GLOBAL AWARENESS:

SCIENCE & SCIENTISTS IN AFRICA

A Module Developed for Teacher Candidates in the US

Spring 2020 | UF Center of African Studies and School of Teaching & Learning

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Global Awareness: Science and Scientists on the African Continent
A Curricular Unit of Study

Introduction

Science is not just a body of knowledge that reflects current understanding of the world; it is also a set of practices used to establish, extend and refine that knowledge[1]. Scientists all over the globe are engaged in studying, exploring and solving major scientific issues and concerns. Efforts to address the world's challenges are not restricted or concentrated in any one geographical area. Science is a human endeavor undertaken by people on different continents, of all ages, races, sexes, and nationalities. Science is global! African scientists are members of the global science community working to solve different global challenges in different scientific fields.

This cohesive and global science curriculum contains learning experiences related to the important role of African scientists as members of the global science community. The aim of the curriculum is to help students develop an awareness of science and the role of scientists engaged in science as a global enterprise. The activities are primarily related to food science and include comparisons to areas of research in the United States. Resources are included to facilitate a deeper exploration of the countries in Africa and ensure correlation to Florida's science standards.

Acknowledgements

The development of this African Studies Global Science curriculum was supported by Title VI National Resource Center: Next Generation Innovation in African studies: Building Knowledge and opportunity for impact. Grant number P0099485 by the U.S. Dept. of Education.

[1] National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. The National Academies Press.

Integrating African Science into Science Education

Big Idea 1: The Practice of Science
A: Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.
B: The processes of science frequently do not correspond to the traditional portrayal of "the scientific method."
C: Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.
D: Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations.

- SC.2.N.1.6 Explain how scientists alone or in groups are always investigating new ways to solve problems.
- SC.3.N.1.4 Recognize the importance of communication among scientists.
- SC.3.N.1.5 Recognize that scientists question, discuss, and check each other's' evidence and explanations.
- SC.4.N.1.7 Recognize and explain that scientists base their explanations on evidence.

Big Idea 2: The Characteristics of Scientific Knowledge
A: Scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.
B: Scientific knowledge is durable and robust, but open to change.
C: Because science is based on empirical evidence it strives for objectivity, but as it is a human endeavor the processes, methods, and knowledge of science include subjectivity, as well as creativity and discovery.

- SC.6.N.2.3 Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests, and goals.

Big Idea 6: Earth Structures
Humans continue to explore the composition and structure of the surface of the Earth. External sources of energy have continuously altered the features of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's water and natural resources.

- SC.1.E.6.1 Recognize that water, rocks, soil, and living organisms are found on Earth's surface.
- SC.2.E.6.1 Recognize that Earth is made up of rocks. Rocks come in many sizes and shapes.
- SC.2.E.6.2 Describe how small pieces of rock and dead plant and animal parts can be the basis of soil and explain the process by which soil is formed.
- SC.2.E.6.3 Classify soil types based on color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.

Big Idea 14: Organization and Development of Living Organisms
A. All plants and animals, including humans, are alike in some ways and different in others.
B. All plants and animals, including humans, have internal parts and external structures that function to keep them alive and help them grow and reproduce.
C. Humans can better understand the natural world through careful observation.

- SC.3.L.14.1 Describe structures in plants and their roles in food production, support, water and nutrient transport, and reproduction.
- SC.3.L.14.2 Investigate and describe how plants respond to stimuli (heat, light, gravity), such as the way plant stems grow toward light and their roots grow downward in response to gravity.
- SC.6.L.14.3 Recognize and explore how cells of all organisms undergo similar processes to maintain homeostasis, including extracting energy from food, getting rid of waste, and reproducing.
- SC.6.L.14.4 Compare and contrast the structure and function of major organelles of plant and animal cells, including cell wall, cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria, and vacuoles.

Big Idea 17: Interdependence
A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.
B. Both human activities and natural events can have major impacts on the environment.
C. Energy flows from the sun through producers to consumers.

- SC.4.L.17.2 Explain that animals, including humans, cannot make their own food and that when animals eat plants or other animals, the energy stored in the food source is passed to them.
- SC.4.L.17.3 Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.

Let's Visit with Scientists on the Continent of Africa

In this activity, you will:

- select and research one African scientist.

For this activity you will need the Resource Document:

- Map of African Countries with Political Boundaries
- African Scientists Making a Difference

DID YOU KNOW?
UF scientists collaborate with many African scientists.
See examples below!

UF and African Scientists in Collaborative Research Activities			
African Scientists	African Country	UF Scientists	Areas of collaboration
Dr. Jemal Yousuf	Ethiopia	Adegbola Adesogan	Animal Science
Samuel Mutisya	Kenya	Todd Palmer	Biology
Simon Musila	Kenya		
Douglas Kamaru	Kenya		
Suzana Bandeira	Angola	David Blackburn	Interdisciplinary Ecology
Senga Raphael	Democratic Republic of Congo	Felicien Masanga Maisha	Emerging Pathogens Institute
Trinity Senda	Zimbabwe	Gregory Kiker	Agricultural and Biological Engineering
Dr. Jemal Yousuf	Ethiopia	Sarah McKune	Environmental and Global Health
Elkana Nyambati	Kenya	Lynn Sollenberger	Agronomy

You will select one scientist from the African Scientists Resource Document to conduct research on, and:

1.1 develop a poster/infographic (e.g., using a Word document/template or PowerPoint slide) about the scientist to include the following:
   - Photograph – preferably showing the scientist at work
   - Country of origin
   - Short biography
   - Brief description of the area of science the scientist is working in
   - Identify the research questions being pursued or the purpose of the scientist's work

1.2 Bring your poster or printed infographic to class to participate in a Gallery Walk.

Nature of Science

In this activity, you will:

- observe an African scientist engaging with a science phenomenon and answering questions that advance our understanding of our physical world.
- compare aquaculture across Africa and the United States.

Introduction: Dr.Kevin Obiero, a scientist, introduces us to aquaculture fisheries in this video (https://youtu.be/avX8XGGQkXk) and the ways in which this commercial industry in Africa is supported by his scientific research and technology.

2.1 After watching the video about Dr. Obiero's research, answer these two questions.

- ○ Describe the nature of Dr. Kevin Obiero's science research.

- ○ Describe 3 ways in which the results of Dr. Obiero's scientific research are important to society?

2.2 Visit the following sites of marine aquaculture in the U. S. and respond to the question below:

https://www.fisheries.noaa.gov/topic/aquaculture
https://www.fisheries.noaa.gov/national/aquaculture/us-aquaculture

- ○ In what ways are the US commercial fisheries and the seafood industry similar to and different from the focus of the marine aquaculture described by Dr.Kevin Obiero?

Activity 3

Mitigating Global Issues

In this activity, you will:

- Identify human activities that have caused a net increase in the amount of CO_2 levels
- Explain how CO_2 affects the pH of water and is a current threat to worldwide marine ecosystems.

Introduction: Carbon dioxide (CO_2) is a naturally occurring gas in the earth's atmosphere important to many biological processes. In the natural carbon cycle, the CO_2 gas is produced, and natural processes ensure the amount is fixed and in equilibrium. Human activities [e.g., mining or burning fossil fuels] have interfered with the carbon cycle, causing a net increase of CO_2 in the atmosphere which creates an imbalance. The rapidly increasing atmospheric carbon dioxide (CO_2) not only alters climate and the chemistry of the atmosphere, but it's absorbed by the oceans, causing a lowering of global pH levels, a process referred to as ***ocean acidification***.

The world's oceans currently absorb as much as one-third of all CO_2 emissions in our atmosphere. This causes the pH to decrease, resulting in the ocean becoming more acidic. It is difficult to predict the overall impact on the marine ecosystem, but many scientists fear that ocean acidification has the potential to decrease marine biodiversity on a very large scale. There is scientific evidence that the oceans are becoming more acidic due to a decrease in the pH. This issue is of global concern as all of our oceans are connected.

3.1 Write one sentence to explain how living things in the ocean might be impacted by a decrease in pH [more acidic].

Simulating Ocean Acidification
Many African countries rely heavily on their coasts and rivers for economic growth and well-being. Unfortunately, marine and coastal ecosystems face many environmental threats. Africa is facing these severe environmental threats, such as untreated wastewater discharge, illegal fishing, and habitat degradation all combined with human-induced climate change. One of the effects of increasing acidity is a reduction in the availability of carbonate. This means that any animal that produces a calcium carbonate shell or skeleton will find it much more difficult to do so. As a result, organisms could grow more slowly, their shells could become thinner, or they might dispense with shells altogether.

Past rapid ocean acidification periods in Earth's history are not analogues for the present perturbation since their rates of change were far slower. The accelerated ongoing CO_2 ocean uptake is outpacing the ocean's capacity to buffer oceanic pH and its carbonate chemistry and gives marine organisms, ecosystems, and humans less time to adapt to a changing environment. At the current rate of global carbon dioxide emissions, the average acidity of the surface ocean is expected to increase by 100–150 percent over pre-industrial levels by the end of this century.

In this simulation, you will use common household products to produce the carbon dioxide needed in the process of ocean acidification.

