

New Mexico FFA

Agriscience Fair

Leadership Development Event

Agriscience Fair

Revised 7/30/2023

Purpose:

The FFA Agriscience Fair provides recognition to students engaged in outstanding experimental immersion SAEs. Students in this award area use scientific principles and emerging technologies to solve complex problems related to agriculture, food, and natural resources systems. The agriscience fair is for middle and high school students. Participation begins at the local level and progresses to state and national levels.

Category Descriptions

Student researcher(s) can compete in the national agriscience fair in one of six categories:

- > Animal Systems.
- > Environmental Service/Natural Resource Systems.
- Food Products and Processing Systems.
- > Plant Systems.
- > Power, Structural and Technical Systems.
- > Social Science.

Categories are determined by which agricultural system would be most interested in the practical recommendations of the experiment. For instance, if a student tests the width of buffer strips adjacent to corn fields to filter out sediments, the project would be in Environmental Service/Natural Resource Systems because the largest impacts would be on the stream system and aquatic organisms living in the stream.

Biotechnology Systems is the study of using data and scientific techniques to solve problems concerning living organisms with an emphasis on applications to agriculture, food and natural resource systems. Because of this, biotechnology research is incorporated into all categories listed depending on the study conducted. Biotechnology Systems is not its own category.

Divisions

The National FFA Constitution provides flexibility to meet the needs of all students. Competition is open to all FFA members in grades 7–12. There are six divisions:

- **Division 1** individual member in grades 7 and 8.
- **Division 2** team of two members in grades 7 and 8.
- **Division 3** individual member in grades 9 and 10.
- > **Division 4** team of two members in grades 9 and 10.
- **Division 5** individual member in grades 11 and 12.
- **Division 6** team of two members in grades 11 and 12.

Grade is determined by the grade level of the member at the time of qualification at the state level. If a team is composed of two members that span two divisions, the team must compete in the division in which the oldest student qualifies. For example, a team of two members in grades 10 and 11 must compete in Division 6.

Common Core References:

7th Grade:

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. *

8th Grade:

CCSS.ELA-Literacy.SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

9-10th Grade:

CCSS.ELA-Literacy.W.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

11th-12th Grade:

CCSS.Math.Content.HSS-IC.B.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

Project Rules

- 1. The rules of the New Mexico Agriscience fair shall be the same as National FFA Rules. Please see the Agriscience Fair Handbook.
- 2. The scorecard for the New Mexico Agriscience Fair shall be the same scorecard use in the national competition.
- 3. In order to qualify for the National Agriscience fair a contestant must earn a Gold rating be 1^{st} in the state competition, and 80% of total possible score.
- 4. Each chapter may have as many participants in any category as they would like.
- 5. Only participants are allowed in the judging area during presentations. Any assistance given to a member from any outside source including teachers, coaches, or advisors will be sufficient cause to eliminate the contestant from the Career Development Event.
- 6. Chapters will receive feedback through the comments section of the scorecard from the judges.

General

All studies not meeting the criteria of the National FFA Agriscience Fair, but are otherwise permissible, must be conducted in a Regulated Research Institution (RRI). A Regulated Research Institution is defined as a professional

research/teaching institution that is regularly inspected by the USDA and is licensed to use animals covered by the Animal Welfare Act and may also be subject to U.S. Public Health Service Policy. Also included are federal laboratories such as the National Institutes of Health and Centers for Disease Control. In addition, pharmaceutical and biotechnology companies and research institutes that utilize research animals that are not covered by the Animal Welfare Act but have been an operational Institutional Animal Care and Use Committee and are following U.S. federal laws are included in this definition. In these studies, proper documentation must be provided, and the project must be reviewed by the National FFA Organization prior to experimentation.

- A research project may be part of a larger study performed by professional scientists, but the project presented by the student researcher(s) must be only their own portion of the complete study.
- Data may not be added to the research project after state-level selection. Projects may not have more than one year of data included. See "Extension of Agriscience Fair Projects" for additional information about extension projects.

