1
00:00:00,380 --> 00:00:03,750
Matthew Buffington: You're listening to
NASA in Silicon Valley, episode 70, and for

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00:00:03,750 --> 00:00:05,780
the intro I have Abby with me here again.

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00:00:05,780 --> 00:00:06,780
Abby Tabor (Host): Hello, hello!

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00:00:06,780 --> 00:00:10,970
Matthew Buffington: This is a slightly interesting
episode just for the sake that when we planned

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00:00:10,970 --> 00:00:17,210
to recording this, I got horrifically ill,
and Abby jumped in at the last minute to go

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00:00:17,210 --> 00:00:18,289
ahead and do this recording.

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00:00:18,289 --> 00:00:19,289
Host: That's right.

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00:00:19,289 --> 00:00:21,949
Matthew Buffington: So Abby, tell us about
the conversation that you had.

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00:00:21,949 --> 00:00:24,029
Host: Alright, well, it turned out to be very
interesting!

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00:00:24,029 --> 00:00:26,210
I met with Sylvain Costes.

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00:00:26,210 --> 00:00:30,769
He is the manager of the GeneLab project,
here at Ames.

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00:00:30,769 --> 00:00:33,200
So you know how NASA does a lot of biosciences.

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00:00:33,200 --> 00:00:36,090
We do biology experiments up on the space
station.

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00:00:36,090 --> 00:00:41,560
So when those experiments end, the science
doesn't end because all that data goes into

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00:00:41,560 --> 00:00:46,510
a repository, which is open to the public,
it's open access, for any researchers to

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00:00:46,510 --> 00:00:47,510
use.

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00:00:47,510 --> 00:00:51,511
And right now they're developing tools,
and really building a system around it, where

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00:00:51,511 --> 00:00:57,780
people can come analyze this space biology
data that NASA helped produce, and looking

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00:00:57,780 --> 00:00:59,940
for discoveries that they can make within
it themselves.

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00:00:59,940 --> 00:01:00,940
Matthew Buffington: Oh wow!

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00:01:00,940 --> 00:01:05,899
Host: And this is for researchers, if that's
your research, or for citizen scientists who

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00:01:05,899 --> 00:01:09,979
may be interested, they'll be able to explore

as well, and getting more out of the data

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00:01:09,979 --> 00:01:10,979
than ever.

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00:01:10,979 --> 00:01:16,270
What Sylvain describes it as is NASA as the
custodian of knowledge about how life is effected

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00:01:16,270 --> 00:01:17,270
in space.

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00:01:17,270 --> 00:01:19,329
Matthew Buffington: Sounds super exciting!

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00:01:19,329 --> 00:01:23,999
So before jump on into it, a reminder for
folks listening, we have a phone number, (650)

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00:01:23,999 --> 00:01:24,999
604-1400.

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00:01:24,999 --> 00:01:32,850
Give us a call and leave a message, and we'll
try to add that into future episodes.

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00:01:32,850 --> 00:01:37,999
If you want to be digital, we are on all the
social media platforms, we're using the

31
00:01:37,999 --> 00:01:39,159
hashtag #NASASiliconValley.

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00:01:39,159 --> 00:01:42,540
We are a NASA podcast, but we are not the
only NASA podcast!

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00:01:42,540 --> 00:01:46,990
I'll give a quick little shout out to some

of our friends over at headquarters, who do

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00:01:46,990 --> 00:01:48,240
Gravity Assist.

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00:01:48,240 --> 00:01:52,090
There's also another weekly podcast called
This Week at NASA.

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00:01:52,090 --> 00:01:56,709
And then of course, our friends over in JSC,
over at the Johnson Space Center, they have

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00:01:56,709 --> 00:02:00,539
Houston, We Have a Podcast.

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00:02:00,539 --> 00:02:01,539
But for today…

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00:02:01,540 --> 00:02:04,200
Host: … Let's listen to Sylvain Costes.

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00:02:04,200 --> 00:02:15,660
[Music]

41
00:02:15,660 --> 00:02:17,740
Host: Hey, Sylvain, thanks for coming in.

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00:02:17,750 --> 00:02:19,420
Sylvain Costes: Thank you for having me.

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00:02:19,420 --> 00:02:22,970
Host: I'm excited to hear about your work
a little bit.

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00:02:22,970 --> 00:02:27,160
Usually we start this off by learning about
you and your background and how did you end

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00:02:27,160 --> 00:02:28,160
up at NASA.

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00:02:28,160 --> 00:02:29,160
Where do you come from originally?

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00:02:29,160 --> 00:02:30,260
Sylvain Costes: Sure.

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00:02:30,260 --> 00:02:33,460
I was born in France.

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00:02:33,460 --> 00:02:37,290
I went through physics and mathematics training
in France in college.

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00:02:37,290 --> 00:02:38,290
Host: Cool.

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00:02:38,290 --> 00:02:43,350
Sylvain Costes: Eventually I transferred to
-- I did an exchange at Texas A&M University.

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00:02:43,350 --> 00:02:45,860
From there, I liked the American education.

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00:02:45,860 --> 00:02:47,020
Host: Yeah?

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00:02:47,020 --> 00:02:49,470
Sylvain Costes: So I decided to go for a PhD.

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00:02:49,470 --> 00:02:56,480
After a Masters at Texas A&M, I did a PhD
at UC Berkeley and spent some time at NCI

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00:02:56,480 --> 00:03:02,050
National Cancer Institute, and then became

an independent investigator at Lawrence Berkeley

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00:03:02,050 --> 00:03:05,460
National Lab, which is a DOE lab.

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00:03:05,460 --> 00:03:08,890
I joined NASA only last December in 2016.

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00:03:08,890 --> 00:03:10,960
Host: So you're pretty new.

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00:03:10,960 --> 00:03:13,490
You're even newer than I am to NASA.

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00:03:13,490 --> 00:03:14,490
Interesting.

