

Manual of Basic Requirements for Theses and Dissertations



UNC CHARLOTTE

GRADUATE
SCHOOL

THE GRADUATE SCHOOL OF THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

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INTRODUCTION

The purpose of the thesis or dissertation is to provide an experience in scholarship which will be of enduring value to the student in understanding how new knowledge is acquired and communicated within his/her chosen field. Thus, the thesis or dissertation should provide tangible evidence of the student's development as a scholar and especially his/her capacity to discover and effectively communicate research findings. The thesis or dissertation should also enlarge the body of knowledge in the student's chosen field.

This guide for the preparation of theses and dissertations at The University of North Carolina at Charlotte (UNC Charlotte) is designed to assist graduate students, major professors and other members of graduate advisory committees in understanding the requirements and suggestions of the Graduate School for theses and dissertations. A written thesis is required for most Master of Science degrees and a written dissertation for all Doctor of Philosophy and Doctor of Education degrees at UNC Charlotte. While individual disciplines may have different ways in which the research at this level may be completed and presented, consistency in certain requirements for formatting is necessary.

In preparing a thesis or dissertation for submission for a master's or doctorate degree, the student should keep in mind that neatness and correctness in form are of importance second only to the accuracy and soundness of the research. This guide will assist the degree candidate in the preparation of an acceptable thesis or dissertation. It is not intended to be an exhaustive manual or style guide. A published guide appropriate for your discipline should be used to cover specific questions of style; however, the following guidelines are required for all UNC Charlotte theses and dissertations. **Do not use another thesis or dissertation as a model for your work, since a particular style or example in a previous work may be incorrect or out of date. The style and format set forth in this manual take precedence over other style manuals and earlier additions of this guide.**

PART 1. FORMAT GUIDELINES

General Formatting

Style

It is recommended, whether you or someone else types your manuscript that you carefully plan for formatting your document from the beginning. Many times it can be difficult and time consuming to correct margins, font changes, tab settings, etc. in the middle of a document. If you set-up your document to agree with the format guidelines listed in this Guide before you begin typing, you will have less risk for error and save time making corrections along the way. **The key to success in the development of your document is following the guidelines in this manual and consistency.**

Type Face And Font Size

An appropriate typeface and font should be used consistently throughout the paper. Do not create unusual fonts for chapter titles; do not use running headers or footers. Changes in font style or typeface are not permitted except for inclusion of illustrative or documentary materials such as computer printouts or if required for mathematical expressions. Script, elite, pica, or executive types are not permitted although the limited use of **bold** is permitted for highlighting. If you are unsure about the acceptability of the typeface you want to use for your final copy of the thesis or dissertation, please verify with the thesis/dissertation reader in the Graduate School that it can be used. If word processing software is used, laser printed copies are the most appropriate; **set the type size at 10, 11 or 12 point (although 11 point is recommended).**

Margins, Spacing, and Pagination

Binding requirements necessitate that all copies must have uniform margins as follows:

- a. The left-hand margin must be one and one-half inches throughout, including appendices, charts, graphs, tables, etc.
- b. The right-hand margin must be one inch throughout.
- c. The bottom margin must be at least one inch (except for the copyright page, which must be two inches).
- d. The first page of chapters must have margins of two inches at the top. All other pages must have a one-inch top margin.

Unless specified otherwise, all theses and dissertations are to be typed with double spacing between lines throughout. Certain sections may be single-spaced, such as: long quotations; table and figure captions, descriptions and footnotes; list of references, literature cited, bibliography, etc. with a double space between each individual reference or computer print-out. Since your text is double-spaced throughout, be sure to eliminate any extra line spacing that might occur between paragraphs, in front or back of tables,

graphs, figures, etc. There should be no triple or quadruple spacing anywhere in your manuscript unless specifically listed in this manual.

The beginning of each new paragraph must be indented. Typing is to appear on only one side of each sheet; however, for the purpose of illustration with charts, photographs, etc., a printed page may face another printed page (see section on pagination on how to number this page).

Small Roman numerals are to be used to number the introductory pages, with the title page (which is the first of these) bearing no number, but is understood to be i. The second page, which is the copyright page, would bear the number ii.