Human Vertebrate

The following policies will govern the use of human beings in agriscience fair research projects:

- No projects involving human cultures of any type (mouth, throat, skin or otherwise) are allowed. However, tissue cultures purchased from reputable biological supply houses or research facilities are suitable for the student researcher(s)' use. Researchers should not use animals (including insects, birds, fish etc.) to represent human tissue. Research in health systems related to humans is beyond the scope of the agriscience fair.
- > Projects that involve taste, color, texture, or any other choice are allowed but are limited to preference only. Quantities of normal food and non-alcoholic beverages are limited to normal serving amounts or less. No project may use drugs, food, or beverages to measure their effect on a person.
- The only human blood that may be used is that which is either obtained through a blood bank, hospital, or laboratory. No blood may be drawn by any person or from any person specifically for an agriscience project. This rule does not preclude student researcher(s) making use of the data collected from blood tests not made exclusively for an agriscience project.
- Psychological, educational and opinion studies are allowed. Projects that involve learning, ESP, motivation, hearing, and vision are also permitted (examples might include surveys, questionnaires, tests, etc.).
- Data/record review studies in which the data is taken from preexisting data sets that are publicly available and/or published and do not involve any interaction with humans or the collection of any data from a human participant for the purpose of the research project are allowed.
- No project will be allowed that is in violation of these rules. No person may perform any experiment for student researcher(s) that violates any of the rules.

Non-Human Vertebrate

The following policies will govern the use of non-human vertebrates in agriscience fair research projects:

1. The use of vertebrate animals in agriscience projects is allowable under the conditions and rules below.

Vertebrate animals are defined as

- a. Live, nonhuman vertebrate mammalian embryos or fetuses.
- b. Tadpoles.
- c. Bird and reptile eggs within three days (72 hours) of hatching.
- d. All other non-human vertebrates (including fish) at hatching or birth.
- 2. Vertebrate animal studies may be conducted at a home, school, farm, ranch, in the field, etc. This includes.
 - a. Studies of animals in their natural environment.
 - b. Studies of animals in zoological parks.
 - c. Studies of livestock that use standard agricultural practices.
 - d. Studies of fish that use standard aquaculture practices.
- 3. Intrusive techniques used cannot exceed momentary pain and must comply with commonly accepted agriculture and livestock management procedures.
 - a. Student researcher(s) are prohibited from designing or participating in an experiment associated with the following types of studies on vertebrate animals:
 - b. Induced toxicity studies with known toxic substances that could cause pain, distress, or death, including but not limited to alcohol, acid rain, harmful chemicals or heavy metals.
 - c. Behavioral experiments using conditioning with aversive stimuli, mother/infant separation, or induced helplessness.
 - d. Studies of pain.
 - e. Predator/vertebrate prey experiments.
- 4. Food and water cannot be used or withheld for more than 24 hours for maze running and other learning or conditioning activities.
- 5. The student researcher(s) and advisor have the responsibility to see that animals are properly cared for in a well-ventilated, lighted, and warm location with adequate food, water, and sanitary conditions. Care must be taken to see that organisms are properly cared for during weekends and vacation periods.
- 6. Livestock or fish raised for food using standard agricultural/aquacultural production practices may be euthanized by a qualified adult for carcass evaluation.
- 7. No vertebrate animal deaths due to the experimental procedures, including hunting or harvesting animals, are permitted in any group or subgroup.
 - a. Studies that are designed or anticipated to cause vertebrate animal death are prohibited.

- b. Any death that occurs must be investigated by a veterinarian or another professional qualified to determine if the cause of death was incidental or due to the experimental procedures. The project must be suspended until the cause is determined and then the results must be documented in writing.
- c. If death was the result of the experimental procedure, the study must be terminated, and the study will not qualify for the National FFA Agriscience Fair.
- 8. Projects that involve behavioral studies or newly hatched chickens or other birds will be allowed, provided no change has been made in the normal incubation and hatching of the organism and all vertebrate rules are followed.

Extension of Agriscience Fair Projects

The completion of a research project can generate additional research questions that are worthy of investigation. Participants will have the opportunity to conduct this additional research if the current year's project could not have been done without what was learned from the past year's research. This project would now be considered an extension project for a competition. If participants have competed at the National Agriscience Fair in the category they are competing in (regardless of the division), they must complete a project extension, and they should complete original work.

