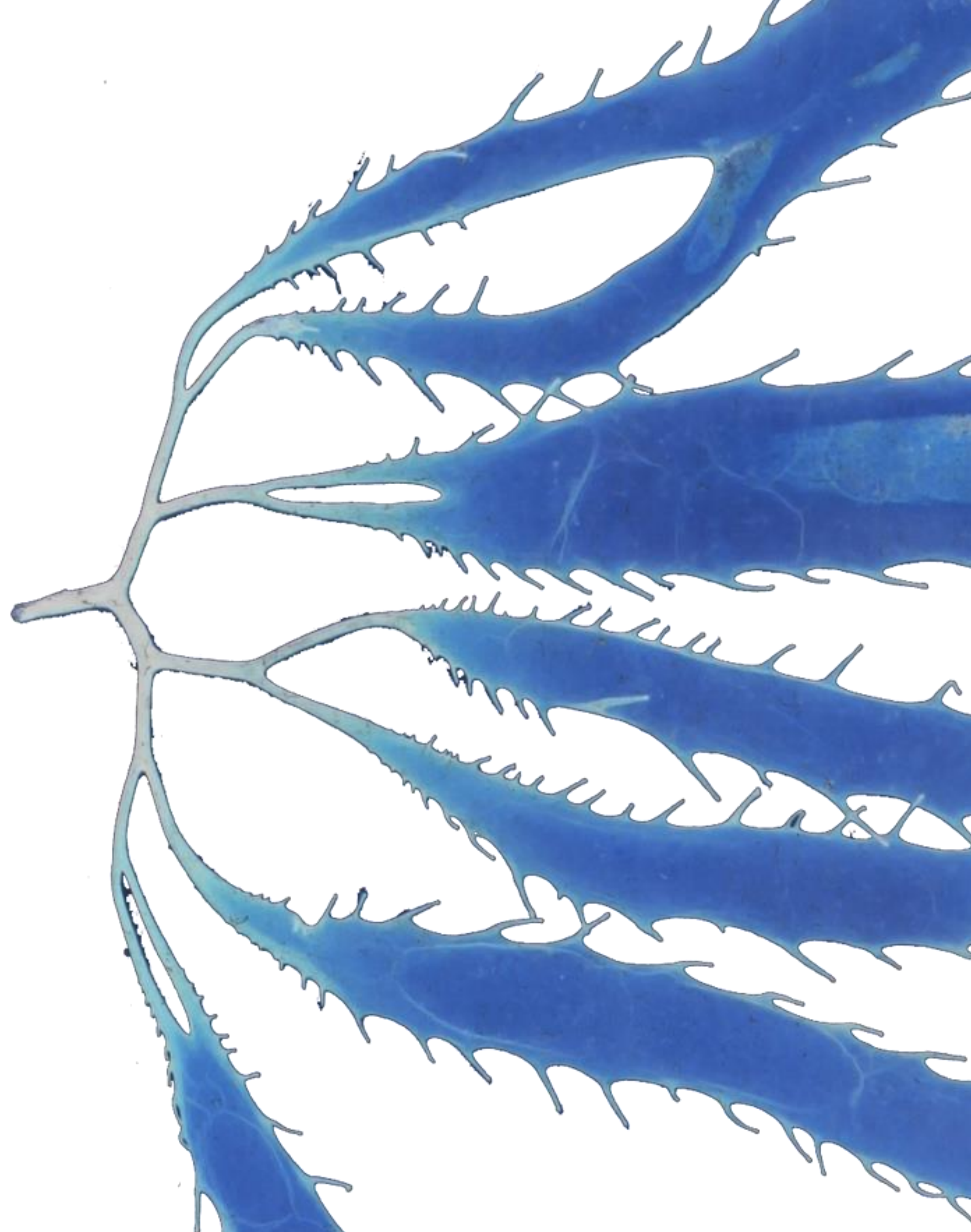


Visualizing Evolution

An Artist's Perspective

Emma Akmakdjian,
UCLA MFA Design | Media Arts,
11 January, 2023



Kathy Ann Miller

UNIVERSITY HERBARIUM • JEPSON HERBARIUM
UNIVERSITY OF CALIFORNIA, BERKELEY
1001 VALLEY LIFE SCIENCES BLDG # 2465
BERKELEY, CA 94720-2465

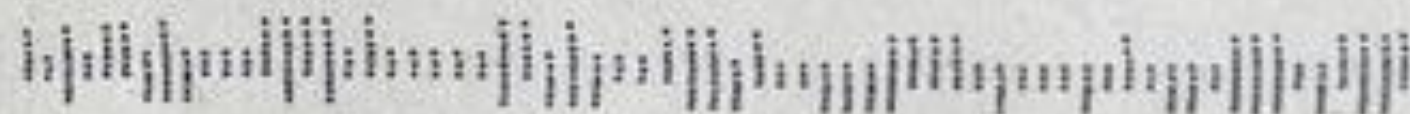
SAN FRANCISCO CA 940

3 NOV 2021 PM 2 L



Emma Akmakdjian

90404-310328



122 years old



ALGAE
Los Angeles County Museum

Macrocyctis pyrifera

Hab. Tidal zone
Loc. San Pedro, California
Coll. Pearl Otelia Pearson Date Spring, 1900



