journal Club

Gather information to replicate the research findings  
Review a paper for journal submission

*How much time do you need?*

3 minutes

30 minutes

3 hours

3 days

*What should you learn from each section?*

## TITLE

### ABSTRACT

- What question(s) are the authors addressing?
- What is the major finding or scientific contribution?
- What is the work's significance?

### MATERIALS AND METHODS

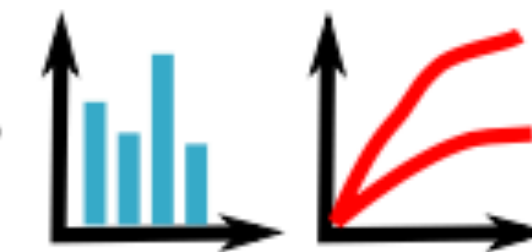
- What are their experimental assays and reagents?
- If there are alternative approaches, how did they select this system?
- Would you do anything differently?

### RESULTS

- What are the conclusions they draw from the data?
- How do these results answer the greater question identified in the abstract?
- Do the results 'add-up' to the final claims of the paper?

### FIGURES, TABLES, AND DATA

- Can you identify the results in the images/charts/graphs?
- Can you circle specific results (i.e. two-fold change in response, effect of treatment vs. control)?
- What are the controls in the experiment and have they presented them properly?

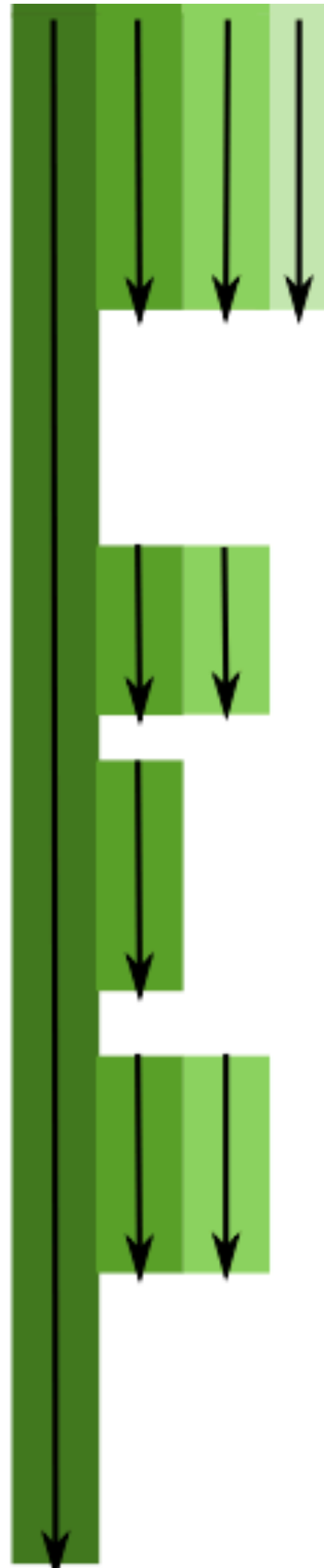


### CONCLUSIONS/ DISCUSSION

- What do the results mean?
- Can you think of other interpretations of their results?
- If you were writing a story with their results, how would you interpret the data?
- What are other implications for the work, besides what the author(s) identified?
- What are the next steps?

### SUPPLEMENTAL INFO AND REFERENCES

- What are the controls and supporting data?
- What other supporting data would you like to see?
- Are there additional references that would deepen your understanding of their work?
- Which references would also be pertinent to your work?





