

# **Fellowship Application Workshop**

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College of Engineering  
Fellowships Committee

# A TRAJECTORY TO OPPORTUNITIES

A graduate fellowship can be a key to your engineering success. Begin now to prepare for fellowship applications and place yourself on a trajectory to opportunity.



## 1 FRESHMAN

Participate in the  
BYU Honors Program

## 2 SOPHOMORE

Find a faculty mentor  
Apply for an ORCA Grant

## 3 JUNIOR

Participate in undergraduate research  
Publish a research paper  
or give a conference presentation

## 4 SENIOR

Apply for fellowships

## 5 GRAD SCHOOL

Pursue an MS or PhD—or both

## OPPORTUNITIES

Breakthrough research  
Leadership  
Strategy  
Innovation  
Policy  
Grand challenges  
Entrepreneurship

# PRESTIGIOUS NATIONAL FELLOWSHIPS IN ENGINEERING

## GRADUATE RESEARCH FELLOWSHIPS

Winners typically go to top U.S. graduate schools  
Worth \$30,000–60,000 per year

Aim for 3.8 GPA or higher  
Participate in undergraduate research  
Apply in the fall of your senior year  
Generally reserved for U.S. citizens or U.S. persons  
BYU's engineering program has a good track record of successful candidates



National Science Foundation



Department of Defense



Department of Energy



NASA



SMART



Hertz

## GRADUATE STUDY ABROAD FELLOWSHIPS

Winners go to graduate school in the United Kingdom or elsewhere

Various dollar values

Aim for 3.9 GPA  
Seek broadening experiences  
Apply at the end of your junior year  
Generally reserved for U.S. citizens or U.S. persons  
Can be very competitive



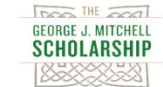
Fulbright



Gates



Marshall



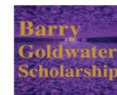
Mitchell



Rhodes

## UNDERGRADUATE SCHOLARSHIPS

Good practice for graduate fellowships  
Can be worth several thousand dollars  
Apply as a sophomore or junior



Goldwater



Tau Beta Pi



Phi Kappa Phi



Many other options

For more information, contact your department fellowship expert (listed below) or visit [www.et.byu.edu](http://www.et.byu.edu).

**CHEMICAL ENGINEERING:** John Harb, 801-422-4393, [john\\_harb@byu.edu](mailto:john_harb@byu.edu)

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**ELECTRICAL AND COMPUTER ENGINEERING:** Karl Warnick, 801-422-1732, [warnick@ee.byu.edu](mailto:warnick@ee.byu.edu)

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**SCHOOL OF TECHNOLOGY:** Richard Helps, 801-422-6305, [richard\\_helps@byu.edu](mailto:richard_helps@byu.edu)

# Trajectory to Opportunities

- Freshman
  - Scholarships
  - Honors Program
- Sophomore
  - Find a faculty mentor
  - Apply for a research grant
- Junior
  - Participate in undergraduate research
  - Write a paper or present at a conference
- Senior
  - **Apply for fellowships**
- Graduate school
  - MS and/or PhD degrees
  - Breakthrough research, leadership, policy, grand challenges, innovation, entrepreneurship

# BYU has a Prestigious Scholarships Office

- They are not BYU's Scholarship Office or BYU's Financial Aid Office
- What they do:
  - Promote national and international scholarships and fellowships
  - Help students apply for external scholarships
  - Make scholarship resources easily accessible
- Where they are:
  - Maeser Building
- Contact info:
  - [national.scholarships@byu.edu](mailto:national.scholarships@byu.edu)
  - [ugrad.byu.edu/scholarships](http://ugrad.byu.edu/scholarships)



# Prestigious Scholarships at BYU

BYU has a heritage of excellence over the years:

- 35 Goldwater
- 28 Gilman
- 59 Fulbright
- 5 Gates Cambridge
- 5 Truman Scholarships
- 5 James Madison
- 11 National Defense Science & Engineering
- 157 National Science Foundation Graduate Research

# Undergraduate Scholarships

- Barry M. Goldwater
- Morris K. Udall
- National Security Education Program
- Phi Eta Sigma
- Phi Kappa Phi
- Golden Key
- Harry S. Truman