DNA discovered in 1953

Los Angeles then and now



circa 1914

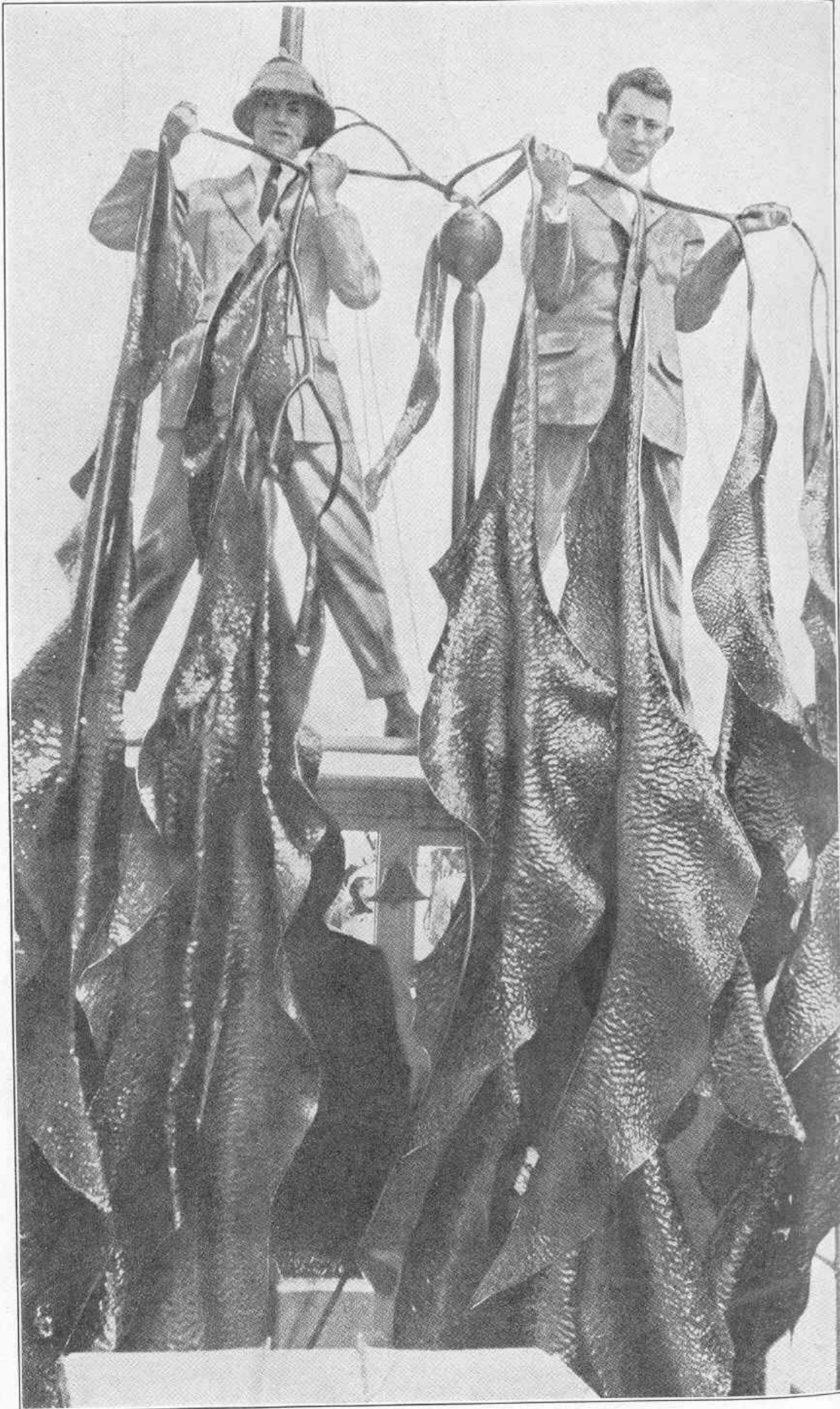


present day

Kelp through the ages

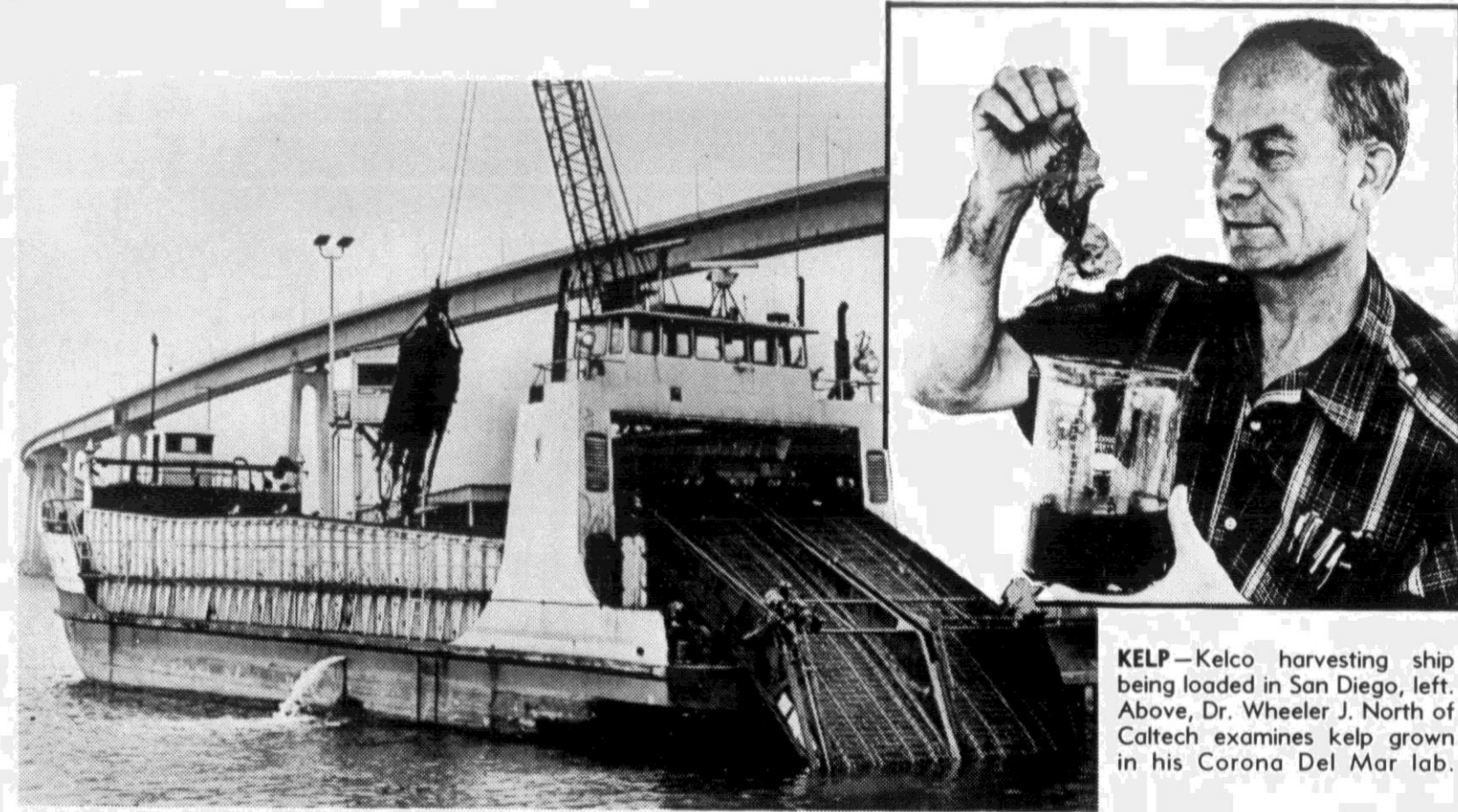
Report No. 100, U. S. Dept. of Agriculture.

PLATE XXII.



PELAGOPHYCUS PORRA, OR ELK KELP.
[Photograph by courtesy of American Potash Co.]

Circa 1900



Times photos by Dave Gatley and R.L. Oliver

KELP—Kelco harvesting ship being loaded in San Diego, left. Above, Dr. Wheeler J. North of Caltech examines kelp grown in his Corona Del Mar lab.

Kelp: A Dwindling Business May Get New Life

You May Have To Yell For Kelp

share of the ration. Kelp in the past years has been used as a fertilizer. Its effectiveness, he said, is the same as conventional fertilizer. A northern Illinois egg farm also used the kelp meal extensively, according to Fred [?], and has achieved superior results with it. Components of kelp are: crude protein, 5.7 per cent; fat, 2.6 per cent; fibre, 7 per cent; nitrogen, 58.6 per cent; moisture, 10.7 per cent; and ash, 15.4 per cent.

60 Elements Forty minerals and elements found in the seaweed in appreciable quantities. They include nitrogen, 1.46 per cent; phosphorus, .21 per cent; potassium, 1.28 per cent; iodine, .08 per cent; chlorine, 3.68 per cent; sodium, 4.18 per cent; calcium, 1.9 per cent; and iron, .08 per cent.

Most vitamins and vitamin

control capabilities in the seaweed. Researchers have theorized that the kelp is not insecticidal but that it reduces the reproductive activity of the insects.

Frost Resistance Claims have also been made that kelp can contribute to winter hardiness of plants. It has been thought in the past that winter hardiness (resistance to frostbite) could be induced only through breeding.

Research has indicated that a nutritional factor might also be involved in developing frost-resistant plants. If a plant's growth is retarded, it has been postulated through experiments, the plant will be resistant to cold to a degree. This idea has led to experiments with chemicals which slow down plant growth. Kelp has seemed to contain something which restrains the growth rate of plants for a period of time.

Whether kelp will assume great importance as a farm



Circa 1950

SCIENCE & TECHNOLOGY

THE CALIFORNIAN B-3

Disappearing Forest

Fragile kelp beds are threatened

STORIES BY
CHRISTINA S. JOHNSON

Kelp forests have all but disappeared in Orange County in the last decade. Now it seems the large colonies of giant, brown seaweed are vanishing in North San Diego

County, too — particularly along its northern beaches, say two biologists surveying the area.

While environmentalists and politicians debate whether human activity — overfishing, dredging, beach nourishment — or natural change has caused the deforestation of the sea floor, some scientists say the problem is a hybrid of both.

But whatever is killing the kelp forests has marched in a steady north to south progression in Orange County over the last two decades.

"We lost them first in Newport Beach, then Laguna Beach," said Mike Curtis, a kelp ecologist at MBC Applied Environmental Sciences in Costa Mesa. Then came San Clemente.

North San Diego County may be next.

Rivaled only by tropical forests and coral reefs for their biological diversity, kelp forests are the form, food and shelter for the richest cold-water community of animal life on the planet.

Their towering, stemlike structures — fringed with long, slippery blades — are also the life-support systems for several economically valuable fisheries, such as the California spiny lobster, the red sea urchin and, before it was severely overfished, abalone, a giant scallop-like shellfish.

At present, there are no kelp canopies between Leucadia and north Carlsbad, though historically these beaches have been dotted with thick mats of kelp, Curtis said. Oceanside has no kelp beds, though beds off Point Loma, La Jolla and Solana Beach have rebounded just fine from damage wreaked in 1998-99 by the warm-water event known as El Niño.

The only kelp beds left in Orange County lie in the waters off Dana Point and Corona Del Mar.

There may be smaller kelp plants — or viable kelp spores — down deep, Curtis said. But there were no canopies of kelp visible from the air as of December 1999. Now, he said, he is becoming concerned that the reefs are becoming isolated from nearby viable sources of kelp spores.

It may take another winter to tell whether the beds will return.

"I am distressed the kelp beds are changing so much," said Wheeler North, a professor emeritus of kelp forest ecology at the California Institute of Technology in



BILL WECHTER/STAFF PHOTOGRAPHER

Circa 2000



Historical pressings of seaweeds, such as this kelp, have proved to be a scientific boon for researchers. Photo courtesy of the Monterey Bay Aquarium

Scientists Use Seaweeds to Travel Back in Time

A new study highlights the treasure trove of data trapped in seaweeds over a century old.

by Annie Roth

September 15, 2020 | 1,000 words, about 5 minutes

Share this:



There are few things I enjoy more than turning a slimy piece of seaweed into a work of art. From scouring the tide pools for the perfect blades, to artfully arranging them on a piece of paper in my herbarium press, every step of the process is immensely satisfying.