Arabic numerals (1, 2, 3, 4, etc.) are to be used to number the pages of the text beginning with the number one. The first page of each chapter should be left unnumbered, but counted in the numbering scheme. All page numbers must be placed in the upper right-hand corner on the margin line at the right and ¾" from the top of the sheet. All pages of the thesis/dissertation, including any appendices, should bear a number notation except the title page and the first page of each chapter.

Organization of Thesis or Dissertation

Generally, a thesis or dissertation consists of three major parts, but there may be as many as five: the preliminary pages, the text, the reference pages, an appendix, and a vita. The following table contains a list of the major and minor parts and their order of placement within the body of the document.

Parts of a Thesis/Dissertation	Page Number	Status
I) Preliminary pages		
a) Title/Signature Page	None, but counted	REQUIRED
b) Copyright Page	Yes, small Roman numeral	REQUIRED
c) Abstract	Yes, small Roman numeral	REQUIRED
d) Dedication Page	Yes, small Roman numeral	OPTIONAL
e) Acknowledgment Page	Yes, small Roman numeral	OPTIONAL
f) Introduction*	Yes, small Roman numeral	OPTIONAL
g) Table of Contents	Yes, small Roman numeral	REQUIRED
h) List of Tables	Yes, small Roman numeral	OPTIONAL
I) List of Figures	Yes, small Roman numeral	OPTIONAL
j) List of Symbols/Abbreviations	Yes, small Roman numeral	OPTIONAL
II) Text	**	REQUIRED
III) References/Bibliography	Yes, Arabic numerals	REQUIRED
IV) Appendices	Yes, Arabic numerals	OPTIONAL
V) Vita	Yes, Arabic numerals	OPTIONAL

* An Introduction may be placed before the Table of Contents depending upon the discipline or the requirements of the student's advisory committee. If it is placed before the Table of Contents it is considered a preliminary page. In this case the word

INTRODUCTION is capitalized and centered with a 1" top margin; the page is numbered with a small Roman numeral.

** If chapters are used in the text, the first page of each chapter should be left unnumbered but should be counted as a page. Arabic numerals are used to number the pages of the text beginning with the number 1. When the introduction is used as the first chapter of the text, it is formatted as the first page of a chapter and is considered page one of the text with a 2" top margin and no page number.

The parts to be included with any thesis or dissertation should be determined by mutual agreement between the student and his or her Advisory Committee. Each component of the thesis/dissertation is described below.

I. Preliminary Pages

Title/Signature Page (Required) (Must conform to formatting described below!)

The title/signature page of a thesis or dissertation should bear the following:

- a. The title of the thesis or dissertation typed in capital letters with a 1" top margin
- b. The full legal name of the candidate
- c. The submission statement as shown:

A thesis (or dissertation) submitted to the faculty of The University of North Carolina at Charlotte in partial fulfillment of the requirements for the degree of _____ in _____

- d. The city and year in which the committee accepts the work
- e. Approved signature lines as shown on the example
- f. Signatures must be in black or blue ink only
- g. This page is not numbered but is counted

The title/signature page should follow exactly the spacing and use of capital letters as shown in the sample pages at the end of this guide. The title should be centered at the top of the page and, to facilitate interlibrary referencing, it should be pared whenever possible so it contains only key terms and necessary words. **Each copy of the title page must have original signatures in either blue or black ink.**

Copyright Page (Required)

Candidates are strongly advised to register copyright for the thesis or dissertation. Whether or not the copyright is registered, a notice of copyright with the following information **must be** included with each copy of the thesis or dissertation. Putting the copyright page in your thesis or dissertation notifies the public as to your claim for copyright; however, the legal registration in Washington D.C. would facilitate litigation if

there were ever a case of infringement. Additional information concerning copyright procedures is provided in Part 2 of this manual.

© 20__
Full Legal Name
ALL RIGHTS RESERVED

This information should be centered and single-spaced with the **last** line 2 inches from the bottom of the page. This page is numbered with a small Roman numeral placed $\frac{3}{4}$ " from the top of the paper and 1" from the right edge of the paper.