# Common Problems

I

Introduction

M

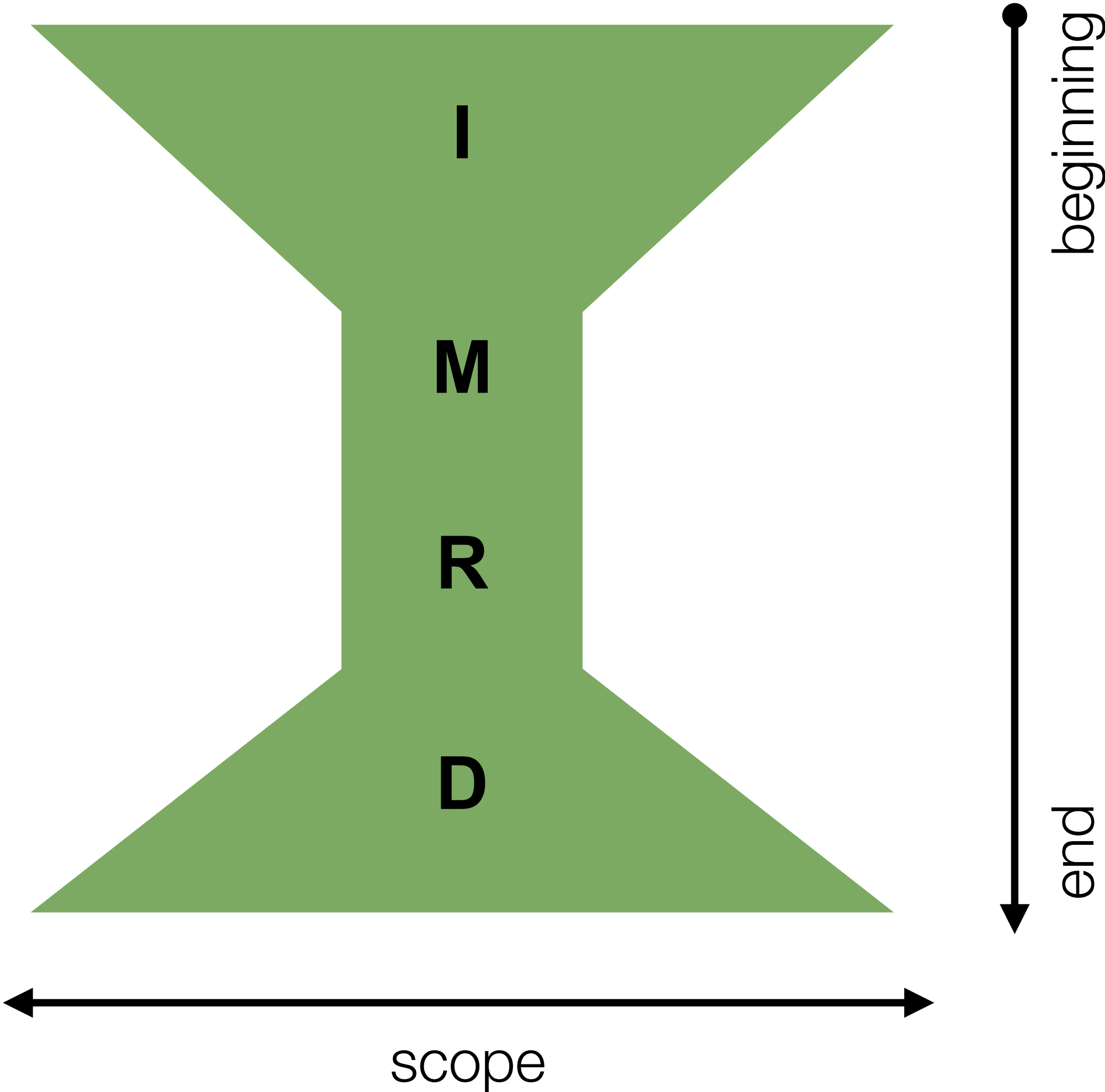
Material and Methods

R

Results

D

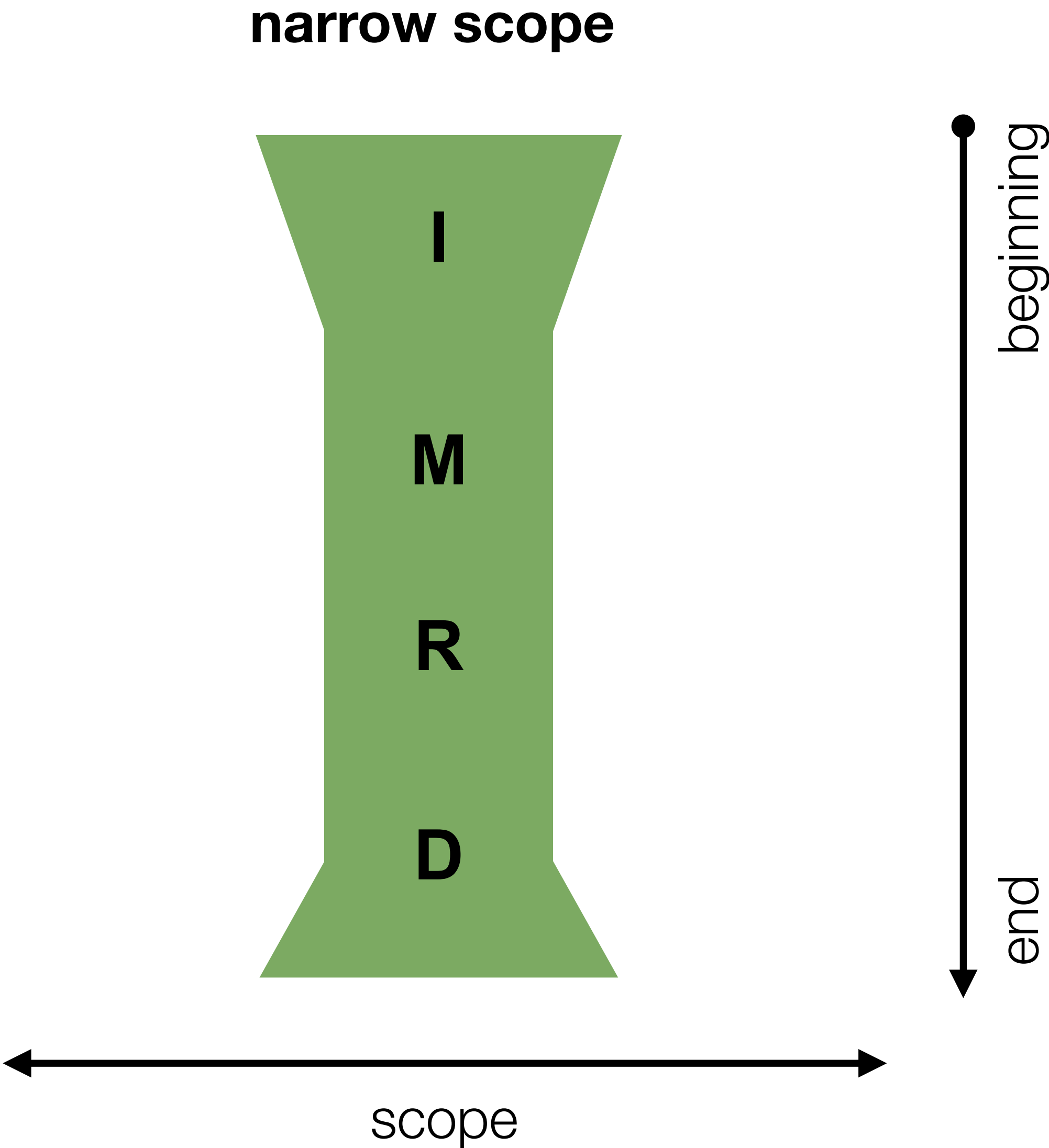
Discussion, Conclusions





# Common Problems

- I** Introduction
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- R** Results
- D** Discussion, Conclusions