Heat & Stress



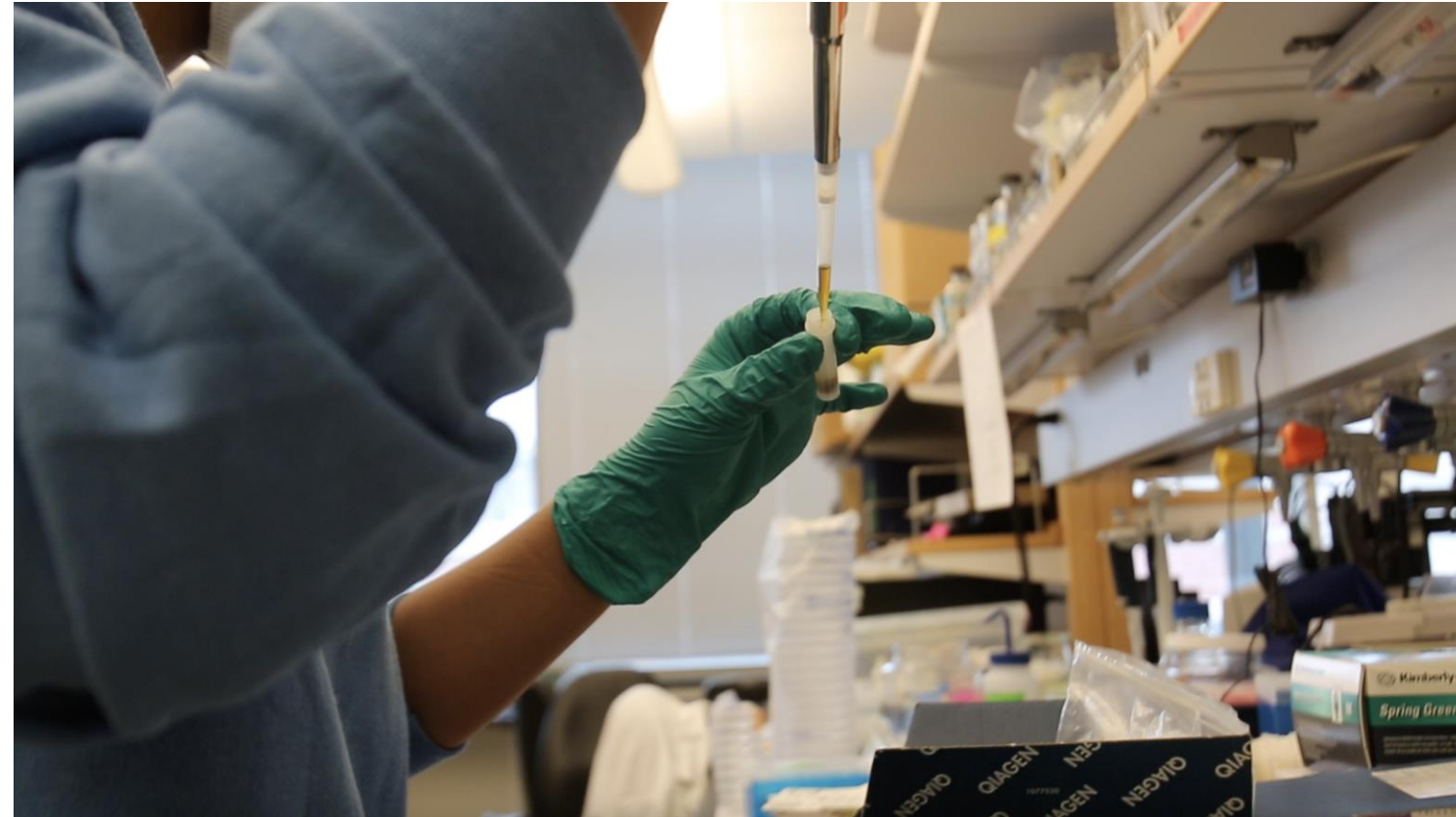
Has the Heat Shock Protein (HSP70) in kelp remained the same or changed over the past 100 years?