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00:03:14,490 --> 00:03:15,490
Sylvain Costes: Good.

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00:03:15,490 --> 00:03:19,890
Host: And I lived in Paris for eight years,
so we have something else in common.

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00:03:19,890 --> 00:03:20,800
Sylvain Costes: Yeah.

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00:03:20,800 --> 00:03:22,100
[Foreign language].

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00:03:22,100 --> 00:03:23,120
Host: No, no, no.

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00:03:23,120 --> 00:03:26,340
[Foreign language].

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00:03:26,340 --> 00:03:28,880
Let's continue in English.

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00:03:28,880 --> 00:03:30,650
From France, what part of France?

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00:03:30,650 --> 00:03:32,300
Sylvain Costes: It's hard to tell.

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00:03:32,300 --> 00:03:37,190
I was born in Bourges, which is one of the
center cities.

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00:03:37,190 --> 00:03:38,870
But I moved, I think, 20 times.

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00:03:38,870 --> 00:03:41,930
By the age of 20, I had moved 20 times in
France.

74
00:03:41,930 --> 00:03:43,580
Host: Oh my gosh.

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00:03:43,580 --> 00:03:47,840
Sylvain Costes: I don't have any really -- City,
I would say I'm from the south.

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00:03:47,840 --> 00:03:50,330
That's really where my family is from.

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00:03:50,330 --> 00:03:51,330
So Toulouse would be --

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00:03:51,330 --> 00:03:52,330
Host: I see.

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00:03:52,330 --> 00:03:53,330
Yeah.

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00:03:53,330 --> 00:03:55,650

Sylvain Costes: The real city is called Rodez,
but I don't really feel like I'm --

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00:03:55,650 --> 00:03:56,980
Host: But everyone knows Toulouse.

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00:03:56,980 --> 00:03:59,280
Sylvain Costes: Yeah, I'm just French in general.

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00:03:59,280 --> 00:04:00,280
Host: Right, okay.

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00:04:00,280 --> 00:04:01,319
Sylvain Costes: I've been everywhere in France.

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00:04:01,319 --> 00:04:03,480
Host: So you're used to moving around, it
sounds like.

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00:04:03,480 --> 00:04:04,480
Sylvain Costes: That's right.

87
00:04:04,480 --> 00:04:08,470
Host: From France to Texas to California,
you've been all over.

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00:04:08,470 --> 00:04:09,610
Sylvain Costes: Yeah.

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00:04:09,610 --> 00:04:11,750
Host: Eventually that led you to NASA.

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00:04:11,750 --> 00:04:13,300
So you're a biologist, is that right?

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00:04:13,300 --> 00:04:14,300
Sylvain Costes: No, I'm a physicist.

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00:04:14,300 --> 00:04:15,300
Host: A physicist.

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00:04:15,300 --> 00:04:16,300
Sorry.

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00:04:16,300 --> 00:04:17,300
Sylvain Costes: My PhD is in nuclear engineering.

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00:04:17,300 --> 00:04:18,300
Host: Oh my gosh.

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00:04:18,300 --> 00:04:22,650
Sylvain Costes: I used to do -- In my Masters,
I was doing nuclear reactor design, so a lot

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00:04:22,650 --> 00:04:23,650
of neutronics.

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00:04:23,650 --> 00:04:27,420
And then in nuclear engineering, there is
a section called health physics, which is

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00:04:27,420 --> 00:04:33,590
understanding how radiation impacts people
as life; so like how you can get cancer from

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00:04:33,590 --> 00:04:34,940
radiation, the risk of ionizing radiation.

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00:04:34,940 --> 00:04:37,040
And so I got into this.

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00:04:37,040 --> 00:04:40,660
And part of that is called medical physics,
which is understanding how radiation can be

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00:04:40,660 --> 00:04:41,660
used to treat cancer

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00:04:41,660 --> 00:04:44,620
Host: That's the connection between physics
and cancer reduction.

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00:04:44,620 --> 00:04:45,620
Sylvain Costes: That's right.

106
00:04:45,620 --> 00:04:46,620
Host: Yeah.

107
00:04:46,620 --> 00:04:49,880
Sylvain Costes: And then little by little,
I left the physics world to move more and

108
00:04:49,880 --> 00:04:51,490
more towards biology.

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00:04:51,490 --> 00:04:57,680
Being a physicist, I've done a lot of -- I've
used a lot of the physics knowledge, so mathematics

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00:04:57,680 --> 00:05:01,820
and modeling, into understanding biological
processes.

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00:05:01,820 --> 00:05:05,150
Until last year, very much focused on radiation.

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00:05:05,150 --> 00:05:10,810
And so the connection with NASA there was
that there is cosmic radiation that astronauts

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00:05:10,810 --> 00:05:11,810
get exposed to.

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00:05:11,810 --> 00:05:15,250
So I've been studying their impact on humans
for a long time.

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00:05:15,250 --> 00:05:16,250
Host: Right.

116
00:05:16,250 --> 00:05:17,250
Radiation is a big challenge for space exploration.

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00:05:17,250 --> 00:05:18,710
Sylvain Costes: It's a big one.

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00:05:18,710 --> 00:05:20,560
Microgravity and radiation are the two big
ones.

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00:05:20,560 --> 00:05:21,560
Right?

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00:05:21,560 --> 00:05:22,560
Host: Right.

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00:05:22,560 --> 00:05:26,600
Sylvain Costes: Now at GeneLab, I'm really
emphasizing everything.

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00:05:26,600 --> 00:05:28,840
Radiation is just one small aspect of what
we're working on.

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00:05:28,840 --> 00:05:35,050
We're really looking at the full response
of the human, and life in general, in terms

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00:05:35,050 --> 00:05:36,280
of living in space.

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00:05:36,280 --> 00:05:37,280
Host: Right.

126

00:05:37,280 --> 00:05:38,280
Sylvain Costes: So microgravity.

127
00:05:38,280 --> 00:05:40,630
Host: The physical effects of the space environment.

