



The Ultimate
Resource Bank
For High School
Science
Students

A CRIMSON EDUCATION PUBLICATION

WINNER OF THE ISEF, 2019

Krithik Ramesh

Krithik won the prestigious Intel Science and Engineering Fair in 2019 by developing a technology to predict the movement of the spine during surgery. He also won an ISEF category in 2018 for his research into the aerodynamics of aeroplane wings.

[Click here to listen to his episode from the Top of the Class podcast.](#)



Favourite Resources

What helped me get started with research

**"The Art of Scientific Investigation"
by W.I.B. Beveridge**

One of the hardest things about doing research is that you may be working in an industry that's still figuring out a "rule book". This book provides an excellent guideline to cultivate good technical skills for beginners and experienced researchers alike.

ArXiv

A lot of papers or journals can be buried by paywalls. ArXiv is a public pre-publishing platform that allows you to read papers at no cost and even allows you to download them as PDFs.

Google Patent Search

This resource is particularly useful for engineers. A cumbersome part of conducting an engineering project is seeing what kind of research and design workflow exists for any given idea you may have so Google Patent Search allows you to quickly search through a comprehensive database of US and international patents. Wet lab, psychology, and even computer science projects can stand to benefit from a patent search.

"If you're able to talk with someone intelligently about your project, in like a hypothetical coffee place, then you've done it correctly. You have a narrative that speaks to your project. The background information is the technical details that you've amassed over reading, like hundreds of papers, literature reviews that you've done, all the experimentation that you did, and bringing it all together."

~ Quote from Krithik's Podcast Episode

Connecting with Krithik

Visit [Krithik's website](#) to learn more about his projects and connect with him on social media.

What helped me get into Computer Science

Stanford CS229 – Introduction to Machine Learning.

For a lot of people artificial intelligence and machine learning stays in abstraction and doesn't get its due credit in technical understanding. This course however provides a lot of understanding on both the practical and theoretical concepts that make this paradigm possible. You

Harvard COMPSCI 224 – Advanced Algorithms

One of the most insightful classes I have ever taken. For those tackling more nontrivial computer science or more applied problems that can use traditional algorithmic principles, this class is for you! These lectures provide detailed insight on the advanced data structures and algorithms and specific use cases. I would consider this a rather technically rigorous course but worth the effort for more sophisticated computer science concepts.

MIT OpenCourseWare (OCW) – Introduction to Probability and Statistics

Machine learning and research in general is a statistical affair. A strong researcher is one who is able to clearly convey your results in a contextualized and verifiable manner. The foundation for any results conclusion and validation comes from being able to interpret data with statistical relevance. A good primer for this material is MIT's intro to stats class that helped me get on my way with research analyses!

What helped me get into Biology and Anatomy

Atlas of Human Anatomy

I found this immensely beneficial to navigate the maze that is the human body. From biomechanics to chemical composition this book is a one-stop-shop to help you learn about the human body.

MIT OpenCourseWare (OCW)

Principles of Medical Imaging Learn how medical imaging works and what anatomical features are presented in a given scan helped me tremendously in my projects.

What helped me with being a good communicator

Your job as researchers is twofold, the first obviously being conducting research but the second is being an effective communicator of science. In my experience, I found that the latter more difficult to cultivate. I would implore everyone who watches these series to take a second to really appreciate the way they deliver information and how you can apply those same techniques. *Watch out for the occasional profanity but I promise it's used in good faith.

- [Patriot Act with Hasan Minhaj](#)
- [John Oliver Last week Tonight](#)

MIT'S STUDENT BODY PRESIDENT

Danielle Geathers

Danielle is the first female black student body president in MIT's 159 year history and she's a Coke-a-Cola Scholar. She is studying mechanical engineering and plans to do a postgraduate degree in law.

[Click here to listen to her episode from the Top of the Class podcast.](#)



Favourite Resources

- [Bozeman Science YouTube Channel](#)
- [The Organic Chemistry Tutor YouTube Channel](#)
- [Americanah](#) - a book by Chiamamanda Ngozi Adichie
- [David and Goliath](#) by Malcolm Gladwell
- [The Black Power Mixtape](#)
- [The Atlantic - Between the World and Me](#)
- [Indiewire - 'Explained' Review](#)
- [Adam Ruins Everything](#)
- [Blackballed - The Black and White Politics of Race on America's Campuses](#)

"So one big thing I did in high school was I played soccer. But at the same time, I tried to figure out how I would integrate my love for STEM and soccer. So I went to a local park, where I would show ESPN sports science videos, where they would show like football scenes, and they would connect physics and math and nutrition. And then I would explain the topics to them and do worksheets for them and I think that tied in all the things that MIT typically wants to see in terms of someone who has their own passion and can figure out how to use that passion to help other people."

~ Quote from Danielle's Podcast Episode

Connecting with Danielle

Danielle welcomes students to connect with her on Instagram. See the podcast episode for the link.