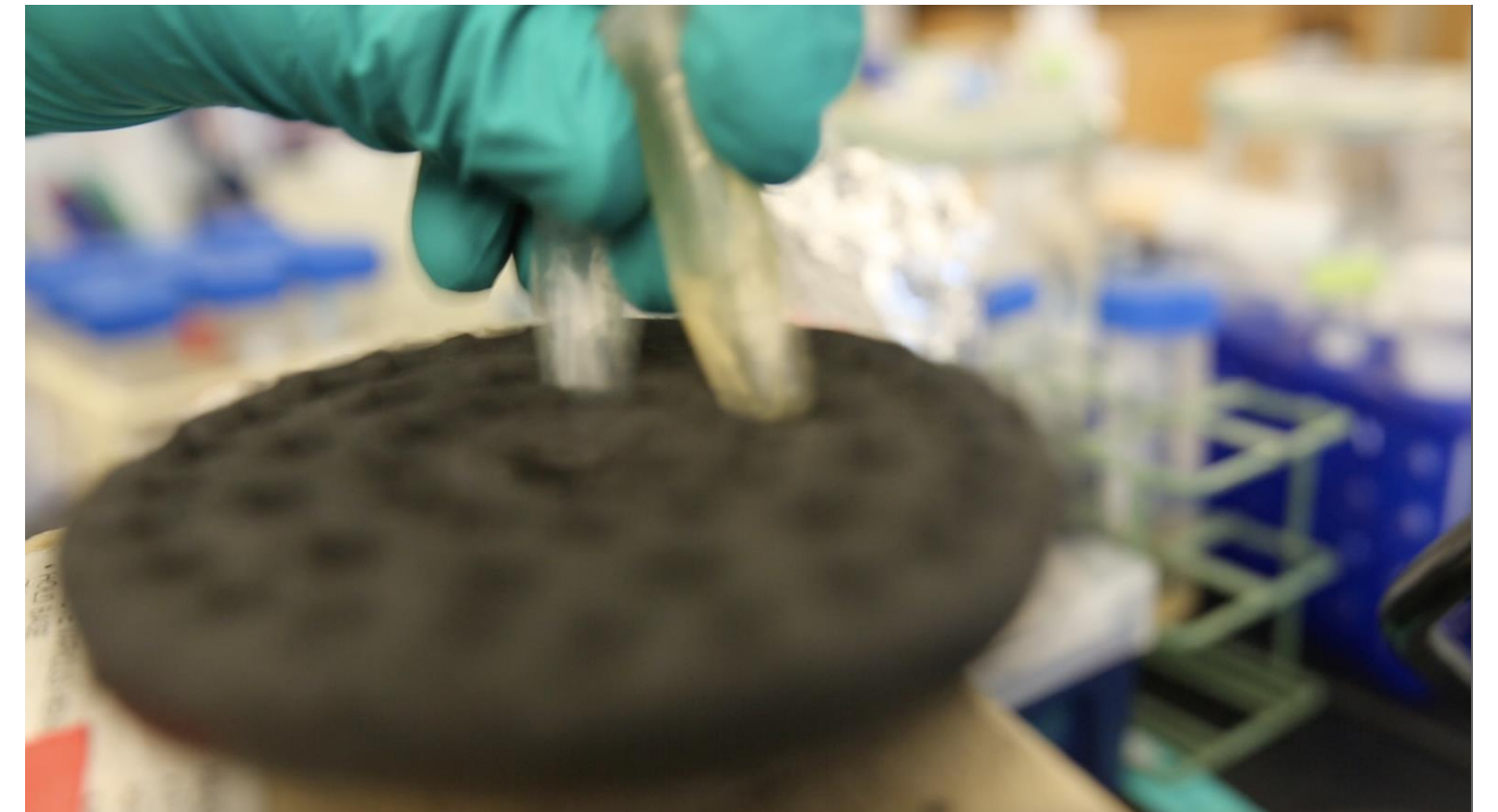
DNA Extraction



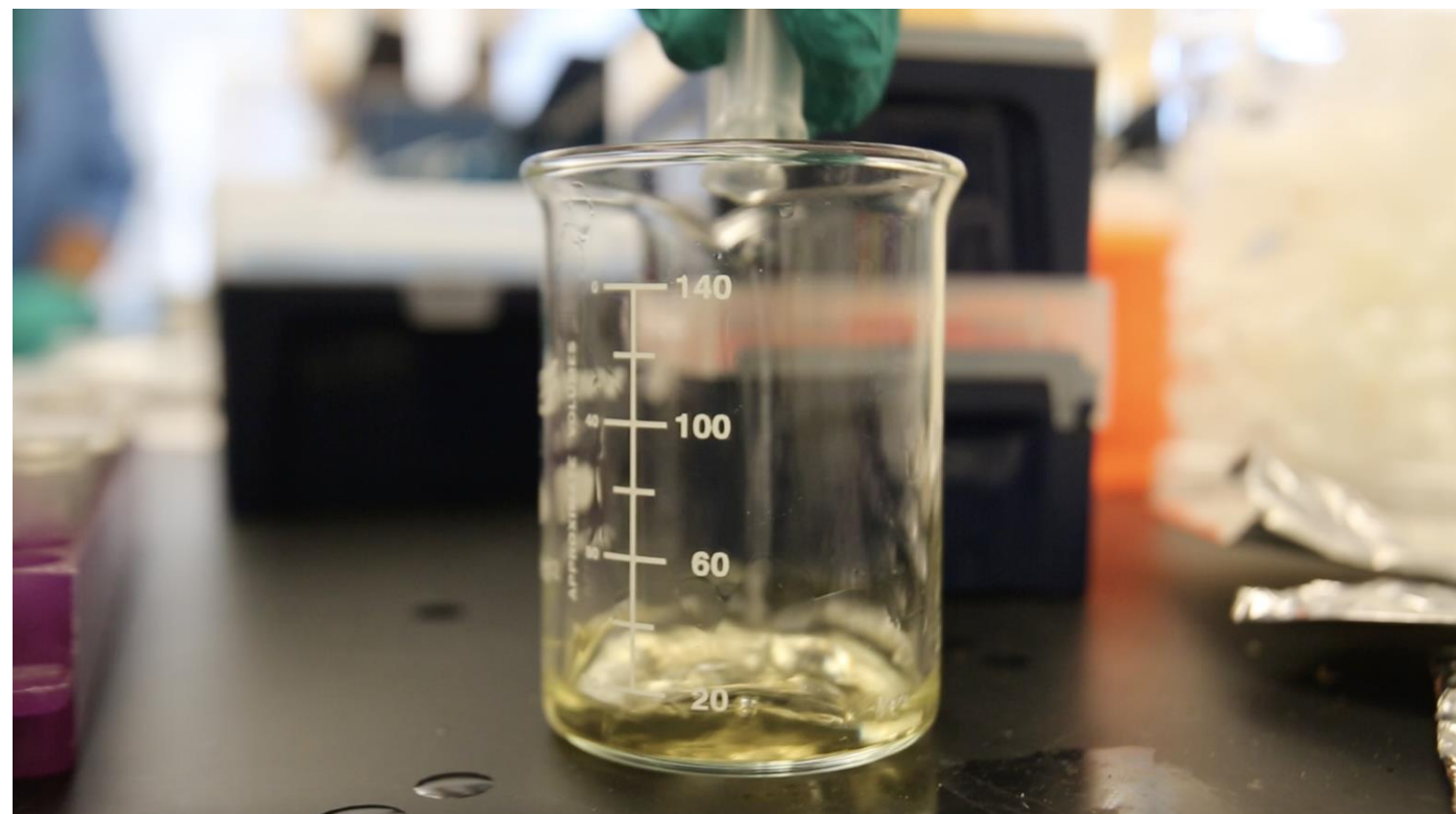
Crush



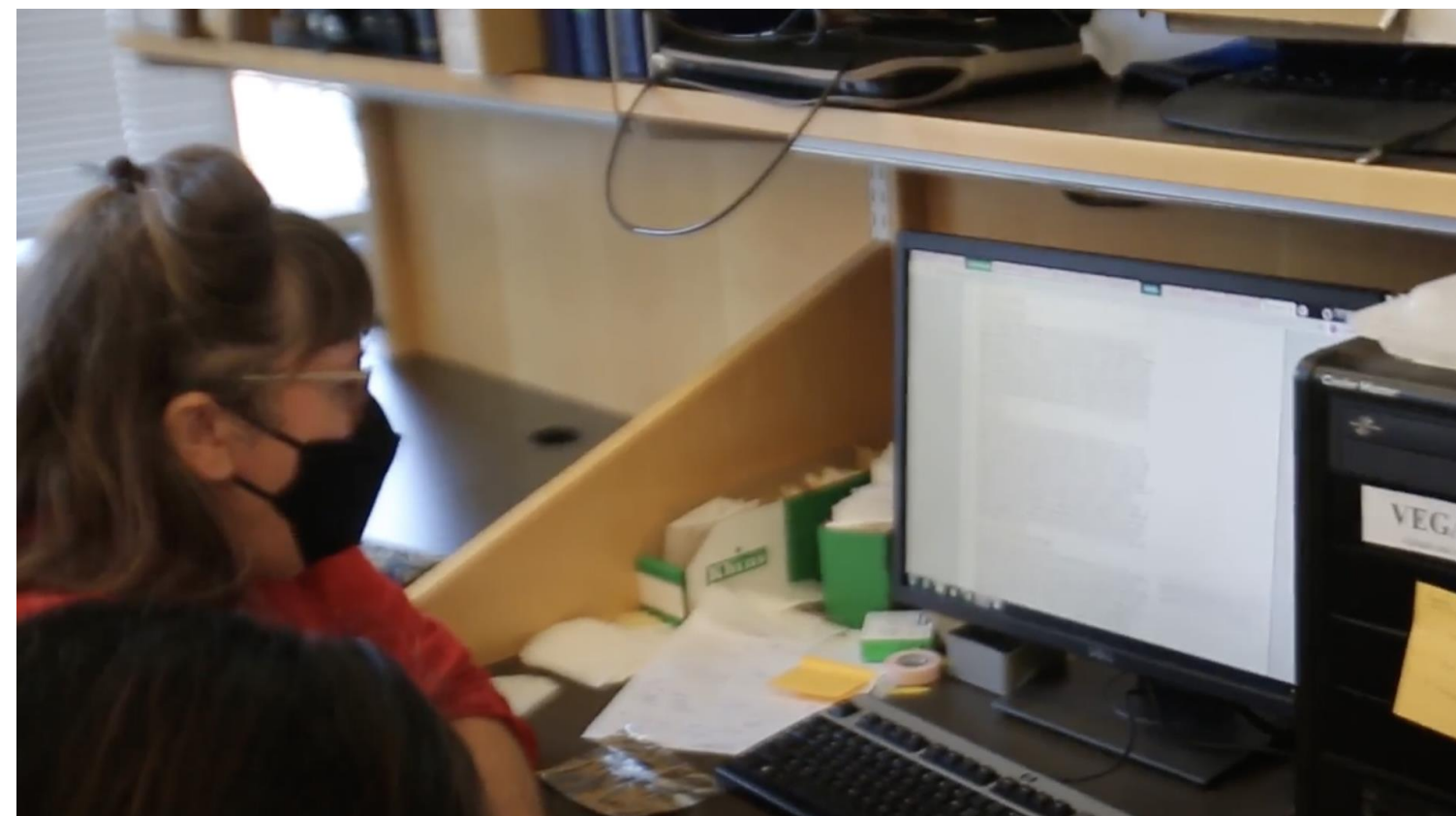
Dilute



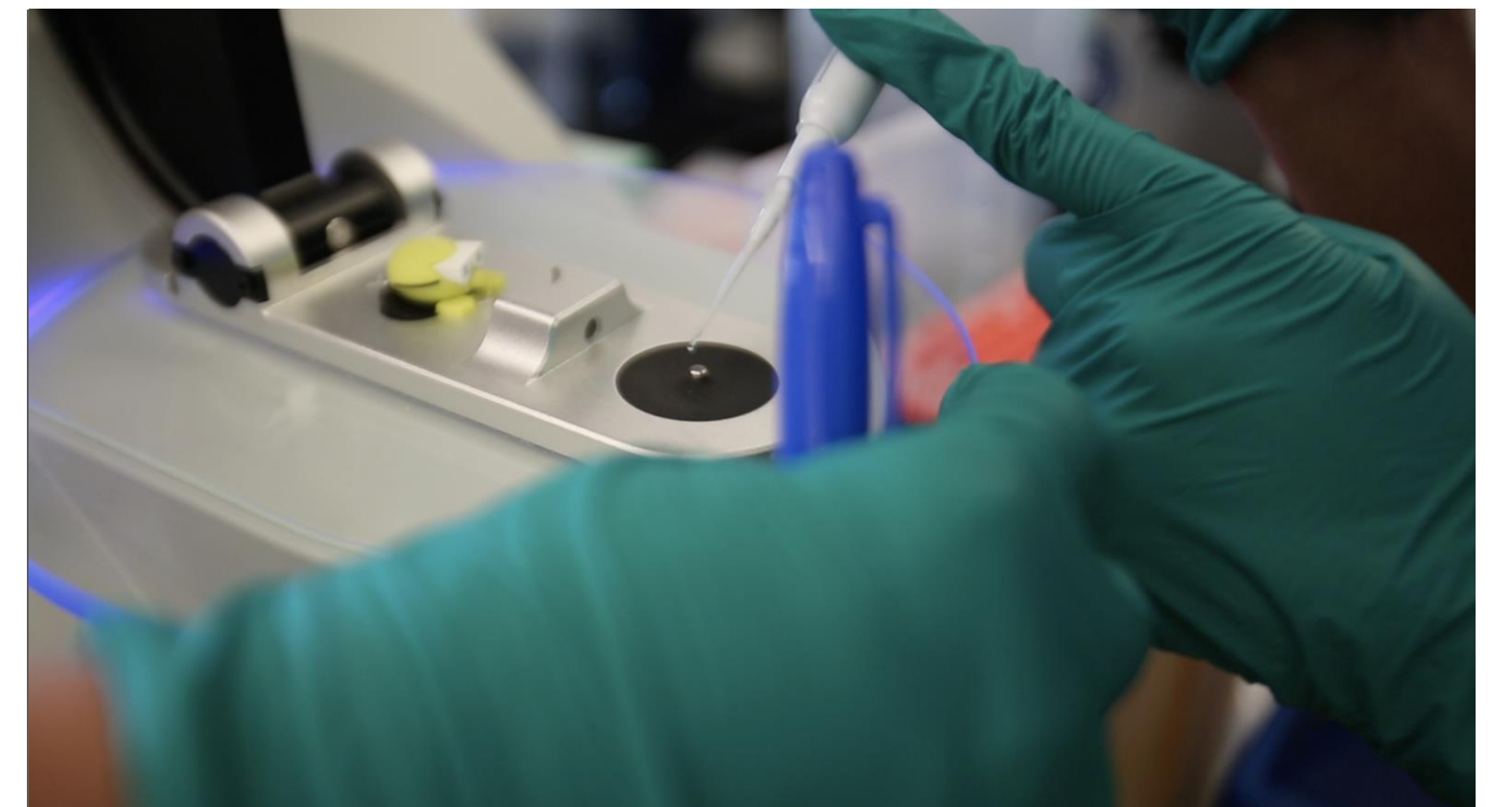
Agitate



Condense

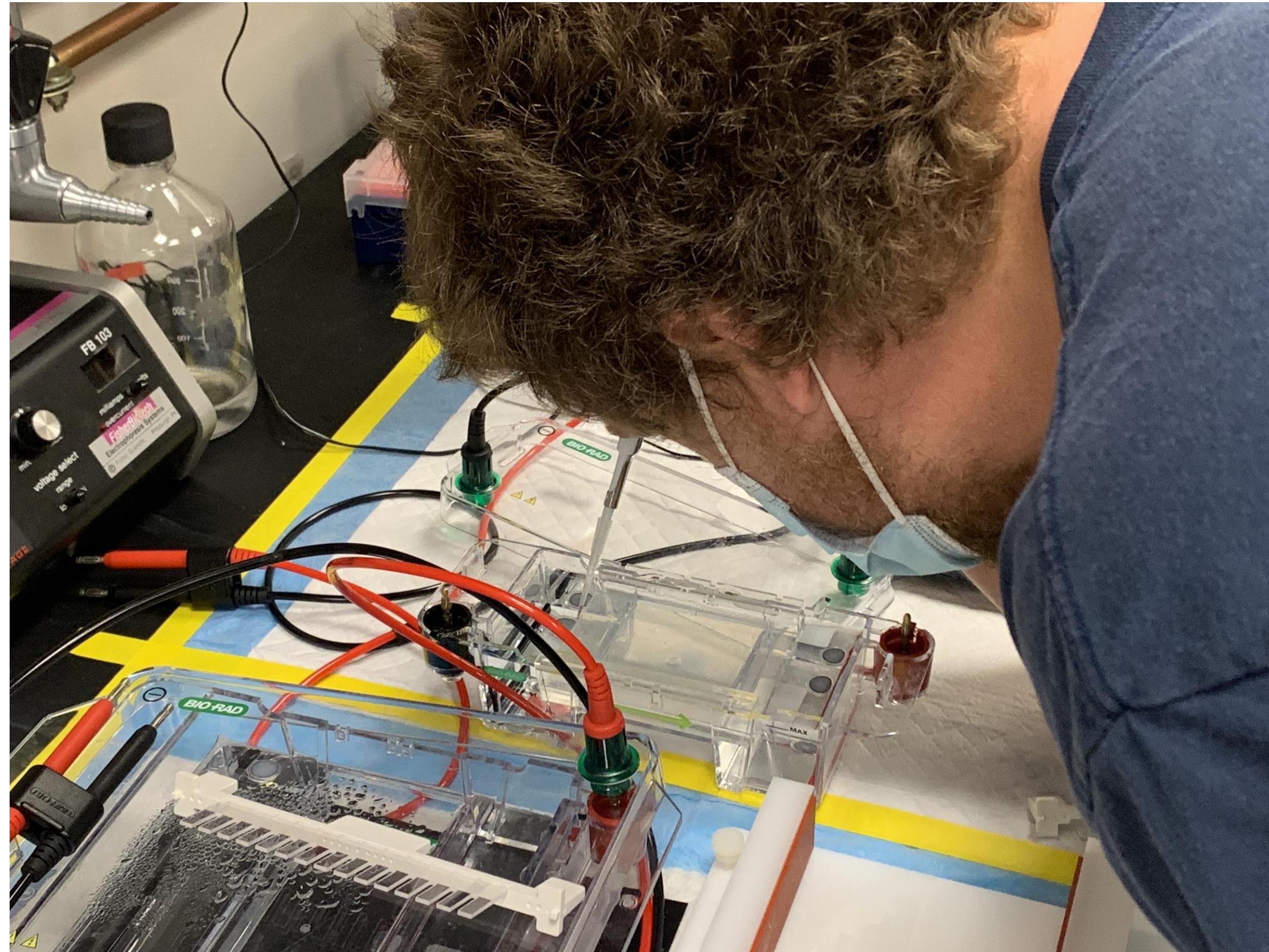


Investigate

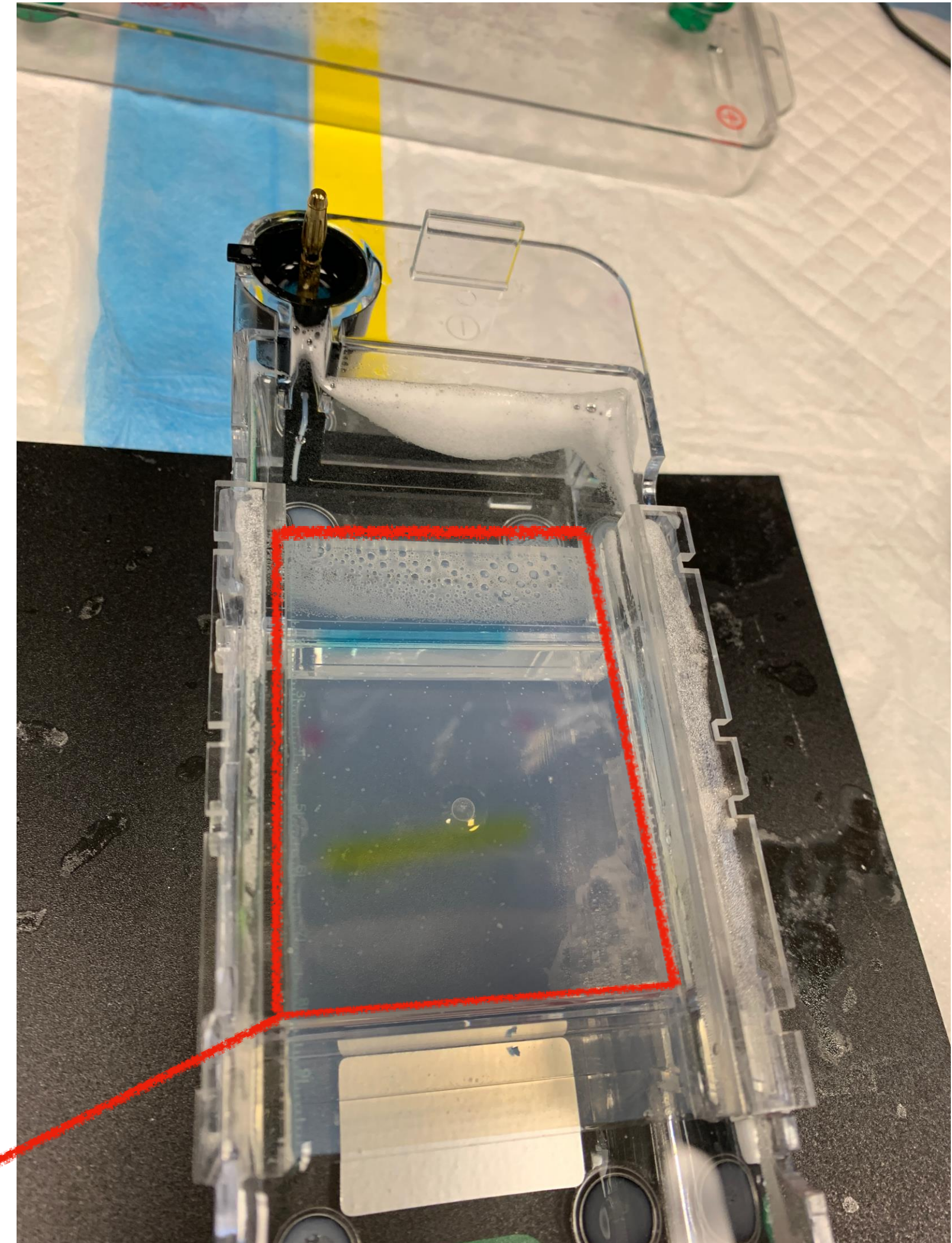


Reveal

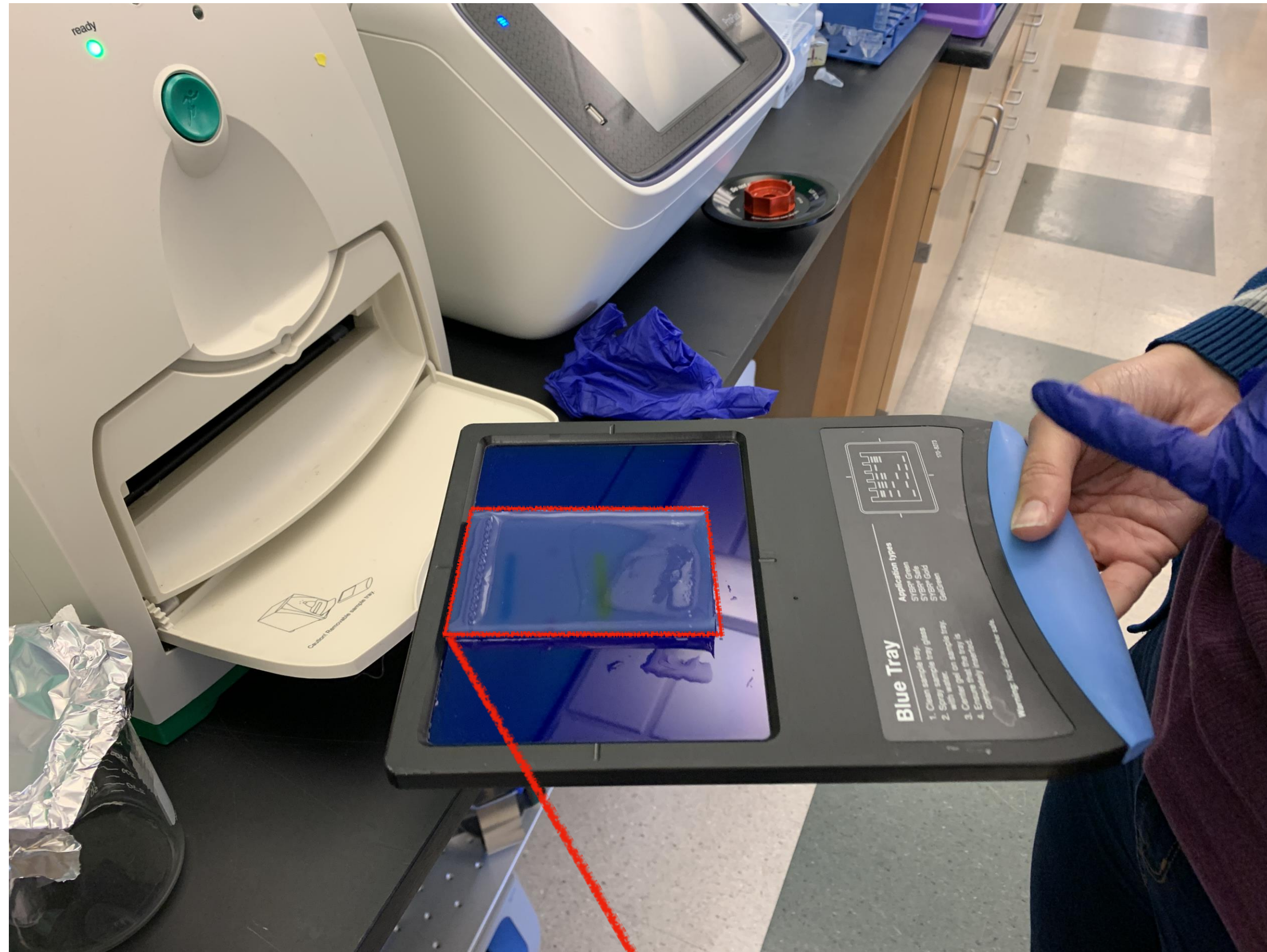
PCR- Polymerase Chain Reaction



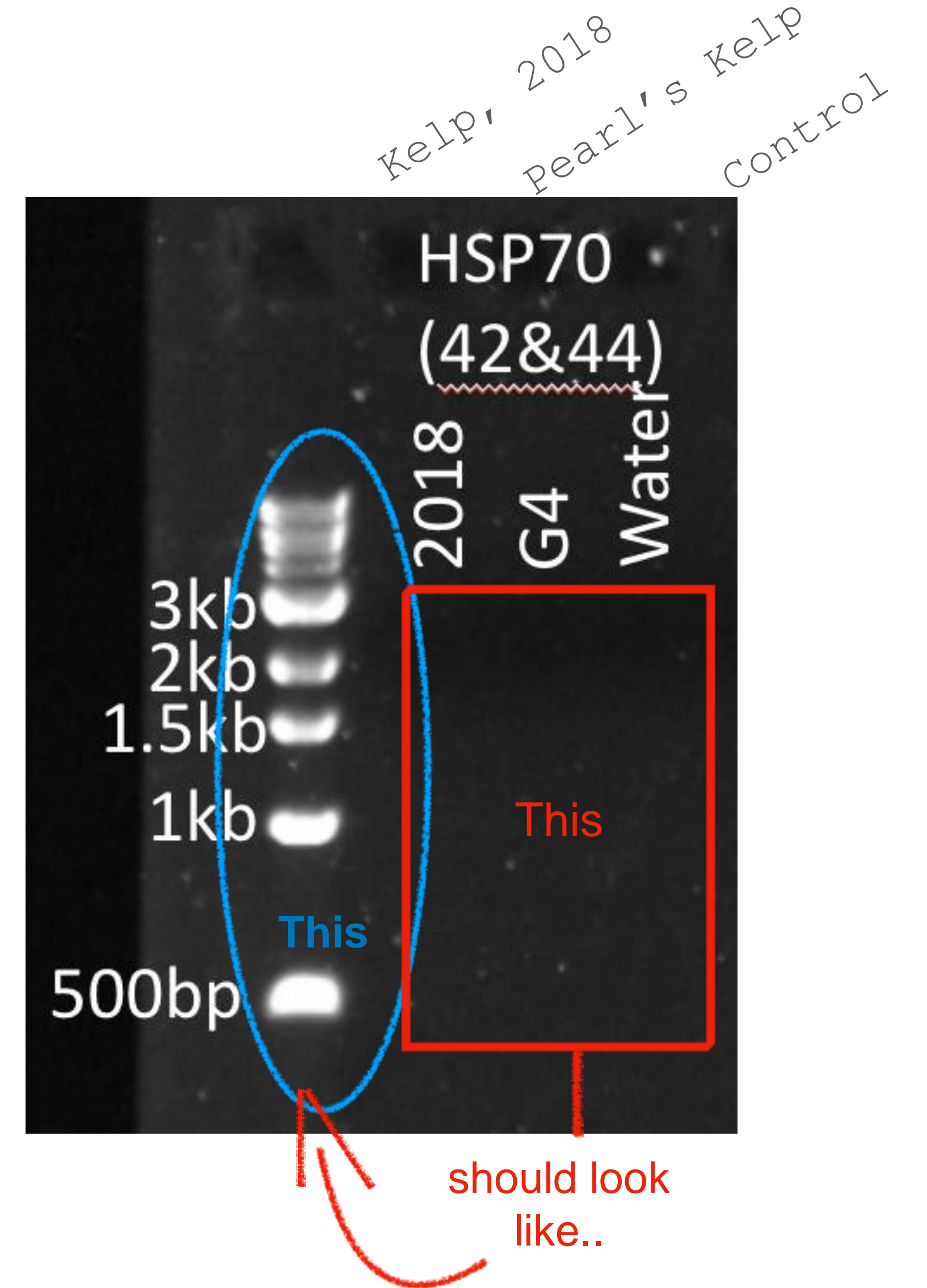
Agar gel with DNA from Pearl's kelp



PCR Results



Agar gel with Pearl's kelp DNA



Back to the drawing board: what to compare?

California