Abstract (Required)

Each copy of the thesis or dissertation is to include an abstract. The abstract page should not be listed in the table of contents. It should be placed following the page for notice of copyright. The abstract is double-spaced, consisting of the briefest possible summary of the work and conclusions not exceeding one page in length. The heading for the abstract is single spaced and should be constructed as follows:

- a. The word ABSTRACT is centered with a 1" top margin.
- b. Skip two single spaced lines.
- c. On the third single spaced line below the word ABSTRACT, type your full legal name (in capitals). Title (in ordinary type). Name (in capitals) of the professor who directed the thesis or dissertation (in parentheses).

EXAMPLE:

WILLIAM TODD SPENCER. Development of an analytical model for traction between cylinders. (Under direction of DR. JOHN ROBERT STERN)

*NOTE: The title of the thesis or dissertation shown on the abstract page and the title/signature page **must** be the same.*

- d. Skip two single spaced lines.
- e. On the third single spaced line below the heading, begin the text of the abstract. The text of the abstract is double spaced. See the example shown at the end of this manual.
- f. This page is numbered with a small Roman numeral placed $\frac{3}{4}$ " from the top of the paper and 1" from the right edge of the paper.

Dedication and Acknowledgment Pages (Optional)

The Dedication page, if used, pays a special tribute to a person(s) who has given extraordinary encouragement or support to one's academic career. The Acknowledgment page should be brief, simple, and free of sentimentality or trivia. It is customary to

recognize the role of the advisor, the other members of the advisory committee, and only those organizations or individuals who actually aided in the project. Further, you should acknowledge any outside source of financial assistance, such as grants, contracts, or fellowships.

- a. The word DEDICATION or ACKNOWLEDGMENTS is centered with a 1" top margin.
- b. Skip two single spaced lines.
- c. On the third single spaced line below the word DEDICATION or ACKNOWLEDGMENTS, begin the text. The text of the dedication is double spaced.
- d. This page is numbered with a small Roman numeral placed $\frac{3}{4}$ " from the top of the paper and 1" from the right edge of the paper.

Introduction (Optional)

Depending on the discipline or the requirements of the student's advisory committee, an Introduction may be included as a preliminary page. In this case it should be included before the Table of Contents.

- a. The word INTRODUCTION is centered with a 1" top margin.
- b. Skip two single spaced lines.
- c. On the third single spaced line below the word INTRODUCTION, begin the text. The text is double spaced.
- d. This page is numbered with a small Roman numeral placed $\frac{3}{4}$ " from the top of the paper and 1" from the right edge of the paper.

Table of Contents (Required)

The Table of Contents of the thesis or dissertation lists all sections following it, including the List of Tables and List of Figures, if used, and all the headings and subheadings exactly as they appear in the text. **Nothing that precedes the Table of Contents should be listed.**

- a. This page should bear the title: TABLE OF CONTENTS centered 1" from the top of the page.
- b. Skip two single spaced lines.
- c. On the third single spaced line below the words TABLE OF CONTENTS, list the first entry. The entries are double spaced.
- d. This page is numbered with a small Roman numeral placed $\frac{3}{4}$ " from the top of the paper and 1" from the right edge of the paper.

Lists of Tables, Figures, and Symbols/Abbreviations (Optional)

If there are any tables or figures appearing in the thesis or dissertation, lists of these may be included. The descriptive titles in these lists must be identical with those in the text,

but only the titles and not the explanatory notes, should be included. Each list appears on a separate page. See examples at the end of this guide.

When many abbreviations or symbols are used, a separate List of Symbols or List of Abbreviations may be included for the sake of clarity.

- a. The titles LIST OF TABLES, LIST OF FIGURES, or LIST OF ABBREVIATIONS are in capital letters and centered 1" from the top of the page.
- b. Skip two single spaced lines.
- c. On the third single spaced line below the heading, list the first entry. The entries are double spaced.
- d. These pages are numbered with a small Roman numeral placed $\frac{3}{4}$ " from the top of the paper and 1" from the right edge of the paper.