# Graduate Fellowships

## **General and Humanities Fellowships:**

Marshall

Mitchell

Rhodes

Gates

Fulbright

Institute for Humane Studies (IHS)

Intercollegiate Studies Institute (ISI)

National Security Education Program (Boren)

Woodrow Wilson (Pickering)

Samuel Huntington Public Service Award

James Madison Memorial Fellowship

## **Science, Engineering & Technology:**

Hertz Foundation

Department of Energy Computational Science Graduate Fellowship

National Defense Science and Engineering Graduate Research Fellowship

National Science Foundation Graduate Research Fellowship Program

NASA Space Technology Graduate Research Opportunities

National Institutes of Health-Graduate Partnerships Program

Rocky Mountain NASA Space Grant

Tau Beta Pi (Engineering)

U.S. Department of Energy

U.S. Department of Homeland Security

Science, Mathematics And Research for Transformation (SMART) Scholarship (DOD)



# Why a Fellowship?

- Most graduate students in engineering fields are supported by stipends from external research grants
- Why is a fellowship better than a regular research assistantship?
  - Winning a prestigious national fellowship is an indicator of future success in research
  - More money
  - Extra funds for tuition, books, supplies, and research expenses
  - Helps in the admissions process for top ranked graduate programs

# National Science Foundation Graduate Research Fellowship

- *Support students who have demonstrated their potential for significant achievements in science and engineering research*
- College seniors or 1<sup>st</sup> year graduate students
- Fields of science, mathematics, or engineering
- Stipend of \$32,000, education allowance, one-time \$1,000 International Research Travel Allowance (\$132k total value)
- 3 years
- Good GPA (3.8+), research products – journal paper and/or conference paper

**Deadline: October to Mid-November**  
(deadlines vary by discipline)



# NSF GRFP Application

- Submit at [www.fastlane.gov/grfp](http://www.fastlane.gov/grfp)
- U.S. citizens, nationals, and permanent residents
- Academic transcripts
- Three letters of reference (online)
- Personal statement
  - How will grad school prepare you to expand scientific understanding and broadly benefit society?
- Research statement
  - Intellectual merit and broader impact on society
  - Creative and transformative
  - Well-reasoned research plan
- GRE scores optional
- Around 2,000 awards out of 12,000 applications (17%)
- See [nsf.gov/grfp](http://nsf.gov/grfp) for more info

# NASA Space Technology Graduate Research Opportunities

- “NASA’s Space Technology Mission Directorate (STMD) seeks to sponsor U.S. citizen and permanent resident graduate student researchers who show significant potential to contribute to NASA’s goal of creating innovative new space technologies for our Nation’s science, exploration, and economic future.”
- Technology areas: propulsion systems, space power and energy storage, robotics and autonomous systems, communication, modeling and simulation, nanotech, materials, structures, thermal management, etc.
- MS and/or PhD students
- \$36,000/yr stipend, \$44,000/yr in travel, fees, etc. – up to \$240,000 total value!
- NASA research collaborator, visit to NASA research center or lab
- Application:
  - Personal statement
  - Project narrative
  - Schedule
  - Curriculum Vitae (CV)
  - Transcripts and GRE scores
  - Letters of recommendation
- **Deadline: November**

# Students Preparing for Prestigious Scholarships Should

- Participate in undergraduate research
- Develop meaningful relationships with people who can open doors for you – faculty mentor
- Know scholarship eligibility requirements and deadlines.
- Apply
- Keep trying!

# Advisor and Recommenders

- Scholarship Advisor
  - An advisor is a critical contact; he or she will help you develop a competitive application, give you meaningful revision advice, and provide answers to questions you have along the way
- Recommenders
  - Choosing the right recommenders can give your application the competitive edge

# Letters of Recommendation

## Carefully select your recommenders

- Letters must be specific and include details
- Choose professionals and academics
- Recommendations need to be positive and well written

## Be helpful

- Provide recommenders with specific information about the scholarship and yourself. A brief listing of your accomplishments or a draft letter will make writing a glowing letter about you much easier for them.