Hsp90 Sequence for *M. pyrifera* External Inbox x



Maddelyn Harden

to me ▾

Hi Emma,

I'm so sorry for my delay in sending this! Here is the genetic sequence for Hsp90 protein annotated in *Macrocystis pyrifera*:

```
fgenesh1_kg.3_#_1381_#_Contig5676
MAAAATRACAALLGLSLVCHHSSAFTGGVVRPRAATSSPTASLSRTVASRGSISAVPSLQQRKKHTSAWL
TGRRDGGARRSSNVATLRMSETAEVADAVVDEGEERYEFQAEVGRVMDIINSLSNRDVFRLRELISNSA
DACDKKRFLAVTEQDGEAGEDTEYRIRVRADKDAKTLIEDSGVGMTKDELKNNLGRIAESGTAKFMDA
IKQGESDVSLIGQFGVGFYSGFLVADKITVYTKSCQSADAPQYKWEQQSSAYTIKEDNTEPLESSGTRI
VLHLKEDSEEYLDDFKIKELSTRYSEFISFPIEVWAEKTSYDQVPDTTAEVAEGEELPKMKTVTRTAMEWE
RMNKMKPIWMRSPREVKDEEYAEFYKSTFKAWDEVAASHFSLEGQVEFRALLFVPSVLPYELSRNMFDE
TSRNMRLYVKRVFINDKFEELLPRWLMFLRGVVDSDELPLNVGREILQRSKMLSVISKRLVRKSLDMFTK
MADDKEKYKVFENFGKYLKVGVEDEDMKDELAKLCRFFSKNHGEDFVSFDEYIKDMKDDQTAIYYVTA
DSRASAEMSPALEKATSLGYDVLFMTEPLDELTVQAIGEYGGKTLTDLGKENVDLAGDEDEKLKKEEQST
ETQGFRQWLQEQLGEKRVQKVEVSQRLVGSAAATLVQSSYGMSPTMARYMRAQAVAFGEQDSTMTGSQQAI
MEINPEHPVVRSLQSSFNTPADADSTKQTALLLYDIAALTGGYSIDDPNAFAQRVTGMLEDRIAGDAAGS
SEGGVSDAEVVG*
```

Peru

Macrocystis pyrifera isolate MGC001 scf7180000838450, whole genome shotgun sequence

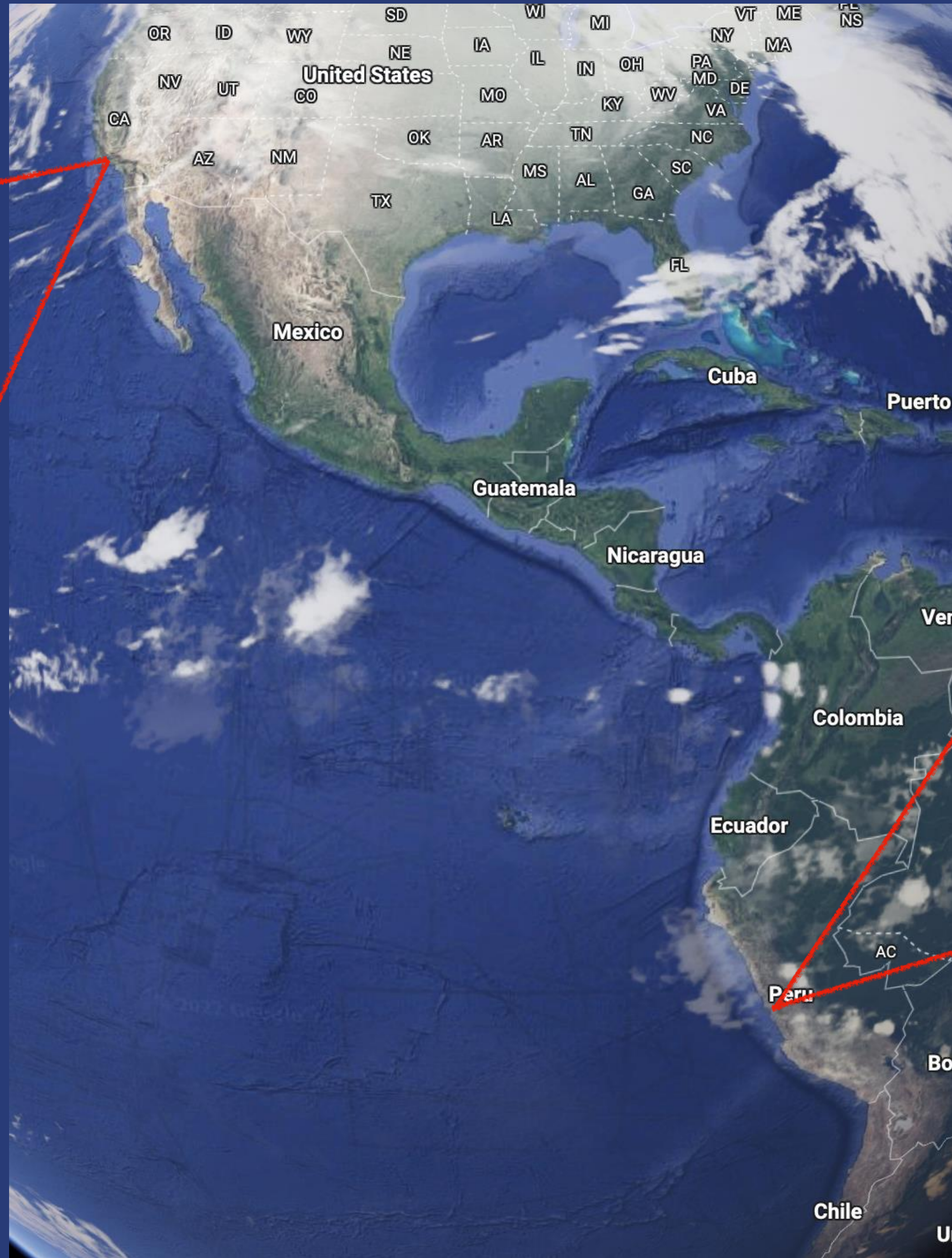
GenBank: JAALFD010079541.1

[FASTA](#) [Graphics](#)

