

SARSEF AZ JSHS HANDBOOK FOR WRITING AND PRESENTING SCIENTIFIC AND ENGINEERING RESEARCH



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Welcome to the Arizona Junior Science and Humanities Symposium (JSHS)
Program hosted by Southern Arizona Research, Science and Engineering
Foundation (SARSEF).

SARSEF is a nonprofit organization supporting students, teachers, schools, families and communities in STEM opportunities and experiences. The mission of SARSEF is to create Arizona's future critical thinkers and problem solvers through science and engineering and our values are innovation, equity, and engagement.

SARSEF is excited to host AZ JSHS and to broaden opportunities to engage students (Grades 9-12) in research in science, technology, engineering, or mathematics (STEM). Individual students present their original research before a panel of judges and an audience of their peers. Opportunities to win college tuition scholarships, engage in career exploration, research lab visits, peer discussions, and networking are generally part of the JSHS experience.

By participating in regional symposia, students may:

- Participate in a forum honoring individual achievement in STEM
- Network with peers who have similar interests
- Hear research presentations by other students
- Develop writing and public speaking skills to help prepare for undergraduate and graduate pursuits in STEM fields
- Hear nationally renowned scientists speak on their work
- Qualify for significant scholarships and other recognition
- Advance to the national symposia

What scholarships are awarded to the top presentations?

In addition to the educational opportunity, the Arizona Regional JSHS also serves as a scholarship competition. The top five finalists attend an expense-paid trip to the National JSHS to present their research and compete for additional prizes (2021 National JSHS will be a virtual event).

The Tri-Services (Army, Navy and Air Force) will distribute \$4,500 in academic scholarships to the top three Arizona finalists:

- (1) \$2,000 to first place
- (2) \$1,500 to second place
- (3) \$1,000 to third place
- (4) Additionally, the University of Arizona will contribute \$1,000 scholarships to each of the top five finalists who attend the University of Arizona.

Scholarships awarded at nationals in each of eight categories are:

- \$12,000 undergraduate tuition scholarships awarded to each of the 1st place finalists
- \$8,000 undergraduate tuition scholarships awarded to each of the 2nd place finalists
- \$4,000 undergraduate tuition scholarships awarded to each of the 3rd place finalists

The National JSHS includes eight categories of student research. The organization of the Arizona Regional JSHS is based upon a review of all student submissions and will reflect the research interests of the students, therefore it will likely not reflect exactly the National JSHS categories.

The major disciplines at National JSHS in which scholarship awards are given are:

- **Environmental Science/Engineering** (Bioremediation, Ecosystems Management, Environmental Engineering, Land Resource Management, Pollution, Toxicity)
- **Biomedical Sciences & Cell/Molecular Biology** (Biomedical Medicine, Microbiology, Molecular/Cellular Biology, Genetics, Immunology, Pharmacology, Virology)
- **Life Sciences** (Developmental Biology, Plant Physiology, Population Genetics, General Biochemistry, Microbiology)
- **Medicine and Health/Behavioral Sciences** (Behavioral Sciences, Biochemistry, Bioengineering, Disease Diagnostics & Treatment, Epidemiology, Immunology, Neuroscience, Physiology, Pathology)
- **Engineering and Technology** (Aerospace, Aerodynamics, Electrical Engineering, Solar Energy, Vehicle Development, Devices, Mechanical Engineering, Robotics)
- **Mathematics, Computer Science, and Computer Engineering** (Probability & Statistics, Math, Computer Algorithms, Databases, Networking, Computer Engineering)
- **Physical Sciences** (Astronomy, Theoretical Physics, Solid State Physics, Acoustics, Optics, Thermodynamics, Particle Physics, Quantum Physics, Nuclear Physics, Internet of Things—the network of physical objects or “things” embedded with electronics, software, sensors, and network connectivity)
- **Chemistry** (Physical Chemistry, Materials, Alternative Fuels, Organic Chemistry, Chemical Engineering, Earth Science, Geochemistry, Energy, Alternative Fuels, Material Science)

JSHS is a collaborative effort with the research arm of the Department of Defense and the National Science Teachers Association. It is administered in cooperation with colleges and universities nationwide. JSHS aims to prepare and support students to contribute as future scientists and engineers—conducting STEM research on behalf of, or directly for, the Department of Defense, the Federal research laboratories, or for the greater good in advancing the nation's scientific and technological progress.

Who can attend the Arizona Regional JSHS?

- Any Arizona high school student interested in STEM studies can participate either as a presenter or as a student observer.
- All Arizona teachers of STEM studies are encouraged to attend. It is truly inspiring to observe these student presentations.
- Thanks to generous sponsors (U.S. Department of the Army, the Office of Naval Research, the Air Force Office of Scientific Research), accepted presenters participate free of charge.

Who can present at the Arizona Regional JSHS?

- Any Arizona high school student may submit a research paper for consideration.
- Students in grades 9–12 identify a research question of interest and conduct original research. Students may work independently or with a mentor, including virtual mentors registered through [National JSHS virtual mentoring program](#).
- Students submit papers on their original research before the submission deadline of March 5, 2021 (www.sarsef.org; <https://www.jshs.org/region/arizona/>). Paper

submissions must follow the research paper format found in this Arizona Junior Science and Humanities Symposium Handbook

- Papers are evaluated and top research papers are selected for oral presentation at the Arizona Regional JSHS
- Students must be a citizen or permanent resident of the United States or U.S. territory to be eligible to receive scholarship awards through JSHS.
- Students may submit a continuation of a previous research investigation; however, a study which merely adds data from a previous year's project is not considered a strong continuation project. If a continuation project is submitted, the student must discuss how the project was expanded (i.e. methodology, new variables); discuss any revisions in experimentation and present new data.
- Team projects. A student may present a report on work done as part of a class project, or as a science fair project, or summer research project. If a presenter is part of a larger group, the presentation should focus on the coordinated efforts of all team members and properly acknowledge the contributions of the team (i.e., students, mentors, and/or teachers). A team leader should be selected to present the results of the group work. The judging criteria used to judge all JSHS presentations remains the same.
- Team projects awards. If an individual presenter from a group project is selected as a Regional finalist and is invited to present at the National JSHS, the same presenter must present at the National Symposium. Scholarships and other awards available at Regional and National Symposia are awarded to the presenter.
- Projects that are demonstrations, 'library' research or informational projects are not appropriate for JSHS

What if my research paper is not accepted?

Students whose research submissions are not accepted for presentation at the Arizona Regional JSHS but were nonetheless complete and met all paper format guidelines will automatically be invited to attend as student observers and may also present research posters at the regional poster session.

Where can I find the important dates for this year's Arizona Regional JSHS?

