

Plagiarism is defined as the act of falsely representing either the words or the ideas of someone else as your own. It is a serious form of intellectual and academic dishonesty.

An underlying principle in science is that the persons who think new ideas and tell others about them, or who make novel observations, should get the credit. Citations and references are a form of credit; they establish scientific precedence and are one of the rewards of doing science. Plagiarism threatens this reward system, and is therefore condemned.

**Penalties for plagiarism can range from getting an “F” on a paper or in a course to expulsion from the university.**

During your academic career here in the Pharmaceutical Sciences Graduate Program at Northeastern University, you will be asked to write many papers and exams, and for Ph.D. students, a thesis proposal and a final thesis. In addition, if you do research, you should publish your work in the scientific literature. What follows is a set of examples to use as guidelines about the proper and improper use of information regarding plagiarism. Some cases are very clear and the faculty are all in agreement that the usage is either right or wrong. In some cases, there is a range of opinion about whether the usage is correct or not, and examples of these “gray areas” are included also. Also, the rules of usage are more or less strict, depending on the circumstances. For instance, citations may be optional when you are writing an exam question from memory in class, but are absolutely required if you are writing a manuscript for scientific publication. Therefore, when writing, **do not plagiarize** and avoid the “gray areas” of improper usage. The following list is not meant to cover all situations, but merely to provide useful examples. If you are in doubt, consult with your faculty advisor or some other mentor.

The following examples are based on an article by C. Fisher, J. Sutherland, J.E. Krause, J.R. Murphy, S.E. Leeman, and J.C. vanderSpek, *Proc. Natl. Acad. Sci. USA*, **93**: 7341-7345, 1996. The original passage is as follows:

“Substance P (SP) is an 11-amino acid peptide. In the biosynthetic pathway of SP, a precursor form of SP, SP-glycine (SP-Gly), is processed by peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) to yield an amide moiety at its carboxy terminus [Chang & Leeman, 1970; Chang et al., 1971] which is important for high affinity binding to its receptor. SP is mainly released from neurons and acts upon target cells evoking various cellular responses throughout the central and peripheral nervous systems [reviewed by Otsuka and Yoshioka, 1993].

“...We have genetically replaced the native receptor binding domain of diphtheria toxin with an extended form of SP, SP-glycine (SP-Gly). The resulting fusion protein, DAB<sub>389</sub>SP-Gly, is composed of the catalytic and transmembrane domains of diphtheria toxin genetically coupled to SP-Gly. ...We demonstrate that following conversion [by PAM], DAB<sub>389</sub>SP is selectively cytotoxic for cell lines that express either the rat or human SP receptor.”

Ten faculty members responded to the following set of ten situations. I have compiled their answers and provided a summary of their opinions. These are the faculty in Biomedical Sciences who will be grading your papers, so ignore their recommendations and opinions at your own risk!

**Situation A.** *Copying someone else’s work word for word without attribution.* A student is asked on a take-home to describe the nature and action of a neuropeptide. Suppose the student responds:

I have chosen to write about the peptide substance P. Substance P (SP) is an 11-amino acid peptide. In the biosynthetic pathway of SP, a precursor form of SP, SP-glycine (SP-Gly), is processed by peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) to yield an amide moiety at its carboxy terminus which is important for high affinity binding to its receptor. SP is mainly released from neurons and acts upon target cells evoking various cellular responses throughout the central and peripheral nervous systems.

Q.: Is this plagiarism?

A: **Yes!** The faculty **unanimously** felt that this is plagiarism. The student is claiming to have written a passage which was in fact written by someone else. Aside from the first sentence claiming to have written the rest of the passage, everything is copied word for word. This is a clear case of intellectual dishonesty.

**Situation B.** *Copying your own work word for word (assuming your original is not plagiarized).* Dr. Susan Leeman is a co-author on the original paper and is asked to write a short synopsis on substance P, which she helped discover. Let us say Dr. Leeman writes:

Substance P (SP) is an 11-amino acid peptide. In the biosynthetic pathway of SP, a precursor form of SP, SP-glycine (SP-Gly), is processed by peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) to yield an amide moiety at its carboxy terminus which is important for high affinity binding to its receptor. SP is mainly released from neurons and acts upon target cells evoking various cellular responses throughout the central and peripheral nervous systems.

Q: Is this plagiarism?