Go to:

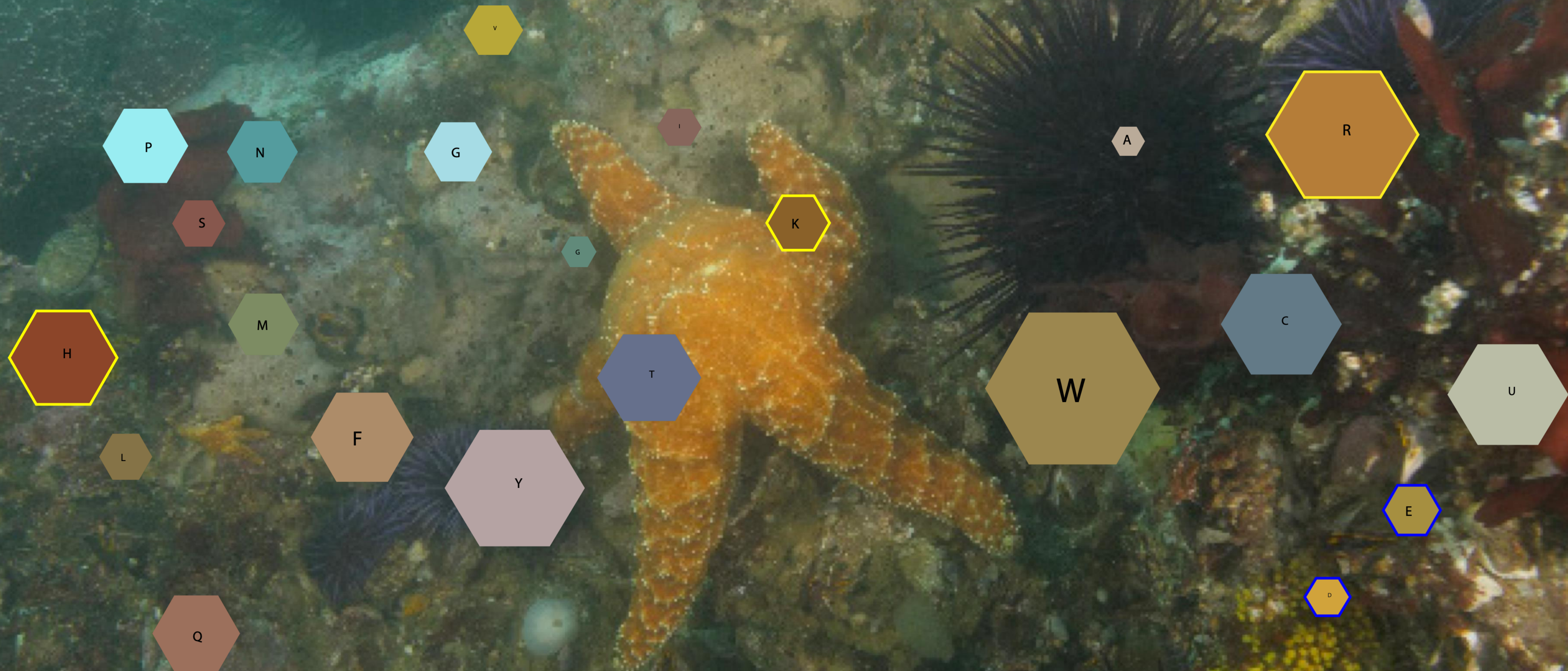
```
LOCUS       JAALFD010079541             2220 bp    DNA         linear     PLN_13_APR_2020
DEFINITION  Macrocystis pyrifera isolate MGC001 scf7180000838450, whole genome
            shotgun sequence.
ACCESSION   JAALFD010079541 JAALFD010000000
VERSION    JAALFD010079541.1
DBLINK     BioProject: PRJNA605694
            BioSample: SAMN14074449
KEYWORDS   WGS.
SOURCE     Macrocystis pyrifera (giant kelp)
ORGANISM   Macrocystis pyrifera
            Eukaryota; Sar; Stramenopiles; Ochrophyta; PX clade; Phaeophyceae;
            Laminariales; Laminariaceae; Macrocystis.
REFERENCE  1 (bases 1 to 2220)
AUTHORS   Paul,S., Salavarría,E., Gil-Kodaka,P. and Villena,G.K.
TITLE     Insight into the genome of Macrocystis pyrifera
JOURNAL   Unpublished
REFERENCE  2 (bases 1 to 2220)
AUTHORS   Paul,S., Salavarría,E., Gil-Kodaka,P. and Villena,G.K.
TITLE     Direct Submission
JOURNAL   Submitted (25-FEB-2020) Laboratory of Mycology and Biotechnology
            UNALM, Laboratory of Mycology and Biotechnology UNALM, Universidad
            Nacional Agraria La Molina, La Molina 15023, Peru
COMMENT   ##Genome-Assembly-Data-START##
            Assembly Date           :: 07-NOV-2019
            Assembly Method        :: MaSURCA v. 3.3.4
            Genome Representation  :: Full
```

