



115th General Meeting | American Society for Microbiology
May 30–June 2, 2015 | New Orleans, Louisiana

WS-06

Effective and High Impact Scientific Writing

Saturday, May 30, 2015, 8:30 a.m. - 4:30 p.m.

New Orleans Ernest N. Morial Convention Center



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Write with your Reader in Mind



- Who are they?
- What do they know?
- Why will they read?



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Word Selection and Use

- Use precise words
- Use power words, minimize hedging words
- Use simple words
- Do not misuse words
- Omit unnecessary words



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Precise Word Choice

Qualitative words that describe magnitude are imprecise and, therefore, of little value when used alone.

Example: Cytokine levels increased markedly.

If you use a qualitative word such as "markedly," quantify it either by citing a figure or a table or by reporting the data in the text. Try to avoid qualitative words completely in the Results section. Save qualitative words for the Discussion, to emphasize the magnitude of a change or a difference.

An actual Reviewer's comment: *After infection, the authors conclude that 5-6% of the cells were GFP +, but with antibody pre-treatment you get a "drastically reduced number". The authors need to define drastically reduced (<1% ??).*



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Precise Word Choice

Example: Ability versus Actuality

Ability: We **could not demonstrate** high-affinity, low-capacity IL-2 receptor binding sites.

"Could not demonstrate" implies that binding sites may have been present, but the technique was not sensitive enough to detect them.

Actuality: **There were no** high-affinity, low-capacity IL-2 receptor binding sites.

"There were no" implies that no binding sites exist (so no method would be able to detect them).



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Precise Word Choice

Example: p53 phosphorylation **did not** increase.

"Did not" implies no expectation

p53 phosphorylation **failed to** increase.

"Failed to" implies an expectation that the value *should* have increased, but didn't.

Unless you have a reason to expect a certain result, you should use the neutral description, "did not increase," when reporting results.



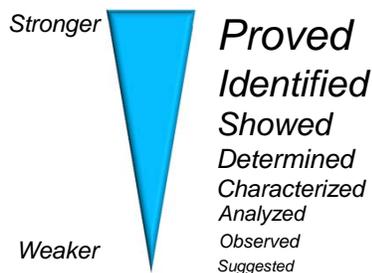
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Effective Use of Power and Hedging Words

Example: The major goal of this study was to observe the effect of radiation on genome stability.

Revised: The major goal of this study was to determine the effect of radiation on genome stability.



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Avoid Over Use of Hedging Words

“Hedging” is a way to protect your arguments or statements from unknown contingencies. It also provides a way to escape from a commitment. However, each use of a hedging qualifier drains force from your sentence. Sometimes the result is a sentence that says nothing at all.

Example: The cause of the degenerative changes is unknown but possibly one cause may be infection by a presumed parasite.

One way of saying “I’m not sure” is usually enough. Try to omit all but one hedging word from a sentence, unless they are needed for accuracy.

Improved: Parasitic infection may cause degenerative changes.



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Commonly Used 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



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Use Simple Words

Example: *There is a large body of experimental evidence that clearly shows that members of the **genus Crotalus congregata simultaneously** in cases of prolonged **decreased temperature conditions** in the **later part of the year***



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Misused Words (Jargon)

Jargon refers to highly specialized technical slang arising from the overuse and misuse of obscure, pretentious or technical words or phrases.

Examples:

significant(ly): use only when referring to statistical significance, and give a *P* value

parameter: reserve this word for its statistical meaning, do not use to mean measurement, value, indicator, or number

Jargon: No pathology was found

Correct: No pathologic condition was found

Others: PCR'd, IP'd, blotted, sac'd, ???



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Difficult Words

Affect is usually used as a verb and means to act on or to influence.

Example: The addition of tetracyclin to the cells did not affect expression of the inducible gene. (it could have been increased, decreased, induced, or something else)

Effect is usually used as a noun meaning result or resultant.

Example: We examined the effect of tetracyclin on the cells.



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Reduce Words to Achieve Brevity

Needless repetition of an idea in a different word, phrase, or sentence should be eliminated. Remove words that do not change the meaning of a sentence.

Examples of Redundant Words; Omit the *red* Italicized Words

continue <i>on</i>	1 a.m. <i>in the morning</i>	<i>positive</i> benefits
refer <i>back</i>	at this point <i>in time</i>	<i>true</i> facts
check <i>up on</i>	collaborate <i>together</i>	large <i>in size</i>
all <i>of</i>	circulate <i>around</i>	many <i>in number</i>
<i>true facts</i>	<i>end</i> result	red <i>in color</i>
enter <i>into</i>	<i>mandatory</i> requirement	repeat <i>again</i>
face <i>up to</i>	<i>new</i> beginning	<i>past</i> history
count <i>up</i>	<i>optional</i> choice	<i>complete</i> stop
five <i>in number</i>	prioritize <i>in order of importance</i>	<i>in order</i> to



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Brevity - Replace Overused Words and Phrases

Instead of	Use
at this point in time	now
due to the fact that	because
employ, utilize	use
high degree of accuracy	accurate
implement	do
in the event that	if
method	way
oftentimes	often
plethora	excess
due to the fact that	due to
prior to	before
retard	slow
subsequent to	after
a considerable number of	many
based on the fact that	because
has the capability of	can
It is interesting to note that	<i>omit</i>



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Brevity - "It ... that" Phrases that can be Replaced

Phrase with Empty Fillers	Shorter Equivalent
It would thus appear that	Apparently,
It is clear that	Clearly,
It is remarkable that	Remarkably,
It is a surprise to us that	Surprisingly,
It is considered that	We think
It is this that	This
It is possible that the cause is	The cause may be
In light of the fact that	Because
It is often the case that	Often
It is interesting to note that	<i>omit</i>
It is not impossible that	<i>omit</i>
A not unlikely cause could be that	<i>omit</i>
It seems that there can be little doubt that	<i>omit</i>
In order to	<i>To</i>

The Definite Article "the"

Should precede specific nouns (i.e., nouns that are defined or unique). For example,

Look at **the** moon.