Information on dates and registration can be found on the SARSEF website <https://sarsef.org/programs/jshs/> and also through the National JSHS at <https://www.jshs.org/region/Arizona/>

SECTION 1: Overview of research sequence and writing process

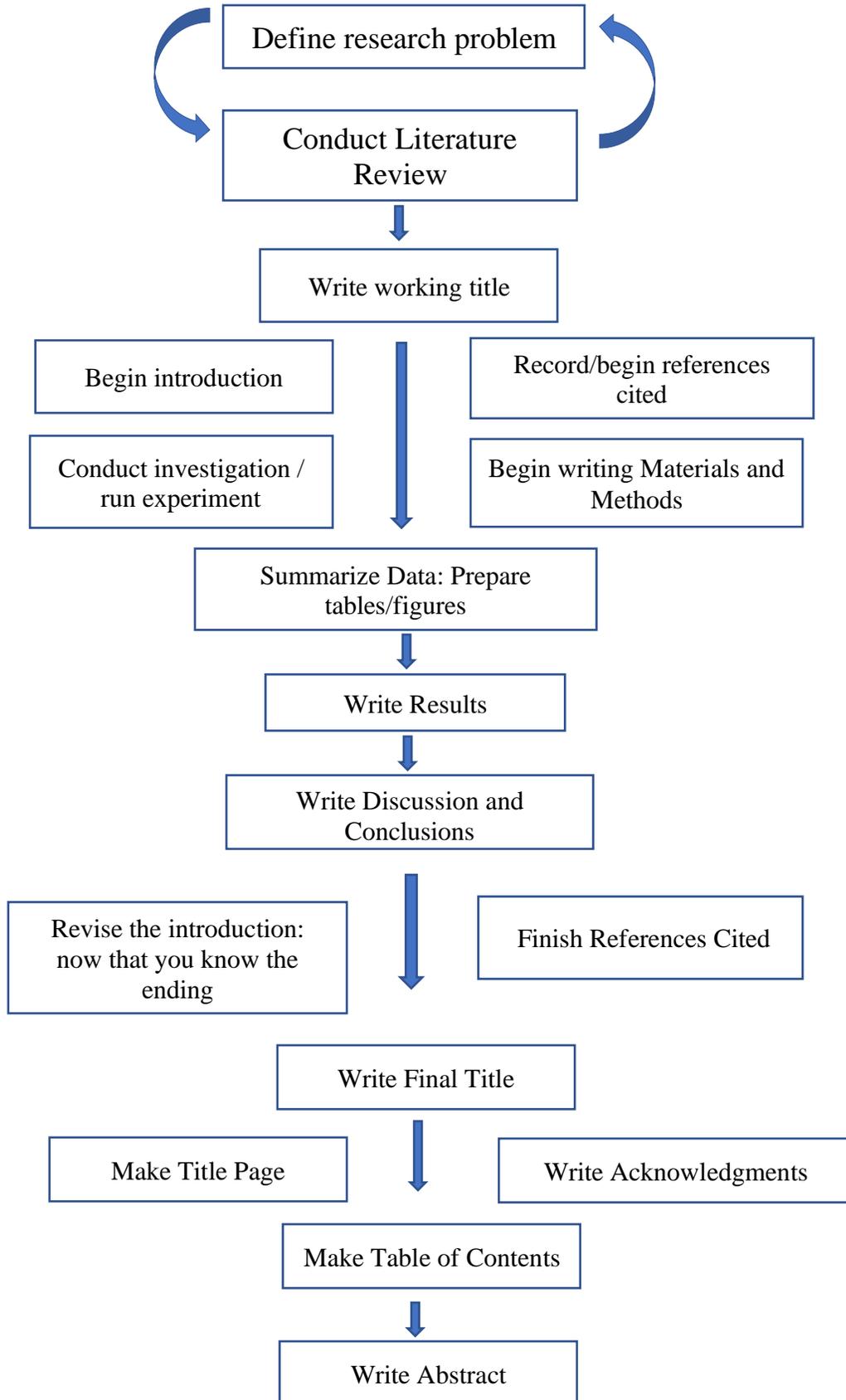
Overview:

The SARSEF AZ JSHS Lab research paper is a written report describing original research results in science, mathematics, or engineering and can be submitted for both the SARSEF Fair and Arizona Junior Science and Humanities Symposium (guidelines meet the criteria for National JSHS). The paper should reflect student research conducted independently, in a small group or under the mentorship of a research scientist. The paper should rely on previously published literature primarily for background and comparative purposes.

Specifications:

- 1-inch margins, size 12 font, serif font (Times New Roman), double spaced
- Minimum of 5 pages and a maximum of 20 pages
- All pages numbered, beginning with Introduction page, in the bottom right-hand corner
- Maximum size limit for the electronic research paper is 2 Mb SARSEF (1.8 Mb National JSHS)
- Photography, graphs, tables, diagrams, charts, or other graphic representation presented in the paper must be simply presented and comply with the maximum file size
- As applicable, the statement that “Research involving non-human vertebrates or human subjects was conducted under the supervision of an experienced teacher or researcher and followed state and federal regulatory guidance applicable to the humane and ethical conduct of such research”
- A few science writing conventions to be aware of:
 - Abbreviations should be defined the first time they appear in the text by placing the abbreviation in parentheses following the spelled-out term. The abbreviation can be used thereafter. Example: “The increase in Sudden Acute Respiratory Corona Virus 2 (SARS CoV-2) has led to quarantines around the globe. SARS CoV-2 was first identified in...”
 - Binomial nomenclature: Genus species names used in biology. *Genus* is always capitalized; species is never capitalized, and *Genus species* names are always italicized. Genus species may be referred to with first letter of the genus and the full species name after first appearance in text, e.g. “The green hermit hummingbird, *Phythornis guy*, forms leks in tropical cloud forests. *P. guy* is an extremely territorial species and will guard the boundaries of a territory against...”

SUGGESTED RESEARCH AND WRITING SEQUENCE:



Tips for successful science writing

Adapted from: Pechenik, Jan (1993) A Short Guide to Writing About Biology. Harper Collins College Publishers. N.Y., N.Y.

- Acknowledge that understanding scientific research requires diligence and persistence; read background information in a quiet setting, be prepared to use a dictionary and a critical and questioning eye.
- Good science writing requires a great deal of editing and revision, especially when you are new at it. Expect to complete several drafts of all writings.
- Think about where you are going before you begin to write, while you write and while you revise. Create a detailed outline before you begin; think of it like a road map so you know where you started & where you want to end up.
- Write to illuminate, not to impress. The goal of science writing is clear communication of information.
- Say exactly what you mean to say; stick to the point.
- Be concise, if you can say it in fewer words, do so.
- Never make the reader back up; lead the reader through your thinking step by step (called the hook and eye approach, carry the thread throughout the entire paper)
- Do not make the reader work harder than he/she needs to.
- Distinguish fact from possibility. Statements like "appears to, may indicate that, supports the ideas (hypothesis) that"... demonstrate the tentativeness that is fundamental to science. Remember the strength of science is its ability to disprove, not prove, hypotheses.
- **DO NOT PLAGIARIZE.** Cite all research and ideas that are not your own. When in doubt, cite. Common knowledge, information found in textbooks (resources), need not be cited.
- Back up all statements of fact or opinion, cite author(s) and research that support your statements.
- Data are. The word data is plural.
- Italicize binomial nomenclature (*genus species*). Genus is always capitalized, species always lower case. Both are always italicized
- Avoid teleological statements. Do not imply or state intention or purpose on the part of evolution or the products of evolution.
- Avoid anthropomorphic statements. Do not ascribe human qualities or motivation to non-human organisms or objects.
- Read your draft aloud to see how it flows. This is the single best way to catch awkward phrasing, missed words and loose connections between ideas.
- Proofread; use spell check and grammar check. Have several other people proofread your writing.

