REU-CAAR: You’re Here!

William Gasarch-U of MD
Credit where Credit is Due

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  **Cybersecurity Scholars Handbook.**
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▶ Bill G modified this **boring** handbook into a **fascinating** 200-slide talk!
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John: Why are you telling them all that?
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- Bill G modified this **boring** handbook into a **fascinating** 200-slide talk!

**John:** Why are you telling them all that?
**Bill:** In academia its very important to credit past work!
Purpose of This Talk

1. Who are the mentors?
2. What are the projects?
3. What is expected of you?
4. What should you expect of us?
5. Nuts and bolts of how the program works.
6. Advice on how to get the most out of this summer!
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REU-CAAR

REU: Research Experience for Undergraduates.

The Title Encompasses a Lot of Computer Science!
REU: Research Experience for Undergraduates.
CAAR: Combinatorics, Algorithms, and AI for Real Problems.
**REU-CAAR**

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The Title Encompasses... A Lot of Computer Science!
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Later I will say who are on the teams and a bit about the projects.

Talks this week will be mentors talking about their projects.
1. **REU-CAAR Director:** William Gasarch
2. **Projects and Mentors**
   - Verif. of Quantum Simulation: Andrew C, Dhurv D, Alexy G.
   - Security Estimation for Post-Quantum Crypto: Dana DS.
   - Differential Economics: John D and Ian M.
   - Comparing AI to Human Int. with Regard to Bias: Tom G.
   - Ramsey Theory on Ordered Sets: Bill G.
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   - Exploring the Hilbert Geometry: Auguste G. and Dave M.
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Admin

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- **Your Salary**: Jodie Grey
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- **Monday Lunches:**
1. **Research!** What is Research? Discuss!
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   Work on problems where the answers are **not** already known.
Program Goals

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2. **Expose you to a variety of career paths.** Discuss!
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   Useful for the future!
What the Program Expects of You

1. Show up every weekday. On time and sober.
   10:00AM-4:00PM (There may be talks at 4:00 as well.)
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This is the Wrong Way To Look at the program

I invite you to talk about jobs you've had. I'll go first.

Upshot

1. This program should not be seen as a job where you put in your 8 hours a day and then you're free to do what you want.
2. You are here because you care about Quantum or AI or ML or Bias or Ramsey Theory or Geometry or Security.
3. So you should want to keep working on your projects, perhaps on a lower level, after you go back to the dorms.
4. Talk to each other in the dorms about your projects!
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2. Actively contribute to your research project and your team.
3. Check e-mail. Reminders, notices, requests will be emailed.
4. Attend lunches, talks, and other activities. (Talks and some activities joint with REU-BRIDGE.)
5. Participate in assessments such as surveys.
6. Joint presentations with REU-BRIDGE the last week.
7. We expect you to ENJOY items 1, 2, 4, 6.
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3. **Background:** Explain *why* the research is important! How it fits into other things!

4. **Connection:** Help connect you to their colleagues, graduate assistants, others. You will learn as much from them (or more!) as you do from your research tasks!
What Faculty Mentors Expect from You

1. Communication:

   - Be clear in verbal & written communication. Seek clarification, ask questions, provide suggestions.
   - Think for yourself and support your own ideas. Be bold!
   - Be reliable for what your mentor asks you to do.
   - Be interested in the project, field, and topic. Become familiar with background literature.
   - Tell team changes that affect your participation.
   - Be flexible and open-minded.

The acronym is CAMERA.
What Faculty Mentors Expect from You

1. **Communication:** Be clear in verbal & written communication. Seek clarification, ask questions, provide suggestions.

2. **Assertiveness:** Think for yourself and support your own ideas. Be bold!

3. **Maturity:** Be reliable for what your mentor asks you to do.

4. **Enthusiasm:** Be interested in the project, field, and topic. Become familiar with background literature.

5. **Responsible:** Tell team changes that affect your participation.

6. **Adaptability:** Be flexible and open-minded.