80% of **the** children in this age group...

The states included in this report...

The vehicles of people convicted of alcohol-impaired driving...

Should **not** precede proper nouns and most nonspecific nouns.

Mercury and Venus do not have moons.

Children are more prone to ear infections than adults.

Proper Use of “the”

How should “the” be used in this sentence?

In desert regions of California, local populations of this long-lived mammal are often less than 50 individuals. Restricted largely to steep, rocky mountain ranges that are scattered across the region, these populations are demographically independent and naturally fragmented by intervening desert.



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Use Powerful Verbs

Instead of	Use
Make an examination of	examine
Present a comparison of	compare
Be in agreement	agree
Perform an analysis of	analyze
Produce an improvement in	improve

Verbs describe actions, states, or occurrences. To give a clause its full strength and keep it short, do not bury the action, state, or occurrence in a noun (typically combined with a weak verb).

Example: The catalyst produced a significant increase in the conversion rate.

Improved: The catalyst increased the conversion rate significantly.

Assembling Words into Sentences

- 👤 *Use the first person*
- 👤 *Use active voice and active verbs*
- 👤 *Use of past and present tense*
- 👤 *Avoid noun clusters*
- 👤 *Use clear pronouns*
- 👤 *Use correct parallel form*
- 👤 *Avoid faulty comparisons*
- 👤 *Avoid errors in spelling, punctuation, and grammar*

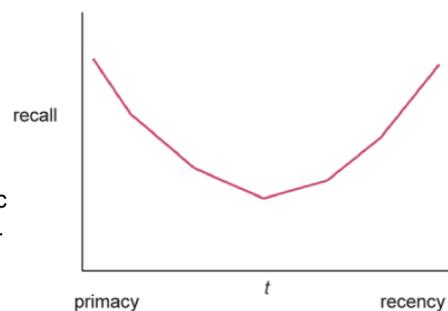


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The Serial Position of Free Recall

Recall is highest at the beginning (primacy) and the end (recency) of an experience (e.g., reading a discrete block of text). This has obvious implications for the positioning of new and important information in a scientific abstract, paragraph or even entire text.



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Active Voice

Readers expect words to appear in a standard order; subject... verb... object

Expected order of action (easy to read) – Active: *The cells expressed IL-6.*

Inverted order of action (difficult to read) – Passive: *IL-6 was expressed by the cells.*

The heavy use of passive voice in scientific writing results in a large number of inverted sentences. Whenever possible, change sentences back to the expected order. This will also usually result in shorter sentences.

Passive: *The phenotype was exhibited by knockout mice.*

Active: *Knockout mice exhibited the phenotype.*



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Active vs. Passive Voice

Vague Passive Phrasing

It is recommended by the authors of the present study that ...

The data, which were obtained by Salk, were probably indicative of. . .

The following results were obtained ...

It was discovered that a sustained coordinated effort will be required ...

Active Precise Wording

We recommend ...

Salk's data probably indicate ...

We obtained the following results ...

We need a sustained coordinated effort.



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Verb Tense

When scientific knowledge has been published in a primary journal it becomes standard knowledge and should be referred to in the present tense.

Examples:

*The investigations of Graff (2002) show that the structure is a true icosahedron.
This phenomenon determines the absorption coefficient of the tissue.*

Section	Purpose	Tense
Abstract	Primarily refers to the author's unpublished results	past
Introduction	Emphasizes previously established knowledge	present
Methods	Describes what the author did and found	past
Results	Describes what the author did and found	past
Discussion	Discusses the relationship of the author's work to previously established knowledge	past and present

Verb Tense

Use **present perfect tense** when observations have been repeated or continued from past to the present

Leptomycin B has been shown to block CRM1 dependent nuclear export.

Use **past tense** for observations, completed actions, and specific conclusions. Numerical data often fit into this category.

Barber (2001) reported that 28 of the 396 mice in his study developed tumors.

Use **past tense** for unpublished results.

*In the current study, the drug killed 95% of the *M. tuberculosis* bacilli.*

Use **present tense** for generalizations and statements of general validity (i.e to refer to the data in your figures and tables).

Figure 3 illustrates the 60-fold increase in promoter activity following transfection.

Verb Tense

It may be necessary to vary the verb tense in a single sentence.

For example, it is correct to say:

In 2012 White demonstrated that XYZ cells grow at pH 6.8.

Figure 2 shows that ABC cells failed to grow at room temperature.

Air was removed from the chamber and the mice died, which proved that the mice require air.

When reporting statistics and calculations, it is correct to say:

The values for the ABC cells are statistically significant, indicating that the drug inhibited apoptosis.

Avoid Long Strings of Nouns and Adjectives

Pairs of nouns and adjectives add variety and flexibility to written English. However, when strung together, too many of them create confusion for the reader.

Example:

Five two week old white Balb/C specific pathogen free mice were inoculated with approximately 10^5 tissue culture infectious doses of adenovirus type 9.



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Use Clear Pronouns: “This” and “These”

Do not misuse the demonstrative pronouns “this” and “these”. Beginning a sentence with either word used as a noun is confusing because pronouns like “this” or “these” need antecedents (the noun they replace), and it is difficult to have a clear antecedent at the beginning of a sentence.

Example: This means the data are inconclusive.

Better: This analysis means the data are inconclusive.

Consider the following: We suggest cessation of treatment initiates a reduction in antibody production and an increase in white blood cell counts, but this is not sufficient to cause remission. (“This” can refer to either cessation of treatment or reduction in antibody production or increase in white blood cell counts).