II. Text

The organization and format of the text should be appropriate to the nature and scope of the research reported. The text must show logical organization; generally, the text includes an introduction or preface, a clear statement of the objectives, an appropriate review of previous research, a description of the materials and methods used in the research, a record of the results obtained, interpretive discussion of results in light of other research, and a summary of the significant findings of the study. Recommendations for future lines of study should also be included.

For theses and dissertations of great complexity involving extensive cross referencing and multiple subheadings, a decimal type of organization is suggested. If the decimal system is used for major and minor divisions of the thesis, it must be used throughout the entire thesis or dissertation, including the appendices. It must also be used for numbering equations, tables and figures. Once a suitable system of subdivision is selected, it should be followed **consistently** throughout the document; combinations of the decimal and the conventional or non-decimal systems are not acceptable. (See example in Table of Contents sample.)

NOTE: Organizing the thesis or dissertation into chapters is not a Graduate School requirement; however, if you do separate the text into chapters, there is a specific format for the title (heading) of each chapter. See sample pages for examples.

Format for chapter headings:

- a. The first page of each chapter must have a heading that is capitalized and centered with a 2" top margin. The first page of each chapter is counted but NOT numbered.
- b. Skip two single spaced lines.
- c. On the third single spaced line below the chapter heading, begin the text. The text is double spaced.

- d. Subsequent pages of the chapter have 1" top margins; page numbers in the text should be placed ¾" from the top of the paper and 1" from the right edge of the paper.

If chapters are not used but the text is still separated into sections (e.g., Introduction, Materials and Methods, Results, Discussion), each new section must have a heading using the format below:

Format for non-chapter headings:

- a. Non-chapter headings should be capitalized and centered with a 1" top margin. The page is counted AND numbered.
- b. Page numbers should be placed ¾" from the top of the paper and 1" from the right edge of the paper.
- c. Skip two single spaced lines.
- d. On the third single spaced line below the heading, begin the text. The text is double spaced.

Either format is acceptable but be sure to apply one or the other **consistently** throughout your document.

III. References/Bibliography (Required)

The thesis or dissertation must include a separate REFERENCES or BIBLIOGRAPHY section. The format of this section must adhere to the following:

- a. The heading of REFERENCES or BIBLIOGRAPHY should be capitalized and centered with a 1" top margin.
- b. Skip two single spaced lines.
- c. On the third single spaced line below the heading, type the first entry.
- d. All entries are to be single spaced with a double space between entries.
- e. Pages are numbered with Arabic numerals placed ¾" from the top of the paper and 1" from the right edge of the paper.

NOTE: The term Bibliography or References should be used consistently throughout the thesis or dissertation. That is, do not list it in the table of contents as Bibliography and then title it in the body of the text as References.

The form used for literature citation within the REFERENCES or BIBLIOGRAPHY section of the thesis or dissertation should be determined by the style manual selected by the discipline for which the research is written or by the student's advisory committee.

IV. Appendices (Optional)

The appendices should be used for whatever material the student or the advisory committee believes should be included but would not be appropriate in the text of the thesis or dissertation. Such materials can include:

- a. the original data obtained in the thesis or dissertation research, including computer programs and printouts, surveys, or correspondence;
- b. detailed descriptions of procedures, which go beyond the general outline of methods and approaches presented in the text;
- c. a particularly extensive review of the literature and other information that may be useful to future scholars who may wish to delve more deeply into the research topic.

If there is more than one appendix, appendices should be defined both by letters and titles, (Example: APPENDIX A: CONSENT FORM).

- a. Appendices must be listed in the table of contents and numbered consecutively following the bibliography/reference pages.
- b. The title should be capitalized and centered with a 1" top margin.
- c. Skip two single spaced lines.
- d. On the third single spaced line below the heading, type the first entry.
- e. Pages are numbered with Arabic numerals placed $\frac{3}{4}$ " from the top of the paper and 1" from the right edge of the paper.

V. Vita (Optional)

The thesis or dissertation may conclude with a biographical sketch of the author. The sketch should be written in the third person and should indicate birth date and birthplace, where the author earned the bachelor's degree and if applicable the master's degree, professional societies to which the authors belongs, and other professional activities.