SECTION 2: SARSEF ARIZONA REGIONAL JSHS RESEARCH PAPER

ORGANIZATION

- Title page, or cover page
- Abstract
- Acknowledgments
- Table of contents
- Introduction
- Materials and Methods
- Results
- Discussion and conclusions
- References, or literature cited
- Appendices (optional)

TITLE & Title Page:

- Student's name
- School name
- Title of the research
- Date

In scientific writing, the title is always intended to convey information. A good scientific title simply orients the reader to the content of your paper in the fewest words possible. A title is:

- concise
- descriptive
- informative

A tentative or working title can be written after the literature review. The purpose of writing the title at this early stage is to help you clarify your aims and intentions.

Your final title should be written after the paper is completed so that it reflects the content of the paper.

Recommendations for creating a title:

- Do not write the title as a question
- Do not use abbreviations in the title
- Avoid "excess" words such as a, an, or the, or phrases such as "a study of" or "investigations of"
- Consider its length. A two- or three-word title may be too short, but a 14- or 15-word title is probably too wordy.

Examples:

Poor: Effects of Antibiotics on Bacteria

Better: Effects of Penicillin on Gram Negative Bacteria

Good: Lysis of Gram-Negative Bacteria by Penicillin

The first example is concise, but neither informative nor descriptive. It is too general. What effects? What antibiotics? What bacteria? The second example is more specific, both in describing the antibiotic and the bacteria, but it still lacks description. The third example is written in scientific style: descriptive and specific.

ABSTRACT: 250 words or less

The abstract is a summary of the most important points in your paper. As such, the abstract is *written last*, after the research paper is written. It is the first thing that a reader reads in determining which papers to read and which to skip over. Thus, it is the first impression of your work to others! So it is worth spending some time writing a good abstract.

The abstract will provide a concise overview of your entire study, in a single paragraph **of 250 words or less**. A well-crafted abstract briefly states the research question or rationale (introduction), how the study was conducted (methods), what was found (results), and what the findings mean (discussion and conclusion).

Make every word of your abstract count! It is difficult to be descriptive and concise but that is what a well written abstract requires. Say only what is essential, focusing your message on the big picture and specific take home messages. Why did you do the project, how did you do it, what did you learn and why does it matter.

The format for the 250-word JSBS abstract includes

1-inch margins

10 or 12-point font (Times or Times New Roman)

The header preceding the abstract body must include:

1. Title of the research
2. Authors name(s)
3. High school, high school city, high school state
4. Name of teacher/mentor/sponsor and his or organization. Precede the individual's name with a subheading (i.e. teacher, mentor, sponsor)
5. Include one line of space between the heading and the abstract body.

ACKNOWLEDGEMENTS:

As a researcher and scholar, it is professional courtesy to acknowledge those who assisted you on your journey. The acknowledgement should state:

- Where the research was conducted
- When the research was done
- The names of those who provided major assistance in any of the following areas:
 - selection of topic
 - planning or guiding course of research
 - construction of apparatus
 - use of laboratory space or equipment
 - any other direct assistance

As a student researcher, judges will neither reward nor penalize you for working with a mentor or having access to specialized equipment. However, it is important to recognize assistance and acknowledge support.

TABLE of CONTENTS:

List of sections and sub-sections and the pages on which each begins in the paper. Wording of the titles of all sections and sub-sections must match the way they appear in the paper.

- List only the page number of the first page of a section
- Keep the right margin of the column of page numbers

INTRODUCTION:

The introduction is a map that guides the reader through the thinking that has led from problem statement to what you are going to do to find a solution. The introduction should clearly state the nature and scope of the problem investigated and provide a rationale for the project and must introduce the topic of research by providing relevant background information and a brief review relevant literature (previous studies). Assume that the reader is scientifically literate but not familiar with the specifics of your topic.

Start out broad and general and move toward specific details and statements in the closing of the introduction. Building on the foundation of previous research, the introduction should provide a rationale for your study, explain your novel or new approach in investigating the problem and its significance. You may also explain the application or any societal impact of your research.

The closing of the introduction should state of the most important point(s) that will be addressed in your paper by clearly stating your research question(s), and hypothesis(es) or prediction of outcome. The final paragraph of the introduction should lead nicely to the next section which describes HOW you did the investigation.

MATERIALS AND METHODS:

The Materials and Methods section is written in narrative paragraph form and in sufficient detail that a trained researcher could replicate your experiment and obtain similar results. **Do not list** the materials or the procedural steps; incorporate them into a narrative. This section should enable the reader to evaluate the appropriateness of your methods and the reliability and validity of your results.

Incorporate the following information (as it applies to your study) into a coherent narrative of how you conducted the investigation. Be specific and provide necessary details.

- Precise description of the sample: experimental organisms such as animals, plants, microorganisms, age and sex, if applicable.
- Methods of data collection; what variable(s) were measured and recorded, how was data collection randomized and how were collection procedures standardized to assure consistency
- Sample size and number of replications
- Time period and frequency of data collection

- Techniques: Solvent & solution concentrations, temperatures and time reported with *metric units* for all quantities
- Apparatus used: type, brand and model. If specially built for project, a diagram or photo with appropriate figure time and explanation may be included
- Cite the literature reference and give only the details specific to your experiment when using a *standard* method
- If using a commercially available kit, simply provide trademark name and procedure used. For example, “DNA was extracted from mesquite leaves using Qiagen DNeasy Plant Mini Kit TM”. You need not include every step of this DNA extraction since it is provided by Qiagen.
- Identify Software used for data collection, data analysis and statistical or graphical analysis
- Criteria for selection and an “informed consent” form if human subjects are used
- Descriptions of any surveys, assessments, etc. used in your research
- Description of how the data were analyzed and which statistical analysis(es) was (were) used

RESULTS:

The results section contains all the major experimental findings of the study and their statistical analyses, presented in a logical order with text and visuals that complement and supplement the text. Report only analyzed and summarized data and highlight the trends observed; do not report raw data and *do not interpret the implications of the results*. Just report the findings.

Prepare your tables or figures before writing the text of the results section. The visual representations will help you clarify your own thinking and make it easier for you to write the results. This will also help reveal whether there are gaps in the data and whether more experimental work should be done.

The results section contains:

- images/visuals: tables, graphs & figures, and/or illustrations or diagrams
- text: summaries of the data collected and highlights of images/figures
- statistical analyses: a measure of variability and certainty with confidence level stated

The images (tables/graphs/figures/diagrams) should:

- highlight a key point in the research & be referred to in the text
- stand on their own so they are clearly understood without reference to the text
- not be redundant. Do not present the same results in multiple visual formats, e.g., presenting the same results in both a table and a graph. Choose the best format for presentation. Consider whether shapes and trends are more important to the readers, or exact values?

The text should:

- summarize the data collected, point out the important features, and connect the results with one another.
- not interpret the results: trends in the data should be highlighted, but no interpretation or extended discussion occurs in the results.

Statistical analysis should report:

- Name of statistical analysis used to evaluate the data
- Explanation of how you prepared the data for analysis
- Test statistics
- Degrees of freedom and/or sample size
- Significance level or probability value
- The confidence level associated with the data.
- Describe error bars if present (standard error, standard error of the mean, standard deviation)

There are two types of statistics presented in a research paper: descriptive statistics, and inferential statistics.