- 1. Student researcher(s) may use findings of previous research to formulate their research hypothesis; however, the student researcher(s) will be evaluated on research they have conducted in the twelve months prior to June 15 annually.
- 2. Previous research and information should only be included in the Literature Review/Other's Work by citing the student researcher(s)' previous work in the same fashion as other scholarly sources. Additionally, student researcher(s)' work could be used to inform discussions and conclusions indirectly (not specifically listed). Judging will be based on the current year of research
- 3. Extension projects should be unique in question and manuscript development. If an extension is filed, the introduction, review of literature, methods, results, and conclusions should not be copied and pasted into the new manuscript. Exceptions to this are methods that follow the same step-by-step procedures. Copying and pasting large sections of text from year to year will be considered plagiarism and will be disqualified.
- 4. The project must document that the additional research is an expansion based on the findings of prior work (e.g., testing a new variable or new line of investigation, etc.) Repetition of previous experiments with the same methodology and research question or increasing sample size are examples of unacceptable extensions and will be ranked as a participant at the national prequalifying judging event.
- 5. The project display must reflect the current year's work only. The project title displayed in the finalist's booth should not mention years (e.g., "Year Two of an Ongoing Study").
- 6. Longitudinal studies are permitted under the following conditions:
 - a. The study is a multi-year study testing or documenting the same variables in which time is a critical variable (e.g., effect of high rain or

- drought on soil in each basin; return of flora and fauna in a burned area over time).
- b. Each consecutive year must demonstrate time-based change.
- c. The display board must be based on collective past data and its comparison to the current year data set. No raw data from previous years may be displayed.
- 7. All extension projects must be reviewed and approved each year, and forms must be completed for each year.
- 8. Successive year projects must indicate change or growth in the project from the previous year(s) in the logbooks and complete the continuation form in the application.
- 9. To complete an extension, students should indicate on the cover page of the application that the project is an extension. Once the student has selected "yes," a link will appear in the blue box on the left-hand side of the application. Complete this form to file an extension.

NOTE: For an extension project to be eligible for competition in the agriscience fair, the project extension form in the online application must be completed and will include the abstract for all other prior years. The documentation should be clearly labeled in the upper right-hand corner with the year (i.e., 2018–2019). Please retain all prior years' paperwork in case event officials request additional documentation.

Multiple Research Projects from a Chapter

If more than one agriscience project is entered from the same chapter and/or school, then projects must differ in

- Research hypotheses (questions or objectives).
- Findings related to the research hypothesis (questions or objectives).
- > Conclusions.
- > Recommendations.
- > Student researcher(s) (each student researcher may only participate in one project).

Each of the published authors must have made a unique and substantial contribution to the research endeavor. It is standard that peripheral contributions be acknowledged (i.e., the student researchers would like to thank Mrs. Smith's Seventh Period Animal Science Class for their assistance in...).

Disqualification

A project will be disqualified if.

- 1. Teams or participants arrive after the designated interview time.
- 2. Any assistance is given to a team or participant from any source other than the Agriscience Fair officials or assistants once judging has begun.
- 3. Agriscience Fair officials stop any participants for manners they deem to be hazardous to themselves or others. Such removal will constitute immediate disqualification.
- 4. The participant does not complete the event they start, unless prior permission from the event officials has been obtained.

- 5. Participants access and/or utilize personal electronic communication devices during the entire course of the event. Participants who access personal electronic communication devices without prior approval will be disqualified (examples include iPads, tablets, computers, cell phones, WiFi devices, etc.).
- 6. An advisor, coach, parent, or fellow chapter member is in the interview area once judging officially begins. Any advisor, coach, parent, or fellow chapter member found in the interview area may disqualify their participant.
- 7. A student substitution is made. See the "Interview" section of this handbook for more information.
- 8. The participant fails to meet any rules or participation guidelines set forth in this handbook.
- 9. Participants commit plagiarism.
- 10. Participants conduct unethical research.
- 11. The student(s) have previously placed in the top three of a division and category at the national level and competes again in the same division and category.
- 12. Participants alter the application and/or written report template.

Plagiarism

An agriscience fair project must be the result of a student's own effort and ability. However, in securing information such as direct quotes or phrases, specific dates, figures or other materials, that information must be marked and identified appropriately. Non-compliance represents plagiarism and will automatically disqualify a participant.