## Respect your recommenders' time

- Give recommenders 2-4 weeks to write the letter
- Let them know the deadline

## Follow up

- Drop in a week before it is due to offer any additional help and remind them of the approaching deadline

# Application

- Make sure to follow directions:
  - Deadline
  - Be complete and correct
  - Appearance is important
- Start early and revise
  - Write your essays early and seek feedback from qualified editors! Revision is not optional. Only those who revise, revise, revise will be successful
- Aim to submit your application early; last minute crises often occur



# Typical Essays

## Personal statement

- “Personal/intellectual biography in narrative form.”
- Discuss personal motivations, experiences, education, and activities
- Show how this ties in to future goals for graduate education and career
- Reveal your personality and make it memorable (i.e. entertaining) but not frivolous or canned.
- Find a balance between interesting and personal and mature and solid

## Research Plan

- Relevant and exciting problem
- Well thought out plan with clear goals and logical steps
- Research must have high impact on the technical field and society
- Rewrite so your passion comes through and writing is clear
- NSF: Thoroughly address both “Intellectual Merit” and “Broader Impacts.”

# Example Rubric (NDSEG)

Points	Section
25	Academic Background (institutions, grades, GRE)
20	Scientific or Research Experiences (incl. employment)
15	Summary of Goals (research interests, why DoD might be interested in the research, relation to long-term goals)
10	Publications, Presentations, and Patents
10	Reference Letters
5	Awards and Honors (since start of undergraduate)
5	Leadership Experiences
5	Memberships & Certifications, Community and Volunteer Experiences
5	Teamwork Experiences

- Students need to publish or present papers
- Lots of diversity in leadership, teamwork, membership/community entries, but there has to be something. Encourage membership in technical societies, Tau Beta Pi, etc.

# A very short history of bad writing

Joseph Williams, *Style: Towards Clarity and Grace*

Scholars and leaders wrote in French and Latin, but as English began to be used in affairs of state, words had to be borrowed, resulting in a two-tiered vocabulary, one for daily life and another for specialized applications

“The legacy of this is both good and bad. English is very flexible – *bravery, mettle, valor, courage* from French; *tenacity, fortitude* from Latin; and English, *fearlessness, guts*. But the language of political, cultural, scientific, and economic affairs is based on a different vocabulary from that learned in the first five or ten years of life.”

“...many English writers became so enamored with an erudite vocabulary that they began deliberately to lard their prose with exotic Latinisms”

“The keynote [of such a style] is the elimination of simple verbs...a verb becomes a phrase, made up of a noun or adjective...in addition, the passive voice is used wherever possible, and noun constructions are used instead of gerunds (by examination instead of by examining)...banal statements are given an appearance of profundity by means of the not un-formation” (George Orwell)

“The adolescents who had effectuated forcible entry into the domicile were apprehended”

“We caught the kids who broke into the house”

# Plainness in writing

“Some writers plump up their prose to impress those who think that complicated sentences indicate deep thinking. And in fact, when we want to hide the fact that we don’t know what we’re talking about, we typically throw up a tangle of abstract words in long complicated sentences.” Michael Crichton

“In literature the ambition of the novice is to acquire the literary voice, the struggle of the adept is to get rid of it.” George Bernard Shaw

Matthew 5:37 “...let your communication be, Yea, yea; Nay, nay: for whatsoever is more than these cometh of evil.”

1 Nephi 14:23 “...the things which were written were plain and pure, and most precious and easy to the understanding of all men.”

In conclusion, the ultimate purpose in dividing the soul into parts for both Plato and Aristotle was political and to explain human behavior. Plato's tripartite division originated from the isomorphic relation between the soul and the city. Both Plato and Aristotle believe that there is some sort of spirited part of the soul and that it is irrational. Furthermore, Aristotle believed that the soul was further divisible; however, he did not specify how many parts it was divisible into. Thus, this raises questions as to its accuracy. Plato at least gave a definite number of parts. Furthermore, Aristotle critiqued the Academic version of bipartition which was very similar to his own. Thus, Aristotle posited a bipartite version that was essentially a tripartite division, with further parts that are not specified. Hence, Aristotle's division is a more accurate representation of the soul; however, both divisions misinterpret the role of the spirited part or of its equivalent.