Descriptive Statistics

Descriptive Statistics describe the most typical values and the variations that exist within a data set (Salkind, 2008). A data set refers to numerical data that is recorded to represent the results of an experiment. Descriptive data is most commonly presented in terms measures of central tendency. These measures describe the central position of the distribution of scores in a dataset. The measures of central tendency are:

- Mean
- Median
- Mode

Measures of variation are important to provide a context for the reported central tendency. These measures describe the distance between scores in a dataset. The measures of spread are:

- Range
- Variance
- Standard Deviation

Inferential Statistics are mathematical calculations performed to determine how likely the differences between groups are due to random chance or are a result of a treatment. Inferential statistics determine whether or not the effects of your experiment are statistically significant. Results are deemed statistically significant when the mathematical differences between groups are more likely due to the change of the independent variable than to luck or chance. More specifically, the inferential statistics tell you whether to reject the null hypothesis (a hypothesis of no effect) and accept an alternate hypothesis. There are many different ways to calculate inferential statistics, including:

- Linear regression analyses
- Logistic regression analyses
- Analysis of variance (ANOVA)
- Correlation analyses

- T-tests
- Longitudinal data analysis
- Chi square test

Creating Tables

Use tables to show large amounts of *summarized data* (usually numbers) in a small space. Do not include raw data in your research paper. If exact values must be listed, a table is normally preferred over a graph. Be sure that there is sufficient information in the table that the reader can understand its content without having to consult the text. (See examples in Appendix A).

Table number and title above the table. Example: “Table 3. Vaccine efficiency...”

Tables are numbered with Arabic numerals in the order of appearance in text. Numbering enables the writer and reader to refer to them quite easily (e.g., Table 3 shows that...).

- Place columns to be compared next to each other, if possible.
- Label each column with a column heading. Make the headings clear but concise. Abbreviations may be used, but do not use periods. Capitalize first words in column headings.
- Include units of measure in the headings if appropriate, e.g., Nitrates (mg/L).
- Align numbers in each column on the right. If decimal points are used, the numbers should be aligned on the decimal point
- Use an initial zero before the decimal (**0.25** mg/L)
- A brief explanation of the table as a whole can follow the title
- Include sample size (n) when appropriate & statistical analysis used with probability level that indicate the results of tests of significance (e.g., t-test, p=0.013545)

Creating Figures: Includes all graphs, photographs, illustrations and diagrams.

Figures are used to convey the overall pattern of the results at a quick glance and also should stand alone, with sufficient information to be understood without consulting the text. (See examples in Appendix B)

- Number all figures with Arabic numerals in the order that they are discussed in the text.
- Number figures separately from tables.
- Label both axes on graphs with the variable being measured, the units of measurement, and the scale.
- Place the *figure title and brief explanation* below the figure. Figure title is a brief but descriptive statement of what is in the figure
- Figures should be placed as near as possible to where they are referred to in the text.

Persuasive Data Visualizations (Dataspire Education & Evaluation <https://dataspire.org/> Hunter-Thomson, 2021):

- In making graphs, you need to make the judgement call
 - Would I feel duped if someone else presented me with a chart like this?
 - Does my chart make it easier to see the idea, or is it actively changing the idea?
 - Does eliminating information hide something that would rightfully challenge the idea I’m showing?

- The following are not always bad, but make sure you use them correctly
 - Truncated axes: can exaggerate perceived differences in a data set
 - Double y-axes: can be difficult to interpret and overly busy
 - Choropleth maps (maps that color by geographic area)
- *Three steps to be more persuasive:*
 - Find the main idea (what is it you want to say with these data?)
 - Make it stand out
 - Emphasize (with color, shape, annotations, etc.)
 - Isolate the important parts
 - Adjust what's around it
 - Remove reference points (only have what is helpful)
 - Add reference points (provide context)
 - Shift reference points (to something that makes it pop more quickly)

Data Visualization Best Practices:

- *Common missteps when making graphs:*
 - Using the graphing platforms default graphs
 - Showing just the raw data
 - Using 3D graphs: our brains have a hard time interpreting these
 - Your numbers don't add up to 100 when they should
 - Proportions don't work or are wrong
 - Graph type makes it hard to compare relevant data
 - Not enough information provided
 - Too much information provided
 - Too gimmicky on images
 - Using the wrong type of graph for your data and/or question
 - Not knowing your message
- *Things to think about to make your graph better:*
 - Limit eye travel
 - Left-justify as your default
 - Align up as your default
 - Keep elements aligned as much as possible
 - Fewest lines up-down, side-to-side in your graph
 - Declutter the space.... steps to remove clutter:
 - Step back and review your figure
 - ID a component that is not necessary
 - Figure out how to remove it
 - Repeat until you cannot remove anything else
 - Focus on 1-2 things in a single graph, if you have more to share make another graph
 - We see only 5-10 things at once...and remember 2-3 (at best)
 - You have 3-8 seconds to capture someone's attention before they decide what the takeaway is (or if they want to give up and move on)

- Leverage attributes we see better:
 - Length
 - Position
 - Width
 - Size
 - Hue/Color
 - Intensity
 - Orientation
 - Shape
 - Enclosure
 - Added Marks/Annotations
 - Curvature
 - Movement

- Use common conventions to your advantage because *we all seek meaning and try to make connections*
 - Up is north, down is south
 - Up is good, down is bad
 - High should be up, low should be down
 - Hierarchies move from up to down
 - Time moves from left to right (2D), back to forward (3D)
 - Connected data points means there is a relationship
 - Categories are arranged/plotted from one extreme to the other
 - Red is negative, green is positive
 - Red means hot/active, blue means cold/inactive
 - Lighter colors are emptier or lower than darker ones
 - Like colors mean like things, different colors mean different things
 - Grey is background or secondary

- Keep your layout consistent
 - Title (your takeaway from the data) ...top ~12% of the space
 - Subtitle (any context for the data) ...below title ~8% of the space
 - Visual field (YOUR graph/map/chart/plot/etc.) ...middle 75% of the space
 - Source (where are the data from?) ...bottom ~5% of the space

DISCUSSION AND CONCLUSION:

Discussion

In the discussion section, you should interpret the results from your research, draw conclusions from your data, and suggest further hypotheses that can be tested based on any discrepancies or ambiguities found in your study. In contrast to the introduction, the discussion should move from a very specific focus of how your results relate to your question and hypothesis, through to a more general comparison with previous work to the most broad and general implications that can be drawn from your study. Do not simply restate the results. This section should analyze and interpret the results in the context of the broader science.

Each paragraph in the discussion section should address one aspect of the explanation of the results. For each paragraph, a topic sentence should be included that tells readers what will be discussed. This section will be used to restate your results, during which, you can refer the reader back to the tables and figures you provided in the results section. In this way you are supporting your claims with evidence (data) from the study.