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Use clear Pronouns

Our study for the first time identified elevated circulating IL-33 levels in patients with eosinophilia. However, on comparing IL-33 levels with previous eosinophilia-related markers and CRP levels, we found that IL-33 levels were less reliable for detecting PE or for the resolution of an eosinophil-mediated immune response and indicators of disease activity of IAEP. Further studies are required to identify the individual levels of each IL-33 form (full-length pro-form and cleaved forms) or inactive IL-33 by sST2 binding. Plasma ECP levels presented higher PE detection rates than other markers, and its progression correlated with clinical improvement ^{Q3} of patients with IAEP. The ECP trends in this study were similar to findings of previous studies of eosinophilic disease.⁵⁻⁷ The data presented here strongly support the use of ECP, rather than IL-33, as a marker of PE and IAEP activity.

Q3 | Please clarify what is meant by “its.” Should “its” be changed to “their,” meaning plasma ECP levels?



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Parallelism

Parallel ideas are equal in logic and importance.

Examples of parallelism include ideas that are joined by "and," "or," or "but", as well as ideas that are being compared.

Parallel ideas should be written in parallel form; the same grammatical structure for two or more parallel ideas.

The form of the first idea prepares the reader for the form of the next idea. As a result, readers can concentrate all of their attention on the ideas, not on the form.

Example: Contrasting ideas Joined by "but"

<u>IL-6 levels</u>	decreased	by 20%	but
<u>IL-2 levels</u>	decreased	by only 10%.	
<i>subject</i>	<i>verb</i>	<i>prepositional phrase</i>	

In this example, the group of words after "but" is in the same grammatical structure as the group of words before "but": (subject, verb, prepositional phrase).



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Parallel Lists

Parallelism allows you to avoid repetition

Example: Pulse rate decreased by 40 beats/min, systolic blood pressure declined by 50 mmHg, and cardiac output fell by 18%.

Revisions: Pulse rate decreased by 40 beats/min, systolic blood pressure by 50 mmHg, and cardiac output by 18%.



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Comparisons

Overuse of "compared to,"

In comparisons containing a comparative term, such as "higher," "greater," "lower," "less," the accompanying term should be "than," not "compared to."

Example: We found a higher K_D at 37° C compared to 25° C.

Revision: We found a higher K_D at 37° C than at 25° C.



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Comparisons

Comparison of unlike things ("apples and oranges")

Example: These results are similar to previous studies.

Revision:

These results are similar to the results of previous studies.

These results are similar to those of previous studies.

Example: The lungs from *Antxr2*^{-/-} mice resembled *Antxr1*^{-/-} mice.

Revision: The lungs from *Antxr2*^{-/-} mice resembled those from *Antxr1*^{-/-} mice.

Note: "That" or "those" can often be used to avoid repeating the noun.



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Comparisons

Absolute statements disguised as comparisons.

Example: This medium contains 4-5 mM phosphate compared to Schneider's medium

Actually, this medium contains about 4-5 mM phosphate regardless of the phosphate concentration in Schneider's medium. The concentration is an absolute value and does not depend on any other concentration.

Revision: This medium contains 4-5mM phosphate, while Schneider's medium contains 9-10 mM phosphate.



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Punctuation

Punctuation should be almost automatic.

If you are having difficulty punctuating a sentence, you probably have created a sentence that will be difficult for readers to understand.

Reduce use of colons and semicolons except to separate items in a series with internal commas.

Example:

All animals were evaluated for the following: (i) changes in body weight, food consumption, and physical activity; (ii) blood serum chemistry, coagulation, and white blood cell counts; and (iii) the production of anti-drug antibodies (ADA) on study days 30, 58, and 86.



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Which and That

A phrase introduced by “that” is restrictive and cannot be omitted without changing the meaning of the sentence.

Such essential material must *not* be set off by commas.

Example: *Animals that were treated with antibiotics recovered.*

A nonrestrictive phrase adds information, but does not limit what it modifies.

Because it can be omitted without changing the meaning, it is set off by commas.

“Which” should be used to introduce a nonrestrictive phrase.

Example: *The cells, which came from six different labs, did not express IL-6.*



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Readability - Sentence Length

Optimal sentence length for most scientific documents is 15 – 20 words, but variation in sentence length and complexity helps to sustain reader interest.

If two parts of a long sentence contain loosely, or unconnected thoughts, they should be split into two separate sentences

Example:

An overly long sentence with weak connections: Exposed mice developed enteric disease and exhibited 21% mortality during the first 3 weeks but controls had no enteric disease and exhibited no mortality; 20-day-old exposed mice weighed 0.6 g less than controls and had a higher incidence of angular limb deformities and also had a greater incidence of rotated tibias and showed bowed tibias, while controls had a significantly higher measurement for tibial shear strength. (69 words in 1 sentence)



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Separated at weak connections, then edited for wordiness: Exposed mice developed enteric disease with 21% mortality during the first 3 weeks. Controls exhibited neither enteric disease nor mortality. At 20 days, exposed mice weighed 0.6 g less, had a higher incidence of angular limb deformities, and rotated and bowed tibias, and showed significantly less tibial shear strength than did controls. (44 words in 3 sentences; average 18 words per sentence)



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Assembling Sentences into Paragraphs

- Organization
- Consistent order
- Consistent point of view
- Continuity and cohesiveness
- Linking key words
- Transitions
- Write concisely



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Paragraph Organization

A paragraph should express a single, clear idea. It should provide sufficient background information to place the idea in perspective, and supporting facts to justify the idea.

Provide an overview first, and then give details; that is, create an expectation and then fulfill it.

Should be organized

Should have continuity

Should emphasize important information

Organization

Give overview first, in a topic sentence. Introduce key term(s).

Give details, in logically organized supporting sentences

Do not omit any steps in the logic



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Use Consistent Order

Parallel form should be used not only at the sentence level, but also at the paragraph level and throughout the entire paper.

If you list items in a topic sentence and then describe them in the paragraph, use parallel form and keep the same order.

For example: If the items in the topic sentence are “viruses”, “bacteria” and “fungi”, the remaining sentences of the paragraph should first explain “viruses”, then “bacteria”, and last “fungi”.