3M YOUNG SCIENTIST CHALLENGE WINNER, 2019

Kara Fan

Kara won the 3M Young Scientist Challenge when she was 14 for creating an antimicrobial nano-silver liquid bandage. She continues to raise awareness about antibiotic resistance.

[Click here to listen to her episode from the Top of the Class podcast.](#)



Favourite Resources

- [Carolina.com](#) - science supplies website
- [Scientific American](#)
- [Pubmed](#) - National Library of Medicine
- [Google Scholar](#)
- [Kurzgesagt - In a Nutshell](#) YouTube channel
- [Discover Magazine](#)
- [Crash Course](#) YouTube channel
- National Geographic and [Nat Geo Twitter](#)
- [Nature Magazine](#)
- [amazon.com](#) and [etsy.com](#) (I needed to buy things like dragonfly wings from etsy for a science project)

"I always use liquid bandages. They're just convenient, and they don't really hurt when you're trying to like peel it off. So that's why I kind of wanted to do a project similar to that. But I didn't really know how to apply silver into a liquid bandage until I just searched up really small pieces of silver like and I found out about nano silver. And actually it's really easy to make! I found a lot of different people who made nano silver with silver nitrate and kale and it's just really easy to make."

~ Quote from Kara's Podcast Episode

Connecting with Kara

Kara welcomes students to connect with her on Twitter. See the podcast episode for the link.

DOUBLE OLYMPIAD MEDALLIST AND HARVARD STUDENT

Ben Zhang

Ben is one of the top academic students to come out of his home country of New Zealand having won gold in the Biology Olympiad and bronze in the Chemistry Olympiad. He received two Premier Scholars and is now studying at Harvard.

[Click here to listen to his episode from the Top of the Class podcast.](#)



Favourite Resources

- [Revisionist History](#)
- [The Anthropocene Reviewed](#)
- [Freakonomics Radio](#)
- [Radiolab](#)
- [Hello Internet](#)
- [Steve Jobs Biography](#)
- [When Breath Becomes Air](#)
- [The Emperor of all Maladies - A Biography of Cancer](#)
- [The Man who Mistook His Wife for a Hat](#)
- [Complications by Atul Gawande](#)
- [The Stranger by Camus](#)
- [The Metamorphosis by Kafka](#)
- Anime: The Original Neon Genesis Evangelion

"I'm really surprised how important maths is in a lot of different, really high paying in demand careers. Which is really interesting because in high school, the sort of sentiment at least I and a lot of my friends had, was like 'When the hell am I going to use these skills? When am I going to differentiate something?' And the truth is, that it's actually more relevant in a lot more real world applications than what kids are made to think."

~ Quote from Ben's Podcast Episode

Connecting with Ben

Ben welcomes students to connect with him on LinkedIn.

**CO-DIRECTOR OF SCIENCE
AT ATHENA BY WI-STEM**

Maha Some

Maha is the 15-year-old Director of Science at ATHENA by Wi-STEM and a legislative ambassador for the American Cancer Society.

[Click here to listen to her episode from the Top of the Class podcast.](#)



Favourite Resources

- [Amoeba Sisters](#)
- [The Organic Chemistry Tutor](#)
- [Melissa Maribel YouTube Channel](#)
- [Athena Slack Community](#)
- [Textbook Resources](#)
- [How to be a Bawse by Lily Singh](#)
- [Free Animated Education YouTube Channel](#)
- [American Assoc for the Advancement of Science](#)
- [The New England Journal of Medicine](#)
- [Science Journals](#)

"So with my extracurriculars, it's all about time blocking, and knowing what you're going to do pretty much every single minute of every day, and really sticking to it. Because even though it's going to require a lot of work, and a lot of effort, it's all going to be worth it in the end. And that's just what keeps me going, knowing that this is all going to be worth it."

~ Quote from Maha's Podcast Episode

Connecting with Maha

Maha welcomes students to connect with her via LinkedIn or Twitter. See the podcast episode for the links.

2019 GOOGLE SCIENCE FAIR WINNER

Fionn Ferriera

Fionn developed a method to extract microplastics from water using vegetable oil and rust powder. He is a fantastic example of what scientists can achieve from home and on a budget.

[Click here to listen to his episode from the Top of the Class podcast.](#)



Favourite Resources

- Enthusiasm!
- A notebook (I prefer dotted with numbered pages in A4) but it is up to you.
- Lots of coloured pens and pencils to bring your ideas to life
- Some building materials: Lego, cardboard, tape, scissors, wood, glue, markers and any thing that occurs to you along the way to make the backbone of your idea
- Some sensors and a microcontroller to test and automate things in the process - look into [Arduino](#) and [Raspberry Pi](#).
- Google Scholar to find other research
- A place to store your results - perhaps a Google sheet or Excel file
- A place to store all articles, videos and websites you find interesting. I use [Pocket](#).
- Time off. My best ideas have come from times where I was not actively inventing.