Student researcher(s) may not

- In any way falsify a permission form, scientific paper or display.
- Use another person's results or thoughts as their own, even with the permission of this person. This includes work done by a family member or a mentor.
- Use information or data obtained from the internet without proper citation.
- > Re-enter a project with only minor changes or re-use parts of a manuscript in a new manuscript even if the original manuscript was written by the same researcher (i.e., copying and pasting from the review of literature)

Ethics Statement

Scientific fraud and misconduct is not condoned at any level of research or competition. Plagiarism, presentation of other researcher's work as one's own, and fabrication or falsification of data will not be tolerated. Fraudulent projects will result in disqualification from the National FFA Agriscience Fair. Unethical behavior will result in notification to the student researcher(s)' local school administration. Exhibited projects and project reports shall be the result of the student researcher(s)' own effort.

Required Forms

As a part of the state competition application process, the application and written report must be submitted via the AET by the due date listed. The required forms are located in the Application Center on FFA.org.

If the application and written report are not submitted by the specified due date, the fair participant(s) will automatically be marked as a participant, and the project will not be judged.

Accessibility for All Students

All accommodation requests must be submitted 30 days prior to the start of the event and are outlined on ffa.org.

State Selection and Certification of Participants

- > The state advisor or state FFA officials must certify that participants are eligible. If an ineligible student participates in the agriscience fair, the member or team will be disqualified.
- > Both members of a team project must be from the same chapter upon qualification.
- Members must qualify at the state level in the category and division in which they are to participate at the national level.
- Projects must be selected at a state or interstate agriscience fair event held between the immediate previous National FFA convention and prior to the national FFA convention in which they are participating.

Recognition

State level: Winners from each division in all categories may be selected annually in each of the State FFA Chapters. Each of those winners' applications and reports should be sent to the National FFA Center for prequalifying judging. See the "Agriscience Fair Prequalifying" section of the handbook for more information.

Interview

All State finalists are required to meet with the judges to explain their projects. Explanation and questioning may not exceed 15 minutes. The interview is an opportunity for judges to ask questions about the project. A team project must be presented by a team of two. If only one team member is present, the team cannot rank higher than fourth overall. Substitutions are not permitted and will cause disqualification. Judges will ask questions to determine the extent of the knowledge gained, your understanding of your project, how it relates to your SAE and possibly how your project relates to other FFA activities. The following is a list of example questions that may be asked:

- 1. How and why was the project selected?
- 2. What was your goal? What did you plan to accomplish in your project?
- 3. Were there any surprises in your project? How did you handle them?
- 4. What did you learn from the experience?
- 5. How much time did you devote to the project?
- 6. What kept you from being discouraged?
- 7. How did you manage time for this project in relation to your other activities?
- 8. How would you advise others to do a project? What is the value of completing an agriscience fair project?
- 9. How can your conclusions be applied to agriculture, food and natural resources industry?

Official Dress

Participants are expected to observe the National FFA Code of Ethics and the proper use of the FFA jacket during the agriscience fair. (Please reference the latest edition of the Official FFA Manual.) Official dress is required for the interview and awards presentation and recognition.

Scoresheets and Rubrics

This section contains scoresheets and rubrics utilized by judges to evaluate written reports and interviews. As developing student researchers, the expectations for the written report are slightly different for Divisions 1 and 2 (grades 7 to 8) compared to Divisions 3 through 6 (grades 9 to 12). Please note that these written reports are evaluated differently.

Agriscience Fair Prequalifying Scoresheet

Divisions 1-2 (Grades 7-8)

Agriscience Fair Prequalifying Rubric

Divisions 1-2 (Grades 7-8)

Agriscience Fair Prequalifying Scoresheet

Division 3-6 (Grades 9-12)

Agriscience Fair Prequalifying Rubric

Division 3-6 (Grades 9-12)

Agriscience Fair Convention Scoresheet

Divisions 1, 3, 5 (Grades 7-12)

Agriscience Fair Convention Rubric

Division 1, 3, 5 (Grades 7-12)

Agriscience Fair Convention Scoresheet

Divisions 2, 4, 6 (Grades 7-12)

