

20.109 Writing Introductions and Discussions



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Macrostructure of a Research Article

- **Introduction** provides general field or context.
- **Methods** follows a particularized path.
- **Discussion** moves from specific findings to wider implications.

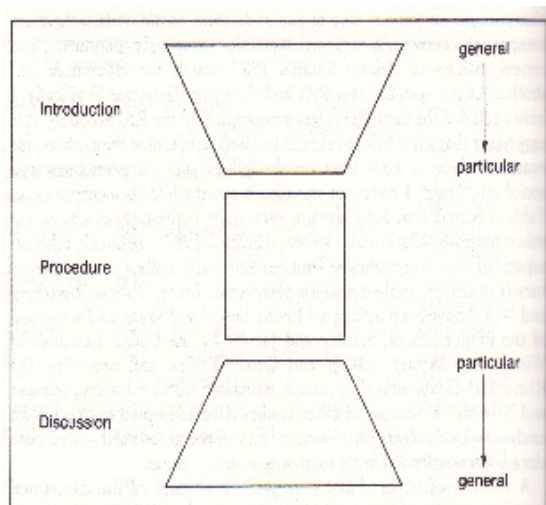
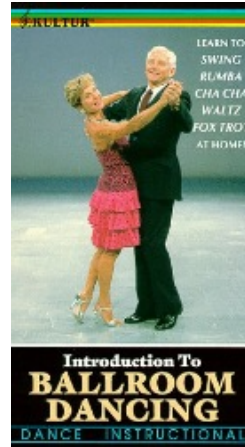


Figure 7 Overall organization of the research paper (Hill et al., 1982).

What is the form and function of an Introduction?

- An introduction is a method to *familiarize and orient* your readers.
- The content of an introduction depends on its *purpose* and the *audience*.
- All models share a *direct approach*. Don't hide your main point or save it until the end of the paper.



Introductions across disciplines contain the essential elements of *context*, *focus*, and *justification*.

Context: Orient your reader to the published literature related to the topic and to essential background information

Focus: Define the research space, stake out territory. What questions are you addressing? What is your hypothesis?

Justification: Show how your work fits into and extends previous work. Argue for the importance of your work.

Swales (1990)

CARS Model of Introductions

Create a Research Space

1. Re-establish significance of research field.
2. Situate actual research in these terms.
3. Show how this niche will be occupied and defended.

Swales (1990)

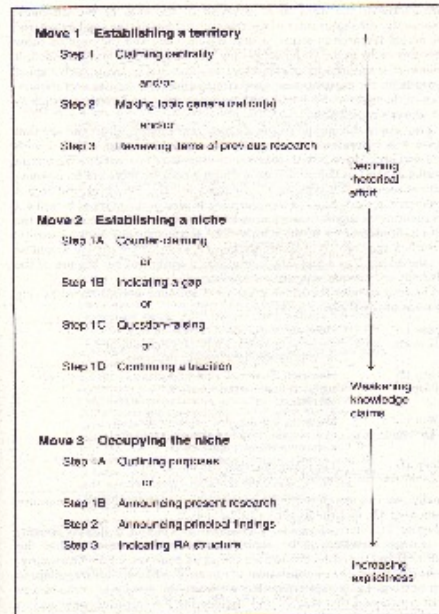


Figure 10. A CARS model for article introductions.

What are Some Common Pitfalls of an Introduction Section?

- Including **unnecessary background** or being repetitive.
- **Exaggerating** (or understating) the importance of your work.
- Using **lackluster** openers and **weak** follow-through in the body of your introduction.
- Not grounding the work in a **context** that will be important to your reader.
- Not **focusing** on a clear and compelling research question or hypothesis.



Tips on Writing Introductions

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CONTENTS	REQUIREMENTS, ADVICE
<p>What is the problem?</p> <ul style="list-style-type: none"> Describe the problem investigated. Summarize relevant research to provide context, key terms, and concepts so your reader can understand the experiment. <p>Why is it important?</p> <ul style="list-style-type: none"> Review relevant research to provide rationale. (What conflict or unanswered question, untested population, untried method in existing research does your experiment address? What findings of others are you challenging or extending?) <p>What solution (or step toward a solution) do you propose?</p> <ul style="list-style-type: none"> Briefly describe your experiment hypothesis(es), research question(s); general experimental design or method; justification of method if alternatives exist. 	<p>Move from general to specific:</p> <p>The problem in real world/research literature --> your experiment</p> <p>Engage your reader: answer the questions, “What did you do?” and “Why should I care?”</p> <p>Make clear the links between problem and solution, question asked and research design, prior research and your experiment.</p> <p>Be selective, not exhaustive, in choosing studies to cite and amount of detail to include. (In general, the more relevant an article is to your study, the more space it deserves and the later in the Introduction it appears.)</p>

Guidelines for Introductions from Two Scientific Publishers:

From the International Committee of Medical Journal Editors:

State the **purpose** of the article and summarize the **rationale** for the study or observation. Give only strictly pertinent references and **do not include data or conclusions** from the work being reported.