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Sexual Harassment and Discrimination

(My second least favorite topic.)
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1. Speak directly to the individual in a respectful manner. This will let you immediately know if the different treatment is a misunderstanding or a major problem.
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2. If you feel uncomfortable, seek advice and guidance from others. Bill Gasarch or Jacquelyn Michaelis (REU-BRIDGE director) can offer assistance and direct you to campus resources for help. Note that in the United State there is Mandatory Reporting: if a mentor or director hears about a case of sexual harassment, they must report it.
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3. While this slide is about Sexual Harassment and Discrimination, feel free to talk to Bill Gasarch or Jacquelyn Michaelis about any issue, even if it is uncomfortable.
You should all know about each others projects:
First Week+++ Talks

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For all projects $p$
First Week++ Talks

You should all know about each other's projects:

For all projects $p$

there exists a mentor $m$ for project $p$ and a day $d$ such that
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You should all know about each others projects:

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there exists a mentor $m$ for project $p$ and a day $d$ such that

mentor $m$ gives a talk on project $p$ on day $d$. 

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there exists a mentor $m$ for project $p$ and a day $d$ such that
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In symbols

$$(\forall p)(\exists m, d)[\text{MENTOR}(p, m) \land \text{TALK}(p, m, d)].$$
First Week - Lunch

1. Monday 12:00-1:00 lunch in IRB.
2. This lunch you will play telepictionary!
3. Tu, We, Th, Fr - Lunch in the union or IRB from your meal card.
4. Bill will join you for lunch some of the first week.
1. Monday 12:00-1:00 lunch in IRB.
First Week - Lunch

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First Week

1. Red Tape stuff (hopefully ends Wed).
2. Research - Every afternoon.
1. **Red** Tape stuff (hopefully ends Wed).
First Week

1. **Red** Tape stuff (hopefully ends Wed).
2. Research—Every afternoon.
Most Weeks

1. Get here by 10:00AM goto your projects room.
2. Research 10:00-12:00 (approx)
3. Lunch 12:00-1:00 (approx). MONDAY lunch IRB
4. Research 1:30-4:00.
5. Talks on Wednesday afternoons at 4:00.
6. Every other Friday you get your paycheck! Don't blow it all on supercomputer time!
7. At night talk about Quantum ML for Security and Ramseyian Geometry
8. On your own on weekends— Explore Washington DC!
9. Some of these items may change (e.g., a talk on a Tuesday).
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   Goto the Whitehouse and say hello to President Biden.
   (Note: Jill Biden has a PhD in Quantum Ramsey Theory.)

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   She does have a PhD in Education and is the first First Lady to have a PhD.)
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Other Things We Will Do

1. Field Trip at Spy Museum (Prob a Monday in July)
2. Lunch where we discuss How to do Bad Science.
3. Lunch where we discuss graduate school (with guests).
4. Game Nights with Pizza! (one or two)
5. Final presentation the last week.
6. Unexpected things will happen! Always expect the unexpected! (Is that a paradox?)
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My Least Favorite Topic

Discuss- what do you think is my least favorite topic?
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Good News That You Know:

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1. You get a stipend.
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**What is ‘your end of the deal’:**
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C.A.M.E.R.A.
1. Verification of Quantum Simulation

We will one day have quantum computers and will need to verify that what they output is correct. One way to do this is to simulate a quantum computer on a classical device. This project will be about how to do that.

4. Student Ruozchen Gong

Misc There may be grad Students and one postdoc Zooming in from China.
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Dana’s Security Project

1. Concrete Security Estimation for Post-Quantum Cryptosystems with Side Information

2. Elevator Pitch
   Quantum computers can, theoretically, factor very quickly. Hence people are already building post-quantum cryptosystems which means those not based on factoring being hard. What about non-math attacks like side-channel? Are the new systems secure against those? Let's find out!

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   Michael Gonzalez, Harikesh Kailad, Alexander Lindenbaum.
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3. **Students** Michael Gonzalez, Harikesh Kailad, Alexander Lindenbaum.
1. Differentiable Economics

2. Elevator Pitch

How do we divide up goods (e.g., children to schools, organs to patients, muffins) in a fair way? What does fair mean? This project will apply AI/ML to these problems.

3. Students

Davidson Cheng, Yang Hong, Reem Al Marzoa, Abdulaziz Memesh.
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Tom’s AI-HI Project

1. Comparing AI to Human Intelligence with Regard to Bias

2. Elevator Pitch

Humans are biased. AI systems are biased. We want to, of course, combat this for AI systems (for humans also, but that would be a Psychology REU). In what ways are human bias and AI similar? different? Can we identify the source of AI bias? Correct it? We’ll try!