Agriscience Fair Convention Rubric Divisions 2, 4, 6 (Grades 7-12)

Project Components

Written Report

The full written report and application must be submitted by State FFA Associations to National FFA by July 1 for the prequalifying judging event facilitated by National FFA. As developing student researchers, the expectations for the written report are slightly different for Divisions 1 and 2 (seventh- and eighth-grade students) compared to Divisions 3, 4, 5 and 6. The purpose of the rubric for Divisions 1 and 2 is to introduce young student researchers to the process of scholarly thinking. As the student researcher ages, skills grow and advance to utilize the rubric for Divisions 3 to 6 (grades 9 to 12). See Prequalifying Rubric: Divisions 1–2 and Prequalifying Rubric: Divisions 3–6 for additional information.

Format of Report

The report should be printed on 8 ½ x 11-inch white paper. The report will have 1-inch margins. Font size must be 12 using Arial, Courier or Times New Roman font. The written report template is required and is available on FFA.org/agrisciencefair by division.

Divisions 1–2 (Grades 7–8)	Divisions 3–6 (Grades 9–12)
See Summary area of the Written Report section of this handbook.	ABSTRACT A brief summary of the paper, which concisely describes the purpose, methods, results and conclusions. The abstract may include potential research applications or future research. The abstract should not contain cited references. It should be no longer than one page and in paragraph form. Because this is the first page of the project report, it will be where the reader forms an opinion on the study. In the abstract, arrange the points in this order: 1. Purpose. 2. Procedure. 3. Results. 4. Conclusions. This section would include methods, primary results/effects of major treatments and main conclusions. Do not include discussion, citations and footnotes, or references to tables and figures.
IMPORTANCE The importance answers the question, "Why was the work done?" Provide an explanation of • Why the research topic is important to the agriculture	INTRODUCTION The introduction answers the question, "Why was the work done?" It provides background on the subject in several paragraphs. The introduction should clearly state the problem that justifies conducting the research, the purpose of the research, its impact on agriculture, the findings of earlier work, and the general approach and objectives. You must cite sources for statements that are not common knowledge. The last paragraph of the introduction includes the objectives of the study.
 industry. What problem the investigation attempts to solve. Each point should be addressed in a paragraph for a minimum of two paragraphs in the importance section. 	

Divisions 1-2 (Grades 7-8)

Divisions 3-6 (Grades 9-12)

OTHER'S WORK

The other's work section details the information that currently exists concerning the research topic. What other information did the student researcher(s) read before conducting the project? What information did student researcher(s) look up during the investigation? Reference information regarding where the publication was found should be listed, then a brief summary should be written by the student researcher(s) for each publication. Publications could include articles about similar studies, similar research methods, history of the research area and any other items that support the current knowledge base for the research topic.

LITERATURE REVIEW

The literature review should detail what information currently exists concerning the research project. Information in the review should be written in APA style and should include publications used for the research. Publications cited could include articles about similar studies, similar research methods, history of the research area, and any other items that support the current knowledge base for the research topic and how the project might complement existing information.

MATERIALS AND METHODS

This section enables others to reproduce the results by duplicating the study. Write in first person, encompass all materials required and explain the study design by sharing the technical and experimental procedures used. If used, any statistical procedures are included here. This section should be a narrative rather than a list of steps on how to do the process.

MATERIALS AND METHODS

A well-written materials and methods section enables others to reproduce the results by replicating the study. Write in past tense, third person, encompass all materials required, state the hypothesis/research questions and explain the study design by sharing the technical and experimental procedures employed. With fieldwork, describe the study site. Include any statistical procedures employed. This section should be a narrative rather than a list of steps on how to do the process.

HYPOTHESIS/ANTICIPATED RESULTS

RESULTS

The student researcher(s) state the hypothesis and/or anticipated results. What are the expected results of the

RESULTS

This section is a summary of the results, even if they are not what was hypothesized. Do not include discussion or conclusions about the data. Tell the reader exactly what was discovered and what patterns, trends or relationships were observed. Decide on the most meaningful way to present the data (tables, figures), and refer to them in the text. Data should be able to stand alone in the form of tables and/or figures. Data should not be added after the state level selection as it may alter the discussion and conclusions.