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00:05:40,630 --> 00:05:41,630
Right?

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00:05:41,630 --> 00:05:42,630
Sylvain Costes: That's right.

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00:05:42,630 --> 00:05:43,630
Host: Right, okay.

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00:05:43,630 --> 00:05:44,630
So you just mentioned GeneLab.

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00:05:44,630 --> 00:05:45,630
What is that?

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00:05:45,630 --> 00:05:47,640
Sylvain Costes: I'm the Project Manager now
for GeneLab.

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00:05:47,640 --> 00:05:52,520
And so let me tell you a bit about GeneLab,
because it's a project that started about

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00:05:52,520 --> 00:05:55,510
four years ago, roughly.

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00:05:55,510 --> 00:06:02,360
The idea, which is I think very good, is that
NASA should be the custodian of the knowledge

137
00:06:02,360 --> 00:06:05,430
of how life gets impacted in space.

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00:06:05,430 --> 00:06:11,220
And so, there are a lot of studies that have
been going on for 20, 30 years under the sponsorship

139
00:06:11,220 --> 00:06:12,220
of NASA.

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00:06:12,220 --> 00:06:13,480
Host: Definitely.

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00:06:13,480 --> 00:06:16,780
We've got a big biosciences division here.

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00:06:16,780 --> 00:06:17,780
Sylvain Costes: Absolutely.

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00:06:17,780 --> 00:06:19,490
And so, there's a lot of scattered information
here and there.

144
00:06:19,490 --> 00:06:26,310
I think we're lucky to live in a time where
now we have this new technology called omics.

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00:06:26,310 --> 00:06:39,520
And so the omics are -- They're trying to
interpret the slight different changes in

146
00:06:39,520 --> 00:06:45,410
your gene sequencing with respect to some
risk to your health.

147
00:06:45,410 --> 00:06:48,850
That's one omics that's exploding right now
in the world.

148
00:06:48,850 --> 00:06:52,900
But there's other omics that have been going
on for a while, one of them is called transcriptomic,

149
00:06:52,900 --> 00:06:57,370
which is 90 percent of the data in GeneLab
are transcriptomic data.

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00:06:57,370 --> 00:07:05,280
There it's the idea of looking at the RNA
expression in tissues or in microbes or in

151
00:07:05,280 --> 00:07:12,050
anything we're looking at, any sample coming
from the space station or from the space shuttle

152
00:07:12,050 --> 00:07:14,730
if they have been analyzed for omics data
up into our repository.

153
00:07:14,730 --> 00:07:17,140
So GeneLab is that big repository of information.

154
00:07:17,140 --> 00:07:18,500
Host: Okay, right.

155
00:07:18,500 --> 00:07:19,520
GeneLab is a database.

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00:07:19,520 --> 00:07:22,590
Sylvain Costes: It's a database, but it's
going to be more than a database.

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00:07:22,590 --> 00:07:24,470
This was the original thought for it.

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00:07:24,470 --> 00:07:27,479
Basically, let's store all this information
to one local place.

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00:07:27,479 --> 00:07:35,100
And so, we've been very active in either identifying

legacy dataset that should be in GeneLab from

160
00:07:35,100 --> 00:07:36,590
the get go from the past.

161
00:07:36,590 --> 00:07:42,400
We're also very active with any new omics
being produced on the ISS, to make sure that

162
00:07:42,400 --> 00:07:44,810
those data comes into our repository.

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00:07:44,810 --> 00:07:47,560
We're not only looking at one type of omics.

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00:07:47,560 --> 00:07:49,570
We're looking at many different omics.

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00:07:49,570 --> 00:07:53,821
There's something else called proteomics,
which is protein profile, epigenetic, which

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00:07:53,821 --> 00:08:00,009
is how your DNA gets decorated by specific
molecules that changes the expression profile

167
00:08:00,009 --> 00:08:01,630
of those molecules.

168
00:08:01,630 --> 00:08:07,050
All these omics techniques are coming to us,
and we're working very actively in identifying

169
00:08:07,050 --> 00:08:09,500
what's been already produced in the world.

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00:08:09,500 --> 00:08:15,390
The idea is to become like the custodian of
knowledge and catering this information to

171
00:08:15,390 --> 00:08:16,390
the public.

172
00:08:16,390 --> 00:08:18,000
Host: Okay, cool.

173
00:08:18,000 --> 00:08:19,250
Let's review.

174
00:08:19,250 --> 00:08:22,530
Omics is this big area that it could be proteomics,
genomics?

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00:08:22,530 --> 00:08:23,620
Sylvain Costes: Absolutely.

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00:08:23,620 --> 00:08:24,720
Host: Right, okay.

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00:08:24,720 --> 00:08:28,199
So any of these companies that are offering
genetic analyses for the public.

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00:08:28,199 --> 00:08:29,199
Sylvain Costes: It's one type of omics.

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00:08:29,199 --> 00:08:30,920
Host: Yeah, that's one type of omics.

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00:08:30,920 --> 00:08:38,240
All of these basically are ways to study what
our DNA is producing or what any organisms,

181
00:08:38,240 --> 00:08:42,880
cells, are doing with their DNA.

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00:08:42,880 --> 00:08:46,540

Is it correct that that's what can be influenced
by the space environment?

183
00:08:46,540 --> 00:08:47,930
Sylvain Costes: Absolutely.

184
00:08:47,930 --> 00:08:54,630
I think if you go back about life in space,
there's really two big questions that we need

185
00:08:54,630 --> 00:08:55,630
to address.

186
00:08:55,630 --> 00:09:04,050
One is really how microgravity confinement,
ionizing radiation can affect living entities.

187
00:09:04,050 --> 00:09:08,770
Here, that question is important with respect
to the astronauts, because we want to make

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00:09:08,770 --> 00:09:10,280
sure they're going to be healthy in the long
run.

189
00:09:10,280 --> 00:09:11,280
Host: Yeah.