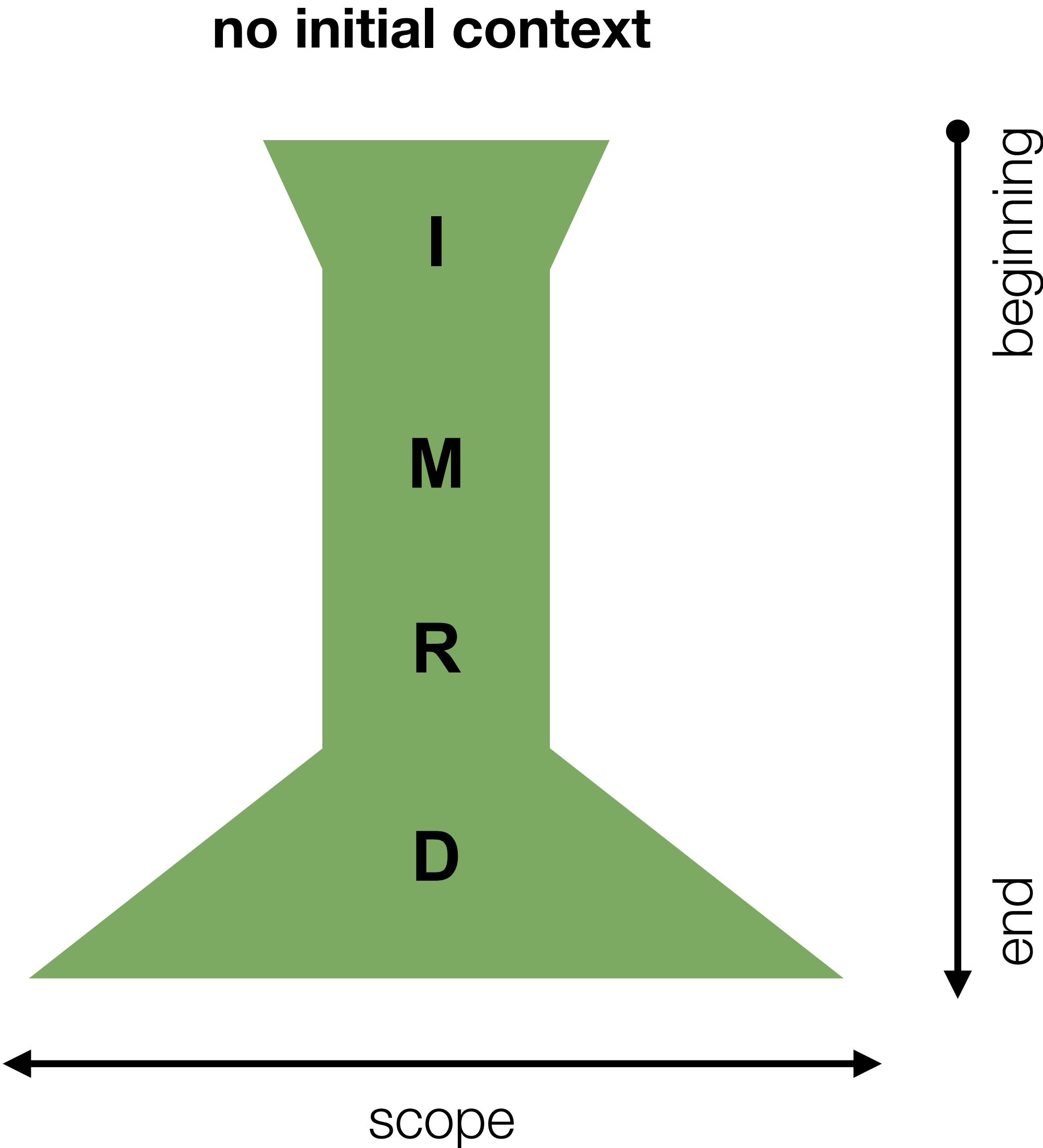






# Common Problems

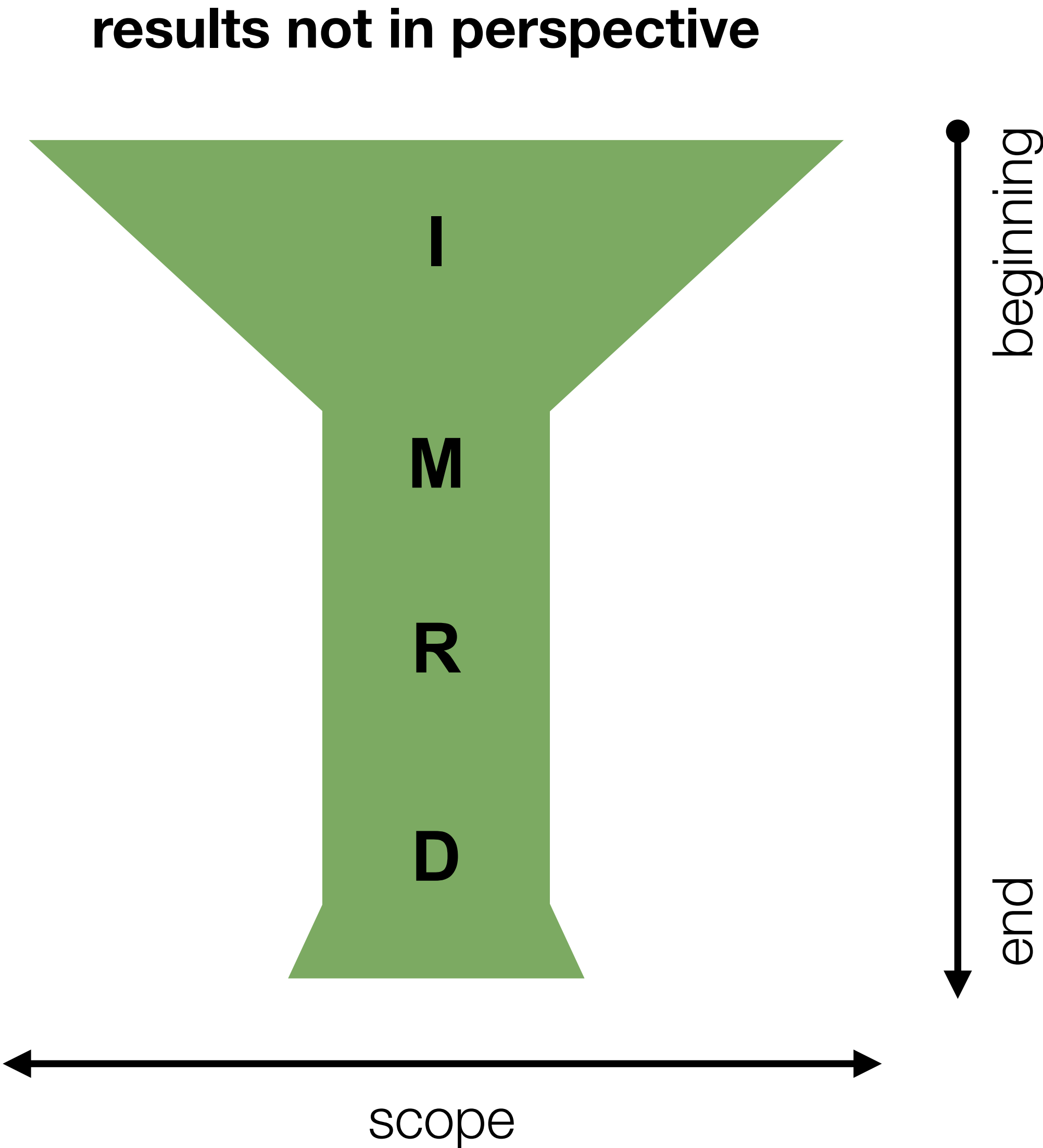
- I** Introduction
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# Common Problems