From the American Society for Microbiology:

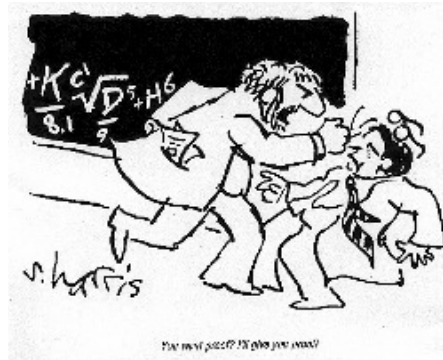
The introduction should **supply sufficient background information** to allow the reader to understand and evaluate the results of the present study without referring to previous publications on the topic. The introduction should also **provide the hypothesis that was addressed or the rationale** for the present study. Use only those references required to provide the most salient background rather than an exhaustive review of the topic.

Guidelines for Introductions are consistent across journals and, often, scientific fields.

An Example of An Introduction from the *New England Journal of Medicine*

- Morbidity and mortality among patients with chronic obstructive pulmonary disease are related in large part to acute exacerbations, which occur one to three times per year.^{1,2,3,4,5,6} *Our understanding of the cause and pathogenesis of these exacerbations is incomplete, and the role of bacterial pathogens is controversial.*^{7,8,9,10} ← **context/focus**
- *In studies performed decades ago*, investigators followed patients with chronic obstructive pulmonary disease longitudinally, with periodic collection of sputum samples for culture, to determine whether there was an association between the isolation of bacterial pathogens in sputum and the occurrence of exacerbations.^{5,6,11} In these studies, the rate of isolation of potential bacterial pathogens from sputum samples during stable disease was identical to the rate during acute exacerbations. This finding led to the conclusion that bacterial pathogens do not cause exacerbations and that their presence in sputum is due to chronic colonization.^{7,12} ← **context**
- *An increased understanding of the genetic heterogeneity* among strains of a bacterial species exposes a major limitations of the older cohort studies.¹³ At the time of these studies, it was not possible to differentiate among strains of a pathogenic bacterial species. Therefore, all strains isolated from sputum over the course of the study were regarded as identical if they belonged to the same species. This approach did not allow for the detection of changes in strains over time. More recent studies have shown that the immune response to bacterial pathogens after exacerbations of chronic obstructive pulmonary disease is characterized by considerable strain specificity, suggesting the importance of differentiation among strains of bacterial pathogens isolated over time from patients with chronic obstructive pulmonary disease.^{14,15,16} ← **justification**
- *We hypothesized* that the acquisition of a new strain of pathogenic bacterial species in a patient with chronic obstructive pulmonary disease who has no preexisting immunity to the strain leads to an exacerbation. *To test this hypothesis*, we conducted a study in which we obtained sputum samples monthly and during exacerbations in a cohort of patients with chronic obstructive pulmonary disease. Bacterial strains isolated from sputum obtained during periods of stable disease and during exacerbations were subjected to molecular typing. *This report represents the results from the first 56 months of this study.* ← **hypothesis/focus**
- New Strains of Bacteria and Exacerbations of Chronic Obstructive Pulmonary Diseases Sanjay Sethi, M.D., Nancy Evans, R.N., Brydon J.B. Grant, M.D., and Timothy F. Murphy, M.D. NEJM Previous Volume 347:465-471 August 5, 2002

Writing the Discussion and Conclusion



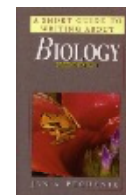
What is the Purpose of a Discussion Section?

- **Summarize findings** presented in the results section
- **Cite supporting literature.**
- **Explain discrepancies** between your findings and previous reports.
- Point out **shortcomings** of your work and define unsettled points.
- Discuss **theoretical and practical implications** of your work.
- End with a short **summary or conclusion** about the work's importance.



Questions You Will Address in a Discussion Section:

1. What did you expect to find, and why?
2. How did your results compare with those expected?
3. How might you explain any unexpected results?
4. How might you test these potential explanations?



Tips for Writing a Discussion Section

“This is the place to interpret your results against a background of existing knowledge. Explain what is new in your work, and why it matters. Discuss both the *limitations* and the *implications* of your results, and relate observations to other relevant studies. State new hypotheses when warranted, clearly labeled as such. Include recommendations, when appropriate.”