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Consistent Order - Example

In response to a foreign macromolecule, five different immunoglobulins can be synthesized: **IgG**, **IgM**, **IgA**, **IgE**, or **IgD**. **IgG** is the main immunoglobulin in serum. **IgM** is the first class to appear following exposure to an antigen. **IgA** is the major class in external secretions such as saliva, tears, and mucus. Thus, **IgA** serves as a first line of defense against bacterial and viral antigens. **IgA** is transported across epithelial cells from the blood side to the extracellular side by a specific receptor. **IgE** protects against parasites. The role of **IgD** is not known.



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Create Paragraph Continuity

Example:

Yersinia contains several **species**. The cause of bubonic plague, also known as the “black death”, is one **species**, *Y. pestis*

Improved:

Yersinia contains several **species**. **One species**, *Y. pestis*, is the cause of bubonic plague, also known as the “black death”.

Building the improved version into a paragraph:

Important pathogens can be found in the genus *Yersinia*. *Yersinia* contains several **species**. **One species**, *Y. pestis*, is the cause of bubonic **plague**. The **plague** bacillus infects lymph nodes near the site of infection.



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Linking Key Words

Repeat key words exactly and early!

Example: *Digitalis increases the contractility of the mammalian heart. This change in inotropic state is a result of changes in calcium flux through the muscle cell membrane.*



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Linking Key Words

What are the keywords in this example?

We determined whether the increased endotoxin susceptibility of Auf^{-/-} mice is due to deregulation of proinflammatory cytokine expression. We measured the serum TNF level in Auf^{-/-} mice after LPS challenge.



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Use Transitions in Paragraphs

Use transition words to connect ideas within a paragraph. For example:

First...	Next...	Alternatively...	In contrast...
Second...	Then...	Subsequently...	In addition...
Third...	Similarly...	For this purpose...	Therefore...
But...	And...	However...	Because...



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Effective use of Transitions

Short but choppy, difficult for reader to see relationship between sentences:

MDA-231 cells secrete a TGF- α -like activity. They contain no classical 6-kDa TGF- α . They synthesize a 30-kDa protein which binds to the EGF receptor. The EGF receptor mediates TGF- α activity.

Long but smooth, easy for reader to see relationship between sentences:

MDA-231 cells secrete a TGF- α -like activity, **but** they contain no classical 6-kDa TGF- α . They **do, however**, synthesize a 30-kDa protein that binds to the EGF receptor, **the receptor that** mediates TGF- α activity.

Clarity over brevity in this case!



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Limit Average Paragraph Length

Paragraph length and complexity influence readability.

A paragraph length of ~150 words is optimal for most scientific articles.

Paragraphs consistently composed of <50 words create a text that is too choppy.



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Readability Statistics

Word 2007: *Tools > Options > Spelling and Grammar > Show Readability Statistics*

Word 2010: *File > Help > Options > Proofing > When correcting spelling and grammar in Word > Show Readability Statistics*

When the readability box is checked, these statistics will appear after you complete a spell check

Readability Statistics	
Counts	
Words	9452
Characters	54859
Paragraphs	90
Sentences	349
Averages	
Sentences per Paragraph	6.0
Words per Sentence	26.6
Characters per Word	5.5
Readability	
Passive Sentences	15%
Flesch Reading Ease	19.9
Flesch-Kincaid Grade Level	15.4
OK	



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Writing the First Draft

- Prewriting
- Journal Selection
- Getting Organized
- Authorship
- Organization and Outlines
- Building and Keeping your Momentum



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Divide the Writing Process into Stages

1. Prewriting



2. Write the First Draft



3. Revise, Revise, Revise



4. Edit



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Prewriting

- Collect all data
- Collect reference material
- Decide on intended audience
- Choose the Journal
- Decide on authorship
- Organize your thoughts



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Journal Selection

- Journals that commonly publish work in this area.
- Impact factor.
- Type of article (research paper, review, case report, etc.).
- Speed of review and publication.
- Page charges.
- Is the expected size (length) of the paper appropriate for this journal?
- When in doubt, email, write or call the editor of the journal and ask whether they will consider a manuscript of the type, subject area, and length that yours is expected to be.
- When you choose a journal, use Instructions to Authors (ITA) to guide your writing.



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Who should be an Author?

Agree on authorship as early in the writing process as possible.

The order of authors implies the relative contribution of each author.

Visibility – only the first 2 or 3 names may be seen in citations.

Co-first-authorship.

The first author typically, but not always, writes the paper.

Authors usually include those who performed the work, made significant intellectual contributions, and/or wrote the paper. All authors should be able to discuss the work and take responsibility for the content.

Individuals whose role is solely to collect data are not usually included as authors.

Some Instructions-to-Authors require each co-author to sign a statement that they have contributed significantly to the paper, understand it, and endorse it.



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Writing the First Draft - Organization

Organizing your thoughts at the outset will save time in the long run and will result in a more effective document.

Organization has both thinking and writing stages.

Outlines are the most widely know methods of organization but there are others.

If it helps you to work from an outline, whether short and simple or long and complex, do so.

If you cannot work from an outline, do not, but do have some idea of what you want to say before you start to write, especially in the Discussion.



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Getting Organized

Collect the abstract of every article that you might need.

Develop an organization system for these articles.

Take notes... write your notes directly on the article or on a separate piece of paper.

It is helpful to write key points of relevance at the top of the front page of each article.

Write the full journal source on each copied article if it is not visible on the front page.



Patterns for Organizing Material

Pattern	Basis
Chronological	Sequence in which something happens
Geographical or spatial	Physical arrangement of entities
Functional	How parts work
Importance	Usually with elements of decreasing importance
Possible Solutions	From least to most likely/best, or building to a climax
Specificity	General to particular or particular to general
Complexity	Usually from simple to complex
Pro and Con	Presenting both sides of an issue or decision
Causality	Cause and effect



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The Approach to Writing

Lay out the major sections of the paper first.

One page for the title, one page labeled Abstract, the next labeled Introduction, and so on through Methods, Results, Discussion, References, and Figure Legends.

