Soiled

Color as a metric
for nutritional analysis.

SVA-NYC Team

Andrew Cziraki, Arthur Janecek, Ash Conrad, Beckett Gookin, Darya Warner, Heather Appleby, Jennifer Nguyen, Martica Apicella, Mike Falk, Sebastian Cocioba, Shane Boddington, Steph Mantis, Tarah Rhoda, Victor Taboada Urtuzuastegui.
Instructor: Suzanne Anker / Advisors: Joseph DeGiorgis, Oliver Medvedik.

Concept

pH standard (ready for spectrophotometer).

Very few commercial soil test kits provide safe chemical tests without generating harmful and hazardous waste.

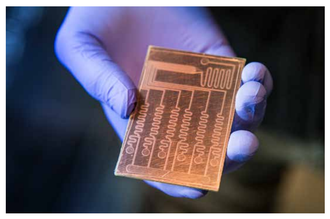
We propose the construction of a **device that limits exposure and increases accuracy**.

Our technology utilizes biological means to accurately detect soil nutrient values.

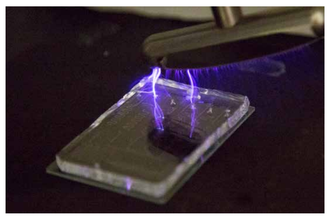
Methodology

Spectrophotometry
Reworked the visual-based LaMotte Industrial Soil Kit for precise quantitative measurement via UV-Vis Spectrophotometry.

Applied linear regression models to determine the ppm concentration of nutrients in soil samples.



Microfluidics
Iterated through various designs using unconventional substrates to find the optimal materials for low cost rigid positive relief molds.



Mobile Colorimeter Platform
3D printed chassis to hold a smart device and microfluidic cartridge

Design an app to leverage the on-board camera as a colorimeter for in-field soil sample analysis.

Human Practices

Backyard used for soil collection in Brooklyn, NYC.

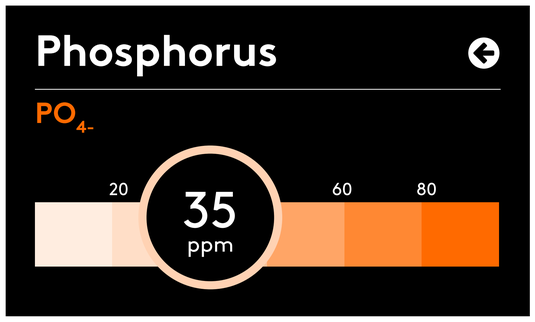
Our project facilitates opportunities for the public to learn about the role soil health plays in urban gardening.

We plan to develop a safer, more accessible way to test the nutritional value of soil, while promoting personal sustainability.

Interpersonal workshops conducted with participants across the five boroughs of New York City to gain insight into the ways in which the urban community engages with its outdoor spaces.

Exhibition at SVA Chelsea Gallery to highlight the interrelationship between science and art. Expanding on the installation at iGEM, our team will present a full-scale exhibition of *Soiled* in conjunction with a speaker series.

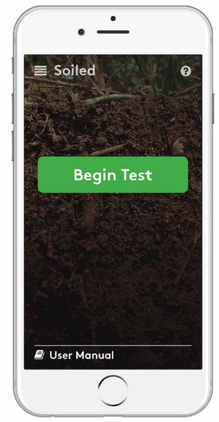
Results

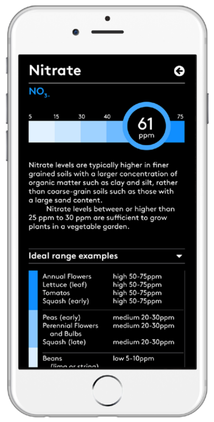


Chromoprotein-expressing constructs were tested, documented, sequenced and cataloged into a library.

Utilizing fluorescent reporter proteins, we developed plasmids for later assembly into genetic-control circuits sensitive to nutrients.

We drafted a microfluidic prototype to minimize exposure to inorganic chemical reactants and provide accurate quantitative results.





Our prototype contains a custom **microfluidic chip** which provides a precise reading through a smart-device camera to form a portable colorimeter.

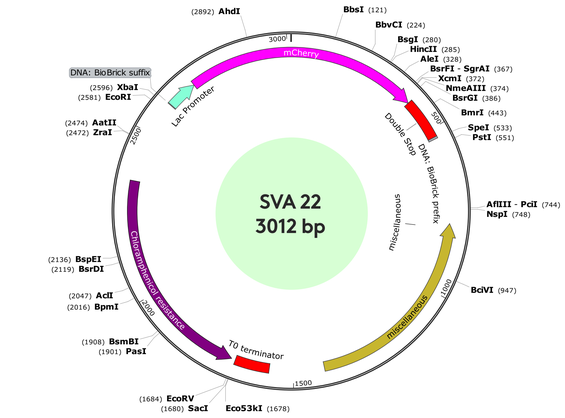
The soil extract reaction provides a color-based display specifying the nutrients therein.

Future Directions

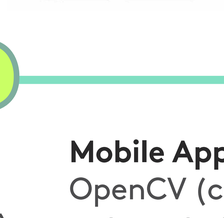
Microfluidic Chip
Miniaturize and expand the chip design (height, width, hydrophobicity) to optimize the flow of reagents via a single vacuum force. Offer it as a consumer product with ten test cartridges.

Mobile App
OpenCV (computer-vision) to automate the analysis of color values to a normalized spectrum.

Synthetic Protein Biosensors
Design protein-based chromogenic and colorless biosensors which remove the need for a host organism or its cellular machinery altogether.



SVA22: This is a composite part of SVA17 (LacI promoter+RBS+eforRed) before SVA4 (double terminator). This part was created for sequencing to be compared to SVA21 to help determine SVA21's difficulties.



E. Coli K-12 expressing chromoprotein mCherry under Lac regulation.

A project by SVA-NYC Team - 2015

GENSPACE
HKUST Rice iGEM
Santa Clara iGEM

Special Thanks
Beatriz Meseguer, Henry Sanchez, Kiera Havens, LaMotte Soil Testing Kits, Luis Navarro, Natalie Karl, Raul Valverde.