# Metadiscourse

- Metadiscourse signals the writer's intentions, gives directions to the reader, or indicates the structure of the text
- *to sum up, note that, however, therefore, furthermore, first, second, finally*
- Metadiscourse is one of the “features of style” used in academic writing that is mimicked by the novice. In the worst case, it is used to create the illusion of coherence
- **Trim out most metadiscourse**

# Telling Stories

“The cause of our schools’ failure at teaching basic skills is not understanding the influence of cultural background on learning”

“Our schools have failed to teach basic skills because they do not understand how cultural background influences the way a child learns”

**Make the characters in your writing subjects, and the actions verbs**



# Cohesion and Coherence

“Some astonishing questions about the nature of the universe have been raised by scientists studying black holes in space. The collapse of a dead star into a point perhaps no larger than a marble creates a black hole.”

“Some astonishing questions about the nature of the universe have been raised by scientists studying black holes in space. A black hole is created by the collapse of a dead star...”

**Cohesion: Put familiar information at the beginning of a sentence, and technical terms or new or surprising information at the end (“Old before new”)**

“Sayner, Wisconsin, is the snowmobile capital of the world. The buzzing of snowmobile engines fills the air, and their tank-like tracks crisscross the snow. The snow reminds me of mom’s mashed potatoes, covered with furrows I would draw with my fork. Her mashed potatoes usually make me sick...”

**Coherence: Sentences in a paragraph have consistent topics. Look at the first few words in each sentence in a paragraph and see if they hang together**

# Emphasis

- Start a long sentence with simple and short elements (simplicity to complexity)
- The end of a sentence is its stress position. Put important words there
- The point of a paragraph is often at the end of the first sentence. Put key words in the stress position of a passage's first sentence to emphasize the concepts that will be developed

# Hedges and intensifiers

Hedges: usually, often, likely, to an extent, most, many, may, might, indicate, suggest

Intensifiers: very, quite, obviously, invariably, of course, show, prove, major, fundamental, principal, as everyone knows

“For a century now, all liberals have argued against any censorship of art, and every court has found their arguments so completely persuasive that not a person any longer remembers how they were countered. As a result, today, censorship is totally a thing of the past.”

“For about a century, many liberals have argued against censorship of art, and most courts have found their arguments persuasive enough that few people remember exactly how they were countered. As a result, today, censorship is virtually a thing of the past.”

- The second version has a less strident tone and suggests a more mature approach
- The paradox of intensifiers...writing can be weakened in its impact by intensifiers and actually strengthened by hedges. Intensifiers convey strong emotion and can appeal to like-minded readers, but are usually unpersuasive for those who don't already share your view

# Elegance

“Its 11- and 12-year-old players, some from struggling neighborhoods, not only cheered a city challenged by violence but charmed the country with their stellar play and outstanding sportsmanship”

These are coordinated balances. Each succeeding balanced element is usually longer than the previous one (short to long)

“Economic changes have reduced the region’s population growth to less than zero, a demographic event that will have serious social implications”

This is a summative modifier. There are also resumptive and free modifiers

# Principles of Clear Writing

Many common rules of grammar are either not very helpful (write clearly!) or can be ignored (don't split infinitives or begin with and or but)

## **Sentence level:**

- **Clarity:** Subjects of sentences are the “character” in the story and verbs express actions
- **Passive voice** is often used in technical writing but first person is also acceptable
- **Stress:** Familiar information at the beginning of a sentence, end with new information
- **Concision:** Eliminate unnecessary words, change negatives to positives, avoid intensifiers, trim metadiscourse (therefore, however, note that)
- **Elegance:** End a sentence with strong words, use balanced phrases

## **Paragraph level:**

- **Stress:** Give the topic of a paragraph at the end of the first sentence
- **Cohesion:** Ends of sentences match the beginning of the next
- **Coherence:** Beginnings of sentences in a paragraph are consistent

From Joseph Williams, *Style: Lessons in Clarity and Grace*

# Fellowship Application Examples

## Personal Statement

Throughout my life, I have always felt that I should use my talents and abilities to make a positive impact on the world and that I could never truly be happy without serving a purpose greater than myself. After being offered a full-tuition academic scholarship at Brigham Young University, I decided to attend and study computer science to apply my strengths. Although I thought that it was a good choice, I lacked passion in my studies because I did not make the connection between engineering and the positive benefits it can have on individual lives. It was not until I spent two years in India that my eyes were opened.