- a. The word VITA is capitalized and centered with a 1" top margin.
- b. Skip two single spaced lines.
- c. On the third single spaced line below the heading, begin the text.
- d. Pages are numbered with Arabic numerals placed $\frac{3}{4}$ " from the top of the paper and 1" from the right edge of the paper.

Inclusion Of Photographs And Prints

Any photographs used in the thesis or dissertation should be of very high quality. Color illustrations are acceptable but any color photographs, maps and charts included should be as high contrast as possible. Photographs can be photocopied onto rag content-cotton paper if a high-quality copy is obtainable. Color photocopying is also available.

Photographs may be developed on photographic paper cut to 8½ by 11 inches with the correct margins as required throughout the rest of the thesis or dissertation.

Although the above methods for the inclusion of photographs are preferred, you have the option to mount photographs and prints, black and white and/or color, on the same type of paper as that used for other portions of the text. Permanent photo mount spray adhesive, good quality rubber cement or drymounting tissue may be used for mounting. Photo mount corners, transparent tape or staples are not acceptable.

You may discuss these various options with the thesis/dissertation reviewer at the Graduate School during your appointment to review the first version of your thesis or dissertation.

Tables And Figures

Many theses and dissertations include tables and figures either in the text or in the appendices or both. Since the specific purpose and organization of tables and figures may vary widely among the various disciplines, the student should consult the style manual recommended by the advisory committee or the scholarly journals and books in his or her field for guidance in design and organization.

Each table and figure must bear an identifying number and a caption. The caption may consist of a descriptive title or a descriptive title plus explanatory notes; captions may be single-spaced.

The term table is used to designate tabulated data; this includes computer printout sheets. The number and caption for the table must be placed above the top line of the table. If any table continues to a following page, the line above the table on the subsequent page should read “Table # (continued)” without repeating the caption.

The term figure is used to designate photographs, half-tone prints, charts, maps, graphs, plates, drawings, diagrams and other mainly nonverbal material. The number and caption for each figure must be placed below the last line or bottom of the figure. If the caption is too long to be placed below the figure, a page should be inserted on which the caption, placed slightly above center, will face the figure. The facing page must bear a number on the blank side of the page at the same location as the page numbering throughout the rest of the thesis or dissertation.

The placement of tables and figures in a thesis or dissertation may be handled in one of the following ways:

- a. Each table or figure may be inserted in the text as near as practicable following the first reference to it in the text;
- b. Tables and figures may be grouped at the end of each chapter;
- c. Tables and figures may be grouped at the end of the thesis or dissertation.

Tables and figures may appear on the same page with text, separated from the text, above and below, by triple spacing. Two or more tables and/or figures may be grouped together on a single page, provided that they fall within the required margins. Tables and figures printed sideways (landscape printing) rather than in the normal upright position (portrait printing) should be oriented such that the top of the table or figure is located at the left or binding side of the paper, and the number and caption should be located at the top of the table or beneath the figure. The page number, however, will remain in the same upright location. In other words, all pages that are numbered would read in order when fanned, with all page numbers being in the same location on each sheet. [Note: Table pages must maintain the 1 1/2" left margin.]

Oversized Material

If you have trouble fitting large tables or figures within the margins of a page, consider the following options:

- a. You may place the table or figure sideways (landscape) on the page, rotating it 90° counterclockwise from its normal position. Place the illustration number and legend sideways also so that all parts can be conveniently read together. Place the page number in the same location as for the other pages, in the upper right corner of the sheet in its unrotated position.
- b. You may place the number and legend on a facing page preceding the table or figure. Type them so that they will be read in the same direction as the illustration (rotated 90° if necessary). Place the page number on the reverse side so that it reads in order with all the other pages. In other words, all pages that are numbered would read in order when fanned, with all page numbers being in the same location on each sheet.
- c. You may photo-reduce the body of the illustration to meet margin requirements. Do not reduce the figure number, legend, or page number.

Footnotes/Endnotes

The student should check with his or her department to determine whether or not the use of footnotes is appropriate form or style for that discipline. If footnotes are used, they should be employed consistently throughout the thesis or dissertation.