190
00:09:11,280 --> 00:09:12,300
Sylvain Costes: So that's one big question.

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00:09:12,300 --> 00:09:18,290
We believe that in addition to the battery
of tests you can do on an astronaut like blood

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00:09:18,290 --> 00:09:25,960
samples, pulse, EKG, whatever, you have other
tools, molecular tools, that we can address

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00:09:25,960 --> 00:09:28,460
by using animal models.

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00:09:28,460 --> 00:09:32,170
Because the problem with omics is typically
you have to sacrifice the animal to get the

195
00:09:32,170 --> 00:09:33,170
information.

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00:09:33,170 --> 00:09:34,170
Host: I see.

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00:09:34,170 --> 00:09:36,530
Sylvain Costes: For a mouse, we're going to
get the liver, we're going to get the brain,

198
00:09:36,530 --> 00:09:40,310
we're going to get the bones, and we can then
run omics on those guys.

199
00:09:40,310 --> 00:09:41,310
Host: Okay.

200
00:09:41,310 --> 00:09:46,380
So to see what impact microgravity or radiation
is having on the body?

201
00:09:46,380 --> 00:09:49,800
Sylvain Costes: On a body that is close to
us.

202
00:09:49,800 --> 00:09:53,930
Mammals are great, but there's also effort
on drosophila, which is insect.

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00:09:53,930 --> 00:09:55,260
Host: The fruit flies.

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00:09:55,260 --> 00:09:56,580
Sylvain Costes: Fruit flies.

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00:09:56,580 --> 00:09:57,580
You also have C. elegans.

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00:09:57,580 --> 00:10:01,750
So there's a variety of animal models we can
use.

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00:10:01,750 --> 00:10:07,300
There is another question that GeneLab is
also helping answering in terms of the information

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00:10:07,300 --> 00:10:08,740
we're putting into the database.

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00:10:08,740 --> 00:10:14,730
It's more understanding the way an ecosystem
is modified by space.

210
00:10:14,730 --> 00:10:18,020
And so, here you can imagine microbes.

211
00:10:18,020 --> 00:10:21,170
We talk about microbes being found on the
walls of the space station.

212
00:10:21,170 --> 00:10:22,170
Host: Yeah, I've seen that.

213
00:10:22,170 --> 00:10:27,700
Sylvain Costes: These kinds of things would
be addressable with omics, but you're more

214
00:10:27,700 --> 00:10:35,010
interesting in seeing what kind of maybe new
species or how a strain can deviate from its

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00:10:35,010 --> 00:10:39,950
original genomic makeup by being in space
for a long period of time.

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00:10:39,950 --> 00:10:43,750
It's also helpful for the client, for instance,
understanding the kind of stress you put on

217
00:10:43,750 --> 00:10:44,750
an ecosystem, like plants.

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00:10:44,750 --> 00:10:45,750
Host: Yeah.

219
00:10:45,750 --> 00:10:50,440
Sylvain Costes: Then you may be able to optimize
how a plant grows on Mars or in the space

220
00:10:50,440 --> 00:10:51,650
station.

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00:10:51,650 --> 00:10:56,180
You see, you can either look at the ecosystem
side or you can look at the human health side.

222
00:10:56,180 --> 00:10:57,180
Host: Yeah.

223
00:10:57,180 --> 00:10:59,670
Sylvain Costes: And so, those two things are
coming together in GeneLab which is interesting.

224
00:10:59,670 --> 00:11:00,690
Host: That's very interesting.

225
00:11:00,690 --> 00:11:04,370
That's what I had just realized as you were
talking; you can look at the effect of space

226

00:11:04,370 --> 00:11:07,950
on an individual, and then all the way up
to the ecosystem scale.

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00:11:07,950 --> 00:11:08,950
Sylvain Costes: Exactly.

228
00:11:08,950 --> 00:11:09,950
Host: That's pretty awesome.

229
00:11:09,950 --> 00:11:10,950
Sylvain Costes: Right.

230
00:11:10,950 --> 00:11:14,730
Host: Okay, so these studies are going on
already.

231
00:11:14,730 --> 00:11:19,310
And then GeneLab collects all that data that
these experiments are producing, is that it?

232
00:11:19,310 --> 00:11:23,190
Sylvain Costes: Yeah, so there's different
ways that I can make their way in GeneLab.

233
00:11:23,190 --> 00:11:28,040
One thing, as I mentioned earlier, was we
talk about legacy data.

234
00:11:28,040 --> 00:11:31,930
Before GeneLab existed, people were already
gathering some omics.

235
00:11:31,930 --> 00:11:35,720
Having said that, the omics have changed a
lot over the past 10 years.

236
00:11:35,720 --> 00:11:40,200
So the legacy data typically have some kind
of technology for transcriptomics that we

237
00:11:40,200 --> 00:11:41,900
don't use as much anymore.

238
00:11:41,900 --> 00:11:49,360
Like we could microwave, which is the old
way of looking at RNA labels, gene expression

239
00:11:49,360 --> 00:11:50,360
labels.

240
00:11:50,360 --> 00:11:53,330
Since then, now we have RNA sequencing, which
is a better technique.

241
00:11:53,330 --> 00:11:57,320
As we go to new omics, we have much larger
datasets.

242
00:11:57,320 --> 00:12:00,770
So the repository is getting bigger as the
big data is coming down the pipe.

243
00:12:00,770 --> 00:12:01,950
Host: Yeah, totally.

244
00:12:01,950 --> 00:12:03,560
Sylvain Costes: That's one way.

245
00:12:03,560 --> 00:12:08,860
But the other aspect of GeneLab is to really
work actively with investigators and collaborators

246
00:12:08,860 --> 00:12:10,190
to generate new data.

247
00:12:10,190 --> 00:12:18,820
And so we work with PI to have their funding
from NASA to fly animal models, plant, microbes,

248
00:12:18,820 --> 00:12:19,820
in the space station.