The title page is typically easy. Even if you are not sure of the exact title, decide on a "working" title. Refer to the Instructions to Authors of the Journal you are targeting for the specific content and layout of the title page.

Write quickly and get your ideas on paper. As new ideas pop into your mind related to another section, make a note of them in the appropriate section as you work.

Don't worry about whether your subjects and verbs agree or whether your paragraph has a topic sentence. These things can be fixed during revisions.



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Building and Keeping Momentum

In scientific writing, each sentence depends on those around it and on other sections of the paper. Therefore, you must sustain momentum when writing your first draft or you'll lose your train of thought!

Set realistic goals. This may be 1 page or 5 pages, but you want to end each session with a sense of accomplishment.

End each writing session by writing into the next session. It will be easier to start writing again and will help you maintain your momentum and train of thought.

Store work from each session under a new file name.

Minimize distractions.

Don't get stuck searching for the right word or phrase. Leave blanks to fill in later.

If you become bogged down with a particular section, start working on another section.



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Start Typing

Reserve a block of time for writing (3-4 hours every day for 4-5 days).

Write when your energy is high, not when you are tired or distracted.

Surround yourself with everything you need to write effectively.

data, drafts of figures and tables, references, computer or paper, coffee...

Work in a quiet place where you will not be interrupted.



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Parts of a Scientific Manuscript



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The Title

A short phrase. Rarely a complete sentence.

Purpose: The title conveys the key points of your study to a reader glancing through a citation index, database, table of contents, or references page.

-  Accurately, completely, and specifically reflect the paper.
-  Be clear, informative, and detailed, but not contain unnecessary details.
-  Contain key words that define your topic.
-  Emphasize subjects or findings that are unique to your study.
-  Entice the reader to read more.
-  Avoid humor (intended or unintended), two-part titles, trivial phrases (“Notes on...” or “A Study of...”).
-  When writing the first draft any title will suffice, you can revise it later.



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Examples of Titles

Too Vague:

Effects of pH on the Growth of Bacteria

Revision:

Effects of pH Variance on Growth of Pseudomonas aeruginosa

Too Detailed:

Effects of pH Variance from 4.0 to 9.0 on the Growth of Prokaryotic Pseudomonas aeruginosa Bacteria (strain142) in Minimal Media under Aerobic Conditions

Revision:

Acidic pH Increases the Growth Rate of Pseudomonas aeruginosa



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Titles – Keywords, Emphasis and Impact!

- 🎯 Evaluation of a new treatment for MERS-CoV Infection
- 🎯 Evaluation of Interferon- α 2b and Ribavirin Treatment of MERS-CoV-infected Rhesus Macaques
- 🎯 Interferon- α 2b and Ribavirin Treatment Improves Outcome in MERS-CoV-infected Rhesus Macaques



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Start with the Question and the Answer

- Formulate your question and your answer before you start writing. They will dictate what to include in your paper and what to leave out.
- The question, and its answer, must be stated in single sentences.
- Knowing the question and the answer will help you organize the data presentation and the rationale of your arguments.
- Do not be concerned if you decide to make changes to the question or the answer during the writing process. An benefit of writing a paper is that you often discover your answer in the process.



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The Abstract

A condensed version of a document, written for people who may never read the complete version.

Purpose: The summary conveys the relevance of the topic to the reader, and summarizes the approach to answering the question, major supporting data, and major conclusions reached by performing the study. It should entice the reader to read further.

Must stand on its own, without the text.

The summary should never repeat exact sentences from your text.

Generally 100 – 250 words in length, one paragraph, check *ITA* for specific rules.



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Continuity in the Abstract

To provide clear continuity throughout the Abstract:

Repeat key terms.

Signal parts of the abstract both visually (by starting a new sentence) and verbally (by using a signal word or phrase) at the beginning of the sentence.

Avoid abbreviations and reference to figures or other information in the text. In most cases, avoid citation of other literature.



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Abstract - Overall Organization

Topic	Signal
Background (if any)	
Question	To determine whether... Therefore, we asked whether....
Experimental Approach	To answer this question we.... To test this hypothesis we....
Results	We found... The results showed...
Answer	We conclude that.... Therefore....
Implication-Speculation-Significance	These results suggest that....



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Example Abstract

PHOSPHORYLATION OF HISTONES BY TISSUE TRANSGLUTAMINASE*

Suresh Mishra¹, Ali Saleh¹, Paula S. Espino², James R. Davie³ and Liam J. Murphy^{1,3}
From the Departments of Physiology¹, Biochemistry and Medical Genetics² & Internal Medicine³, University of Manitoba, Winnipeg R3E 0W3 Canada

Running Title: Histone phosphorylation by TG2.

Address correspondence to Liam J. Murphy, Room 843, John Buhler Research Centre, University of Manitoba 715 McDermot Ave., Winnipeg MB R3E 3P4. Tel.: No: (204) 789 3779; Fax: (204) 789 3940; Email: ljmurph@cc.umanitoba.ca