You will need:
- Safety goggles
- An acid-base indicator such as bromothymol blue, diluted with water: 8 milliliters bromothymol blue (0.04% aqueous) to 1 liter of water
- Two clear 10-oz plastic cups (the tall ones)
- Paper cups, 3-oz size
- Masking tape
- Plain white paper
- Permanent marker
- Baking soda
- White vinegar
- Two Petri dishes to use as lids for the plastic cups
- Graduated cylinder or measuring spoons
- Gram scale or measuring spoons

You will:
- Put on your safety goggles.
- Pour 1 1/2 fluid ounces (40–50 mL) of acid-base indicator solution into each of the two clear plastic cups.
- Add 1/2 teaspoon (2 grams) of baking soda to the paper cup.
- Tape the paper cup inside one of the clear plastic cups containing the indicator solution so that the top of the paper cup is about 1/2 inch (roughly 1 centimeter) below the top of the plastic cup. Make sure the bottom of the paper cup is not touching the surface of the liquid in the plastic cup—you don't want the paper cut to get wet. The second plastic cup containing indicator solution will be your control.
- Place both clear plastic cups onto a sheet of white paper and arrange another piece of white paper behind the cups as a backdrop (this makes it easier to see the change).

- Carefully add 1 teaspoon (about 5-6 mL) of white vinegar to the paper cup containing the baking soda (image below). Be very careful not to spill any vinegar into the indicator solution, as vinegar is an acid. Immediately place a Petri dish over the top of each plastic cup.

Background information and lab adapted from: https://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F & https://www.exploratorium.edu/snacks/ocean-acidification-in-cup?media=7384, respectively.

List your **OBSERVATIONS** here:

3.2 Why was the cup covered?

3.3 What would account for the observations you made?

3.4 Write one **CLAIM** about the reaction that occurred in the cup.

3.5 Discuss your observations and claim with your partner and write the evidence to support the claim you have made.

3.6 **Reasoning/Making the connection to the phenomena occurring in the oceans:** What happens when there is an increase in the CO_2 levels in the air surrounding the water?

A Tale of Two Countries— Uganda & South Africa

In this activity, you will:

- Compare the physical geography of South Africa and Uganda including topography, climate and weather, soil, location, seasons
- Identify fruits and vegetables that are common in Uganda and South Africa

For this activity you are provided a:

- map showing the countries making up the continent of Africa
- Physical Geography of Uganda and Africa Resource Guide

Introduction: Africa is the second largest continent. It is bounded on the west by the *Atlantic Ocean*, on the north by the *Mediterranean Sea,* on the east by the *Red Sea* and the *Indian Ocean*, and on the south by the *Atlantic* and *Indian Oceans.* Notably, the Equator cuts the continent into two regions – the tropical region bounded by the Tropic of Cancer in the north and by the Tropic of Capricorn in the south.

4.1 Locate the equator on the map provided. Identify and list all the countries and their capitals that are cut through by the equator

Table 4a: African Countries and Capitals Dissected by the Equator

Countries	Capitals

4.2 Describe the locations of the countries of South Africa and Uganda in relation to the equator (i.e., latitude, cardinal direction, etc.).

4.3 Complete the table below using the information provided in the Physical Geography of Uganda and Africa Resource Guide.

Table 4b: Comparison of Agricultural Characteristics in Uganda and South Africa			
Characteristic		Uganda	South Africa
Geographical Location			
Climate			
Seasons	Wet		
	Dry		
Crops			
Soil			

Food Nutrients Across the Continents

In this activity, you will:

- Examine factors that affect fruits and vegetables in Africa and the USA
- Explain the impact of climate, soil and topography on the quantities of nutrients in fruits and vegetables
- Compare and contrast food grown in Africa and the United States of America

Introduction

There are many factors that make your fruits and vegetable flavorful and distinct. They include, sunlight, irrigation practices, pruning, and/or soil composition, as well as how the fruits are stored. Terroir affects the taste of other crops in addition to grapes (Trubek, 2008; Jacobsen, 2010). Terroir is the sum of the complete environmental conditions in which a particular fruit is grown. Soil, topography, and climate especially influence unique characteristics of fruit. The prevailing belief is that flavor of the fruit reflects the soil and climate of the region it is grown.

Geography and geomorphology affect the availability of different minerals, soil and water pH, water quality, slope, and aspect of the land which the crop is grown. Geographically, soils differ in their chemical and physical properties. However, physical properties (e.g., clay vs. alluvial soils) may affect fruit more than the chemical since the physical properties of soil is what help move the water supply to the roots and eventually to the fruit. Physical properties may also affect the structure of the tree. The roots may grow deeper into the soil and tap into a higher water table or have access to more nutritive soils. The chemical properties of soil are important, but mainly when there are deficiencies in or an excess of nutrients (e.g. nitrogen, phosphorus, potassium etc.). "The physical environment (soil, weather, topography), not the tiller of the soil, the shepherd, or the vintner, is the primary source of the distinctive tastes of French wine and cheese" (Trubek, 2008, p. 19-20).

5.1 Read the following articles:

i. Retallack & Burns. (2016). The effects of soil on the taste of wine. *GSA Today, 26*(5). https://www.geosociety.org/gsatoday/archive/26/5/pdf/i1052-5173-26-5-4.pdf

ii. Trubek (2008). The Taste of Place: A Cultural Journey into Terroir. University of California Press. **Focus on the following pages: pp. 18-29 and 40-53.** https://content.ucpress.edu/pages/10672/10672.ch01.pdf

iii. Jones, G.V., Reid, R., and Vilks, A. (2012). Climate, grapes and wine: Structure suitability in a variable and changing climate. In Dougherty, P.H. (Ed.), *The Geography of Wine—Regions, Terroir and Techniques* (p. 109–133). Springer. doi: 10.1007/978-94-007-0464-0_7.
Focus on pp. 109-110; 118-122; and "Conclusions"
https://ceulearning.ceu.edu/pluginfile.php/307699/mod_resource/content/1/Unwin%20Terroir%20in%20Percy%20H.%20Dougherty%20The%20Geography%20of%20Wine%20Regions%2C%20Terroir%20and%20Techniques%20%202012.pdf

5.2 Answer the following questions about the articles above:

i. In what ways does soil PH affect the taste of wine (grapes used to make wine)?

ii. How does sunlight affect the taste of fruits and vegetables? Provide an explanation for your answer.

iii. Based on information provided in the articles and your knowledge of the differences in weather, soil and topography, you will compare fruits and vegetables across the continents and complete the table below. For example, tomatoes are grown in both Africa and the United States. You will then select 3 fruits and 3 vegetables to compare based on taste, sugar content, water quantity and outer color.

Table 5: Comparison of African- & American-Grown Fruits and Vegetables

Name of Fruit or Vegetable	Characteristic of Crop			
	Taste	Sugar Content	Water quantity	Outer Color

iv. Did you know there are a number of international food stores in Gainesville (and other cities)? These stores are stocked with fruits grown in the tropics and from elsewhere in the world. Google stores in the area you live that provide access to African-grown fruits and vegetables. [If you cannot visit the store and/or purchase the 6 items, check their website for images and/or inventory of their fruits and vegetables.] Compare the characteristics of each with American grown fruits and vegetables of the same kind.

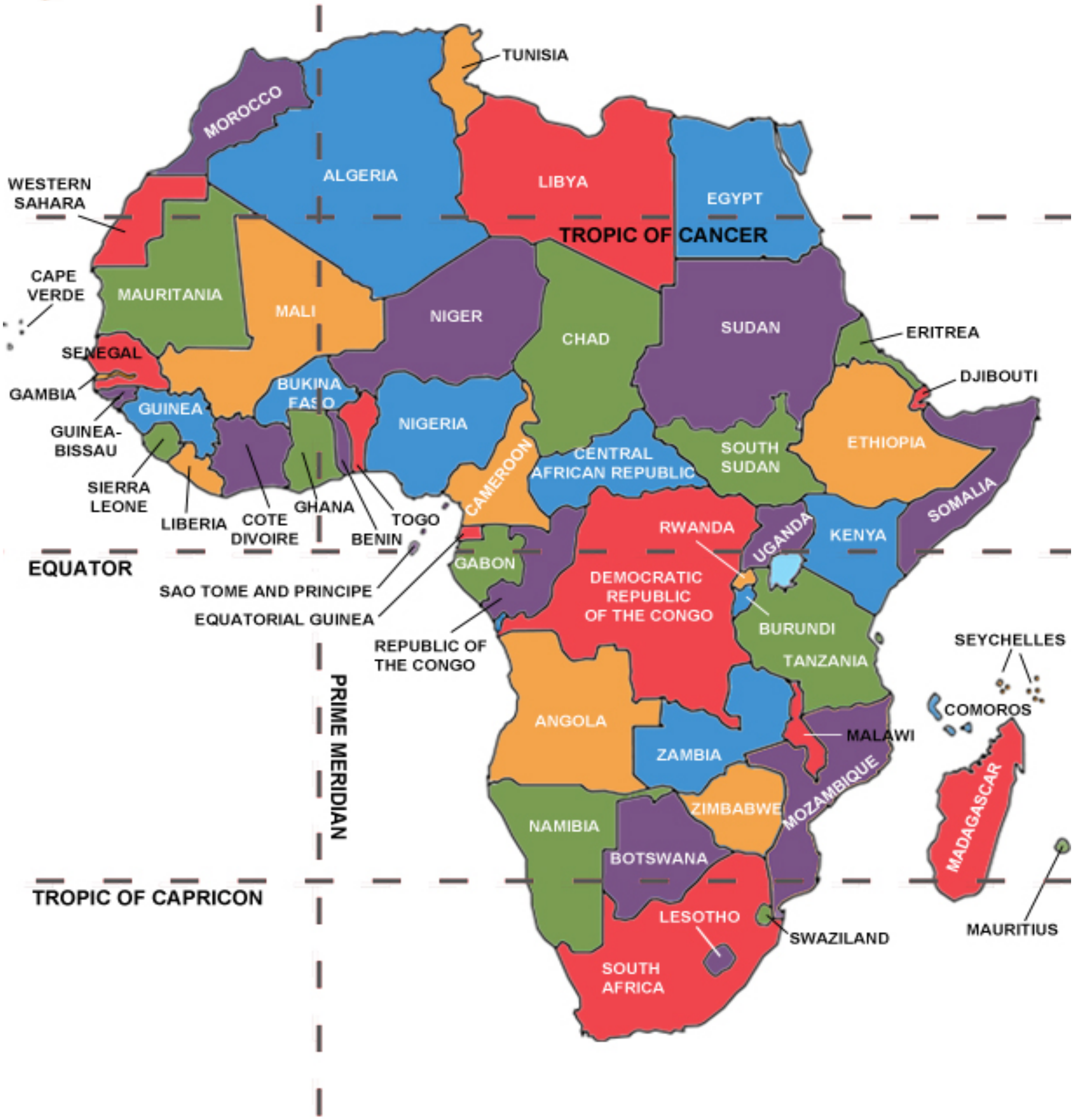
List at least 3 differences:

Based on what you read, what factors would entice you to purchase these?

African Science & Scientists—What Did We Learn?

Create a reader/storyline about the work of ***a named African scientist*** or ***Science on the African Continent*****.** The reader should be applicable and relevant to the grade of your choosing including specific connections to your state's science benchmark.

Map of African Continent with Political Boundaries



African Scientists Making a Difference

African Scientists	African Country	Area of expertise
Wilfred Ndifon	Cameroon	A biological scientist whose research seeks to design an improved vaccine for malaria, and the development of technologies for predicting immunological predisposition to specific diseases so that they can be prevented before symptoms appear
Quarraisha Abdool Karim	South Africa	An epidemiologist who has helped to understand how the HIV/AIDS epidemic is decimating her country's population, most notably by investigating how the epidemic affects women and how to prevent its spread through greater engagement with communities and participants in HIV prevention trials
Wangari Maathai	Kenya	Founder of the Green Belt Movement which led the re-forestation movement in Kenya and was awarded the Nobel Peace Prize in 2004. She was also a social, environmental and political activist in Kenya.
Ahmed Zewail	Egypt	He was awarded the 1999 Nobel Prize in Chemistry for his work on femtochemistry.
Denis Mukwege	The Democratic Republic of Congo (DRC)	Gynecologist and Pentecostal pastor. He founded and works in Panzi Hospital in Bukavu, where he specializes in the treatment of women who have been raped by armed rebels. He was awarded the Nobel Peace Prize in 2018.
Sydney Brenner	South Africa	Brenner made significant contributions to work on the genetic code, and other areas of molecular biology while working in the Medical Research Council (MRC). He was awarded the Nobel Prize in Physiology or Medicine in 2002.
Max Theiler	South Africa	South African-American virologist and physician. He was awarded the Nobel Prize in Physiology or Medicine in 1951 for developing a vaccine against yellow fever in 1937, becoming the first African-born Nobel laureate.

Allan MacLeod Cormack	South Africa	A physicist who won the 1979 Nobel Prize in Physiology or Medicine for his work on X-ray computed tomography (CT).
Claude Cohen-Tannoudji	Algeria	He shared the 1997 Nobel Prize in Physics with Steven Chu and William Daniel Phillips for research in methods of laser cooling and trapping atoms.
Francisca Nneka Okeke	Nigeria	Prof. Okeke is the recipient of the L'Oreal-UNESCO for Women in Science Award for her significant contributions to the understanding of climate change. She actively participates to encourage girls and women to participate in the development of science and technology.
Margaret Mungherera	Uganda	Margaret was a senior consultant psychiatrist and medical administrator in Uganda. She advocated for psychiatric services throughout Uganda, beyond the capital, to improve conditions for Uganda's health-care providers and to get doctors organized in African countries in general.
Alta Schutte	South Africa	Prof. Schutte is a South African hypertension and heart disease specialist whose main motivation is to alleviate the burden of HIV infection and non-communicable diseases of black communities in Sub-Saharan Africa.
Julie Makani	Tanzania	Dr. Makani is a Tanzanian researcher and one of the most prominent hematologists in Africa. Her work on anemia and sickle cell disease has led to a new understanding of the illnesses — and led to her being awarded the Archbishop Desmond Tutu Leadership Fellowship for promoting excellence in biomedical science in Africa and the Royal Society Pfizer Award.
Thomas Maina Kariuki	Kenya	His research includes the study of infectious diseases and enabling the development of vaccines for diseases that affect areas of poverty such as investigating the influence of worm infections on vaccination outcomes. Kariuki spreads awareness about the rise of non-communicable diseases in Africa such as cancer, strokes, diabetes, and cardiovascular disease, particularly between the ages of 30 and 70.

Thomas R. Odhiambo	Kenya	He was a Kenyan entomologist and environmental activist who directed research and scientific development in Africa. He founded the International Centre of Insect Physiology and Ecology (ICIPE) and helped to establish three institutions of learning: The Third World Academy of Sciences, the Kenyan National Academy of Sciences and the African Academy of Sciences.
Haile Debas	Eritrea	Haile Debas is an African surgeon and educator. He is recognized internationally for his contributions to academic medicine and is currently widely consulted on issues associated with global health
Seyi Oyesola	Nigeria	Seyi Oyesola is a Nigerian doctor, who co-invented "hospital in a box". "Hospital in a box" is a mini hospital run with solar energy or off-grid and completely mobile.
Mohamed Osman Baloola	Sudan	He developed a remote monitoring and control system for diabetes symptoms. He set about creating an artificial pancreas [clarification needed] and a remote system to monitor the stability of glucose levels in diabetics.
Oheneba Boachie Adjei	Ghana	Oheneba is a leading authority on spinal surgery. He specializes in spinal reconstruction and the treatment of kyphosis and scoliosis. In 1998, Adjei founded Focos, a Ghana-based foundation of orthopedics and complex spine. He recently returned to Ghana to run his foundation and
Bosede Afolabi	Nigeria	Bosede Afolabi is a Nigerian practitioner who has dedicated most of her medical career to the study of sickle-cell anemia and how the world's most common hereditary blood disorder affects pregnant women.
Olamide Orekunrin	Nigeria	Olamide Orekunrin is a doctor who set up Flying Doctors Nigeria, the first air ambulance service in West Africa, transporting victims of medical emergencies, including industrial workers from the country's booming oil and gas sector.

Betty Gikonyo	Kenya	Dr. Betty Gikonyo is a pediatric cardiologist, a medical entrepreneur, and one of the country's best-known healthcare professionals. Together with her husband, Betty Gikonyo raised US$14 million to build the Karen Hospital. As part of her charity work, Gikonyo co-founded the Heart to Heart Foundation, an organization that raises funds for poor children suffering from heart ailments.
Godwin Godfrey	Tanzania	Dr. Godwin Godfrey was Tanzania's first pediatric heart surgeon. His quest has been to help some of the 300 suffering children, who await surgery at Tanzania's largest teaching hospital.
Kachinga Sichizya	Zambia	Dr.Kachinga Sichizya is a highly-trained neurosurgeon that has dedicated his efforts to provide medical services for sick children.
Otu Oviemo Ovadje	Nigeria	A highly accredited Nigerian medical doctor who invented the Emergency Auto Transfusion System (EAT-SET): an affordable, simpler and effective blood auto-transfusion system.
Selig Percy Amoils	South Africa	Amolis was an ophthalmologist and biomedical engineering inventor. In 1965, Amoils refined the cryoextraction method of cataract surgery by developing a cryoprobe that was cooled through the Joule-Thomson effect of gas expansion. His system is still widely used in the fields of ophthalmology and gynecology.
Mosoka Fallah	Liberia	Dr. Mosoka Fallah is a Harvard-trained epidemiologist and immunologist. He was one of the leading health officials fighting the spread of Ebola in Liberia. He was instrumental in developing the "training of trainers" workshops for health workers across the national response.
Kopano Matlwa Mabaso	South Africa	Dr. Kopano Matlwa Mabaso is a South African medical doctor & novelist. She is currently Executive Director of Grow Great —a campaign aimed at mobilizing South Africa towards achieving a stunting free generation by 2030. She also co-founded Ona Mtoto Wako an initiative that sought to take lifesaving antenatal health care to pregnant women living in remote and rural parts of developing country settings.