It is established practice in some disciplines to place footnotes at the end of each chapter. These are called endnotes and their use is acceptable; however, footnotes are preferred for doctoral dissertations since this allows the paper to be read continuously from beginning to end on microfilm.

Reproducing The Thesis Or Dissertation

Copies or reproductions must be on 8½ x 11 white 100% cotton or rag paper. Any duplicating process that is used must produce a permanent, sharp, high-contrast black image suitable for microfilming. Caution should be used in selecting the duplicating process to be sure that the copy produced is completely free of spots, lines, smudges or

process to be sure that the copy produced is completely free of spots, lines, smudges or other blemishes. The Graduate School will refuse any copies, which do not meet the requirements for paper type or are not suitable for binding or microfilming. It is strongly recommended that you select a typist carefully. Students who use more than one typist for the thesis or dissertation run a great risk of various irregularities. You may expect to get a neater copy if you engage a typist who has had experience in preparing theses or dissertations than if you undertake to type your own or entrust your theses to typists with little experience in this area. In any case, an understanding about corrections in the finished thesis or dissertation should be arrived at in advance. The typist should be furnished a copy of these guidelines and informed of the necessity for strict adherence to the regulations therein. The typist also should be furnished a copy of any other published or departmental (or college) rules of style required to be used. The Graduate School will not accept a thesis or dissertation that is incorrect in matters of style and form.

Continuous Registration

Students in graduate degree programs are required to maintain continuous registration for the thesis or dissertation until work is completed. The continuous registration requirement begins with the semester in which the student first registers for thesis or dissertation credit. **Also note, students must be enrolled during the term in which they graduate from the University.**

PART 2. SUBMISSION PROCEDURES

Preliminary Review Of The Thesis Or Dissertation By The Graduate School

The Graduate School has staff members who serve as thesis/dissertation reviewers for the purpose of checking these manuscripts to be sure that they meet the specified guidelines. Since many students are writing and submitting their theses and dissertations in a given semester, and many do not submit their final copies until close to the deadlines, you will need to **make an appointment with one of the reviewers** as early as possible **before the deadline for final submission of the thesis or dissertation**. All copies of the unbound approved thesis or dissertation **must** be submitted to the Graduate School by the deadline published in the Schedule of Classes for fall, spring or summer semesters. Please note that there are different deadlines during the fall and spring semesters for submitting a thesis and dissertation. The deadline for the summer is the same for both theses and dissertations. **It is extremely important that you schedule your defense far enough in advance of the deadline for submitting the final copies of the document to the Graduate School so that you have time to make any necessary changes or corrections. You may not submit the final version of your thesis or dissertation to the Graduate School before completing your defense.**

Be aware of the deadline date to deposit a doctoral dissertation or a masters thesis with the Graduate School. In planning the submission of your thesis/dissertation, you must

leave sufficient time to complete the all of the following steps before the published deadline date:

- a. Prepare a copy of the thesis or dissertation that is acceptable for the defense and have this draft reviewed by the Graduate School for format (this is the preliminary review). You are required to make an appointment for this review with the Graduate School Thesis/Dissertation reviewer.
- b. Successfully complete the defense of the thesis or dissertation.
- c. Make any changes to the document required by your thesis/dissertation committee or the Graduate School.
- d. Make an appointment with the Graduate School Thesis/Dissertation reviewer for a final review before you have the thesis/dissertation printed for final submission.
- e. Submit the required number of the approved final copies of the thesis or dissertation to the Graduate School on or before the published deadline.

A student who delays too long in attempting to secure approval of the thesis/dissertation close to a specified graduation deadline and is unable to make necessary changes or corrections in time, will have to delay his/her graduation to the next semester or summer session.

To make an appointment for the preliminary review call the Graduate School at 704-687-6348. **It is best to not print your final copy on the 100% rag or cotton paper until it has been approved by the Graduate School, as this paper is expensive.**

While the student (or the student's designee) waits, the reviewer will check the thesis or dissertation to insure that it has been prepared in conformity with the guidelines set forth in this manual. The reviewer will note the nature of the corrections, if any, that have to be made and will give a copy of these notations to the student. The thesis or dissertation will be returned to the student (or student's designee), who will be responsible for having all required corrections made. If the number of required corrections is extensive, the student is advised to have the thesis or dissertation rechecked according to the procedure outlined above after the corrections are made.