Background	Tissue transglutaminase (TG2) has recently been shown to have intrinsic serine/threonine kinase activity. Since histones are known to be cross-linked by TG2 we investigated whether histones are also substrates for TG2 kinase activity. TG2 was able to phosphorylate H1, H2A, H2B, H3 and H4 histones <i>in vitro</i> . Using peptide substrates and phosphospecific antibodies we demonstrated that TG2 phosphorylated Ser10 in H3 and that this phosphorylation was reduced by acetylation whereas phosphorylation of Ser10 by TG2 enhanced acetylation. Furthermore we demonstrated that exogenous TG2 phosphorylated H1 and H3 in nucleosome preparations. We examined the abundance of TG2 in DNA-associated proteins from MCF-7 cells treated with phorbol ester (TPA) and estradiol (E2). TG2 abundance was significantly reduced in E2 treated cells and enhanced in TPA treated cells. In summary we have demonstrated that TG2 is able to phosphorylate purified histone proteins, and H3 and H1 in chromatin preparations, and it is associated with chromatin in breast cancer cells. These studies suggest a novel role for TG2 in the regulation of chromatin structure and function.	serine/threonine kinase (4). It is localized to many compartments in the cell including the cell membrane, the cytoplasm and the nucleus (1). TG2 is involved in a multitude of cellular process of which the best studied is apoptosis where it is responsible for the formation of apoptotic bodies.
Question		
Experimental Approach		
Results		TG2 is translocated to the nucleus by a mechanism that involves importin- $\alpha 3$ (5,6), where it can crosslink histones (7,8). Crosslinking of the core histone subunits, H2A and H2B, by TG2 appears to involve glutamine and lysine residues at C-terminal domain (9). Histone H1 has also been shown to be a substrate for TG2 (9). Histones bind in a sequence-independent manner to DNA to form chromatin. They are subject to extensive post-translational modification that appears to be important in regulating chromatin function. For example, the amino terminal tails of histones can be both phosphorylated and acetylated and these modifications are thought to regulate chromatin structure to facilitate transcription, DNA replication, mitosis and DNA repair.
Answer		
Significance		Histone crosslinking by TG2 may be responsible for the changes in DNA function such as transcription and replication (11) although the exact molecular mechanisms

Introduction

Nearly all scientific documents have an introductory background section that presents work in the field, the current state of the field, the gap in knowledge, a rationale for the current study or report and conclusions/recommendations/significance to be drawn.

Ensure that you include all information necessary to put your text into the broader context of scientific knowledge.

Use signals, specific words, and phrases to indicate the purpose of the section.

Topic Sentence

The topic sentence is usually the first sentence of the paragraph. It introduces the topic of the paragraph.

The topic sentence of the first paragraph begins your text on general terms and engages your reader's interest.



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Introduction - Previous Studies

Several paragraphs that briefly develop a condensed history of previous studies that your work challenges or extends. Do not exhaustively review the literature, but do discuss and reference relevant previous work.

Purpose: To provide context and significance for your work. Also, to show that you are well-versed in the topic and appropriately know the literature.

Introduction

The p53 tumor suppressor gene has been called the 'guardian of the genome' due to its ability to induce several responses within the cell to maintain genomic stability. To maintain the genomic stability of the cell, p53 functions as a sequence-specific transcription factor that regulates the expression of downstream genes required for cell cycle arrest or apoptosis (Vogelstein *et al.*, 2000; Vousden and Lu, 2002), ultimately preventing damaged DNA from further replication...

... The interaction of histone acetyltransferases with p53 is further enhanced by phosphorylation of serine residues within the N-terminus of p53. Together, these post-translational modifications of p53 result in a phosphorylation/acetylation cascade further enhancing p53 activity (Sakaguchi *et al.*, 1998). Several studies have also shown that the type of post-translational modification may play a role in determining which downstream pathway is initiated by p53. For example, the apoptotic pathway has been shown to be dependent on phosphorylation of p53 at serine 46, while cell cycle arrest is not dependent on serine 46 phosphorylation (Oda *et al.*, 2000).



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Background → Gap in Existing Knowledge

A few sentences should state the gap in existing knowledge of the topic and relate the context to your work or argument.

Purpose: To smooth the movement of your introduction from the general history to information specific to the rest of your text. Connect the context directly to your work.

which downstream pathway is initiated by p53. For example, the apoptotic pathway has been shown to be dependent on phosphorylation of p53 at serine 46, while cell cycle arrest is not dependent on serine 46 phosphorylation (Oda *et al.*, 2000).



Although most of our knowledge about regulation of p53 function is at the protein level, transcriptional regulation of p53 gene expression during the cell cycle has long been known to occur but has been characterized to a far less extent. In the absence of a DNA-damaging agent, growth-arrested mouse fibroblasts or normal nondividing human B lymphocytes naturally arrested in G₀ have been shown to re-enter the cell cycle



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Background - Hypothesis or Overall Conclusions

The last sentence is nearly always your hypothesis, which is the main objective, prediction, or question you hope to answer. The introduction may also end with a statement of the overall conclusions of the paper. A “mapping” section may also be included to inform the reader of what they will find in the rest of the paper.

Purpose: To pose the question or problem that your text will address; also to show the reader what to expect in the rest of the paper.

expressed due to the absence of a positive regulator, H0XA5, which normally induces transcription of the p53 gene (Raman *et al.*, 2000). Therefore, understanding the factors that regulate p53 transcription will provide insight into the relationship between p53 expression during the cell cycle and its deregulation during oncogenic transformation.

The focus of this work is aimed at deciphering how p53 mRNA levels are regulated during the cell cycle in response to mitogen stimulation. In characterizing an additional 1000bp of upstream DNA sequences, we have identified one positive and two negative regulatory elements. At one element, approximately 960 bp upstream from the transcription start site, we show binding of a *trans*-acting factor, that appears to be a member of the C/EBP family of transcription factors, to the p53 promoter in a cell cycle regulated manner.



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Materials and Methods

Purpose:

Readers use the Methods section to determine whether sufficient analytical methods were used to make the results meaningful.

Serves as a historical marker, denoting the technology available at the time.

Provides readers with a way to test your results; they should be able to reproduce the results you obtained by following your methods.

What Should Be Included in the Methods?

Names of chemicals, instruments, and special equipment used.

Should provide a step-by-step procedure. Sometimes a diagram of an apparatus or a flowchart of the procedure can be used to clarify complicated methods.

Omit details of well known methods that have already been reported; cite a reference.

Briefly describe methods that have been reported but are less well known, and cite a reference.



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Information to Include in Methods Section

Names	Measurements	Descriptions
Chemicals	Concentrations	Procedures
Procedures	pH	Statistical analysis
Special equipment	Temperature	Instruments
Equations	Wavelength	Study Sites:
Instruments:	Time intervals	Topography
Model #	Number of samples	Vegetation
Manufacturer	Volumes	Climate
	Weights	Ecology

Necessary Information: There should be enough detail that a scientist in the same field could reproduce the experiment or study and obtain the same results.