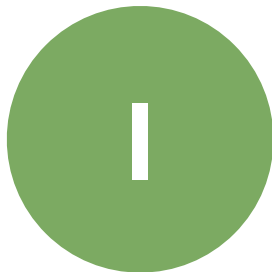
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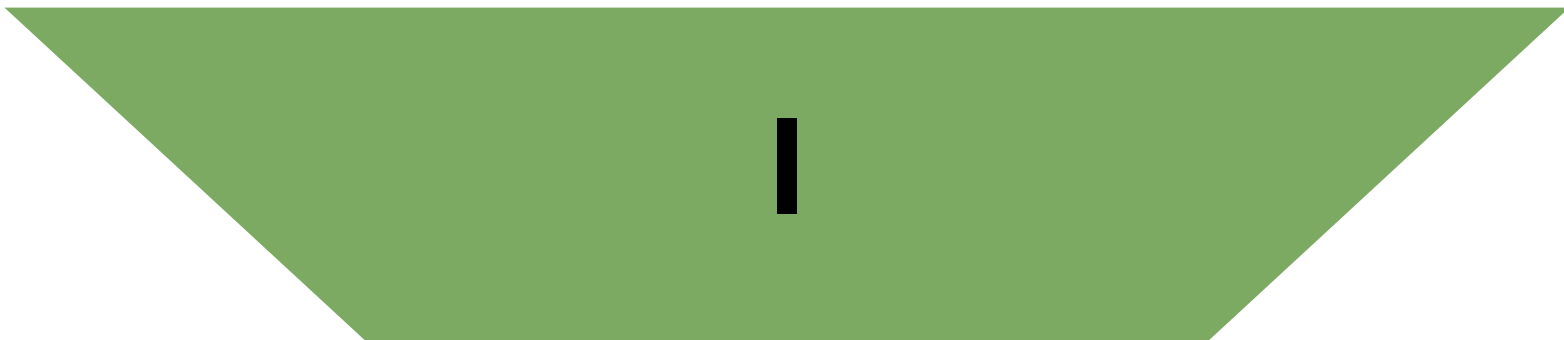


# Common Problems

introduction.. to something else!