A: The faculty generally felt that this is not plagiarism, since it is not possible to steal your own words or ideas. However, several faculty felt that it would be poor scientific form to keep using the same words over and over again.

even if they are your original thoughts. One faculty pointed out that each publication is supposed to be a novel contribution to the literature, and that publishing the same passages over again violates the spirit of this idea. Another faculty raised the issue that in a joint publication, it is not usually possible to sort out who wrote what, and that if someone is claiming all the credit for what was really a group effort, then it is a form of plagiarism. Finally, one faculty thought it would show lack of imagination to copy your own words when publishing in the scientific literature, but that it is perfectly acceptable to lift part of your published papers and use them without attribution when writing confidential manuscripts such as grant applications. Thus, in this faculty's mind, the context is important.

**Situation C.** Copying someone else's work word for word, using quotation marks, and giving a reference. A student is asked on a take-home to describe the nature and action of a neuropeptide. Suppose the student responds:

Fisher et al. (*PNAS* 93:7341, 1996) write: "Substance P (SP) is an 11-amino acid peptide. In the biosynthetic pathway of SP, a precursor form of SP, SP-glycine (SP-Gly), is processed by peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) to yield an amide moiety at its carboxy terminus (Chang & Leeman, 1970; Chang et al., 1971) which is important for high affinity binding to its receptor. SP is mainly released from neurons and acts upon target cells evoking various cellular responses throughout the central and peripheral nervous systems (reviewed by Otsuka and Yoshioka, 1993)."

The student also includes all of the references in a bibliography.

Q: Is this plagiarism?

A: The faculty generally felt that this is not plagiarism, but many faculty warned that it could be the basis of a low grade, since the student is just parroting back the words of someone else, rather than demonstrating that the student understood the answer. One faculty did consider this plagiarism. Another faculty said that students should not be allowed to use quotations in take-home exams, for the reasons given above. If you plan to use quotations, you may want to check with your instructor first.

In my opinion, some proper uses of quotations include:

A. Paying someone a compliment. Sometimes a person has made a particularly apt analogy or explanation that you may want to capture word-for-word. For instance, in a recent review published in *Nature* (v.387, p. 851, 1997), Dr. Rafael Yuste quotes a phrase by Dr. Bertil Hille which states that "potassium channels are like the stops of an organ". (B. Hille, *Ionic Channels in Excitable Membranes*; Sinauer, Sunderland MA, 1992). Dr. Yuste then goes on to explain the analogy; how that organ stops change the sounds of the organ keys just like potassium channels modulate the electrical activity of neurons and other excitable cells. In quoting Dr. Hille, Dr. Yuste gives him full credit but also demonstrates that Dr. Yuste understands the point of the analogy and he makes that point clear to the reader in a very effective way.

B. If you strongly disagree with someone. It often happens in science, that scientists disagree. However, it is considered bad scientific form to make a disagreement personal by misquoting someone or taking their words out of context. One way to avoid this problem is to quote the person you disagree with, being very careful that you do not misquote them or take their words out of context, and that you properly cite their work. Then, having established what the other person said, you can dispassionately and logically discuss the reasons why you disagree.

C. As an introduction. Let's say the student above uses the quotation about substance P (SP) as an introduction and an outline for the topics to come. After the quotation, the student goes on to review the history of how SP was discovered to be an 11 amino acid peptide, the details of how it is synthesized in the body, the nature of the SP receptor and the evidence in the literature that the amide moiety is necessary for high affinity binding to the SP receptor. Finally, the student finishes with a thorough discussion of the physiological effects of SP. This is a valid use of a quotation that enhances the quality of the student's answer. In fact, many authors, both scientific and otherwise, like to start each chapter with a quotation related to the topic. This is perfectly acceptable as long as the quote is not the whole answer.

This is not a complete list of valid uses of quotations, but in general, use quotations sparingly. Ask yourself the following question: Does this quotation enhance the quality of my writing more than if I explain the ideas in my own words? If the answer is an honest yes, then go ahead. Otherwise, don't. Do not use quotations as a crutch to hide the fact that you do not understand what the author is saying, or because you feel uncomfortable writing. You will be graded down for doing so.

**Situation D.** Copying someone else's work word for word, using quotation marks, and giving a reference for a take-home exam when the exam instructions said to "use your own words". A student is asked on a take-home exam to describe the nature and action of a neuropeptide using his or her own words. Suppose the student responds:

Fisher et al. (*Proc. Nat. Acad. Sci.* 93:7341, 1996) write: "Substance P (SP) is an 11-amino acid peptide. In the biosynthetic pathway of SP, a precursor form of SP, SP-glycine (SP-Gly), is processed by peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) to yield an amide moiety at its carboxy terminus [Chang & Leeman, 1970; Chang et al., 1971] which is important for high affinity binding to its receptor. SP is mainly released from neurons and acts upon target cells evoking various cellular responses throughout the central and peripheral nervous systems [reviewed by Otsuka and Yoshioka, 1993]."