More Tips from the UW-Madison Writing Center

Questions to address:	How to address them:
<i>What do your observations mean?</i>	<ul style="list-style-type: none"> • Summarize the most important findings at the beginning.
<i>What conclusions can you draw?</i>	<p>For each major result:</p> <ul style="list-style-type: none"> • Describe the patterns, principles, relationships your results show • Explain how your results relate to expectations and to literature cited in your Introduction. • Explain plausibly any arguments, contradictions, or exceptions. • Describe what additional research might resolve contradictions or explain exceptions.
<i>How do your results fit into a broader context?</i>	<ul style="list-style-type: none"> • Suggest the theoretical implications of your results. • Suggest practical applications of your results. • Extend your findings to other situations or other species. • Give the big picture: do your findings help us understand a broader topic?

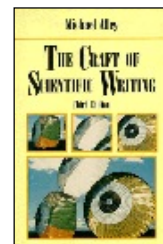
Eight Common Components of a Discussion Section

1. Background information
2. Statement of results
3. (Un)expected outcome
4. Reference to previous research
5. Explanation
6. Exemplification
7. Deduction and Hypothesis
8. Recommendation



What is the Purpose of a Conclusion?

“Besides presenting an analysis of the key results in the conclusion sections, you also give a *future perspective* on the work. In some documents that future perspective might be recommendations. In other documents that future perspective might be a nod to the direction in which your research will head. A third kind of future perspective is to mirror the scope and limitations that you presented in the beginning of the document.”



What are the Pitfalls of a Discussion/Conclusion Section?

- Including **too much information** (wordy arguments, not focused, meandering, etc.).
- **Failure to follow** arguments set up in the **introduction**.
- **Failure to** focus on the **current results**.
- **Speculating** too much or not enough.
- **Improper tense** (Discussion largely in present tense).
- **Hedging** excessively.



Excessive Hedging

“The cause of the degenerative changes is unknown but *possibly* one cause *may* be infection by a *presumed* parasite.”

Rule of thumb: One hedge word per sentence!



Common Hedging Words



nouns	adverbs	verbs
supposition	presumably	appear
idea	probably	postulate
speculation	possibly	suggest
conjecture	apparently	seem
possibility	not unlikely	may be
inference	seemingly	speculate

PNAS Online



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Neurobiology

Cortical auditory signal processing in poor readers

(dyslexia / specific language impairment / auditory cortex / magnetoencephalography / electroencephalography)

Srikantan Nagarajan^{*†‡}, Henry Mahncke[§], Talya Sulz[†], Paula Tallal^{†§}, Timothy Roberts[‡], and Michael M. Merzenich^{*†‡¶}

► DISCUSSION

This study in adults who are poor readers directly demonstrates differences in evoked responses originating from the primary auditory cortex and its immediate environs that correlate with concurrently measured behavioral deficits in the individuation and discrimination of successively occurring stimuli. It demonstrates that in these individuals, there are fundamentally different cortical response dynamics generated by brief stimuli, along with substantially weaker cortical responses to rapidly successive stimuli across the same time-scale over which these individuals exhibited degradation in detection, recognition, and discrimination of rapidly successive simple and complex acoustic stimuli.

▲ TOP
▲ ABSTRACT
▲ INTRODUCTION
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▼ REFERENCES

How do the three aspects of neurological response difference recorded in this study relate to one another? An initial stimulus event appears to generate stronger than normal poststimulus inhibition. Hypothetically, with deeper, prolonged suppression or inhibition, the recovery time governing the capacity of the cortex to respond to a rapidly following input event is lengthened. Along with smaller distributed neural activation evoked by any brief event within a >200-ms time window after the first event, there is a large difference in the distributed response coherence marking the salient features, (e.g., the intrasyllabic sound parts of words) of a multicomponent stimulus in this time domain. Clearly, these findings directly relate to experiments on temporal integration of brief and successive stimuli and to "sensory memory trace" experiments which, to date, have been conducted only in normal subjects (22-38).

The average sensor array coherence reported in this study is a sensor-position independent measure of distributed response coherence (30) that reflects the degree of response synchrony in the underlying neuronal generators of A-1 and its environs. In studies conducted in animal models, it has been shown that complex acoustic events are represented in primary and lay cortex by distributed, strongly temporally coordinated ("coherent") populations of excited neurons (39). Our observation of weaker β_1 and γ

coherence in the β_1 band (but not for higher ISs) in experimental subjects is consistent with the hypothesis that coherence in this frequency range contributes to stimulus discrimination and recognition, and to figure-ground (signal-noise) stimulus distinctions (40), which appear to be degraded in this subject population (41). Interestingly, in contrast to earlier studies that have reported clear peaks within the γ -band in the spectra of individual channels in the range of 20-40 Hz (22), the coherence recorded in this study did not exhibit a peak in the γ -range frequency, in either poor readers or normal controls.