Unnecessary Information: Omit unnecessary details that distract the reader and waste space. These include names that are vague, unofficial, or names of typical laboratory equipment (gloves, stirrers, pipettes, balances).

Measurements of amounts where concentrations suffice are unnecessary.

Descriptions of items or procedures that are common knowledge are also unnecessary.



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Results

Purpose: To present the data and develop a convincing case that the results answer the question posed by your study.

Subheadings signal topics of subsections visually. Topic sentences and transition phrases or clauses at the beginning of subsections and paragraphs signal topics verbally.

For studies in which the results of one experiment determine what the next experiment will be, the story consists of a repeated four-part pattern:

- Question
- Experiments
- Results
- Answer

Words such as 'We found' signal the results.

Most figures and tables are used in the Results.

Refer to specific Figures and portions of Figures.

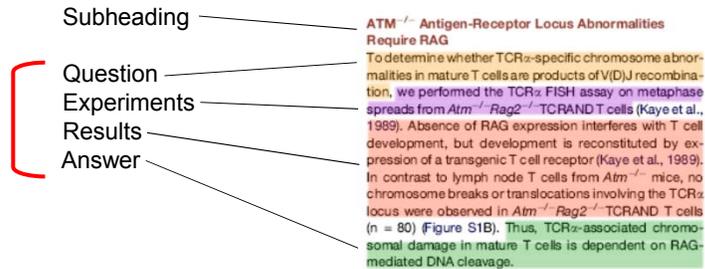


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Results – Example 1

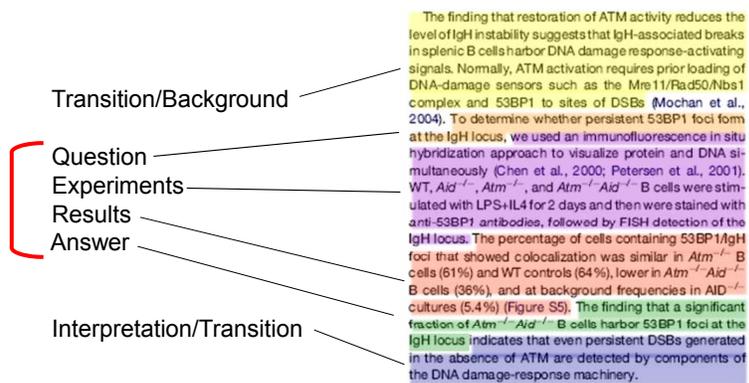
For studies in which the results of one experiment determine what the next experiment will be, the story consists of a repeated four-part pattern:



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Results – Example 2



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Figures and Tables

- Together, the figures and tables should tell the story of your paper.
- Omit nonessential figures and tables and nonessential data.
- Do not present the same data in both a figure and a table.
- Each figure and table should be simple, with a clear point.
- Figures and tables should be as parallel as possible in design.
- Minimize repetition between the text and the tables
- Figure legends and footnotes of tables should contain sufficient information to make the figure or table understandable without reference to the text.
- Use large size fonts that will be legible when reduced to publication size, but minimize the use of text in figures.
- Optimize the layout and space requirements of each figure.



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Presenting Data Effectively

Flow Diagram – pathways, procedures

- Emphasizes concepts
- Eliminates unnecessary words

Tables – quantitative data

- Use a title
- No figure legend
- May use footnotes

Line Graphs – shows trends

- Many points for one variable
- Often used for concentration or time dependence
- Symbols must be clearly distinguishable from the line and from each other
- May use different colors if comparing multiple relationships (but check whether journal accepts color figures and what costs are)
- Use different colors if comparing multiple relationships

Histograms – testing only a few conditions

- Compares different conditions

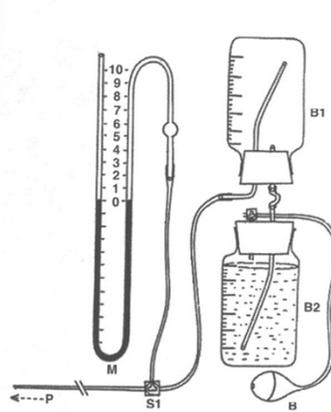
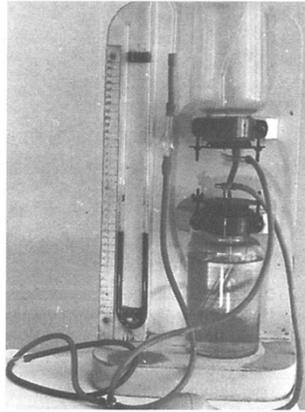
Visual Data – autoradiograms, gels, photographs (cells, EM, *in situ* hybridization)



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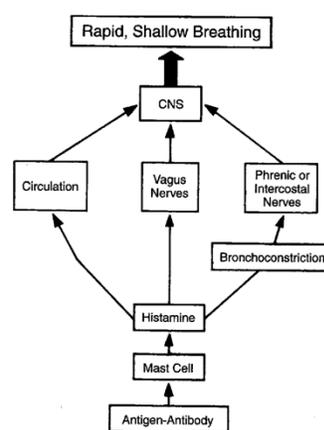
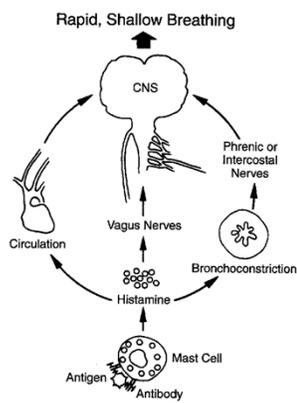
Which Figure is the Most Useful?



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Which Figure is the Most Useful?



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How Would You Optimize This Figure?