The student also includes all of the references in a bibliography.

Q: Is this plagiarism?

A: The faculty was unanimous that this is not plagiarism, but the student deserves an "F" for not following directions. See Situation C above for proper uses of quotations.

**Situation E.** *Paraphrasing (describe using your own words) someone's work to answer a question on an exam without giving a reference.* A student is asked on a take-home exam to describe the nature and action of a neuropeptide using his or her own words. Suppose the student responds:

Substance P (SP) is a peptide made up of eleven amino acids and is made from a precursor peptide, substance P-glycine (SP-Gly). The enzyme peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) modifies SP-Gly to produce the mature peptide SP which has an C-terminal amide group that is important for binding of the peptide to its receptor. When released, SP causes various cellular responses in the nervous system, which include ....

Q: Is this plagiarism?

A: This is a gray area. The faculty was evenly divided as to whether this is plagiarism. Everyone agrees that the student did not copy, which is good. However, the student is not giving credit to the source of his/her ideas. Here, context is everything. Some faculty felt that since the exam did not specify references, the student was justified in leaving them out. Other faculty assumed that on a take-home exam it should be obvious that references are required.

Since the faculty is divided, these are my opinions:

On an in-class exam, I do not expect students to produce from memory complete references or even authors names, unless that was part of the question (e.g.: Who discovered substance P? Who rediscovered it?).

On a take-home exam, the exam should state that references are required, but even if it doesn't, assume that they are. Part of the learning experience of a take-home exam is to show that you can find information, assimilate it, and apply it to the information that you learned in the classroom. Providing references is one proof that you can find the information.

As a general rule, when in doubt, give references. No one will take off points for including references, but about half our faculty will take off if they are missing.

Also, part of your training is learning to associate scientific facts and concepts with the authors who described those things in the literature. As a scientist, you are expected to know the names of at least the prominent people publishing in your area. There is a practical aspect to this. Let's say that you want a bioassay for substance P. You can find that information much easier if you remember that S. Leeman is one of the co-authors on some of the early papers that described the technique.

**Situation F.** *Partially paraphrasing someone's work to answer a question on an exam without giving a reference, and then interweaving sentences copied from the original.* A student is asked on a take-home exam to describe the nature and action of a neuropeptide using his or her own words. Suppose the student responds (the copied sentences are italicized for clarity):

Substance P (SP) is a peptide made up of eleven amino acids and is made from a precursor peptide, substance P-glycine (SP-Gly). *SP-Gly is processed by peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) to yield an amide moiety at its carboxy terminus which is important for high affinity binding to its receptor. SP is mainly released from neurons and acts upon target cells evoking various cellular responses throughout the central and peripheral nervous systems.*

Q: Is this plagiarism?

A: Yes! The faculty was in agreement that mixing in phrases or sentences that are copied without attribution clearly constitutes plagiarism. Although one faculty indicated that the extent was a factor in whether or not the student should be formally disciplined. In contrast, other faculty members wanted to point out that the extent of copying does not matter, and feel that copying without attribution is plagiarism no matter how much or little takes place. Note that in situation C example A above, Dr. Yuste put the words of Dr. Hille in quotation marks even though the quote was only nine words long. If he hadn't, he probably would have been charged with plagiarism. Also, some of the faculty want the students to know that it is very easy to spot when someone is interweaving copied sentences, since there are often glaring differences in style. Don't do it!

**Situation G.** *Taking the ideas of someone else without attribution.* A student is required to write an alternate thesis proposal in which he or she is to propose a novel set of experiments. Suppose the student writes:

Substance P (SP) is a peptide made up of eleven amino acids and is made from a precursor peptide, substance P-glycine (SP-Gly). The enzyme peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) modifies SP-Gly to produce the mature peptide SP (Chang & Leeman, 1970; Chang et al., 1971) which has an C-terminal amide group that is important for binding of the peptide to its receptor. When released, SP causes various cellular responses in the nervous system (reviewed by Otsuka and Yoshioka, 1993).

I propose to produce a fusion protein consisting of the transmembrane and catalytic domains of diphtheria toxin coupled to SP (DT-SP). I will then test whether DT-SP will selectively kill cell lines that express the SP receptor. The student included a bibliography, but there is no reference to the paper by Fisher et al.

Q: Is this plagiarism?