Bright Simons	Ghana	An astrophysicist, Bright Simons founded mPedigree, which lets customers verify the authenticity of drugs with a simple text message code. mPedigree combats fake pharmaceuticals that ran rampant in Ghana, Nigeria, Kenya and India.
Jamila Abbas	Kenya	Jamila Abbas, is a computer scientist, software engineer, businesswoman and entrepreneur in Kenya.[2] She is the co-founder and chief executive officer of MFarm Kenya Limited, an internet-based organization that helps farmers find the best farm implements, seeds, access to weather reports and market information.
Brian Turyabagye	Uganda	Brian Turyabagye invented a biomedical smart jacket that diagnoses pneumonia using Bluetooth.
Arthur Zang	Cameroon	Invented a touchscreen heart-monitoring tablet called the Cardio Pad. The tablet enables heart patients in remote areas to access healthcare without journeying to the cities where most heart specialists work.
Florence Wambugu	Kenya	Florence is a Kenyan plant pathologist and virologist. She is known for her advocacy of using biotechnology to increase food production in Africa.
Osh Agabi	Nigeria	Osh Ababi created a device that he says can be used to detect the smell of explosives and even cancer cells. The device, called Koniku Kore, could also be used to sniff out illnesses in the same way dogs can detect cancerous cells via smells.

References:

Meet 30 innovators finding African solutions for African problems
https://qz.com/africa/500950/meet-30-innovators-finding-african-solutions-for-african-problems/

List of African Nobel laureates
https://en.wikipedia.org/wiki/List_of_African_Nobel_laureates

Geography of South Africa

Cape Town, South Africa

Johannesburg, South Africa

Durban, South Africa

Climate:

Cape Town

In **Cape Town**, the average temperature ranges from 12 °C (53.5 °F) in July to 21 °C (70 °F) in January and February. The summer temperatures are not excessively high because of the influence of the ocean, though sometimes a hot and dry wind called *Berg*, able to raise the temperature to around 35 °C (95 °F), blows from the mountains. On the contrary, a strong southern breeze called *Cape Doctor* often blows in summer, cooling and cleaning the air. Above the top of Table Mountain, the flat-topped mountain overlooking the city, about a thousand meters (3,300 feet) high, a layer of clouds often forms, which the city's inhabitants call in a colloquial manner "tablecloth".
Here are the average temperatures of Cape Town.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	16	16	14	12	9	8	7	8	9	11	13	15
Max (°C)	26	27	25	23	20	18	18	18	19	21	24	25
Min (°F)	61	61	57	54	48	46	45	46	48	52	55	59
Max (°F)	79	81	77	73	68	64	64	64	66	70	75	77

In Cape Town, 505 millimeters (20 inches) of rain fall per year, with a maximum in late autumn and winter, from May to August. Here is the average precipitation.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	12	8	17	45	85	80	85	70	45	30	17	11	505
Prec.(in)	0.5	0.3	0.7	1.8	3.3	3.1	3.3	2.8	1.8	1.2	0.7	0.4	19.9
Days	2	2	3	6	9	9	10	10	7	5	3	2	68

The amount of **sunshine** in Cape Town is very good in summer, when the sky is often clear, but it remains good even in winter: in June and July, there are about 6 hours of sunshine per day. Here are the average sunshine hours per day.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	11	11	9	8	7	6	6	7	8	9	10	11

West Coast and West of the country:
The west coast of South Africa is affected by the Benguela Current, which cools the sea and makes the climate arid, since it inhibits the formation of vertical air currents that could condense. In this area, annual precipitation drops below 350 mm (13.5 in), but in a wide west-central area, where the southern part of the Namib Desert is found, it drops even below 200 mm (8 in).
Here is the average rainfall of Alexander Bay, located in the northern part of the coast, on the border with Namibia, where rainfall even drops below 50 mm (2 in) per year.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	1	2	2	4	4	8	5	6	3	0	0	2	37
Prec.(in)	0	0.1	0.1	0.2	0.2	0.3	0.2	0.2	0.1	0	0	0.1	1.5
Days	0	0	1	1	1	2	2	2	1	1	0	0	11

Along the coast, the cold current also causes the formation of fog, mist and low clouds, especially in the morning.
However, in Alexander Bay, the sun frequently shines all year round, though not as frequently as in inland areas.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	10	10	9	8	8	8	8	8	9	9	10	10

Here, the climate is constantly mild, with average daytime temperatures around 15 °C (59 °F) in winter and around 20 °C (68 °F) in summer, even though rapid increases in temperature may occur when the wind blows from the desert, which lies to the east and is scorching hot in summer. However, due to fog, humidity and wind, you can feel cold, especially in winter.
Here are the average temperatures of Port Nolloth, in the northern part of the coast.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	15	15	14	13	11	11	10	10	11	12	13	15
Max (°C)	19	18	18	17	17	17	16	16	16	16	17	18
Min (°F)	59	59	57	55	52	52	50	50	52	54	55	59
Max (°F)	66	64	64	63	63	63	61	61	61	61	63	64

Moving inland, we find the plateau, where the influence of the sea is reduced, and the daily temperature range is noticeably wider. This means that summer days can be scorching hot, in particular from October to March, but nights are usually cool, while winter nights can be cold, with possible frosts after cold air outbreaks of Antarctic origin, while days remain mild and mostly sunny.

Upington

Here are the average temperatures of Upington, located in the western part of the plateau, not far from the borders with Namibia and Botswana, and 835 meters (2,750 feet) above sea level. Here, the temperature reached 44.6 °C (112.3 °F) in January 2012, and 45.3 °C (113.5 °F) in January 2016.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	22	21	19	15	10	6	5	7	11	15	17	20
Max (°C)	34	33	31	27	23	20	20	22	25	28	31	33
Min (°F)	72	70	66	59	50	43	41	45	52	59	63	68
Max (°F)	93	91	88	81	73	68	68	72	77	82	88	91

The rains, which as we mentioned are scarce, occur in winter along the west coast, while in inland areas they occur in summer, in the form of afternoon showers. Here is the average precipitation in Upington.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	25	35	35	25	10	4	2	4	4	9	17	17	187
Prec.(in)	1	1.4	1.4	1	0.4	0.2	0.1	0.2	0.2	0.4	0.7	0.7	7.4
Days	4	5	6	4	2	1	0	1	1	2	3	3	32

The sun in Upington shines all year round.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	11	11	10	10	9	9	9	10	10	11	12	12

South and East Coast of the country:

Port Elizabeth

In Port Elizabeth, 630 mm (24.8 in) of rain fall per year, with a relative minimum in summer, between December and February. Here is the average precipitation.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	35	35	50	45	65	60	60	55	60	65	60	40	630
Prec.(in)	1.4	1.4	2	1.8	2.6	2.4	2.4	2.2	2.4	2.6	2.4	1.6	24.8
Days	3	5	6	5	6	5	5	6	8	8	7	5	69

In winter, temperatures are spring-like, since the average in July is 14 °C (57 °F), although short cold waves from Antarctica can occasionally lower the night-time temperature to around freezing (0 °C or 32 °F) between June and September. Summer is pleasant, since the average in January and February is 21 °C (70 °F), with a lively and constant breeze from the sea. Throughout the year, every now and then, hot and dry winds can blow from the mountains, which lie a short distance from the coast. Here too, like in the aforementioned Mediterranean climate zone which includes Cape Town, the best time of the year is the summer. Here are the average temperatures in Port Elizabeth.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	18	19	17	15	12	10	10	11	12	13	15	17
Max (°C)	24	24	23	22	21	20	18	18	18	20	21	23
Min (°F)	64	66	63	59	54	50	50	52	54	55	59	63
Max (°F)	75	75	73	72	70	68	64	64	64	68	70	73

The sun in Port Elizabeth frequently shines all year round, though in summer, it doesn't shine as frequently as in Cape Town.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	9	8	7	7	7	7	7	8	7	8	8	9

Durban

Continuing north-east, on the coast of KwaZulu-Natal, in **Durban** it gets quite hot and humid in summer: the average in January and February is around 24.5 °C (76 °F), and the humidity makes the heat muggy, even though the breezes blow in the afternoon, giving a bit of relief; thunderstorms may occur in the afternoon or in the evening, giving some additional relief (or maybe, disturbing those who are on the beach). Here, about 1,000 mm (40 in) of rain fall per year, of which more than 100 mm (4 in) fall per month from November to March, while in winter, from June to August, it doesn't rain much. Here is the average precipitation.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	120	130	115	90	60	35	25	40	65	85	120	125	1010
Prec.(in)	4.7	5.1	4.5	3.5	2.4	1.4	1	1.6	2.6	3.3	4.7	4.9	39.8
Days	11	9	9	7	4	3	3	4	6	10	11	12	89

In winter, daytime temperatures are very pleasant, on average around 23 °C (73 °F). Here are the average temperatures.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	21	21	20	17	14	11	11	13	15	17	18	20
Max (°C)	28	28	28	26	25	23	23	23	23	24	25	27
Min (°F)	70	70	68	63	57	52	52	55	59	63	64	68
Max (°F)	82	82	82	79	77	73	73	73	73	75	77	81

The amount of sunshine in Durban is higher in winter, being the dry season. In summer, it is a bit lower than in other areas of South Africa, since the rains are more frequent.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	6	6	7	7	7	8	7	7	6	5	6	6

The Plateau (Middle) of the country:

Johannesburg

Johannesburg, the largest city of the country, is located at 1,700 meters (5,600 ft) above sea level, in the plateau called *Highveld*, and thanks to the altitude, it has a pleasant and sunny climate. In the warm season, from October to March, it's hot during the day, with possible thunderstorms in the afternoon or in the evening, while nights are cool. Winter, from May to August, is dry and sunny, with very cool or even cold nights, while temperatures become usually mild during the day. Sometimes at night, the temperature can drop below freezing, especially in June and July. Here are the average temperatures.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	15	14	13	10	5	2	2	5	8	11	13	14
Max (°C)	27	26	25	23	21	18	18	21	24	25	25	26
Min (°F)	59	57	55	50	41	36	36	41	46	52	55	57
Max (°F)	81	79	77	73	70	64	64	70	75	77	77	79

A few times over the last century, even snowfalls have occurred, in the period from June to August. Throughout the year, 705 mm (27.8 in) of rain fall on average, of which approximately 90/120 mm (3.5/4.7 in) fall per month from November to March. Here is the average precipitation.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	125	90	90	50	15	10	5	5	25	75	110	105	705
Prec.(in)	4.9	3.5	3.5	2	0.6	0.4	0.2	0.2	1	3	4.3	4.1	27.8
Days	14	10	11	8	3	2	1	2	4	9	13	14	91

North East of Country:

Kruger National Park

The Kruger National Park, where you can find elephants, lions and other animals of the savannah, is located on the border with Mozambique, mostly at an altitude ranging from 300 to 500 meters (1,000 and 1,600 feet). Here the winter is dry and sunny, with large temperature variations between night and day: at night, it can get cold, about 10 °C (50 °F) or less, while during the day the temperature gets warm, around 26/27 °C (79/81 °F). Therefore, when going on safaris in this period, it's better to dress in layers. Summer is hot and humid, with possible afternoon thunderstorms. Here are the average temperatures in Skukuza, the main camp of the park, located at 270 meters (890 feet) above sea level, at the lowest point of the park.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	21	20	19	16	11	6	7	9	13	16	18	20
Max (°C)	32	32	31	29	28	26	26	27	29	30	30	32
Min (°F)	70	68	66	61	52	43	45	48	55	61	64	68
Max (°F)	90	90	88	84	82	79	79	81	84	86	86	90

In the Kruger National Park, the rains, scarce in winter, become relatively abundant in summer because of afternoon thunderstorms. Here is the average precipitation.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	95	95	70	35	15	10	10	10	25	45	65	95	565
Prec.(in)	3.7	3.7	2.8	1.4	0.6	0.4	0.4	0.4	1	1.8	2.6	3.7	22.2
Days	9	8	8	5	3	2	1	2	3	6	9	9	65

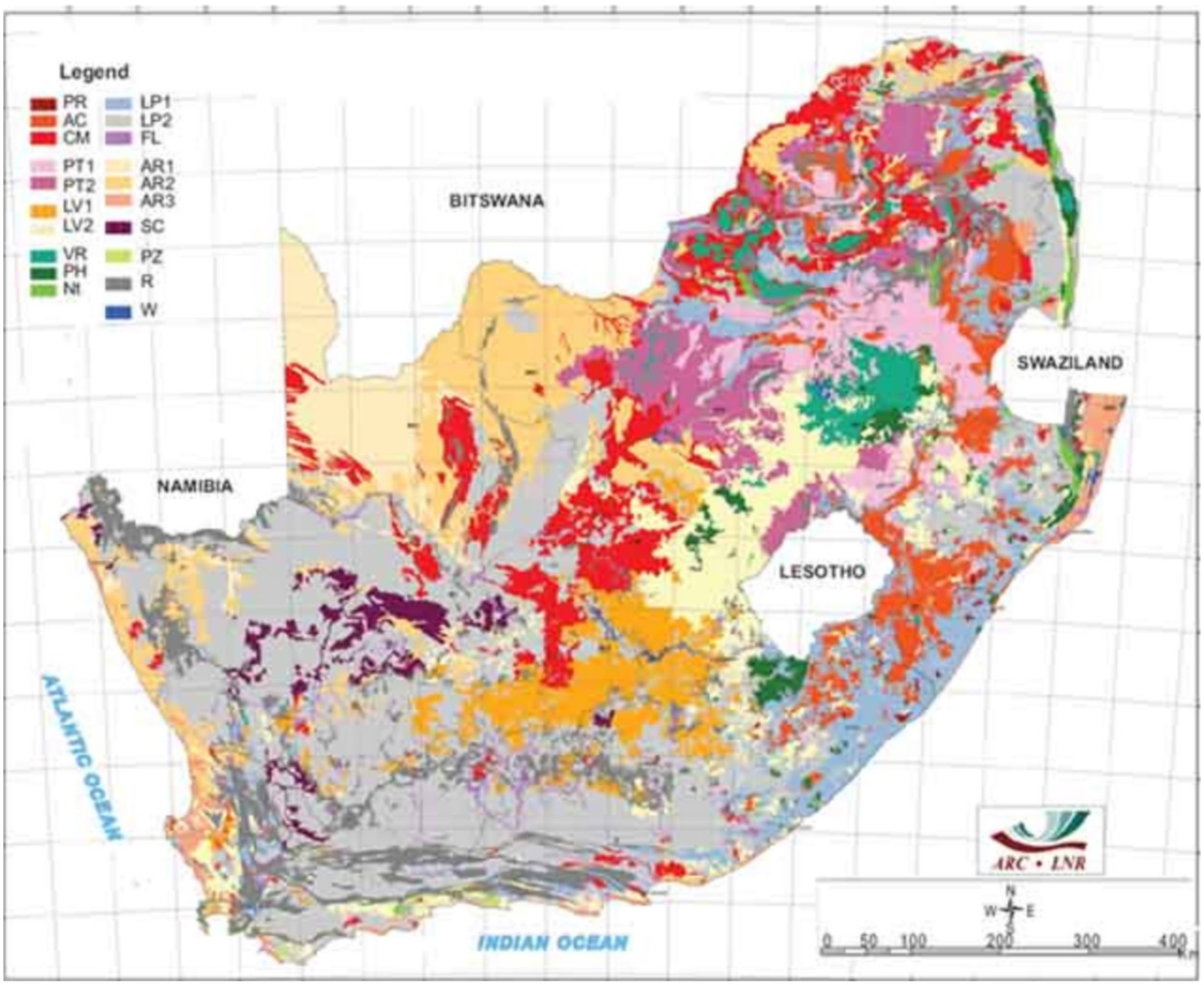
The amount of sunshine is good all year round, however, it is higher in winter, since it is the dry season.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	7	8	7	7	8	8	8	8	8	7	6	7

Soil characteristics

Red-yellow well drained soils generally lacking a strong texture contrast

Ferralsols (FR)	Red and yellow soils with a humic horizon
Acrisols (AC)	Red and yellow, massive or weakly structured soils with low to medium base status
Cambisols (CM)	Red, massive or weakly structured soils with high base status



Soils with a plinthic catena	
Plinthosols1 (PT1)	Red, yellow and greyish soils with low to medium base status
Plinthosols2 (PT2)	Red, yellow and greyish soils with high base status
Soils with a strong texture contrast	
Luvisols1 (LV1)	Soils with a marked clay accumulation, strongly structured and a reddish color
Luvisols2 (LV2)	Soils with a marked clay accumulation, strongly structured and a non-reddish color.
	In addition, one or more of vertic, melanic and plinthic soils may be present
Well-structured soils generally with a high clay content	
Vertisols (VR)	Dark colored, strongly structured soils dominated by cracking and swelling clays (vertic soils). In addition, one or more of melanic and red structured soils may be present
Phaezems/Kastanozems (PH/KS)	Soils with dark colored, well-structured topsoil with high base status (melanic soils).
	In addition, one or more of vertic and red structured soils may be present

Nitisols (NT)	Deep, well drained, dark reddish soils having a pronounced shiny, strong blocky structure (nutty), usually fine (red structured soils). In addition, one or more of vertic and melanic soils may be present
Soils with limited pedological development	
Leptosols1 (LP1)	Soils with minimal development, usually shallow on hard or weathering rock, with or without intermittent diverse soils. Lime rare or absent in the landscape
Leptosols2 (LP2)	Soils with minimal development, usually shallow on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape
Fluvisols (FL)	Soils with negligible to weak profile development, usually occurring on deep deposits
Sandy soils	
Arenosols1 (AR1)	Red, excessively drained sandy soils with high base status - dunes are present
Arenosols2 (AR2)	Red and yellow, sandy well drained soils with high base status
Arenosols3 (AR3)	Greyish, sandy excessively drained soils

Strongly saline soils	
Solonchaks (SC)	Strongly saline soils generally occurring in deep deposits on flat lands
Podzolic soils	
Podzols (PZ)	Soils with a sandy texture, leached and with sub-surface accumulation of organic matter and aluminium with or without iron oxides, either deep or on hard or weathering rock
Rocky areas	
Regosols (R)	Rock with limited soils

Common South African fruits:

Guavas


Papaya **Dates**

Common South African Vegetables:




Baby marrow **Beetroot**

Brussel sprouts **Maize**

Parsnips **Radishes**

Geography of Uganda


Kampala, Uganda


Gulu, Uganda

Mbale, Uganda

Climate:

The northern part of Country:

Gulu

Here are the average temperatures of **Gulu**, located at 1,100 meters (3,600 feet) above sea level. Here, the temperature can reach 36/37 °C (97/99 °F) from January to March.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	17	17	17	17	17	17	16	16	16	17	16	16
Max (°C)	31	32	30	29	28	27	26	27	27	28	29	30
Min (°F)	63	63	63	63	63	63	61	61	61	63	61	61
Max (°F)	88	90	86	84	82	81	79	81	81	82	84	86

Here is the average rainfall: there is a single rainy period from April to October.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	10	40	80	170	200	140	160	220	170	160	90	40	1480
Prec.(in)	0.4	1.6	3.1	6.7	7.9	5.5	6.3	8.7	6.7	6.3	3.5	1.6	58.3
Days	1	3	6	9	9	9	10	12	10	10	6	3	88

In the north, the sun regularly shines in the dry season, while in the rainy season, the hours of sunshine decrease a little. Here are the average sunshine hours per day.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	9	9	8	8	8	8	6	6	8	8	8	9

Center and South of Country:

Kampala

In the capital, Kampala, which lies practically at the Equator, a short distance from Lake Victoria and at 1,100 meters (3,600 feet), daytime temperatures range from 29 °C (84 °F) between January and March to 27 °C (81 °F) between June and August; night temperatures are even more stable, hovering around 17/18 °C (63/64 °F) throughout the year. Lake Victoria is large enough to affect the climate along its banks, reducing a bit the daily temperature range while increasing moisture.
Here are the average temperatures of Kampala.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	18	18	18	18	18	18	17	17	17	17	18	18
Max (°C)	29	29	29	28	27	27	27	27	28	28	27	28
Min (°F)	64	64	64	64	64	64	63	63	63	63	64	64
Max (°F)	84	84	84	82	81	81	81	81	82	82	81	82

In Kampala, precipitation amounts to 1,260 mm (50 in) per year. Here is the average precipitation.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	70	65	130	170	120	70	65	95	110	140	150	90	1265
Prec.(in)	2.8	2.6	5.1	6.7	4.7	2.8	2.6	3.7	4.3	5.5	5.9	3.5	49.8
Days	5	5	10	12	11	6	5	7	9	9	8	7	94

In Kampala, the amount of sunshine is decent, but not excellent, most of the year, and decreases a bit in the "long rains season", from March to May.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	7	7	6	6	6	7	7	7	7	7	7	7

Mountain region of the country:

Kabale

Here are the average temperatures of Kabale, located near the park, at 1,900 meters (6,200 ft) above sea level.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	11	11	11	12	12	10	9	10	11	11	12	11
Max (°C)	24	24	24	24	23	24	24	24	25	24	23	24
Min (°F)	52	52	52	54	54	50	48	50	52	52	54	52
Max (°F)	75	75	75	75	73	75	75	75	77	75	73	75

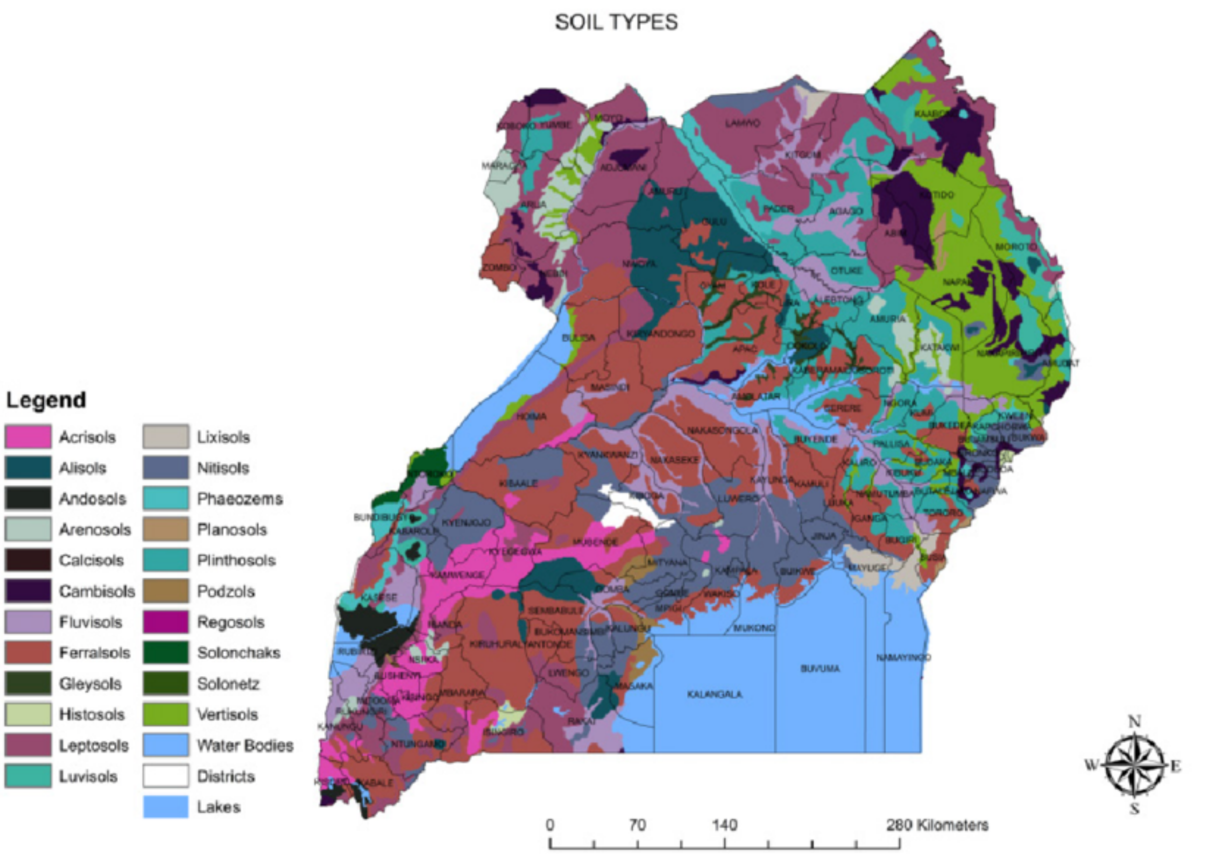
As mentioned, the southwest is one of the driest areas of the country. In Kabale, about 1,000 mm (40 in) of rain fall per year, although the only really dry months are June and July. Here is the average rainfall.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec.(mm)	65	80	115	140	100	30	20	55	100	110	115	90	1015
Prec.(in)	2.6	3.1	4.5	5.5	3.9	1.2	0.8	2.2	3.9	4.3	4.5	3.5	40
Days	8	10	13	16	10	3	2	6	11	13	16	10	116

The sun in Kabale does not shine very often, though at higher altitudes, as mentioned, it shines even less often.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	5	6	5	5	4	6	6	5	6	5	5	4

Soil types in Uganda:



Crops:
Uganda's main food crops have been plantains, cassava, sweet potatoes, millet, sorghum, corn, beans, and groundnuts. Major cash crops have been coffee, cotton, tea, cocoa, vanilla, and tobacco.

Common Ugandan Fruits:




Jack fruit **Pawpaw fruit**

Passion fruit

Common Ugandan vegetables:

Chinese spinach **Cassava and its leaves**

Amaranth **Eggplant varieties**

Ebugga plant **Wild spider flower leaves**


Sweet potato and its leaves

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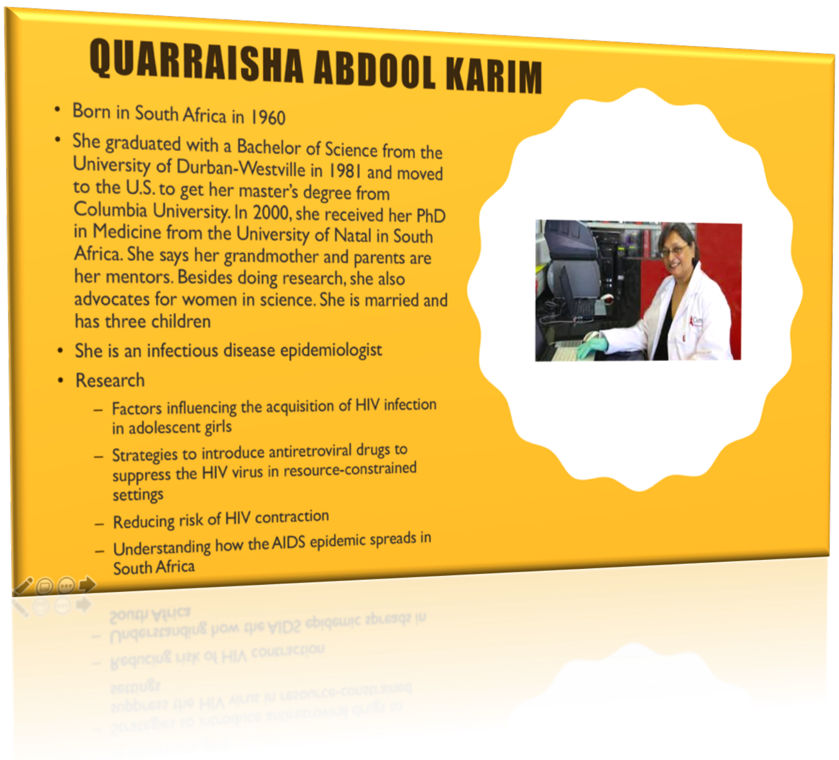
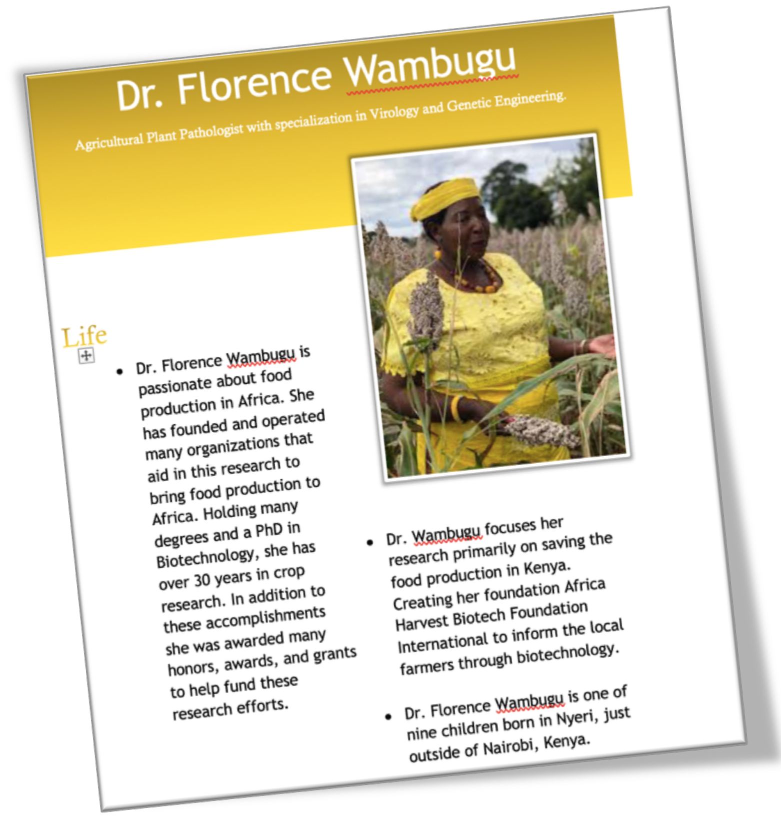
Exemplars

Activity 1:





Seyi Oyesola (Nigeria)

About Nigeria

In 2017, Nigeria's population was 190.9 million people. Of those, about 90 million live in extreme poverty. Nigeria's economy thrives on the sale of petroleum. While it is a rich country in petroleum, the cities have enormous sanitary problems and thus the people have major health concerns.

Biography

Seyi Oyesola is a Nigerian doctor who created the "hospital in a box." Dr. Oyesola was fed up with the hospitals in Nigeria that were always short on supplies and prone to power outages. Because of this, Dr. Oyesola co-invented the "hospital in a box:" a solar-powered, mini hospital which includes an operating room that can be transported to remote areas of Africa and set up quickly.

He called this invention "CompactOR," and it has the ability to serve as a portable operation room, fitted with everything needed for emergency healthcare: including defibrillators, EKG monitoring machine, an anesthetic machine, and surgical lighting.

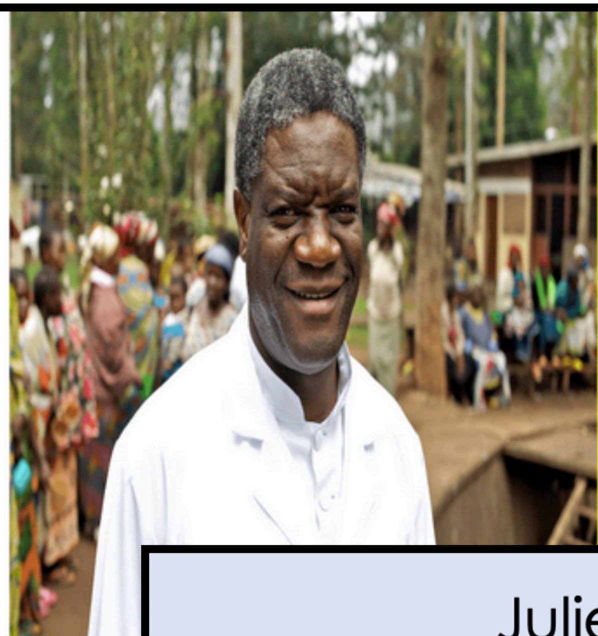
Seyi Oyesola

Dr. Oyesola is from Nigeria. He spent some of his childhood in Cleveland, Ohio but returned to Nigeria after high school to attend college. He graduated from the University of Lagos with an M.D. in Science. He co-developed CompactOR, more famously known as "hospital in a box." It is solar-powered and includes a defibrillator, EKG monitoring, anesthetic machines, and surgical lighting. It was invented to treat common traumas that often turn into fatalities in rural areas where hospitals are not within accessible distances. Currently, Dr. Oyesola is Chief Medical Director of Delta State University Teaching Hospital in Nigeria.

Dr. Oyesola is a physician. His reasoning to pursue this invention is that he believes more solutions to help Africa should come from Africans. He wants to change the narrative that Africa relies on foreign aid and cannot find its own solutions.

Denis Mukwege

- born on March 1st 1955 shortly before the independence of the DRC.
- The congo has been under a civil for years since thier independence and financial ruin
- His main focus was his practice in gynecology and pediatric care of sexually assaulted women's and children
- He founded his own hospital dedicated to his practice (has had two the first one was destroyed)
- He has won 4 awards for his work along with his fight for a non-violence in the congo
- Currently is the director and chief surgeon of Panzi Hospital (the 2nd one)



Julie Makani

Country of Origin: Tanzania

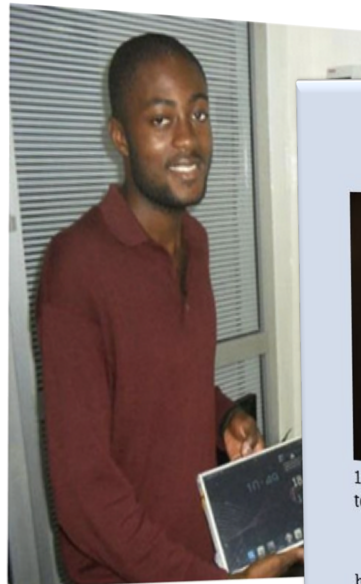
Biography: As a hematologist, Makani's main job is to study characteristics of blood in the human body. After earning her PhD on the clinical epidemiology of sickle cell disease, she earned a fellowship and began the Sickle Cell Disease (SCD) program at the Muhimbili University of Health and Allied Sciences. Here, she is observing over 2,000 SCD patients. Her research focuses primarily on the biomedical research behind various diseases and their influence on SCD.

Area of Science: Hematology, study of blood

Main Research Question:
How does malaria, bacterial infections, stroke, anemia, and other infections/disease influence Sickle Cell disease?

Arthur Zang

- A computer Engineer from Cameroon, Africa
- He was born on November 26, 1987 in Cameroon. This is where he attended college at the Polytechnic School of Yaounde. He spent time studying in a hospital in Cameroon. It was here that he came to the realization that there were only thirty cardiologist and twenty million people in Cameroon. When he was 24 he created the cardio pad to increase the outreach that cardiologist have. It is a touchscreen tablet that is can give heart exams. Scientist use these to reach people in rural areas.
- Computer Engineering is managing and designing computer software. Computer Engineers update hardware, develop systems, and design new equipment.
- Arthur Zang's purpose is to expand the outreach of cardiologist. He plans to expand the outreach even further by finding ways to make inexpensive medical equipment that can be sent into rural areas.



Betty Gikonyo

Betty Gikonyo is a pediatric cardiologist from Kiamabara, a settlement in Kenya's Central Province. Her family was quite poor: in fact, Gikonyo did not have her own pair of shoes until she was 13 years old. However, she was able to attend the Alliance Girls High School just outside of Nairobi. Her motivation for becoming a health professional came from her mother's diagnosis with cancer when Gikonyo was just 14 years old. Her older brother was also a doctor, and her family took great pride in his accomplishments.

Gikonyo now has over 40 years of experience as a cardiologist, and is the first female in her profession from Kenya. She earned both her Bachelor and Master of Medicine degrees from the University of Nairobi in Kenya and her Doctorate from the University of Minnesota in the United States. Gikonyo cofounded the Karen Hospital in Nairobi with her husband, who is also a cardiologist and the personal doctor to the third president of Kenya. Their hospital's mission statement is "to be an influential healthcare provider for the African region." Gikonyo is currently the CEO of Karen Hospital and is still an honored team member working to provide care and funds for poor children suffering from cardiological ailments.

Activity 6:

Sense Making Activity #6

Standard:
S.C.5.P.10.1
Investigate and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.