249
00:12:19,820 --> 00:12:24,730
And we help them maybe get more information
from their samples and make sure that all

250
00:12:24,730 --> 00:12:26,870
their omics go in the database at the end.

251
00:12:26,870 --> 00:12:30,120
Host: This is the side that I know a little
bit about from working at Ames.

252
00:12:30,120 --> 00:12:34,640
Our bioscience department, they work with
researchers at other institutions.

253
00:12:34,640 --> 00:12:35,640
Right?

254
00:12:35,640 --> 00:12:36,640
Sylvain Costes: Right.

255
00:12:36,640 --> 00:12:39,960
Host: Who want to fly an experiment to space
to do their science.

256
00:12:39,960 --> 00:12:41,310
That's what you're talking about.

257
00:12:41,310 --> 00:12:42,310
Right?

258
00:12:42,310 --> 00:12:43,310
Sylvain Costes: Absolutely.

259

00:12:43,310 --> 00:12:46,610
Host: We'll help them carry out that experiment,
and then also we get to use the data.

260
00:12:46,610 --> 00:12:47,610
Sylvain Costes: Absolutely.

261
00:12:47,610 --> 00:12:52,450
There is that aspect of NASA Ames where an
investigator will work with a principal investigator

262
00:12:52,450 --> 00:12:59,420
that got funding to actually fly on the ISS
specific mission and specific experiment.

263
00:12:59,420 --> 00:13:01,810
Part of our work is also there.

264
00:13:01,810 --> 00:13:06,310
I think there's something new about GeneLab
that as the new project manager I'm trying

265
00:13:06,310 --> 00:13:12,150
to push for is I really think that GeneLab
should be serving three different communities.

266
00:13:12,150 --> 00:13:18,910
The data repository by itself, that data really
talks to the specialists, the bioinformatician

267
00:13:18,910 --> 00:13:23,050
that can go in there and download the data,
work with the data, and interpret the data.

268
00:13:23,050 --> 00:13:24,050
Host: Specialists, yeah.

269
00:13:24,050 --> 00:13:25,630
Sylvain Costes: Very, very specialized people.

270
00:13:25,630 --> 00:13:26,630
Host: Yeah.

271
00:13:26,630 --> 00:13:27,630
Sylvain Costes: Scientists.

272
00:13:27,630 --> 00:13:30,459
But then you have another group which is the
scientists in general, which they don't know

273
00:13:30,459 --> 00:13:33,250
how to do the bioinformatics, but they know
how to ask the right question.

274
00:13:33,250 --> 00:13:34,250
Host: Yeah.

275
00:13:34,250 --> 00:13:37,620
Sylvain Costes: And so, we want to provide
tools for them to be able to access the information

276
00:13:37,620 --> 00:13:41,649
without having to do all these very tedious
and slow work.

277
00:13:41,649 --> 00:13:46,610
Some of the repository data are now being
used to be processed to generate a new level

278
00:13:46,610 --> 00:13:51,160
of data that we would call higher order data
that can be interpreted.

279
00:13:51,160 --> 00:13:57,230
From there, for instance, the idea would be
is there a signature of cancer in some liver

280
00:13:57,230 --> 00:13:59,730
samples that I got from the space station.

281
00:13:59,730 --> 00:14:03,980
A specialist on cancer, but not a specialist
in bioinformatics, can ask this question by

282
00:14:03,980 --> 00:14:05,400
being provided the right information.

283
00:14:05,400 --> 00:14:06,400
Host: I see.

284
00:14:06,400 --> 00:14:09,200
Also, that means they're not doing a brand
new experiment.

285
00:14:09,200 --> 00:14:10,200
They're using data that exists.

286
00:14:10,200 --> 00:14:10,940
Sylvain Costes: Exactly.

287
00:14:10,940 --> 00:14:11,620
Host: Cool.

288
00:14:11,620 --> 00:14:16,640
Sylvain Costes: And so now you can think of
this -- It's the same data, but they've already

289
00:14:16,650 --> 00:14:21,420
been preprocessed by us, and then they are
now -- There's a bigger emphasis on tools

290
00:14:21,420 --> 00:14:22,990
to visualize this information.

291
00:14:22,990 --> 00:14:27,540
And so, we're still working with this with
an investigator.

292
00:14:27,540 --> 00:14:32,500
The idea would be to really have, at the end,
even a higher-level type of information that

293
00:14:32,500 --> 00:14:34,820
would be very succinct but very simple to
access.

294
00:14:34,820 --> 00:14:38,490
With a few clicks, someone could go in there
and ask for their favorite gene.

295
00:14:38,490 --> 00:14:42,070
So is P53 modify in space.

296
00:14:42,070 --> 00:14:46,680
And then you could ask to look at all the
mouse data, or you could say, "Okay, I want

297
00:14:46,680 --> 00:14:47,680
mouse and drosophila."

298
00:14:47,680 --> 00:14:48,680
Host: Yeah.

299
00:14:48,680 --> 00:14:53,420
Sylvain Costes: This now talks to not only
scientists, but really even high school students

300
00:14:53,420 --> 00:14:54,589
can do these kind of questions.

301
00:14:54,589 --> 00:14:55,589
Host: Really?

302
00:14:55,589 --> 00:14:56,640
Sylvain Costes: Yeah, we had a GeneLab for
high school.

303
00:14:56,640 --> 00:15:01,750
Liz Blaber was the PI who actually organized
this.

304
00:15:01,750 --> 00:15:02,750
It was very successful.

305
00:15:02,750 --> 00:15:03,750
Host: Awesome.

306
00:15:03,750 --> 00:15:06,800
Sylvain Costes: High school students can make
sense out of this data with the right guidance,

307
00:15:06,800 --> 00:15:07,800
so it's possible.

308
00:15:07,800 --> 00:15:08,800
Host: Wow, that's impressive.

309
00:15:08,800 --> 00:15:09,800
That's bioinformatics.