A: **Yes! Yes! Yes!** Note that there is almost nothing wrong with the first paragraph, since the words are the student's own and there are proper references except for the missing citation from Fisher et al. What is extremely disturbing are the second paragraph and the missing citation. The student is falsely claiming to have thought of an original set of experiments knowing full well that those experiments have already been performed by others (Fisher et al.), who do not get credit. Even more disturbing, the student is clearly attempting to deceive the faculty by omitting the reference to Fisher et al. This is an example of intellectual theft and deceit. Since this behavior attacks the very heart of the citation

reward system in science, it is dealt with most harshly. If a senior practicing scientist did this, that person would be barred from receiving federal grants for several years, and would risk losing their reputation and/or career. If a postdoctoral fellow were detected doing this, he or she would lose their position and would have very little chance of finding another one. If a graduate student at Northeastern University did this, he or she would face expulsion from the university subject to the procedures of student judicial affairs.

**Situation H.** *Paraphrasing someone's work without giving a reference for inclusion in a manuscript for submission to a scientific journal.* A student is writing a first draft of a manuscript on experiments with substance P that the student and his or her advisor will submit for publication. Suppose the student writes:

Substance P (SP) is a peptide made up of eleven amino acids and is made from a precursor peptide, substance P-glycine (SP-Gly). The enzyme peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) modifies SP-Gly to produce the mature peptide SP which has an C-terminal amide group that is important for binding of the peptide to its receptor. When released, SP causes various cellular responses in the nervous system, which include ....

Q: Is this plagiarism?

A: The faculty was pretty evenly split on this situation. I think everyone agreed that this was unacceptable as a final draft for submission to the journal. There are statements of fact that need referencing (e.g. who established that PAM modifies SP-Gly?) However, one of the issues is that this is a rough draft, and is not meant to be the final product. Several faculty stated that the faculty advisor was responsible for the final product, and hence should either supply the missing references or point out to the student where references are needed. In my opinion, the student should know that references are needed, and even if the student hasn't looked all of them up, the student should indicate where references will be needed in the final draft. In general, it is a good idea when writing for publication to give people all the credit that is due them, as they will be more likely to give you credit in return. There are lots of issues regarding how one has to be fair in spreading credit around, but these are too involved to go into here.

The more important issue is whether the student and the advisor need to reference Fisher et al. First, the student needs to let the advisor know that the text is paraphrased from the Fisher article. If the advisor completely rewrites this section, it becomes a moot point, but if not, over half the faculty feels that the advisor and student are required to give credit by referencing the Fisher et al article. A reference here indicates that the article by Fisher et al. was used as a source for the organization, words and/or ideas expressed by the student and the advisor to the extent that it needs to be acknowledged. However, one faculty felt that this particular passage constitutes "common knowledge" about substance P (see situation J below), and aside from the specific references about facts (e.g. Chang & Leeman's papers on PAM), no reference to Fisher et al. was needed. Ultimately, the advisor and the student are going to have to look at the final product, compare it with Fisher et al., and decide whether or not a reference is needed. Note that these considerations apply only to the **general content** of writing the introduction. If the student and advisor discuss anything about SP-fusion proteins or anything else related to the **specific content** of the paper by Fisher et al., then a reference is definitely needed at the point in the paper where that work is discussed.

Finally, Dr. Roger Giese feels that paraphrasing other people's work should be avoided altogether. He writes "The best way to avoid plagiarism is to not look at your references when you write. This requires you to fully understand the material first, so you can organize it on your own and express it in your own words...." If the student had followed this advice, a general reference to Fisher et al. would not be needed.

**Situation I.** *Committing to memory passages of text and writing them word for word on an in-class essay exam designed to test your understanding of the material.* Suppose a student was asked to give an example and describe the nature and actions of a neuropeptide on an in-class exam, and from memory writes the following:

Substance P (SP) is an 11-amino acid peptide. In the biosynthetic pathway of SP, a precursor form of SP, SP-glycine (SP-Gly), is processed by peptidylglycine  $\alpha$ -amidating monooxygenase (PAM) to yield an amide moiety at its carboxy terminus which is important for high affinity binding to its receptor. SP is mainly released from neurons and acts upon target cells evoking various cellular responses throughout the central and peripheral nervous systems.

Q: Is this plagiarism?

A: This is a gray area, and some faculty believe that this is plagiarism, while others do not I've included this, since this is an unusual case that occurred here at Northeastern but in a different graduate program. A student answered her exam questions by memorizing the assigned texts and then writing word for word from memory. On one exam, a faculty member accused the student of plagiarism since the exam was designed to test the student's understanding of the material. Other faculty disagreed whether this was plagiarism, but suggested that the student deserved a low grade because she had not followed directions. The end result was that the student withdrew from the university. The important point on that type of exam is to demonstrate to your professors that you understand the material, not that you have a prodigious memory.