Sameera Moussa was born in 1917, in Egypt at a time when women were not seen as equals to men, but she showed society all that a woman is truly capable of. She was the first female Egyptian nuclear scientist. When she was ready to go to college, everyone wanted her to pursue engineering, but she decided to follow her passion and chose to study nuclear science. During the beginning of her career, her mother battled with Cancer, and although her mother fought for as long as she could, she still lost her life to cancer. This event changed the course of Sameera's life. This motivated her to keep conducting more and more research into nuclear energy. This research got her invited to places no Egyptian woman had ever ventured into. She became a professor in Egypt and continued to develop her research with nuclear energy. Her dream was that she would be able to find a way for anyone to afford nuclear treatment. She had a pure soul, and was driven by the desire to make nuclear treatment as cheap as aspirin. Her findings led her to the U.S.'s secret atomic facilities and was even offered a full time position there. She declined because she wanted to stay true to her country. She advocated for peaceful uses of atomic energy. Especially because this is a time where the most destructive weapon mankind had seen was being developed, atomic bombs. Atomic bombs get their power from the fission(or splitting) of nuclei. The nucleus in an atom is held together by very strong forces. Many people did not want to watch a woman become so influential, and shortly after her first visit to America she died in a car accident. It is tragic that she never got to live a full life, but her work and dedication to improving the health and science field for the purpose of helping people makes her an inspiration to us all. She is a feminist icon, and lives on in our hearts, reminding us to fight to make the world a better place for everyone.

Activity Six Sense Making

SC.35.CS-PC.2.4

Explain how access to technology helps empower individuals and groups (e.g., gives them access to information, the ability to communicate with others around the world, and allows them to buy and sell things).

This will be a story about Arthur Zang and his experience in college. It will address the problem of the ratio of cardiologist to people in Africa. Arthur Zang will embark on a journey to the solution: creating the heart monitoring tablet. The story will show how technology and communicating with other scientist allowed for the creation of this tool. The end will show the benefits that the new heart monitoring technology has on communities in Africa. Then it will talk about Arthur Zang's new research and his goals to make more helpful tools to reach people throughout Africa.

Sense Making Activity

If I were to create a story on my scientist, Julie Makani, I would tell it from her perspective. I think it would be really interesting if she would be talking to the reader as they read it so they felt like they were in on the experience of her research. The Florida standard I would associate with this story would be SC.4.N.1.2: Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups. Because Makani is interested in sickle cell disease's interaction with other diseases, students can learn how her observations drive her work. I could see the story's outline looking similar to this:

1. Introduction. Have Julie Makani explain her background, education, and current field of study.
2. Explain importance and relevance to the student. Give a real life example and why her research is so important to the reader.
3. Research process. Have Julie Makani explain her research process step by step. Explain why observation is so important in science and how it drives her work.
4. There's still more research to be done! Explain that her work isn't over yet, but she's glad that she could take the students to see what happens in her daily life as a scientist.

The story would also explain various vocabulary terms when needed.

Activity #6 Sense-Making

Standard: SC.4.N.1.8 Recognize that science involves creativity in designing experiments.
Scientist: Seyi Oyesola
Outline:

1. Introduce Seyi Oyesola and his background/upbringing.
    a. Born in Nigeria
    b. Moved to Cleveland, Ohio when he was a child
    c. Graduated from University of Lagos
2. Returned to Nigeria and saw a huge issue occurring.
    a. He noticed how far away hospitals were from so many communities
    b. He heard about people dying from things that are easy to recover from with medical assistance
        i. Accidents, trauma, heart attacks, etc.
3. How could he help communities get access to medical treatment?
    a. Mention how he knew he had to make a CREATIVE solution to the problem
    b. He can't build his own hospital with a full staff in remote communities, but something in between
4. Lightbulb moment: portable hospital.
    a. Talk about hospital-in-a-box
        i. How it works, what's in it, how portable it is
5. Now, communities can have access to medical care and recover from their issues and live!

African Scientist Storyline:
Julie Makani
Florida Science Benchmark:
SC.3.N.1.1 Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.
SC.3.N.1.4 Recognize the importance of communication among scientists.
SC.3.N.1.5 Recognize that scientists question, discuss, and check each other's evidence and explanations.
Grade: 3rd Grade
Storyline:

- The story begins with the birth of Julie Makani
- It goes on to discuss her childhood, her attendance at St Constantine's Primary School in Arusha, Tanzania, and her dream to become a medical researcher
- It shows her training at Muhimbili University in 1994 and her receiving her medical degree.
    - Discusses her exploration and investigation of the natural world specifically in the field of hematology
- It discusses her conducting her post-graduate studies in internal medicine at the Hammersmith Hospital, Royal Postgraduate Medical School
- It goes on to discuss how she became a Wellcome Trust Research Fellow and the completion of her PhD on clinical epidemiology of sickle cell disease
    - Discusses her exploration and investigation of anemia and sickle cell disease. Also, discusses her collaborating and communication with fellow scientists in her field.
- It then goes on to discuss her position as the Associate Professor in the Department of Haematology and Blood Transfusion at the Muhimbili University of Health and Allied Sciences (MUHAS) and the research she does.
    - Discusses the research practices(questioning, discussing, and checking each other's evidence and explanations) she engages in her position as an associate professor and researcher
- The story will conclude with Julie receiving the Royal Society Pfizer Award in 2012 for her work with sickle cell disease and her explaining the purpose and goals of her work.

Story Outline:

Quarraisha Abdool Karim was born in 1970 in South Africa. This is a country with an HIV/AIDS epidemic. HIV is an infection that can lead to AIDS. This virus affects your immune system and weakens it so that it can't fight off infections it could normally get rid of. QAK first started research in this area by trying to understand how the infection spread among women. She collected information through surveys and research about factors that impact the spread of HIV, such as migration.

She realized she needed to research this topic more, so she continued her education further. She received her PhD in Medicine from the University of Natal in South Africa in 2000. In 2007, she was the principal investigator of a study published by The Center for the AIDS Program Research in South Africa (CAPRISA), which studied how effective a gel was in preventing women from getting HIV. It was a blind randomized controlled trial that had some women use the gel and some women use a placebo gel (meaning it is harmless and doesn't have any medicinal effects). The group that got assigned the placebo didn't know they were using the placebo (that's why the experiment was "blind"). Scientists compared the results from the two groups. Researchers found that the gel reduced HIV infection by 39% overall (https://science.sciencemag.org/content/329/5996/1168). This was a landmark clinical trial.

Standards:

SC.5.N.1.4: Identify a control group and explain its importance in an experiment.
Students will identity the control group in the trial as being the one that received the placebo gel.

SC.5.N.1.2: Explain the difference between an experiment and other types of scientific investigation.
Students will compare QAK's first studies as being observations and investigations in which she collected information but didn't change anything about the participants or the world around them. In the CAPRISA trial, there were variables that were changed (using the gel or not) and she was able to establish a cause/effect relationship.

A Story About Seyi Oyesola
(An Outline by Ana Mattos)

Benchmark: SC.5.N.1.1 Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

Intro:
There once was a man by the name of Seyi Oyesola. Seyi was born in Nigeria, but raised mostly in Ohio, United States.
After graduating high school in Ohio in 1975, he returned to Nigeria and got his medical degree in 1986 from the University of Lagos. He became Dr. Oyesola. His return to Nigeria was spurred by a problem he had identified in his home country.
That problem was a lack of access to healthcare for the majority of the population. Many people in his home country of Nigeria did not have access to appropriate healthcare. Another problem was that healthcare facilities were often short on supplies, or did not have power.
So, Dr. Oyesola had to come up with a solution.
His solution? "Hospital in a box."

Middle:
"Hospital in a box" is a solar-powered, mini hospital which includes an operating room that can be transported to remote areas of Africa and set up quickly.
More specifically, he called this invention "CompactOR." It has the ability to serve as a portable operation room, fitted with everything needed for emergency healthcare: including defibrillators, EKG monitoring machine, an anesthetic machine, and surgical lighting.
This solution did not come out of nowhere however. Dr. Oyesola had to collect all the knowledge and experience that he had gained over the years, and create a prototype. He had to test it continuously until he came up with the perfect solution. All great things take time and effort.

End:
Dr. Oyesola worked a long time to achieve everything he has done. Every great inventor and creator takes the time, effort, and is not afraid to fail and try again. Great things do not happen overnight, and problems are not solved overnight. However, with resilience we can come together as a team, and solve grand problems.

Activity 6 Sense-making
Standards:
SC.4.N.1.8 Recognize that science involves creativity in designing experiments.
SC.4.N.1.1 Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

Storyline:

- Story will begin by explaining what the apartheid was in South Africa and how it has been ended.
- Then I will introduce someone in the born free generation, Kopano Matlwa. I will talk about how she was going to the University of Oxford to study medicine when she noticed an injustice happening back home in South Africa.
- Kopano thought it was not right for people in South Africa to now be equal, yet there are still children who are stunted due to poverty and not being able to access the nutrition and healthcare they need. Because of this, Kopano released her first book *Coconut* at the age of 21.
- After graduating with a degree in public health, she became a physician and started working towards ending stunting in children. She is currently the executive director of a campaign called Grow Great. This campaign has a goal of ending stunting by 2030.
- Not only is Kopano a doctor, but she travels the world and gives speeches to share awareness. She even did a Ted Talk.
- Kopano is not only changing the world through researching and spreading awareness about stunting, but she also co-founded an organization called Ona Mtoto Wako. This organization is trying to make healthcare more available and free for expectant mothers in rural areas by making healthcare mobile and coming to them.
- I will end the book by acknowledging all the amazing accomplishments that Kopano has achieved and how it is an inspiration to all.