310
00:15:09,800 --> 00:15:12,220
You're saying high school students are working
on that.

311
00:15:12,220 --> 00:15:13,340
Sylvain Costes: Absolutely, yeah.

312
00:15:13,340 --> 00:15:14,340
It's really amazing.

313
00:15:14,340 --> 00:15:15,899
The new generation is well trained.

314
00:15:15,899 --> 00:15:16,899
Host: Wow, yeah.

315
00:15:16,899 --> 00:15:18,950
NASA is getting the next generation ready.

316
00:15:18,950 --> 00:15:19,950
That's awesome.

317
00:15:19,950 --> 00:15:20,950
Sylvain Costes: Yeah.

318
00:15:20,950 --> 00:15:24,740
There were like, what, 20-plus kids that came
here this summer and they spent 3 weeks.

319
00:15:24,740 --> 00:15:25,740
Host: Wow.

320
00:15:25,740 --> 00:15:28,870
Sylvain Costes: They worked on the data that
was on the database.

321
00:15:28,870 --> 00:15:32,279
At the end, they did a presentation and it
was really good.

322
00:15:32,279 --> 00:15:35,029
Host: That's a good way to spend your summer
as a high school student.

323
00:15:35,029 --> 00:15:36,029
Sylvain Costes: I agree.

324
00:15:36,029 --> 00:15:37,029
Host: Not just hanging out at the beach.

325
00:15:37,029 --> 00:15:38,029
Right?

326

00:15:38,029 --> 00:15:39,820
You said three communities that GeneLab serves.

327
00:15:39,820 --> 00:15:41,360
Did we hit all three?

328
00:15:41,360 --> 00:15:43,279
Sylvain Costes: Yeah.

329
00:15:43,279 --> 00:15:48,430
Those visualization aspects is really -- you
could have a visualization layer that would

330
00:15:48,430 --> 00:15:53,000
be fairly sophisticated for still scientist
type of people.

331
00:15:53,000 --> 00:15:57,560
But then you could really have even a higher-level
visualization that is really simple where

332
00:15:57,560 --> 00:16:00,339
you can ask very simple questions.

333
00:16:00,339 --> 00:16:04,550
Anyone who doesn't know science but was curious
about space could say, "Is there any change

334
00:16:04,550 --> 00:16:06,230
in inflammatory response in space?"

335
00:16:06,230 --> 00:16:07,230
Host: Okay.

336
00:16:07,230 --> 00:16:12,410
Sylvain Costes: And so at least on the omics
level, looking at protein and RNA, you could

337
00:16:12,410 --> 00:16:18,110

extract this kind of information, actually,
and report this information back to the public.

338
00:16:18,110 --> 00:16:24,790
What we're envisioning is really this multitier
level where you can really, for a specialist,

339
00:16:24,790 --> 00:16:27,899
you would probably much play with the data
the way they are.

340
00:16:27,899 --> 00:16:32,639
For the scientist community, you would have
visualization tools and some processing tools

341
00:16:32,639 --> 00:16:34,399
if you want to do some grinding yourself.

342
00:16:34,399 --> 00:16:35,399
Host: Okay.

343
00:16:35,399 --> 00:16:37,410
Crunch the numbers and that data.

344
00:16:37,410 --> 00:16:38,410
Yeah.

345
00:16:38,410 --> 00:16:40,910
Sylvain Costes: The system would be, by the
way, on the cloud.

346
00:16:40,910 --> 00:16:45,970
But then at the end, the very light level
data, which doesn't take much room, is those

347
00:16:45,970 --> 00:16:47,120
visualization data.

348
00:16:47,120 --> 00:16:52,829

But then they're very much guided by us, because
we have to make choices in what we want to

349
00:16:52,829 --> 00:16:53,829
display.

350
00:16:53,829 --> 00:16:54,829
Host: Right, right.

351
00:16:54,829 --> 00:16:59,220
Sylvain Costes: To do this, we think that
we will involve the scientific community through

352
00:16:59,220 --> 00:17:04,589
something – NIH [National Institutes of
Health] uses a similar model called AWG, analysis

353
00:17:04,589 --> 00:17:05,589
working group.

354
00:17:05,589 --> 00:17:10,799
The idea is to put together multiple principal
investigator experts in one topic and put

355
00:17:10,799 --> 00:17:15,299
them together to tease out what will be the
best way to analyze some type of data.

356
00:17:15,299 --> 00:17:22,490
For instance, we could focus on the rodent
data or you could focus on the microbe data.

357
00:17:22,490 --> 00:17:27,810
You could imagine different AWG, analysis
working groups, for these different questions.

358
00:17:27,810 --> 00:17:32,750
Host: Okay, so different groups of scientists
will decide this particular kind of data is

359
00:17:32,750 --> 00:17:37,600
probably most useful for the community, so
we're going to create some tools to process

360
00:17:37,600 --> 00:17:38,600
it?

361
00:17:38,600 --> 00:17:39,600
Sylvain Costes: Some tools or some way of
displaying them.

362
00:17:39,600 --> 00:17:40,600
Host: Okay.

363
00:17:40,600 --> 00:17:42,930
Sylvain Costes: How can you make it very,
very easy for anyone to understand what's

364
00:17:42,930 --> 00:17:43,930
going on.

365
00:17:43,930 --> 00:17:46,000
What is the right processing pipeline?

366
00:17:46,000 --> 00:17:47,000
We call them pipelines.

367
00:17:47,000 --> 00:17:51,950
It's like a bunch of different scripts that
you put together that will take the raw data,

368
00:17:51,950 --> 00:17:58,450
which are very big, and turn them into a very
small amount of data that is small but very

369
00:17:58,450 --> 00:18:00,530
meaningful to us.

370

00:18:00,530 --> 00:18:02,870
You can imagine, Google does the same thing
with their data.

371
00:18:02,870 --> 00:18:06,240
They have all these very large databases that
they work with.