**Situation J.** *Stating in your own words a commonly accepted scientific fact or idea without giving a reference.* Note that in the original passage, Fisher et al. wrote the following:

Substance P (SP) is an 11-amino acid peptide.  
There is no reference.

Q: Is this plagiarism?

A: This is not plagiarism, but it may be a failure to give credit. This is a huge gray area in writing manuscripts for publication. Statements of commonly accepted scientific fact such as “The reaction of hydrogen and oxygen produces water” or “DNA encodes genetic information” are often not referenced since it is assumed that everyone already knows this information and you are just reminding the reader before you go on to some other point. However, what is one person’s commonly accepted scientific fact may not be someone else’s. The context and the intended audience for your writing play a role in determining whether you should include references. In this case, I would only make the two following points:

The whole first paragraph is meant as an introduction, and the paragraph as a whole is referenced by the review of Otsuka and Yoshioka. Citing a review article is one way of dealing with summarizing and referencing a lot of little facts, but just make sure that all those little facts are included in the review article you are citing and the summary is in your own words.

Some of the co-authors in the paper by Fisher et al. did the original work that established that substance P is an 11-amino acid peptide. Thus the references supporting this fact include at least one co-author of this paper. Whether or not an author decides to cite him or herself is optional, if the work is well known.

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I hope that you found this discussion about plagiarism useful. As you see, not all the issues are cut and dried, but there is unanimous condemnation of unattributed copying of other people’s words or ideas.

Finally, some words about style. You may already know all this, but a review doesn’t hurt.

If you look carefully at the quote from Fisher et al., several stylistic conventions were used. Of course the quotation marks are used to denote the extent of text that was copied from the original. However, there are other stylistic clues for the discerning reader. Three dots (...) indicate where I edited the original passage by cutting words. Hopefully I did not change the meaning of the original, but by indicating to the reader where I cut out words, the reader can then go back to the original article and decide for him or herself. Square brackets ([...]) indicate where I added material. Sometimes editing the original loses the meaning unless a phrase is reinserted. In this case I had cut out parts describing the actions of PAM and needed to add this back to convey the meaning to the reader. Also, people sometimes add things in brackets if they think that the original is not clear. Sometimes you may see the Latin word *sic* in parentheses or brackets. This signifies that the person copying the text noticed a mistake in grammar, usage or scientific facts, and wants to assure the reader that the mistake is in the original, not in the copying. Also, the copier may wish to emphasize part of what is being copied. This is generally done by placing the words to be emphasized in a different font, such as italics, or by underlining. This raises a problem, however, because the original author may have emphasized parts of the writing with italics or underlining. To remove this ambiguity for the reader, the copier should include the phrase “emphasis mine” in parentheses directly after the emphasized portion. This will alert the reader that the italics or underlining were not in the original document,. The point of all these rules is to let the reader know exactly where and how the copier has edited the original.

By now you will have noticed that I’ve enclosed the references in brackets. That is because the bibliographic style of the journal *Proceedings of the National Academy of Sciences USA* uses superscripted numbers to denote references (which can be missed if you are not looking for them), and I wanted to make sure you recognized where the references were located. Unfortunately, there are almost as many different bibliographic styles as there are scientific journals. If you are writing a meeting abstract in which space is limited, the bare minimum for a reference to a journal article is the last name of the first author, an abbreviated journal name that would be recognized by persons in the field, the volume and first page number, and the year. Thus, the reference by Fisher et al. could appear in the text and be as short as (Fisher et al. *PNAS* **93**:7341, 1996), where 93 is the volume, 7341 is the first page, and *PNAS* is an informal version of the official abbreviation *Proc. Nat. Acad. Sci. USA*. The et al. is an abbreviation for the Latin phrase *et alia*, meaning “and others” and is used when there are more than two authors. If there are just two authors, both last names must be used. Other commonly recognized informal abbreviations include *JAMA* for the *Journal of the American Medical Association*, *JBC* for the *Journal of Biological Chemistry* and *JCB* for the *Journal of Cell Biology*. However, *Nature* is always *Nature*, *Science* is always *Science* and *Neuron* is always *Neuron*; these journals are not abbreviated.

For take-home tests, you have more room and can choose the style of any one journal, unless the instructor specifies a style. Bibliographic formats are specified in the *Instructions to Authors* sections of the journals. Personally, I prefer a style similar to the *Journal of Neuroscience* in which full reference titles, and first and last page numbers are given in the bibliography, and the authors names appear with the year of publication in parentheses in the text. Other fields (e.g. Medicinal Chemistry) prefer a more bare-bones approach. **Whatever you do, be consistent.** If your are writing for publication, you have to use the style specified by the intended journal.