"So I tested a lot and then I had tons of data. And with data, you can all of a sudden talk a lot. So I looked at data and looked at trends, and looked to see if my ideas had worked or not. And even if they don't work, you've still done an investigation, and I think you can actually still win science fairs, even if your technology doesn't work."

~ Quote from Fionn's Podcast Episode

Connecting with Fionn

Fionn welcomes students to connect with him via Instagram or Twitter. See the podcast episode for the link.

ISEF FINALIST AND MEDICAL RESEARCHER

Ellen Xu

Ellen taught herself elements of computer science and machine learning. She used the skills to develop an algorithm to help diagnose Kawasaki Disease, a rare heart condition that her sister has.

[Click here to listen to her episode from the Top of the Class podcast.](#)



Favourite Resources

- [ITSP Magazine and Podcast](#) - Exploring the intersection of technology, cybersecurity and society
- [TEDx Talks](#)
- [Girl Genius Slack Community](#) - Empowering girls in STEAM worldwide
- [The Lean Startup](#) by Eric Ries
- [Hack Club](#) - Hack Club is a nonprofit network of high school coding clubs and makers around the world.
- [Brightside YouTube channel](#)

"I think a lot of things that school teaches is useful to get a foundation. But ultimately, if you want go into a field that isn't taught in school, it's mainly on your own self accord. So I think the first thing I did was I tried to find resources online and other communities that I could look into, in order to try and just get started into machine learning."

~ Quote from Ellen's Podcast Episode

Connecting with Ellen

Ellen welcomes students to connect with her via LinkedIn or Twitter. See the podcast episode for the links.

**ENTREPRENEUR, CODER AND
HARVARD BUSINESS SCHOOL ADMIT**

Kaushal Reddy Ottem

Kaushal just turned 17 and has been admitted to Harvard Business School for postgraduate study. He is an app developer with two companies and an author of five books.

[Click here to listen to his episode from the Top of the Class podcast.](#)



Favourite Resources

- [iOS & Swift - The Complete iOS App Development Bootcamp](#)
- [The Complete App Design Course - UX, UI and Design Thinking](#)
- [Design Mobile Apps: UI, UX & Prototyping in Adobe XD & PS](#)
- [Pre-Programming: Everything you need to know before you code](#)

"You can easily learn coding until the intermediate level. And after that is when the hard things start. That's when you need other aspects, such as research skills, you need business skills, you need other skills to take your idea or to take that knowledge and apply it into an application or whatever you want to create."

~ Quote from Kaushal's Podcast Episode

Connecting with Kaushal

Kaushal welcomes students to connect with him via LinkedIn

**CODER AND FOUNDER
OF TECHVIK**

Satvik Tripathi

Satvik has taught himself 14 different coding languages and is the co-founder of TechVik, a technology blog with more than one million readers and a team of 75 authors from around the world.

[Click here to listen to his episode from the Top of the Class podcast.](#)



Top Courses in Artificial Intelligence and Machine Learning

- [CS50's Introduction to Artificial Intelligence with Python](#)
- [Cornell CS4780 "Machine Learning for Intelligent Systems"](#)
- [Stanford CS221: Artificial Intelligence: Principles and Techniques](#)
- [Stanford CS234: Reinforcement Learning](#)
- [Stanford CS330: Deep Multi-Task and Meta Learning](#)
- [Stanford CS224N: Natural Language Processing with Deep Learning](#)

Articles from the TechVik Blog

- [Popular Machine Learning Algorithms You Should Know in 2020](#)
- [Introduction to Machine Learning Algorithms: Linear Regression](#)
- [An Introduction to Machine Learning Algorithm: Principal Component Analysis](#)
- [Classification: The Foundation for Neural Network Algorithms and Advanced Dataset Predictions](#)
- [Federated Learning: Democratized and Personalized AI, with Privacy by Design](#)
- [Neural networks: Mathematical Replication of Biological Neuron](#)
- [A Brief Introduction of Generative Adversarial Networks \(GANs\)](#)
- [Understanding Convolutions for Deep Learning](#)

Read the Abstract of Satvik's Book Chapter:
**[Artificial Intelligence: A Brief Review -
Computer Science & IT Book](#)**

To Learn to Code

- [Python course for beginners](#)
- [Free Interactive Python Tutorial](#)
- [Harvard CS50x course](#)
- [MIT Introduction to Computer Science and Programming in Python Course](#)
- [Google Codelab](#)
- [Julia Academy](#)
- [The Julia Programming YouTube Channel](#)
- Learn more through other's projects on [GitHub](#) and if you are stuck anywhere then you will definitely find help at [Stack Overflow](#).

Top Programs for High School Students

- [Stanford Pre-Collegiate Studies](#)
- [Yale Young Global Scholars](#)
- [Stanford University Mathematics Camp](#)
- [MITES- MIT](#)
- [Research Science Institute](#)
- [Women's Technology Program \(WTP\) – MIT](#)
- [The Summer Science Program: SSP](#)

Connecting with Satvik

Satvik welcomes students to connect with him via LinkedIn.

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