372
00:18:06,240 --> 00:18:11,130
But at the end, when you type a keyword for
a specific question you're asking, the system

373
00:18:11,130 --> 00:18:15,941
is able to point immediately to a webpage
with an actual answer to your question, which

374
00:18:15,941 --> 00:18:18,250
is remarkable.

375
00:18:18,250 --> 00:18:21,380
In the background there's a lot of things
happening for this, and there's that huge

376
00:18:21,380 --> 00:18:23,380
database working for you.

377
00:18:23,380 --> 00:18:29,020
Host: Are you creating the search engine that
will browse this huge database of biological

378
00:18:29,020 --> 00:18:30,020
information?

379
00:18:30,020 --> 00:18:31,020
Sylvain Costes: We're thinking of that.

380
00:18:31,020 --> 00:18:35,950
It's a bit more difficult for us because when
you think of Google, they really have what

381
00:18:35,950 --> 00:18:39,230
they call big data, which is a lot of data.

382
00:18:39,230 --> 00:18:41,150
GeneLab doesn't have big data.

383
00:18:41,150 --> 00:18:43,010
We have complex data.

384
00:18:43,010 --> 00:18:44,230
Host: Okay.

385
00:18:44,230 --> 00:18:48,460
Sylvain Costes: We don't have that many experiments
from space mission.

386
00:18:48,460 --> 00:18:56,010
If you go on our website right now, you will
find 130-plus studies, and less than half

387
00:18:56,010 --> 00:19:03,380
of them are actually space missions, and the
other ones are ground studies that mimic what's

388
00:19:03,380 --> 00:19:04,490
happening in space.

389
00:19:04,490 --> 00:19:05,950
Host: Okay.

390
00:19:05,950 --> 00:19:06,950
Simulations?

391
00:19:06,950 --> 00:19:08,870
Sylvain Costes: Simulation.

392
00:19:08,870 --> 00:19:13,460
This is the caveat is that we have lots of

data, but they are complex data and they're

393
00:19:13,460 --> 00:19:14,460
not big data.

394
00:19:14,460 --> 00:19:17,570
We have very sparse metrics of information.

395
00:19:17,570 --> 00:19:22,130
And so, there's still some question about
how you're going to go about those data.

396
00:19:22,130 --> 00:19:26,929
And so, that's really where working with the
scientific community will help us figure out

397
00:19:26,929 --> 00:19:32,679
what are the best pipelines with these specific
constraints in mind, which is an additional

398
00:19:32,679 --> 00:19:33,679
challenge.

399
00:19:33,679 --> 00:19:37,309
But I think the technology and I think machine
learning may be helpful there.

400
00:19:37,309 --> 00:19:38,309
Host: Really?

401
00:19:38,309 --> 00:19:39,309
Machine learning is part of this?

402
00:19:39,309 --> 00:19:40,559
Sylvain Costes: We're thinking of that, too.

403
00:19:40,559 --> 00:19:41,559
Host: Interesting.

404
00:19:41,559 --> 00:19:47,049
Sylvain Costes: Because there might be some
clever way of interpreting those sparse metrics

405
00:19:47,049 --> 00:19:48,299
that we're dealing with.

406
00:19:48,299 --> 00:19:55,070
There are a lot of things still that are undefined
in the scientific community.

407
00:19:55,070 --> 00:19:59,660
I think GeneLab is really at the cutting edge
of this information.

408
00:19:59,660 --> 00:20:02,140
It's super exciting, but it's a challenge.

409
00:20:02,140 --> 00:20:06,880
I think it's a visionary approach to have
created GeneLab.

410
00:20:06,880 --> 00:20:11,530
But any visionary approach also brings a lot
of challenges that needs to be dealt with.

411
00:20:11,530 --> 00:20:14,320
Host: Yeah, but NASA is all about challenges
and taking them on.

412
00:20:14,320 --> 00:20:14,900
Sylvain Costes: Absolutely.

413
00:20:14,900 --> 00:20:15,400
That's why we're here. Right?

414
00:20:15,400 --> 00:20:15,900
Host: Right.

415
00:20:15,900 --> 00:20:16,820
Exactly.

416
00:20:16,820 --> 00:20:18,300
I wanted to ask you.

417
00:20:18,300 --> 00:20:24,700
You've spoken about how GeneLab will be accessible
to different levels of expertise.

418
00:20:24,700 --> 00:20:29,059
Is it also open to anyone to go browse and
look at?

419
00:20:29,059 --> 00:20:30,059
Sylvain Costes: Absolutely.

420
00:20:30,059 --> 00:20:32,930
The intent is to have these different tier
levels.

421
00:20:32,930 --> 00:20:36,890
Currently the current version we have is 1.0,
and we're moving to 2.0.

422
00:20:36,890 --> 00:20:41,990
1.0 is very much a repository where you can
just download the data.

423
00:20:41,990 --> 00:20:46,440
The version 2.0 would have -- And it's public,
sorry.

424
00:20:46,440 --> 00:20:47,440
Anyone can go in there.

425
00:20:47,440 --> 00:20:48,440
There is no restriction.

426
00:20:48,440 --> 00:20:49,440
Host: Amazing.

427
00:20:49,440 --> 00:20:53,220
Sylvain Costes: A high school student can
download the data on his or her hard drive

428
00:20:53,220 --> 00:20:55,210
and play with them if they want to.

429
00:20:55,210 --> 00:21:00,000
There are a lot of free tools out there that
you can do that, really.

430
00:21:00,000 --> 00:21:04,220
But 2.0 is going to have more interesting
things coming down the pipe.

431
00:21:04,220 --> 00:21:10,100
We have now a workspace so people can log
in and actually see all your data that you

432
00:21:10,100 --> 00:21:12,360
want to add to the current GeneLab data.

433
00:21:12,360 --> 00:21:13,760
You can bring your own data.

434
00:21:13,760 --> 00:21:18,590
If you want to do a comparison, for instance,
with your favorite experiment and some space

435
00:21:18,590 --> 00:21:20,929
samples, you can do it inside the system.

