

Davidson College | Kimberley Tanatswa Muchenje | May 25th - July 10th, 2022 Jekesa remangwana (Futures ignited): Inspiring a generation of biotechnologists to combat the healthcare crisis and food insecurity in Zimbabwe

Overview

This project aims to provide high school students between the ages of 14-19 years with an opportunity to conduct hands-on scientific research in molecular biology, biochemistry, and immunology. This six-week boot camp will be targeted at empowering students with biotechnological skills necessary to translate basic molecular biology research findings into diagnostic tools, vaccines, and other treatments for diseases as well as enhanced agricultural output. Students will have the opportunity to apply the knowledge they learn to identify healthcare/biomedical and agricultural issues in Zimbabwe that can be solved with the application of biotechnological skills and they will attempt to solve this problem by undertaking the necessary research experiments.

Objectives

- Conduct a molecular biology, biochemistry, and immunology research bootcamp for high school students in Zimbabwe with myself, and three other student volunteers as teachers
- Mentor and inspire students to pursue the expanse of careers in Biotechnology to solve Zimbabwe's urgent healthcare crisis that has stirred up public unrest and conflict
- Kindle an innovative culture in students who are interested in biology research and help them come up with creative projects that translate research findings to treatments for diseases that Zimbabweans battle
 - As a long term achievement, disease treatments stemming from scientific knowledge produced by Zimbabwean researchers will show the general public the benefits of science research and encourage them to seek treatment for themselves and their families thus raising both physical and mental health and internal and external peace
- As a long term achievement, students who gain biotechnology skills can generate crops that are resistant to pests, diseases or adverse environmental conditions reviving Zimbabwe's declining agricultural industry which serves as the country's key source of income and this will alleviate food shortages and increase peace amongst people.

Background

Zimbabwe continues to battle hyper-inflation, food shortages, a high unemployment rate, high disease risk, and surging political unrest. The number of citizens living under the poverty line rose to 49.3% in 2020 due to the COVID-19 (coronavirus) pandemic and its impacts, according to the World Bank's latest economic analysis for the country (World Bank Group, 2021)¹. Zimbabwe's health issues have been perpetuated by the fact that people tend to not seek disease treatments in good time or at all as a result of a struggling economy. The country is also in dire need for active efforts to address healthcare issues related to COVID-19, malaria, pregnancies, HIV, and laboratory diagnostic tools for disease and developing the field of biotechnology is the prime solution. The economy of Zimbabwe relies solely on the agricultural industry. Students will gain molecular biology research skills that are applied in agricultural biotechnology, a field that generates crops that are resistant to pests, diseases, and adverse environmental conditions like droughts. Equipping students with these skills is a long term intervention to combat food shortages in Zimbabwe by producing more crops. Currently, there are few institutions in place for scientific research in Zimbabwe due to lack of funding sources. Students in high school do not get

¹World Bank Group. (2021, June 9). *Zimbabwe economic update: COVID-19 further complicates Zimbabwe's economic and social conditions*. World Bank. Retrieved January 24, 2022, from <https://www.worldbank.org/en/country/zimbabwe/publication/zimbabwe-economic-update-covid-19-further-complicates-zimbabwe-s-economic-and-social-conditions>

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exposure to cutting edge research techniques that are currently used in the rest of the world in the fields of biotechnology and biomedical research. It is crucial to train and educate a generation of scientists to grow our biotechnology and biomedical research fields.

Overview of Project and Potential Obstacles

I will team up with three college student volunteers to conduct a six-week boot camp teaching high school students to conduct research in molecular biology, biochemistry and immunology followed by biotechnology projects to solve identified medical and agricultural problems. I will cast a wide net to recruit ~25 students from high schools in Zimbabwe. The USAP community school in Zimbabwe, a mentorship program and high school that helps students apply to colleges and universities outside of Zimbabwe, will provide physical space and basic laboratory equipment for students. Courses taught in the first two weeks of the program will serve as a primer, covering research methods, safety and human practices, experimental design, and demonstrations of basic techniques to be encountered in a molecular biology laboratory. The core syllabus will consist of learning important research techniques like molecular cloning, PCRs, CRISPR cas9 and Next-Generation sequencing. To obtain additional key laboratory equipment, I will partner with the African Institute of Biomedical Science and Technology (AiBST). AiBST is a research institution that aims to conduct translational research and to deliver medical products and services that address Africa's healthcare challenges and they will provide research facilities and equipment for students to utilize. Following these courses, students will generate projects following the mentorship and guidance of their teachers. In the mentorship component of this bootcamp, I have identified 8 Biotechnology students, two professors and a representative from Kidzcan, an NGO that works with cancer patients to speak about career paths in the field. I anticipate facing a challenge in recruiting a diverse group of students but I will combat this by beginning the search earlier. We may face challenges due to lack of efficient modes of transportation to get to the bootcamp location but we also hope to combat this by situating the students in Harare where the bootcamp will be done.

Timeline: February-April Generate tutorial videos for all techniques in my lab at Davidson College
Whole month of May (purchase laboratory equipment and have it set up by representatives at USAP)
Week 1: Train volunteers and share course introductory information and material to students remotely
Week 2-3: Teach students core material for the course and run basic molecular biology experiments
Week 4: Conduct extensive research experiments at AiBST and develop final projects in the afternoons

Week 5-6: Conduct final research experiments and present research projects

Future Sustainability

Through the USAP program, which now consists of a large network of students across all parts of the world including myself. Each boot camp participant will be connected with a mentor completing their undergraduate degree in biotechnology and biomedical science to provide continuous career development and guidance. The USAP program will also provide a sustainable source of student volunteers to undertake this bootcamp with me yearly in Zimbabwe. Additionally, the research equipment purchased in the first iteration of the biotechnology bootcamp will be kept in place at the USAP community school for use in future years.

¹World Bank Group. (2021, June 9). *Zimbabwe economic update: COVID-19 further complicates Zimbabwe's economic and social conditions*. World Bank. Retrieved January 24, 2022, from <https://www.worldbank.org/en/country/zimbabwe/publication/zimbabwe-economic-update-covid-19-further-complicates-zimbabwe-s-economic-and-social-conditions>

Name: Kimberley Tanatswa Muchenje
 Project Name: Inspiring a generation of biotechnologists to combat
 School: Davidson College

TOTAL FUNDS REMAINING:
 200

Total Additional Funding:

TOTAL EXPENDITURES:
 9800

Student Expenses					Project Expenses				
Travel (Including Airfare)	Lodging	Communications	Food (Biweekly)	Miscellaneous	Non-Student Travel and Lodging	Direct Equipment and Supplies	Marketing and Event Support	Staffing Costs	Miscellaneous
\$ 1,500.00	\$1,000	\$ 200.00	\$ 200.00		\$ 2,000.00	\$ 4,000.00		\$ 300.00	\$ 200.00
			\$ 200.00						
			\$ 200.00						
Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
1500	1000	200	600	0	2000	4000	0	300	200

Total Student Expenses:
 3300

Total Project Expenses:
 6500

Notes: F11- To assist students living outside of the Harare capital where the USAP school facilities will be with transport and housing. G11- Includes lab equipment, stationary, printing services, utilities for the bootcamp space like water, wifi and electricity etc.