I traveled to various cities and villages throughout India as a volunteer for the Church of Jesus Christ of Latter-day Saints. I met thousands of people and became aware of how blessed my life had been in comparison to many who struggle daily for the bare necessities of life. I met with many people whose adversity had led to feelings of hopelessness and despair. In many ways, the experience was frustrating because I knew that I could never help everyone who needed it. There were simply too many to count.

## Personal Statement

Only a few months ago, Boulder, Colorado experienced widespread flooding and high numbers of landslides as a result of torrential rainfall. These events cost millions of dollars and numerous lives. Just years ago, New Orleans flooded as a result of Hurricane Katrina, and the floodplain rivers of Bangladesh inundate cities with water almost annually. Natural hazards exemplify only some of the plethora of issues—from adequate food production and distribution to infrastructure maintenance and repair—that society still needs to understand and address. However, the complexity of these issues is seen, if for no other reason, because they have not yet been satisfactorily solved. I entered the civil engineering field because I hoped to lower the costs (both to life and to property) that natural and human-induced hazards generate. Continuing in this field, I have learned that many of these problems simply need to be better understood before satisfactory decisions can be made. My aim in completing both a master's and a doctoral degree is to get the training I will need to begin addressing the hazards facing society today.



## Personal Statement

Some time ago, a question from Facebook's Questions application caught my eye. Someone had asked "Why do we need to learn math? When are we going to need it after high school?" As I thought about these questions, I realized that the real questions were "why do we need to learn? How are we going to use that learning after school?" I reflected back to my high school classes where many of my classmates asked similar questions. Although I didn't have much of an answer back then, I enjoyed learning, especially math and science. This love of learning eventually led me to my answer.

## Proposed Plan of Research

Over the last few decades, characterizing optical fibers based on their transmission properties such as attenuation, dispersion, and spectral response has enabled rapid development and expansion within the telecommunications industry and the field of fiber optics. However, it is not a sufficient means of characterization for advanced fibers and fiber-based devices. The underlying physical properties of fibers, such as size, refractive-index distribution (RID), and residual-stress distribution (RSD), determine the optical properties and performance of such devices. Currently, novel fibers and fiber-based devices are conceived, designed, fabricated, and then characterized by their measured transmission. Assumptions about their physical properties are made to reconcile observed transmission characteristics with theoretical prediction and fabrication changes are made based on these assumptions. The ability to directly measure three dimensional RID and RSD of fibers and fiber-based devices would fundamentally transform the research process as these assumptions would be replaced with measured data.

## Proposed Plan of Research

Computational fluid dynamics (CFD) has sought numerically refined, quantitatively accurate, and algorithmically stable solutions to the Navier-Stokes equations for years. Proper modeling of these equations is crucial to making informed decisions about topics varying from wind loads on buildings to flood mitigation. However, solving these equations is often difficult because of their nonlinear structure and dependence on time and geometry (Anderson 2009). For example, traditional finite element analysis fails to accurately express these flows because it uses piecewise-linear functions to approximate flow, fundamentally changing the solution with grossly simplified geometries. As a potential NSF Graduate Research Fellow, I aim to model the Navier-Stokes equations more stably and accurately than traditional methods using isogeometric analysis and T-splines.

visit [researchdevelopment.byu.edu](http://researchdevelopment.byu.edu) for more info!

# DEPARTMENT OF ENERGY

## SEMINAR FOR GRAD STUDENTS



### David Solan

*Former Deputy Assistant Secretary  
for Renewable Power*

Learn more about Department  
of Energy fellowships and  
internships and the pathway  
to becoming a federal hire.

**NOVEMBER 11TH**  
**2-3 PM**  
**2330 WSC**



# Takeaways

1. Find a faculty mentor and get involved in undergraduate research
2. Start early. Writing quality is important
3. Get more information about fellowships:

[ece.byu.edu/honors](http://ece.byu.edu/honors) (I'll post these slides here)

[engineering.byu.edu/scholarships](http://engineering.byu.edu/scholarships)

## **Contacts:**

**Kristi Chase (Engineering) – funding, administrative review**

**Gus Williams (CE)**

**Karl Warnick (ECEn)**

**John Harb (ChE)**

**David Fullwood (ME)**