The discussion section should:

- Restate the importance of your scientific research: the research question & its relevance
- State whether your hypothesis was supported, not supported, or partially supported and demonstrate how the results support your statement
- Avoid using words such as: obviously, clearly, or proves and instead use words that express the tentative nature of science: suggests, indicates, proposes or supports
- Mention possible explanations for trends and patterns reported in the results section
- State whether your results were expected and explain why or why not
- Discuss the limitations of the study and provide suggestions for how future research on this topic could be improved
- Explain how your results agree or contrast with previously published work (relate to previous work highlighted in introduction or introduced in the discussion; be sure to include appropriate citations)
- Discuss, when appropriate, any groups that had irregular results compared to the other groups
- Address any foreseeable questions others might have regarding your research

Conclusion

The conclusion section should connect back to your introduction and explain whether or not your research provided any answers to your original research question. The conclusion section should:

- Include possible applications and extensions of your research
- Connect the research to possible real-world applications
- Apply the results of your experiment to the scientific community, including the scientific knowledge you've contributed in response to your research
- Describe new questions that have arisen from your research and suggest research studies that could be completed in the future (next steps)

The last paragraph of the conclusion section should summarize your analysis, declaring the degree to which your results show a relationship between the independent and dependent variables. Here, you will need to explain how that final conclusion was made and briefly support your conclusion with evidence.

REFERENCES CITED:

Science is a collaborative activity whether you are working with others in a lab, with a mentor in person or remotely, or reviewing previous research and background literature to better understand how to frame your research question. It is *critically important* that you cite your sources and credit others with their ideas and research. Plagiarism is unethical. When in doubt, cite.

Citation rule:

- All citations in the text of your paper must be listed in the "References Cited" section and all references listed on the "References Cited" section must appear in the text of your paper.

- The references cited section differs in this way from a “Bibliography” or “Resources Listed” in which you list everything you read whether or not it is cited in the paper.

SARSEF recommends American Psychological Association (APA) citation using parenthetical citation with authors’ last name and date of publication. Previous research or findings discussed in the body/text of your paper must be cited. To do so, the author’s last name and the year of the publication from which the information was obtained, is inserted into the text at the appropriate point. In citing with the author’s name and date of publication, there is no need to write out the title of the article or the name of the journal (or other source).

The following guide of how to cite using APA format, is modified slightly and heavily credited to <http://www.pitt.edu/~kblock/apa.html>

Citing a single author:

Example 1: When the author's name is used as a part of the narrative, place only the year in parentheses

- Jones (1987) investigated learning styles and demonstrated that...

Example 2: the author's name was not used as a part of the narrative. In such cases, place the author's surname and the date of the publication in parentheses, separating them by a comma

- In a recent study of learning styles (Jones, 1987) it was shown that

Citing two authors:

Example 3: If there are two authors, cite both names each time the publication is referred to in the text. When authors names are used as a part of the narrative, separate the names by the word “and” and put the publication date in parentheses

- Jones and Smith (1988) investigated learning styles...

Example 4: If the names are NOT part of the narrative, include both names within parentheses, separated by an “&” with a comma before the date of publication

- In a study of learning styles (Jones & Smith, 1988) students with...

Citing more than two authors:

When there are more than two authors on a publication, list all the names the first time the reference is cited in the text. In subsequent citations, use only the name of the first author, followed by "et al." (et al means “and others” in Latin).

Example 5 illustrates the two ways a text citation might look the first time the publication is referred to in the text.

- Allen, Baird, Carlson, and Doe (1985) investigated learning...
- A recent reaming study (Allen, Baird, Carlson, & Doe, 1985) investigated several factors...

Example 6 illustrates the two ways a text citation might look when the references are referred to again in the text:

- Allen et al., (1985) conducted their studies...
- Time on task has been found to be an important factor in learning (Allen et al.,1985).

For more information on American Psychological Association (APA) citations and references cited, check out these resources:

<http://www.pitt.edu/~kblock/apa.html>: How to cite in text

<https://pitt.libguides.com/citationhelp/apa7>: How to write references cited/bibliography

Tip: Help keep track of your papers and proper referencing using Google Scholar

Search for your publications on Google Scholar. When you find a source on the Google Scholar search page, click on quotation mark at the bottom of the description, next to the star and it will provide you the proper format for your references cited page. Copy and paste the proper citation into your list of references. See the two screen shot examples below:

The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes [\[PDF\] sciencemag.org](#)

R Uenoyama, T Miyazaki, JL Hurst... - ... *Advances*, 2021 - advances.sciencemag.org
Domestic cats and other felids rub their faces and heads against catnip (*Nepeta cataria*) and silver vine (*Actinidia polygama*) and roll on the ground as a characteristic response. While this response is well known, its biological function and underlying mechanism remain undetermined. Here, we uncover the neurophysiological mechanism and functional outcome of this feline response. We found that the iridoid nepetalactol is the major component of silver vine that elicits this potent response in cats and other felids ...

☆ All 4 versions

Showing the best result for this search. See all results

The screenshot shows a Google Scholar search result for the article "The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes" by R. Uenoyama et al. A "Cite" dialog box is open, displaying citation formats for MLA, APA, Chicago, Harvard, and Vancouver. A blue arrow points from the "quotation mark" icon in the search result to the APA citation format in the dialog box.

R. Uenoyama et al. Science Advances (2021)

The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes

R Uenoyama, T Miyazaki, JL Hurst... - ... *Advances*, 2021 - advances.sciencemag.org

Domestic cats and other felids rub their faces and heads against catnip (*Nepeta cataria*) and silver vine (*Actinidia polygama*) and roll on the ground as a characteristic response. While this response is well known, its biological function and underlying mechanism remain undetermined. Here, we uncover the neurophysiological mechanism and functional outcome of this feline response. We found that the iridoid nepetalactol is the major component of silver vine that elicits this potent response in cats and other felids ...

☆ All 4 versions

Showing the best result for this search. See all results

Cite

MLA Uenoyama, Reiko, et al. "The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes." *Science Advances* 7.4 (2021): eabd9135.

APA Uenoyama, R., Miyazaki, T., Hurst, J. L., Beynon, R. J., Adachi, M., Murooka, T., ... & Miyazaki, M. (2021). The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes. *Science Advances*, 7(4), eabd9135.

Chicago Uenoyama, Reiko, Tamako Miyazaki, Jane L. Hurst, Robert J. Beynon, Masaatsu Adachi, Takanobu Murooka, Ibuki Onoda et al. "The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes." *Science Advances* 7, no. 4 (2021): eabd9135.

Harvard Uenoyama, R., Miyazaki, T., Hurst, J.L., Beynon, R.J., Adachi, M., Murooka, T., Onoda, I., Miyazawa, Y., Katayama, R., Yamashita, T. and Kaneko, S., 2021. The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes. *Science Advances*, 7(4), p.eabd9135.

Vancouver Uenoyama R, Miyazaki T, Hurst JL, Beynon RJ, Adachi M, Murooka T, Onoda I, Miyazawa Y, Katayama R, Yamashita T, Kaneko S. The characteristic response of domestic cats to plant iridoids allows them to gain chemical defense against mosquitoes. *Science Advances*. 2021 Jan 1;7(4):eabd9135.