Several behavioral studies on reading-impaired (26) and children have revealed a significant association between reading ability and performance on successive auditory signal recognition. Indeed, in the population of poor readers drawn from the general population in the present study, the greater magnitude and duration of neuronal activation of brief, rapidly successive stimuli, Subjects identified as reading impaired in these studies occasionally fall on the left side of the normal distribution of reading ability and associated auditory signal processing abilities for processing successives (42). Additional studies with larger population of subjects are required to determine whether the neurological responses to successive events also are correlated with reading and auditory processing abilities across the entire human population distribution, as indicated by the earlier psychophysical studies and these initial MEG response studies. It should be noted that we excluded a very small minority of poor readers whose performance on a battery of auditory perceptual tasks (testing abilities to distinguish between, recognize, and recognize rapidly successive acoustic inputs) appeared to be normal. We believe that the neurology of such a class of subjects, which appears to represent ~5-10% of poor reading adults, is very different than that of the larger, main population of reading-impaired individuals.

Although reported differences in successive sound processing are presumably not unidirectionally linked to our experimental and control subject population comparisons, several electroencephalography, brain imaging, and behavioral studies have described phenomena that relate to the current observations. McAnally and Stein (43) have shown that frequency-following field potential responses evoked by modulated acoustic stimuli are weaker in dyslexic than in normal adults. Wilson and colleagues (12) have shown that there is a specific deficit in sentence frequency-modulation rate discrimination at low (200-300 Hz) frequencies that may well reflect a weakness in response to rapidly successive acoustic stimulus events relevant for speech feature representation. Skottner and colleagues (45) have shown that there are differences in the early and late response to brief auditory stimuli presented at short ISIs in language-learning impaired children who perform poorly in an acoustic temporal ordering task. Several investigators have shown differences in spontaneous β_1 - and γ -band power in the electroencephalography signals between adults and children with reading-impaired compared with controls (16, 47). Krauss and colleagues (48) have shown that there are differences in "harmonic regularity" responses 500-600 ms poststimulus, in language-impaired children. Mismatch-negative responses correlated with the ability of these children to differentiate phonemic stimuli, and mismatch negativity was weak or absent in subjects in which phonetic distinctions were not acoustically made. Although the experimental paradigms of the present study differ significantly from these mismatch negativity studies, we have also observed differences in the responses evoked by 50-700 ms after the first stimulus (in short ISIs of 100 and 200 ms) ($P < 0.0001$), that not shown, consistent with the findings of Krauss and colleagues as well as those of other investigators who have shown (40,42,49) that response effects that relate directly to the accuracy of word speech recognition in reading-impaired adults (2,25,50). It should be noted that although earlier events in the evoked responses recorded in our study could be considered as salient in auditory cortex, these later

► CONCLUSION

This study provides further evidence that most reading-impaired individuals have an enduring "deficit" in their cortical processing of brief and rapidly successive inputs, paralleled by a fundamental difference in the fidelity of the processing of detailed features of rapidly successive and rapidly changing acoustic inputs. When coupled with related psychophysical and electrophysiological studies, these data clearly suggest that this abnormal signal-processing "problem," in at least most reading-impaired adults, is lifelong. We emphasize that this demonstration of a cortical entry-level impairment does not rule out the contribution of "top-down" effects on receptive deficits. Differences could potentially arise via top-down effects either from multiple cognitive consequences derived from abnormal language learning and usage or from fundamental deficiencies in attentional or memory resources critical for language development and processing. Nevertheless, because the auditory cortex represents a main gateway for acoustic information entry into the neural speech representational system, these findings strongly suggest that acoustic reception in reading-impaired adults develops with fundamental processing and learning-derived representational forms of complex acoustic inputs like speech that differ substantially from normals. Such representational differences could have widespread consequences for speech and language learning, representation, and usage and for subsequent phonological-orthographic symbol representation in reading.

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► ACKNOWLEDGEMENTS

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Data Set: Annual Deaths in the United States from Substance Abuse, 1988

Tobacco	346,000
Alcohol	125,000
Alcohol & Drugs	4,000
Heroin/Morphine	4,000
Cocaine	2,000
Marijuana	75

Task: Draw three conclusions from these data.