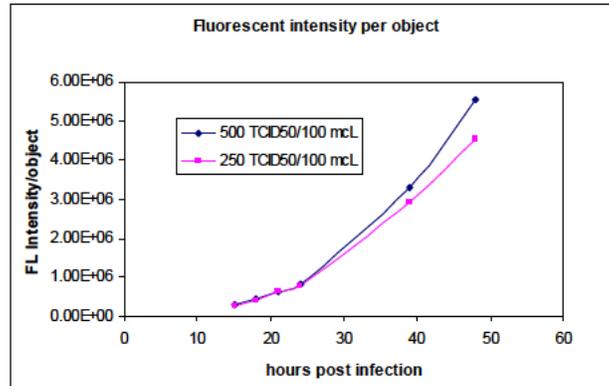


Figure 2. Fluorescent intensity per foci increases slowly during the early stages of virus infection when new foci are formed. After 24 hpi the fluorescence per foci increases substantially ending with almost 6-fold increase from 24 to 48 hpi.



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Improved Figure and Figure Legend

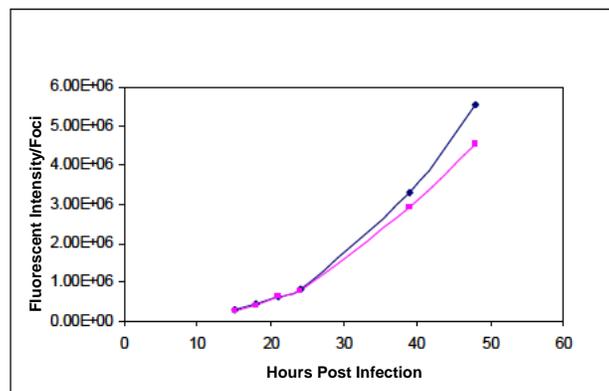


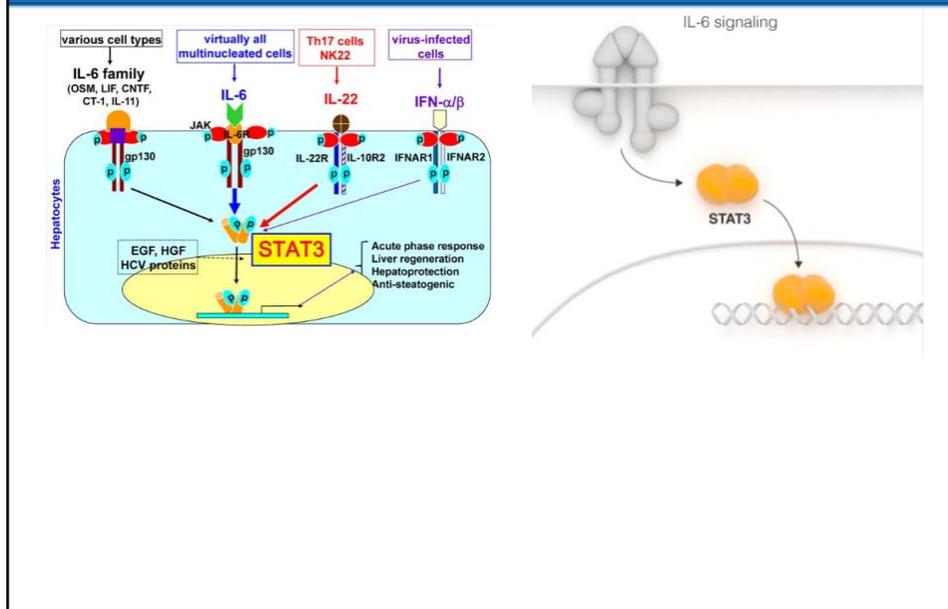
Figure 2. Post infection, fluorescent intensity per foci increases over time. Infection concentrations: 250 TCID₅₀/100 µL (pink line); 500 TCID₅₀/100 µL (blue line).



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Figures – Clarify your Message!



General Guidelines for Figure Legends

- Give enough information that the reader can understand the figure without referring to the text of the article.
- State briefly the message you wish the reader to receive (the most important finding evident in the figure).
- State original magnification and stain, if applicable.
- Define abbreviations and explain symbols used in the figure
- Name the method used; describe the method in detail only if that is the journal's style.
- Keep the legend as short as possible.
- Put the legends for all figures on separate pages, not on the figures



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Discussion

The primary purpose of the discussion is show the relationship among observed facts.

Specifically:

Present the principles, relationships, and generalizations shown by the *Results*

Point out any exceptions or any lack of correlation and define unsettled points

Show how your results and interpretations agree (or contrast) with previously published work

Discuss theoretical implications of your work as well as any possible practical applications

Summarize your evidence for each conclusion.



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Structuring Your Discussion - A

Summarize the study and the main results

Interpret the results and suggest an explanation for them

Describe how the results compare with what is known about the problem;
review the literature

Suggest how the results might be generalized

Discuss the implications of the results

State the limitations of the study

List the conclusions



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Structuring Your Discussion - B

The British Medical Journal (BMJ)* instructs authors to structure the discussion as follows:

- Principal findings
- Strengths and weaknesses of the study
- Strengths and weaknesses compared to other studies, discussing particularly any differences between results
- Meaning of the study: possible mechanisms and implications for clinicians or policymakers
- Unanswered questions and future research

**The case for structuring the discussion of scientific papers. 1999. BMJ 318:1224-1225.*



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References

Every reference in the text must be in the reference list.

Every reference in the reference list must be in the text.

Every reference must say what you claim it says.

Have a sufficient number of references to accurately give credit to the work of others and to direct readers to sources of further information.

All discussion of previous work or ideas of others **MUST** be referenced.

References must be formatted as described in the ITA.



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Plagiarism

What is Plagiarism?

Plagiarism is a form of intellectual theft and intellectual fraud.

Representing the words of others as your own.

Presenting the intellectual work of others as your own. This includes ideas, not just words.

Avoid Plagiarism www.ithenticate.com

Give credit where credit is due.

You are not expected to include only original ideas in your writing.

You are expected to know and reference the literature.

Failure to cite accurately may constitute plagiarism.



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