BibTeX EndNote RefMan RefWorks

SECTION 3: WRITING, REVISING, and PROOFREADING:

Writing takes time. Have a clear purpose in mind when you sit down to write and allow yourself quiet time to focus. Final papers are never written in one sitting so allow yourself enough time for writing *and revising*. The nice thing about writing a research paper is that you can work on portions of the paper in isolation, starting with introduction and the methods. The methods are the easiest part to write because you have done the investigation and you know what needs to be included. (Refer back to page 7, Suggested Research and Writing Sequence)

After you have completed your first draft, read it *OUT LOUD* to yourself. **Reading the paper out loud is the best way to catch awkward phrasing, redundancy and run on sentences.** Then set the paper aside for at least a full day. Just forget about it. After a day (or two), re-read the paper and edit as needed.

Be sure to have your science teacher, English teacher, mentor or someone in the lab read the paper and give you feedback. Be sure to ask one or two people who are not familiar with what you are doing to read the paper and give you comments. Have you communicated clearly? Ask them to mark any sections or statements that were unclear and that they had to read over more than once to understand.

Tips for revising your paper:

- Strive for clarity, making statements concise and specific
- Remove unnecessary words as they generally get in the way of clear communication
- Use third person grammar when possible
- Be aware of verb tenses throughout the paper;
Abstract: past tense
Introduction: Present and past tense are appropriate for the introduction
Past tense or present perfect tense (researchers *have shown* that...) is used in the literature review and Materials & Methods
Results: past tense
Discussion and Conclusion: Present tense. The present tense is acceptable here as you are inviting your readers to join in your considerations of how the results relate to the bigger picture of the investigation.
- Generally, avoid the use of pronouns, especially “it”. Is the meaning clear, is it obvious what the pronoun refers to? Avoid using them and it will not be an issue.
- Do not use contractions in formal science writing: don’t becomes do not

SECTION 4: JSHS Oral Presentation

All students presenting research in the oral session, must prepare the following:

- JSHS Research Paper
- Abstract
- Oral Presentation
- [Statement of Outside Assistance](#)

Students selected to present at the Arizona Regional JSHS give an oral presentation of their research to an audience of their peers, teachers, and judges. Approximately 40 students will be chosen from the pool of all research paper submissions. The top five presenters will be invited to attend and compete at the National JSHS competition. A sixth presenter will be selected as an alternate should one of the top five finalists not be able to attend the National JSHS.

1st Place Finalist will receive \$2,000 and the opportunity to present at National JSHS
2nd Place Finalist will receive \$1,500 and the opportunity to present at National JSHS
3rd Place Finalist will receive \$1,000 and attend the National JSHS
4th and 5th Place Finalists attend the National JSHS

In addition, each of the top five finalists will receive a \$1,000 scholarship to the University of Arizona.

Requirements for the Oral Presentation

Timing of Presentation

- Presentation may not exceed 12 minutes
- Followed by a six-minute question period from the judges.

A session moderator will aid the student speaker in maintaining this schedule. The procedure for maintaining the time includes a final two-minute signal for the student, and a one minute signal. At the 12-minute point, the student speaker must stop the presentation even if he or she has not finished.

Only judges may ask questions of the presenter. The presenter should repeat a question before answering so the audience hears the questions clearly. The moderator will end the question session after six minutes.

Slide Deck Presentation

Suggestions to Prepare for the Oral Presentation

Remember, you are the expert. No one in the audience knows as much about your research investigation as you. Therefore, remember to explain your research in enough detail so the audience will understand why you did the research, what you did, how you did it, and what you learned.

Whenever possible, avoid jargon or unnecessary terminology. If it is essential to use specialized terms, remember to explain the specialized term briefly.

Think of your presentation as storytelling. Give your audience enough time to understand what you are trying to convey, do not rush. The best public speaking advice focuses on carrying a consistent story line through your presentation. Tell your audience what you are going to say, say it, then remind them of what you said.

Your goal is to tell a compelling story about how you answered an interesting scientific question. To do this, be consistent in your word choices across the presentation so as to carry the thread throughout the speech. Do not make your audience have to translate between terms as this will take away precious processing time and attention.

Tips for creating effective slides:

- Include all the key parts and information of the research paper: background information and rationale, research question and hypothesis, methods, results and conclusions, acknowledgements and a reference slide if you have cited references in your presentation
- Be sure to have a slide for acknowledgements, may be the second slide after the title slide or your final slide
- Minimize the amount of text on a slide. The audience CANNOT both read and listen to your speech.
- Do not put anything on a slide that you cannot explain
- Graphs, tables and other representation help explain your results (see Data Visualization suggestions, page 14-15)
- Keep graphs and images simple and uncluttered
- Be sure that the graph or table can “stand on its own”, without need of more text or explanation
- Focus on important take home information
- If applicable, remind the audience of something you presented in an earlier slide and relate current slide to it

Tips for presenting effective slides:

- Interact with the visual aids (slides); they are not just a backdrop to your presentation
- Point to information on the slide to emphasize what you are saying
- Slow down and walk your audience through your graphs and figures, call out the variables on each axis of a graph, and state the significance of the position and shape of the graph line.
- Deliver your presentation at an unhurried, comfortable pace. Help the audience to see what you want them to see in your figures; be a courteous tour guide of your research process and findings.

It helps to practice your presentation before a non-specialized audience. Practice will help perfect the presentation and the timing. Do listen to the advice of your non-specialized audience but also get help from a teacher or other advisors as needed. Practice often enough that you are

comfortable but be careful not to over rehearse. Try to relax and enjoy the opportunity to share your work.

PowerPoint Suggestions from National JSHS:

Student presenters are reminded to:

- Embed any video, or other presentation developed through other software, into PowerPoint.
- Save the PowerPoint presentation to an IBM-compatible thumb drive, and plug into available PC-based equipment with that thumb drive.
- Bring back-up media.
- If using video, students must comply with the following ground rules:
 - o The video component cannot make up more than one (1) minute of the presentation and must be directly relevant to the project.
 - o No audio or background music is permitted other than sounds that are an integral part of the research. Recorded or mechanically produced narration is not permitted. Narration must come from the speaker.
- Videos (and audio, if any) may be used only for those aspects of the presentation that cannot adequately be presented in a slide.
- Video material presented must be an integral part of the research and should not be a substitute for presentation of data.
- Videos must not be used for presentation of common procedures, equipment or showing laboratory facilities.
- Videos should illustrate work that was done and should not be used for stimulation or aesthetic value.

SECTION 5: Judging Criteria for Arizona JSHS

Judging Criteria Regional and National judges evaluate students' presentations using the criteria below. Judges rank each of the presentations based on these criteria and using a scale from 1 to 5. The scores are tallied for each presenter and used as the basis for discussion among judging team members where each criterion is considered.