California

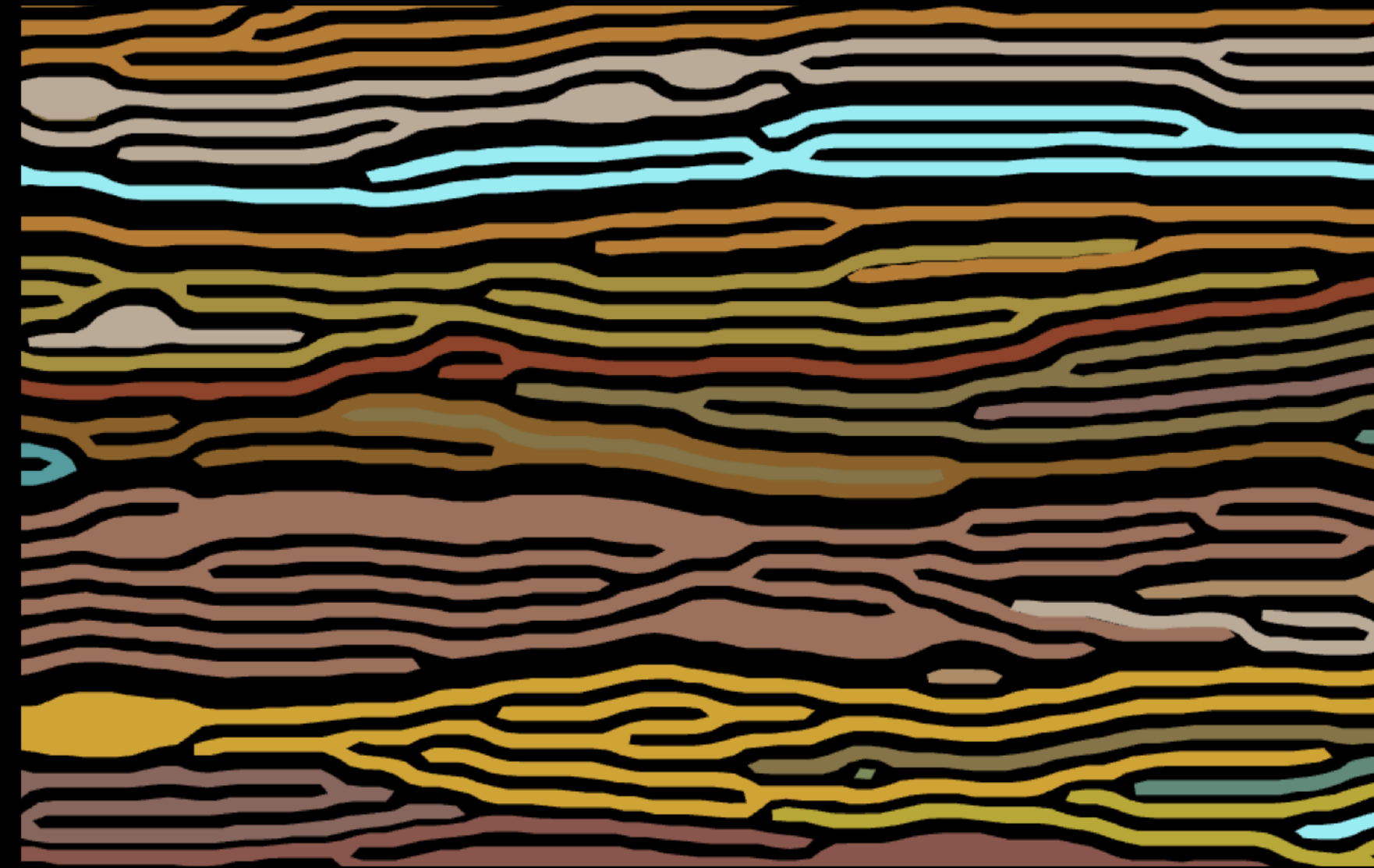


Peru

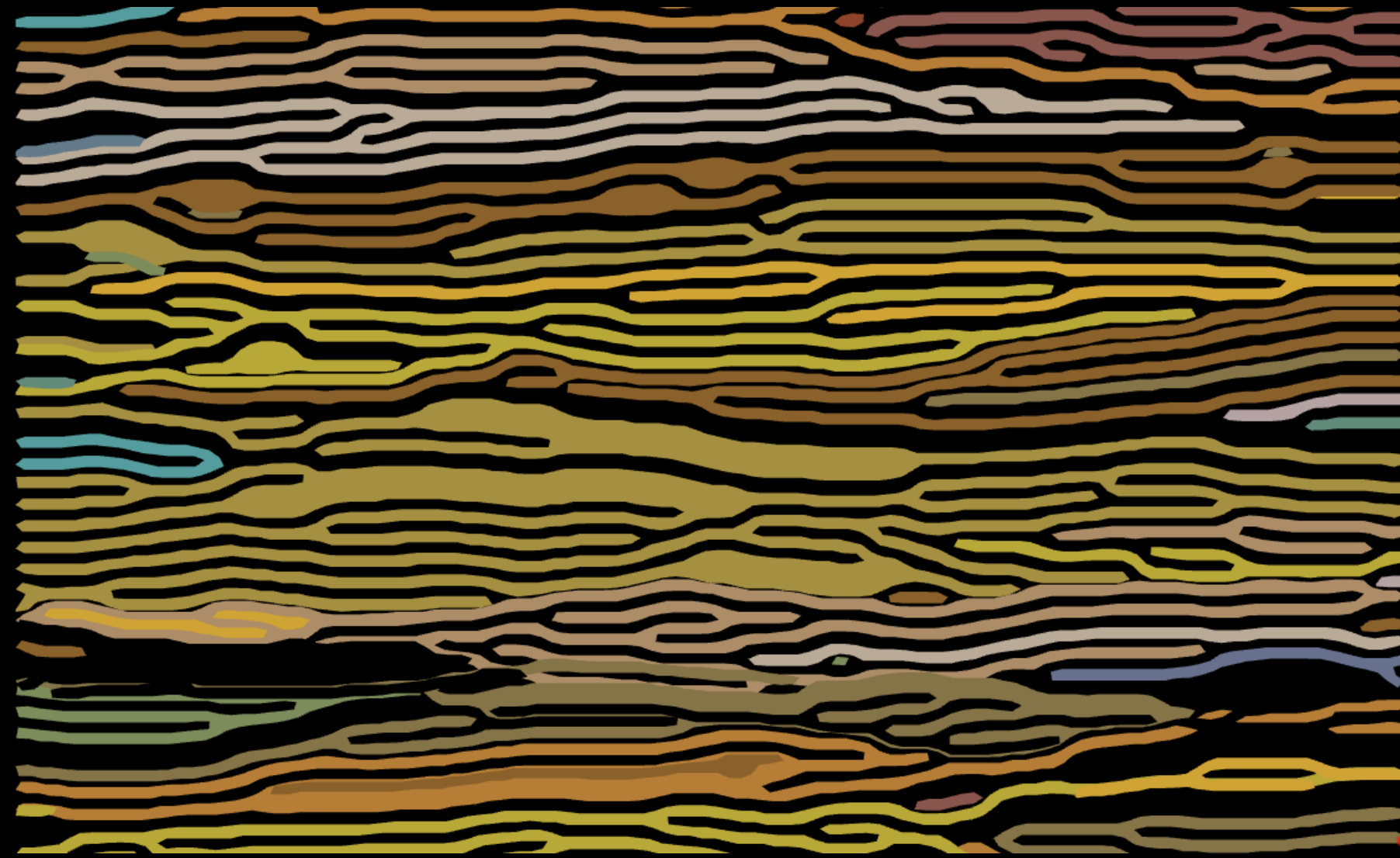
.. Transformation



Peru



California





Marine debris buoy,
Santa Rosa Island,
S. CA



300 lbs of sea urchin shell
Nature Conservancy, N. CA



Reach your hands into the buoy and
wave your arms side to side like you
are treading water



Thank you

Special Thanks to my collaborators and contributors:

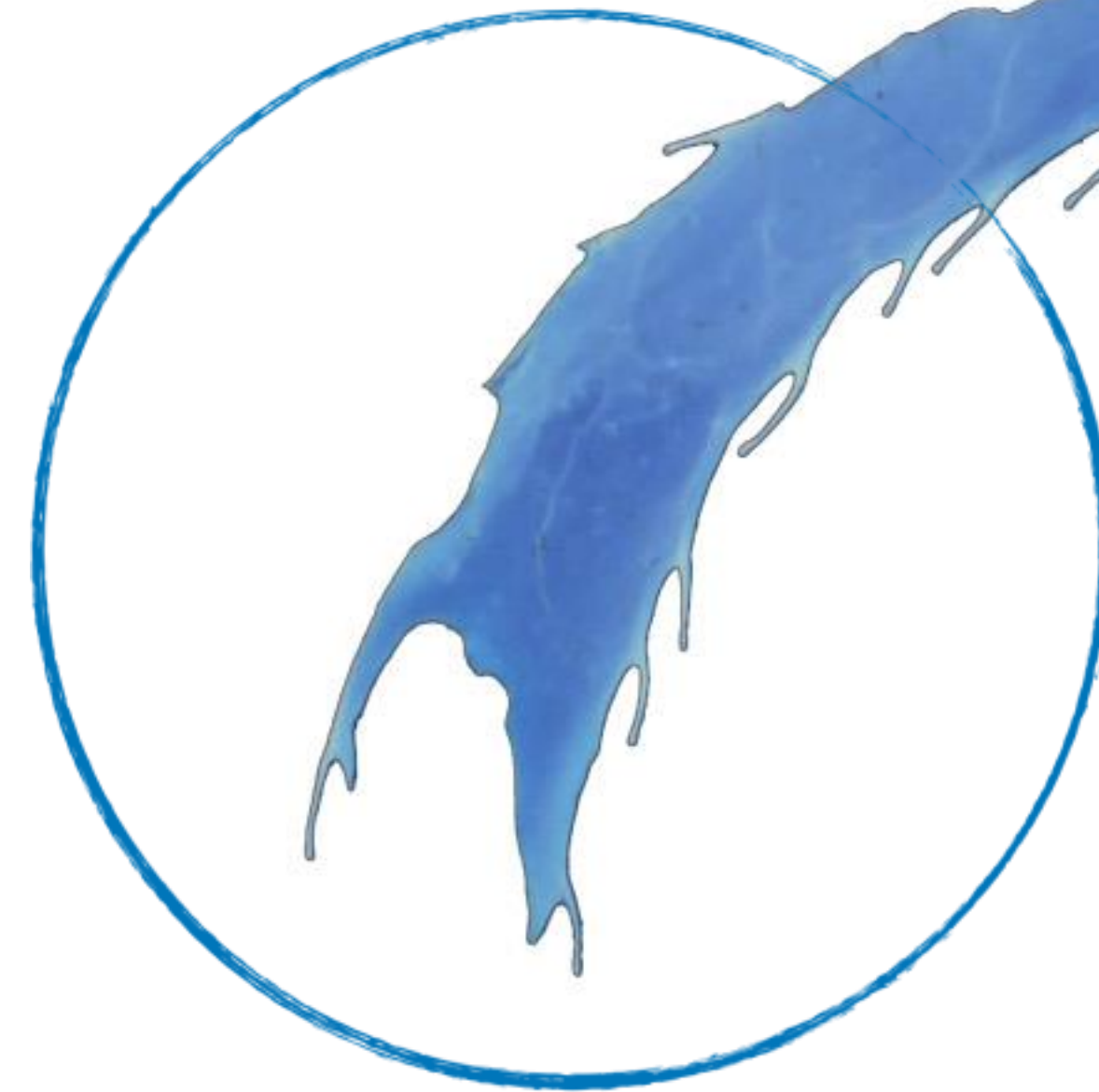
Prof. Siobhan Braybrook
Dr. Steven Beuder
Dr. Lauren Dedow
Harvest Moon
Joseph Forrest
Matthew Furmanski
Patrick Webster

And my thesis committee:

Prof. Siobhan Braybrook
Dr. Kyle Cavanaugh
Casey Reas
Dr. Victoria Vesna

Learn More about the molecular kelp research at
Braybrook Lab

<https://sites.lifesci.ucla.edu/mcdb-braybrook/>



Collaborate



KELP FORESTS OF AUSTRALIA'S GREAT SOUTHERN REEF

The Great Southern Reef dominated by kelp forests

UNIVERSITY OF TASMANIA IMAS

ART&ALGAE: AN ARTIST'S JOURNEY INTO THE SCIENCE OF SEAWEED

JOSIE ISELIN

KELP AQUACULTURE AS AN ENVIRONMENTAL AMENITY

Arcata, Yreka, Santa Rosa, Long Beach

ROBIN CRAIG

FORESTS OF LIGHT

TAYLOR GRIFFITH

<https://kelpkulture.com/>

Subscribe to our Youtube Channel