This section is a summary of the results, even if they are not what was hypothesized. Do not include discussion or conclusions about the data. Tell the reader exactly what was discovered and what patterns, trends or relationships were observed. Decide on the most meaningful way to present the data (tables, figures), and refer to them in the text. Data should be able to stand alone in the form of tables and/or figures. Data should not be added after the state level selection as it may alter the discussion and conclusions.

Divisions 1–2 (Grades 7–8)	Divisions 3–6 (Grades 9–12)
DISCUSSION In this section, the student researcher(s) should include information about the meaning of the results, how the results relate to the Other's Work section and what impact the study has on the agriculture industry.	DISCUSSION AND CONCLUSIONS In this section, draw conclusions from the results of the study and relate them to the original hypothesis. It is helpful to briefly recap the results and use them as a foundation for the conclusions. If the results were not what was expected, take this opportunity to explain why. Give details about the results and observations by elaborating on the mechanisms behind what happened. Tie the study in with the literature, but do not hesitate to offer sound reasoning of your own. Discussion should refer to facts and figures in the results section and provide recommendations for practice and future research. Discussion and conclusions should also address the impact the research has on the agriculture industry.
CONCLUSIONS In the conclusion, the student researcher(s) should share recommendations on what should be done or what should change as a result of the research. It is helpful to briefly recap the results and use them as a foundation for the conclusions. If the results were not what was expected, take this opportunity to explain why. The student researcher(s) should share what the next steps are to continue the study.	
See Other's Work area of the Written Report section of this handbook.	REFERENCES Only significant, published and relevant sources accessible through a library or an information system should be included. All citations in the text must be included in the reference section. When information or facts are used that are not common knowledge, give credit to the source of that information by citing a reference. Use the APA style recognized citation system throughout the report.
SUMMARY The summary should be two to three paragraphs describing the study conducted. Describes why the student researcher(s) chose to conduct the study, why the study is important to the agriculture industry, how the student researcher(s) conducted the study, what the student researcher(s) found by conducting the study and how the results apply within the agriculture industry.	See Abstract area of the Written Report section of this handbook.
ACKNOWLEDGEMENTS Acknowledge anyone who helped in any aspect of the project in this section.	ACKNOWLEDGEMENTS Acknowledge anyone who helped in any aspect of the project in this section.

Divisions 3-6 (Grades 9-12) Divisions 1-2 (Grades 7-8) SKILL DEVELOPMENT SKILL DEVELOPMENT The student researcher(s) select five appropriate The student researcher(s) select three appropriate competencies based on the study conducted. Three competencies based on the study conducted. Two competencies must be from the study's primary competencies must be from the study's primary pathway, and the other two can be from any pathway, and the third can be from any pathway. The pathway. The student researcher(s) demonstrate skills student researcher(s) demonstrate skills that are that are appropriate for the scope of the project. The appropriate for the scope of the project. The project project demonstrates application of skill attainment demonstrates application of skill attainment with with measurable impact on the overall study. measurable impact on the overall study. SPELLING/GRAMMAR **APA STYLE/SPELLING** The student researcher(s) should use correct spelling, The student researcher(s) should use correct spelling, complete sentences and proper grammar throughout complete sentences, proper grammar and the report. APA or MLA-style writing used throughout the appropriate APA-style writing throughout the report. report.

Framework of Report

Student(s) must use the division appropriate written report template available on <u>FFA.org/agrisciencefair or</u> the following headings to create a research report. All reports must meet the additional criteria listed in the *Format of Report* section.

Divisions 1–2 (Grades 7–8)	Divisions 3–6 (Grades 9–12)
 Title Page Project Title Includes student's name(s), chapter, state, category Division Importance Why is this topic important to the agriculture industry? What problem does the investigation solve for agriculture? Other's work Materials and Methods Hypothesis/Anticipated Results Results Discussion What do the results of the study mean? How are they related to what others found in the "Other's Work" section? Conclusions Summary Acknowledgements 	 A short title 50 character or less Title Page Project Title Maximum 3 lines/15 words Includes student's name(s), chapter, state, category Division Abstract No longer than one page Introduction Literature Review Materials and Methods Results Discussions and Conclusions Acknowledgements References