- Statement and identification of research problem
- Scientific thought, creativity/innovation, appropriate duration
- Research or engineering design and procedures
- Logical conclusion relevant to the research problem. What was learned? Did student recognize contribution to the field?
- Skill in communicating



Junior Science & Humanities Symposium Judging Score Sheet

JSHS recognizes students for original research achievements in the sciences, technology, engineering or mathematics (STEM). The overall test is that students demonstrate valid investigation and experimentation aimed at discovery of knowledge. The judging criteria and scoring for JSHS are presented. A total score of 30 points is assigned using the below scale and serves as the basis for discussions among the judging team. Rank each students' oral presentation using the following criteria and weights: 5 = Superior 4 = Excellent 3 = Good 2 = Satisfactory 1 = Fair

Judging Criteria	Suggested Weight
Statement and identification of research problem <ul style="list-style-type: none"> • Is the problem clearly stated? • Does the presenter demonstrate understanding of existing knowledge about the research problem? 	1 2 3 4 5
Scientific thought, creativity/originality <ul style="list-style-type: none"> • Student demonstrates his or her individual contributions to and understanding of the research problem • Appropriate duration of collection and data analysis • Innovation of Original Concept and Scientific Thought/Process <ul style="list-style-type: none"> ○ Standard Protocol/Design ○ Innovative Protocol/Design 	1 2 3 4 5
Research design, procedures (materials & methods), results <ol style="list-style-type: none"> 1. Science <ul style="list-style-type: none"> • Appropriateness of research design and procedures • Process skills demonstrated by the student in the solution to the research problem and/or the research design • Identification and control of variables • Reproducibility 2. Engineering, computer science, technology <ul style="list-style-type: none"> • Workable solution that is acceptable to a potential user • Recognition of economic feasibility of solution • Recognition of relationship between design and end product • Tested for performance under conditions of use • Results offer an improvement over previous alternatives 	1 2 3 4 5
Discussion/Conclusions <ul style="list-style-type: none"> • Clarity in stating conclusion • Logical conclusion that is relevant to the research problem and the results of experimentation or testing • Recognizes limits and significance of results • Evidence of student's understanding of the scientific or technological principles • Theoretical or practical implications recognized • What was learned? 	1 2 3 4 5
Skill in communicating research results-- Oral Presentation and written report <ul style="list-style-type: none"> • Clarity in communicating research results to non-specialized audience and to judges • Definition of terms as necessary • Appropriate use of audio-visuals • Response to questions from judges 	1 2 3 4 5
Includes References/Bibliography and acknowledges major assistance received	1 2 3 4 5

Resources: SARSEF would like to acknowledge the following organizations whose work inspired and was adapted to create this research writing and presentation handbook for Arizona students and teachers.

Dataspire Education & Evaluation LLC <https://dataspire.org/> Kristin Hunter-Thomson, 2021

Guidelines for Preparation and Presentation of Student Research. The Illinois Junior Science and Humanities Symposium ©1995-98 Board of Trustees, Southern Illinois University

Iowa Junior Science and Humanities Symposium Student Teacher Handbook. Belin-Blank Center, University of Iowa <https://belinblank.education.uiowa.edu/students/jshs/#prepare>

National Junior Science and Humanities. www.jshs.org

Pechenik, Jan (1993) A Short Guide to Writing About Biology. Harper Collins College Publishers. N.Y., N.Y.

Learning Tools and Resources

Online Statistics Education: A Multimedia Course of Study (<http://onlinestatbook.com/>). Project Leader: [David M. Lane](#), Rice University. <http://onlinestatbook.com/2/index.html>

List of good data resources, from Dataspire Education and Evaluation, LLC

<https://dataspire.org/finding-authentic-and-relevant-data-to-use>

- <https://www.hhmi.org/biointeractive>
- <http://datanuggets.org/>
- <https://tuvalabs.com>
- <https://concord-consortium.github.io/codap-data/>
- <http://www.vizhealth.org/>
- <https://www.google.com/publicdata/directory/>
- <https://mynasadata.larc.nasa.gov/>
- <https://datainthe classroom.noaa.gov/>

Graphing Platforms/Software Alternatives to Google Sheets:

Google Sheets is a good place to make quick look graphs, but it is actually a spreadsheet program that we have round-peg-square-holed into a graphing program. Here are some other (free) programs that are specifically built to be a graphing program:

- [Tuva](#) - tools designed to help students make and manipulate graphs quickly
- [CODAP](#) - graphing simulation and real-world data
- [Infogram](#) - Create infographics, charts, and maps
- [ArcGIS for Schools Bundle](#) - online free access to ESRI's GIS mapping software
- [Tableau Public](#) - data tool built for workforce, so has a bigger lift of entry

Tuva Resources to Get Started:

- [Importing Your Data into Tuva resources](#)
- [Quick Reference to Tuva Tools](#) - reference sheet of what all the different things are
- [Tuva Tutorials](#) - learn how to use the Tuva tools through guided assistance
- [Types of Tuva Instructional Materials](#) - each described so it is easy to compare

- Tuva [Support](#) center

Tuva Teaching Resources:

- Quickstart guides: [Math & Statistics](#) and/or [Next Gen Science Standards](#)
- [Graph Choice Chart](#) to help your students choose the best graph type for their data
- [Introductory Activities: Man's Best Friend](#) - explore dog data to learn the Tuva tools
- Student handouts:
 - [CER handout](#) to help students make sense of data
 - [Describing Shapes of Distributions](#)- reference handout for students
- Exploring pedagogy:
 - [Data & the 5E Instructional Model](#)
 - [Data & Claim-Evidence-Reasoning](#)

[Turning Data into Evidence: Where Science Standards and Data Meet](#)

SECTION 6: APPENDICES

Appendix A

EXAMPLE of a TABLE:

Table 3. Vaccine Efficacy Overall and by Subgroup in Participants without Evidence of Infection before 7 Days after Dose 2.

Efficacy End-Point Subgroup	BNT162b2 (N=18,198)		Placebo (N=18,325)		Vaccine Efficacy, % (95% CI) [†]
	No. of Cases	Surveillance Time (No. at Risk)*	No. of Cases	Surveillance Time (No. at Risk)*	
Overall	8	2.214 (17,411)	162	2.222 (17,511)	95.0 (90.0–97.9)
Age group					
16 to 55 yr	5	1.234 (9,897)	114	1.239 (9,955)	95.6 (89.4–98.6)
>55 yr	3	0.980 (7,500)	48	0.983 (7,543)	93.7 (80.6–98.8)
≥65 yr	1	0.508 (3,848)	19	0.511 (3,880)	94.7 (66.7–99.9)
≥75 yr	0	0.102 (774)	5	0.106 (785)	100.0 (–13.1–100.0)
Sex					
Male	3	1.124 (8,875)	81	1.108 (8,762)	96.4 (88.9–99.3)
Female	5	1.090 (8,536)	81	1.114 (8,749)	93.7 (84.7–98.0)
Race or ethnic group‡					
White	7	1.889 (14,504)	146	1.903 (14,670)	95.2 (89.8–98.1)
Black or African American	0	0.165 (1,502)	7	0.164 (1,486)	100.0 (31.2–100.0)
All others	1	0.160 (1,405)	9	0.155 (1,355)	89.3 (22.6–99.8)
Hispanic or Latinx	3	0.605 (4,764)	53	0.600 (4,746)	94.4 (82.7–98.9)
Non-Hispanic, non-Latinx	5	1.596 (12,548)	109	1.608 (12,661)	95.4 (88.9–98.5)
Country					
Argentina	1	0.351 (2,545)	35	0.346 (2,521)	97.2 (83.3–99.9)
Brazil	1	0.119 (1,129)	8	0.117 (1,121)	87.7 (8.1–99.7)
United States	6	1.732 (13,359)	119	1.747 (13,506)	94.9 (88.6–98.2)

* Surveillance time is the total time in 1000 person-years for the given end point across all participants within each group at risk for the end point. The time period for Covid-19 case accrual is from 7 days after the second dose to the end of the surveillance period.