3. Students

Maya Murry, Anneke Wernerfelt, Dalal Ahmidouch.
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3. **Students** Maya Murry, Anneke Wernerfelt, Dalal Ahmidouch.
Ramsey Theory on Ordered Sets

1. Elevator Pitch

If you color $\mathbb{N}$ (the natural numbers) RED and BLUE there will be an infinite $A \subseteq \mathbb{N}$ that is all the same color. This set $A$ has the same order-type as $\mathbb{N}$. This means that $A$ looks just like $\mathbb{N}$ if you look at how it is ordered. What about coloring $\mathbb{Z}$ (integers)? $\mathbb{Q}$ (rationals)?

3. Students

Joanne Boyland, Nathan Hurtig, Robert Rust.
1. Ramsey Theory on Ordered Sets

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Students: Joanne Boyland, Nathan Hurtig, Robert Rust.
Bill’s Ramsey Project

1. Ramsey Theory on Ordered Sets
2. Elevator Pitch
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3. **Students** Joanne Boyland, Nathan Hurtig, Robert Rust.
Auguste-Dave Geometry Project

1. Exploring Hilbert Geometry
2. Elevator Pitch
Computational Geometry asks questions like Given a set of lines find all of the points of intersection. It is assumed they mean lines in the plane or perhaps $\mathbb{R}^n$. What if you are in another space? What can you do? This project!

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Madeline Bumpus, Caesar Dai, Samuel Monoz, Renita Santhoshkumar, Songyu Ye.
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3. **Students** Madeline Bumpus, Caesar Dai, Samuel Monoz, Renita Santhoshkumar, Songyu Ye.
Furong’s Fair Div and Bias

1. Fair Division, Resource Allocation, and Bias

2. Elevator Pitch

At one point it was hoped that automating decisions would decrease human bias. Darn! There are times when it inherits human bias. This project looks at how to deal with that (and reduce bias) in the context of ML/AI for resource allocation.

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Suhani Agrawal, Justin Huang, Ben Kreiswirth.
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3. Students Suhani Agrawal, Justin Huang, Ben Kreiswirth.
Complain SOONER Rather than Later

Over the last year there was only THREE complaints:

• Being Virtual is a Real Downer
• This summer the program is in person!
• Talks should be at 4:00 instead of 3:00 so can get more done
• Done!
• Non Citizens Could not get ID cards and hence had to pay Full Price at the Gym

Mihai Pop of REU-BRIDGE was amazed this was true. I had to remind him that incredibly stupid university rules are not unusual.

▶ If those are our only problems then we are in good shape.
▶ I am sure new problems will arise.
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Better to get a problem resolved EARLY, whatever they are.
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Key to a good relationship:
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its finding whose to Blame :-)

Who is Funding This?

1. National Science Foundation (NSF).
2. Andrew C had some spare quantum coins.
3. Google/An Zhu (An Zhu was an ugrad at UMCP who worked in Theory).
5. Other Schools mini-grants.
6. The Winkler Foundation.
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Bill Gasarch’s Mother is Pearl (Nee Winkler) Gasarch
Pearl Gasarch’s Brother is Irwin Winkler
Irwin Winkler is a produce in Hollywood.
Irwin Winkler

Bill Gasarch’s Mother is Pearl (Nee Winkler) Gasarch

Pearl Gasarch’s Brother is Irwin Winkler

Irwin Winkler is a produce in Hollywood.

1. Produced 55 movies
2. Directed 7 movies
3. David Selznick Lifetime achievement award
4. Produced **Rocky++**, **Goodfellows**, **Creed**

For more about him: [https://www.imdb.com/name/nm0005563/?ref_=fn_al_nm_1](https://www.imdb.com/name/nm0005563/?ref_=fn_al_nm_1)

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Why am I telling you this?
Irwin Winkler has established a Charitable foundation that gives money to many worth causes AND also to our REU!
The Winkler Foundation

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Adam Winkler is Irwin’s son who administers the foundation. He’s a law professor so he gets academia. (The other two sons are in the biz.)

https://www.amazon.com/s?k=Adam+Winkler&ref=nb_sbnoss_2
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Where Does the Winkler Money Go?

Things the NSF won’t pay for:

▶ Money for housing for non-citizens.
▶ The Monday Lunches.
Questions from You?

I welcome questions now and anytime!