NOTE: The thesis/dissertation reviewers make the final determination for the Graduate School as to whether or not manuscripts meet the guidelines specified in this manual and are acceptable for binding. Therefore it is critical that you make any and all of the corrections specified by the reviewer.

Final Submission Of The Thesis Or Dissertation

Both masters and doctoral candidates must arrange an APPOINTMENT with a reviewer before submitting the final corrected copies of the thesis or dissertation to the Graduate School. While the student (or the student's designee) waits, the thesis/dissertation editor will check the document to insure that all required corrections have been made. If additional corrections have to be made, the student will receive a list of the required changes.

When you submit your thesis/dissertation to be accepted by the Graduate School, you are responsible for making sure that all pages are present and arranged in the proper order for binding. Each final copy of the thesis or dissertation must be submitted to the Graduate School in a separate box or envelope, which can be fastened. Do not attach the pages of your document together by any means. The container must bear the following information:

- a. Student's name
- b. Full title of thesis or dissertation
- c. The major department (or college)
- d. The degree
- e. Total number of pages

The Thesis Binding Form (the same form is used for both theses and dissertations) will be given to you by the Graduate School after your final thesis/dissertation has been approved and accepted by the Graduate School. The way you list the title of your thesis/dissertation and your name on this form is exactly the way they will appear on the bound volumes; **it is extremely important to print this information legibly.**

Distribution Of Copies And Binding

The master's candidate must submit three copies of the thesis for binding to the Graduate School while the doctoral candidate must submit four copies of the dissertation (three for binding and one copy that will remain unbound). In both cases copies will be bound and distributed as follows: first and second copies to the Library and third copy to the major department. The fourth copy submitted by each doctoral candidate (which does not have to be bound) is sent off campus for microfilming to ProQuest/University Microfilms International (UMI). (*NOTE: Only three copies are required if the student plans to submit the dissertation electronically for microfilming. This process is explained in more detail below.*) You may submit additional copies for binding for your personal use; however, these copies must be identical including original signatures and 100% white rag or cotton paper. If you wish to have the personal copies sent to you, you must provide a mailing label with adhesive backing with your name and address typed or written legibly. Allow up to eight weeks for delivery of your personal bound copies. There is a fee for each copy (including personal copies) that is bound.

Copyright Procedures And Microfilming

As stated previously, students are strongly advised to register the copyright for their thesis or dissertation. An additional fee is charged if you wish to do this. Procedures for registering copyright are available from the Graduate School. Whether or not the copyright is registered, follow the guidelines in this manual for preparing the copyright page.

To obtain legal registration of the copyright for the master's thesis, you should write directly to: The Copyright Office, Library of Congress, 101 Independence Ave. S.E.,

Washington, D.C. 20559. For general copyright information or questions relating to copyright registration, see their web page at <http://lcweb.loc.gov/copyright>. For the doctoral dissertation, University Microfilms International (now ProQuest) will act as your agent and register the copyright for you. To do this, you must sign the dissertation agreement form and pay a fee; they will then file the application for copyright on your behalf.

Publication in Masters Abstract is also suggested but is optional and requires an additional fee. Procedures for this are available in the Graduate School.

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ABSTRACT

JENNIFER RENEE BALL. Isolation and characterization of *Triticum aestivum* root cDNA sequences which show significant homology to the gram-negative bacterial transposon Tn1721. (Under the direction of DR. HELEN W. JOHNSON)

While previously screening a bread wheat (*Triticum aestivum* cv. Pavon) pollen embryo cDNA library, four clones were identified that showed high homology to the bacterial transposon Tn1721. Finding these clones led to studies to ascertain whether the bacterial sequence was actually present in the wheat genome or was simply an artifact of the cloning procedure. Using the transposon as a probe, a root cDNA library was screened. Two putative clones were isolated from this library and sequenced in both directions. Consensus sequences were used to search the nucleotide databases for homologies. This search revealed that both clones were highly homologous to the *tetR* gene of Tn1721. Northern hybridization using RNA isolated from roots confirmed that the Tn1721 sequence was present in genes expressed by this tissue. These results support the hypothesis that regions of the Tn1721 transposon are integrated into the wheat chromosomal DNA and that this may be an example of an interkingdom horizontal transfer of DNA from a bacterium to a plant.