Introduction



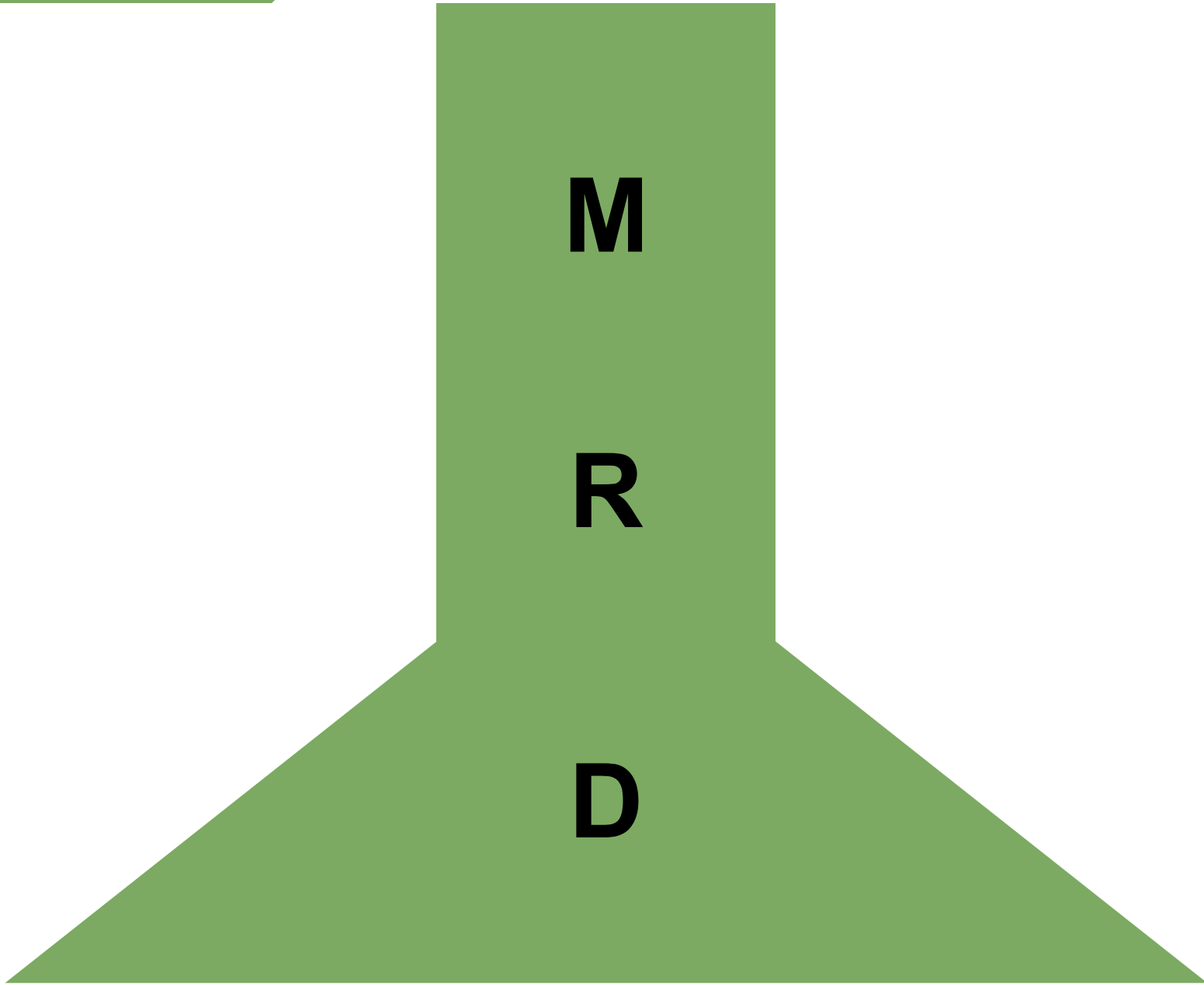
Material and Methods



Results



Discussion, Conclusions



scope