[†] The confidence interval (CI) for vaccine efficacy is derived according to the Clopper–Pearson method, adjusted for surveillance time.

[‡] Race or ethnic group was reported by the participants. “All others” included the following categories: American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, multiracial, and not reported.

Source: Polack, F. P., Thomas, S. J., Kitchin, N., Absalon, J., Gurtman, A., Lockhart, S., ... & Gruber, W. C. (2020). Safety and efficacy of the BNT162b2 mRNA Covid-19 vaccine. *New England Journal of Medicine*.

Appendix B: Examples of Figures: Graphs and Diagrams

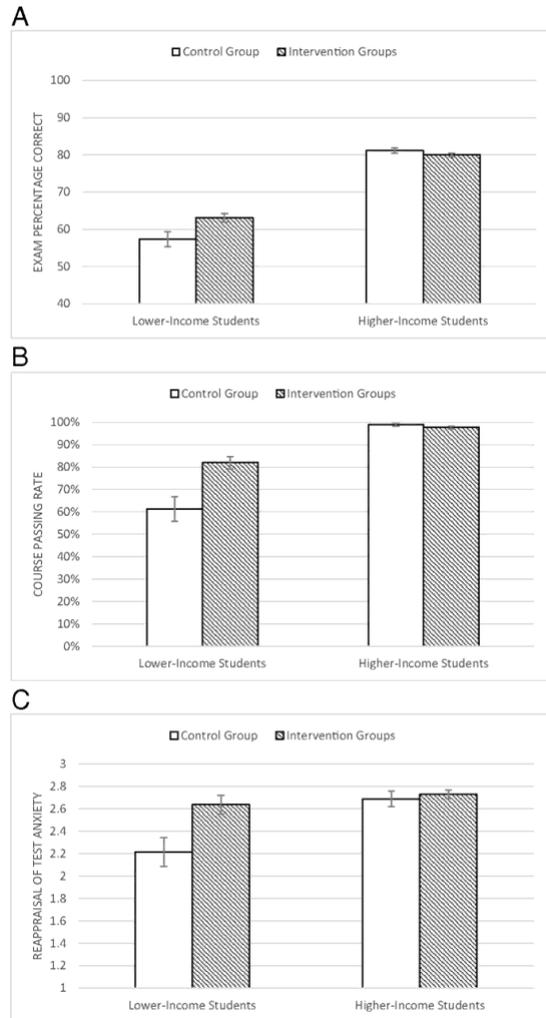


Figure 2. Effects of emotion regulation interventions on examination performance (A), course passing rate (B), and reappraisal of test anxiety (C).

Effects of emotion regulation interventions on examination performance (A), course passing rate (B), and reappraisal of test anxiety (C). Comparisons are between students given any of the three interventions and students given the control exercises. Students are defined as lower- or higher-income based on free or reduced lunch status. Error bars represent ± 1 SE of the mean.

Source: Rozek, C. S., Ramirez, G., Fine, R. D., & Beilock, S. L. (2019). Reducing socioeconomic disparities in the STEM pipeline through student emotion regulation. *Proceedings of the National Academy of Sciences*, 116(5), 1553-1558.

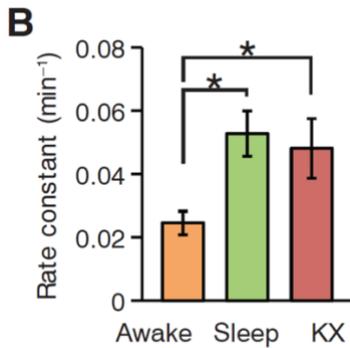


Figure 3B: The different rates at which β -amyloid ($A\beta$) was cleared from the brains of mice that were awake, asleep, or in an induced sleep state using the anesthetic ketamine/xylazine (KX). The * indicates a P value < 0.05 , ANOVA with Bonferroni test. The error bars represent standard error of the mean.

Source: L. Xie *et al.* 2013. Sleep drives metabolite clearance from the adult brain. *Science* 342 (6156), 373-377.

View article:

<http://science.sciencemag.org/content/342/6156/373>

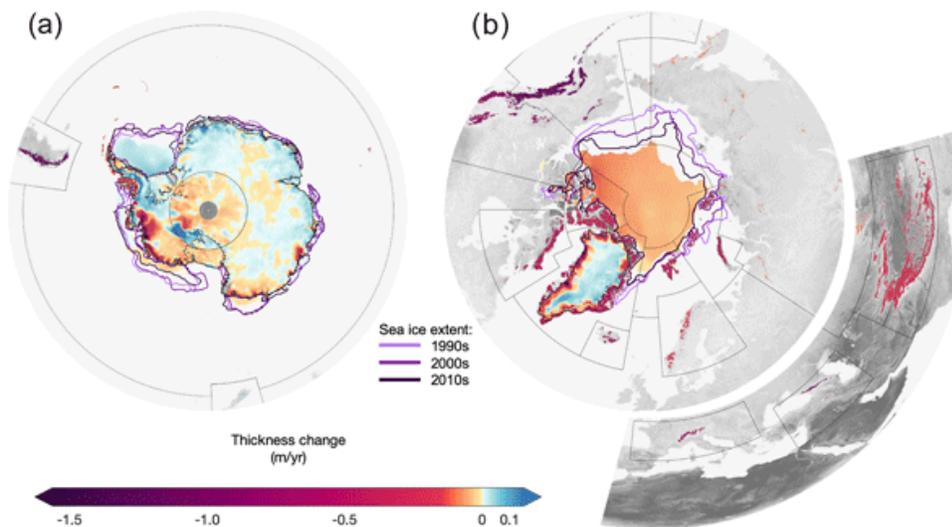


Figure 1. Average rate of ice thickness change in the (a) Southern Hemisphere and (b) Northern Hemisphere. Changes in Antarctic (1992–2017) and Greenland ice sheet (1992–2018) thickness were estimated using repeat satellite altimetry following the methods of Shepherd *et al.* (2019). Sea ice thickness trends between 1990 and 2019 are determined from numerical sea ice and ocean modelling (Zhang and Rothrock, 2003), as well as the average minimum of sea ice extent in February (Antarctic) and September (Arctic) (purple lines) for each decade during the same period. Glacier thickness change between 1992 and 2018 for glacier regions defined in the Randolph Glacier Inventory (RGIC Consortium, 2017) (black boundaries) are from mass change estimates (Braun *et al.*, 2019; Foresta *et al.*, 2016; Jakob *et al.*, 2020; Tepez *et al.*, 2021; Wouters *et al.*, 2019; Zemp *et al.*, 2019b) which have been converted to a thickness change assuming an ice density of 850 kg m^{-3} . The black circle at the south pole indicates the southern limit of the orbit of ERS and ENVISAT satellite altimeters, which were in operation between 1992 and 2010. The area between 81.5 and 88°S has been covered by CryoSat-2, which launched in 2010

Source: Slater, T., Lawrence, I. R., Otosaka, I. N., Shepherd, A., Gourmelen, N., Jakob, L., Tepez, P., Gilbert, L., & Nienow, P.. (2021).

Review article: Earth's ice imbalance. *The Cryosphere*, 15(1), 233–246. <https://doi.org/10.5194/tc-15-233-2021>



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