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The important element in the Acknowledgments is simple courtesy in which there are usually two possible ingredients to consider. First you should acknowledge any significant help you received from any individual whether in your department or elsewhere. Specifically, you should acknowledge the source of special materials, documents, or equipment. Further, you should acknowledge the help of anyone who contributed significantly to the work or to the interpretation of the work. Second, you should acknowledge any outside source of financial assistance, such as grants, contracts, or fellowships. A word of caution is in order. Often it is wise to show the proposed wording of the Acknowledgments to the person whose help you are acknowledging. He or she might well believe that your acknowledgment is insufficient or (worse) that it is too effusive.

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LIST OF ABBREVIATIONS

ABA	abscisic acid
ABRE	abscisic acid response element
ANOVA	analysis of variance
BHT	butylated hydroxytoluene
cDNA	complementary DNA
cpm	counts per minute
DS	dextran sulfate
dATP	deoxyATP
ddATP	dideoxyATP
2,4-D	2,4-dichlorophenoxyacetic acid
EcMt	early cysteine-labeled metallothionein
KN	kinetin
mAb	monoclonal antibody
mRNA	messenger RNA
rRNA	ribosomal RNA

CHAPTER 1: INTRODUCTION

Transposons are genetic elements that are mobile within a genome, therefore, they are one of the major causes of genomic variation (Lewin 1994). However, evidence is growing that transposable elements are capable of horizontal transfer. That is, they can move across genomes of different species (Prins and Zadocks 1992). Our laboratory is interested in the identification and characterization of bacterial transposon-like nucleotide sequences found in the wheat genome that may be an example of horizontal DNA transfer.

Reynolds and Kitto (1992) screened a Mexican spring wheat (*Triticum aestivum* cv. Pavon) cDNA library to identify genes expressed specifically during pollen embryogenesis. After sequencing unique clones from this library, four sequences were found that showed high homology to the bacterial transposon, Tn1721. This transposon was derived from a gram-negative bacterium and is a Tn3-like transposon found in the Tn21 subgroup (Grinstead et al. 1990). It is a unique sequence since it contains a basic transposon (Tn1722) that is capable of independent transposition. As shown in Figure 1, Tn1722 contains an open reading frame that encodes a 525 amino acid chemotaxis protein (Allmeier et al. 1992). The Tn1722 portion of the transposon contains the *tnpR* and *tnpA* genes which are utilized during the genetic resolution and integration of either the major or minor sequences. The entire transposable element also includes three inverted repeats which function as the insertion and excision sites for the transposon.

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APPENDIX A: PCR OPTIMIZATION

The optimization of the PCR reactions were conducted on the bacterial plasmid pJOE105, which contains the entire *Tn1721* transposon. This optimization required three independent experiments to determine the best parameters for each set of primers: MgCl₂ concentration, target DNA concentration, and thermal cycling parameters.

Magnesium provides the divalent cations required by the DNA polymerase to function. The MgCl₂ concentrations were optimized by titration reactions ranging from 1.55 mM to 3.55 mM final concentration in each reaction tube.

The concentration of target DNA was optimized to ensure the highest possible primer specificity. DNA was diluted serially for each reaction to determine the lowest concentration of polynucleotide that still yielded visible bands on EtBr-stained agarose gels; for pJOE105 this was ≤ 1 ng of DNA.

PCR cycle parameters were examined to reduce the so called plateau effect which results in the non-specific amplification of background products. Taking this into account, cycling parameters were set to allow efficient amplification with the lowest number of cycles. Conditions were set at 33 cycles of 1 min. at 94 C for denaturation, 1 min. at 56.5 C for annealing, and 2 min. at 72 C for synthesis, followed by 10 min. at 72 C for extension.