436
00:21:20,929 --> 00:21:27,880
The other thing is 2.0, as we move on, we'll
be having move and more tools that you can

437
00:21:27,880 --> 00:21:31,260
use to process some samples and do some analysis.

438
00:21:31,260 --> 00:21:37,390
Host: Does that mean like a cancer researcher
could take their own data from their own lab

439
00:21:37,390 --> 00:21:40,840
and compare, I don't know, genetic changes
to what we see in space?

440
00:21:40,840 --> 00:21:41,950
Sylvain Costes: Absolutely.

441
00:21:41,950 --> 00:21:43,970
That's exactly the idea.

442
00:21:43,970 --> 00:21:47,770
You could have someone who's a specialist
in breast cancer.

443
00:21:47,770 --> 00:21:50,840
We know for instance breast is a very sensitive
tissue for radiation.

444
00:21:50,840 --> 00:21:52,610
It's a classic model.

445
00:21:52,610 --> 00:21:58,210
It would not be a bad idea to look at the
-- A lot of the animals that were flown on

446
00:21:58,210 --> 00:22:01,920
the ISS and in the space shuttle are female
mice.

447
00:22:01,920 --> 00:22:05,200
For many reasons, it's easier to work with
female than male.

448
00:22:05,200 --> 00:22:08,710
Typically males tend to fight in the same
cage, for a start.

449
00:22:08,710 --> 00:22:11,730
So we can't put as many males as we can put
female in a cage.

450
00:22:11,730 --> 00:22:12,730
Host: Yeah.

451
00:22:12,730 --> 00:22:15,230
Sylvain Costes: And so, the female have the
mammary gland, which is another very interesting

452
00:22:15,230 --> 00:22:17,390
tissue because they're very sensitive to radiation.

453
00:22:17,390 --> 00:22:19,880
You could look at cancer incidents through
radiation.

454
00:22:19,880 --> 00:22:25,440
It would be an interesting question to look
at specific early onset of cancer, a signature

455
00:22:25,440 --> 00:22:30,480
at the genomic level, and then compare it
to the space station data that's on GeneLab,

456
00:22:30,480 --> 00:22:31,480
for instance.

457
00:22:31,480 --> 00:22:32,890
I don't think anyone has done that yet.

458
00:22:32,890 --> 00:22:33,890
Host: Interesting.

459
00:22:33,890 --> 00:22:35,980
All right, and GeneLab would make that comparison
possible.

460
00:22:35,980 --> 00:22:40,680
Sylvain Costes: Should be, if we have -- Having
said that, we need to first have some mammary

461
00:22:40,680 --> 00:22:45,760
gland data in GeneLab for ISS or space shuttle.

462
00:22:45,760 --> 00:22:46,970
They might be out there somewhere.

463
00:22:46,970 --> 00:22:50,510
A lot of the data are being generated by the
PI as we're talking.

464
00:22:50,510 --> 00:22:53,299
So there's more that are going to come along.

465
00:22:53,299 --> 00:22:56,600
Hopefully some of this information will be
there as we -- The longer we wait, the more

466
00:22:56,600 --> 00:22:57,720
information that will be there.

467
00:22:57,720 --> 00:22:59,289
Host: Right, that's going to grow with time.

468
00:22:59,289 --> 00:23:00,289
Sylvain Costes: Exactly.

469
00:23:00,289 --> 00:23:01,289
Host: Yeah, cool.

470

00:23:01,289 --> 00:23:06,350
So do you guys just receive data, or do you
ever work with the samples that come back

471
00:23:06,350 --> 00:23:07,350
from the space station?

472
00:23:07,350 --> 00:23:09,730
Because there are biological experiments happening
up there.

473
00:23:09,730 --> 00:23:10,730
Right?

474
00:23:10,730 --> 00:23:11,730
Sylvain Costes: It's a great question.

475
00:23:11,730 --> 00:23:13,480
Actually we do both.

476
00:23:13,480 --> 00:23:17,820
The majority of the work is obviously on taking
other people's data.

477
00:23:17,820 --> 00:23:23,710
But NASA has recognized that some samples
may not be taken by any PI, and so it would

478
00:23:23,710 --> 00:23:26,080
be a bit of a waste.

479
00:23:26,080 --> 00:23:27,430
Host: They may not be used by -- ?

480
00:23:27,430 --> 00:23:29,020
Sylvain Costes: Right.

481
00:23:29,020 --> 00:23:35,750
And so GeneLab has come up with a prioritization

of samples that we think are very important.

482
00:23:35,750 --> 00:23:39,750
One of the strategies would be that if we
can really focus our attention to specific

483
00:23:39,750 --> 00:23:44,570
tissue on a regular basis, then we'll have
a very clear characterization of this tissue.

484
00:23:44,570 --> 00:23:47,870
As time goes by, we'll have multiple time
points in space.

485
00:23:47,870 --> 00:23:54,250
So a long duration versus a short duration,
looking always at a same tissue in the same

486
00:23:54,250 --> 00:23:59,730
type of animals, then we'll be able to see
how the time dependencies are showing up.

487
00:23:59,730 --> 00:24:04,520
To do this, we have what we call the sample
processing lab, which is a small group in

488
00:24:04,520 --> 00:24:09,620
GeneLab that either work with other principal
investigators when they need help to process

489
00:24:09,620 --> 00:24:10,620
samples.

490
00:24:10,620 --> 00:24:14,760
But also there's something called tissue sharing
agreement where we can get some tissue from

491
00:24:14,760 --> 00:24:17,179
the ISS that are not clamed by anyone else.

492
00:24:17,179 --> 00:24:21,250
There's a list of tissue that we'd rather
see coming in through this prioritization.

493
00:24:21,250 --> 00:24:22,370
Host: What would be an example?

494
00:24:22,370 --> 00:24:24,059
What would be tissues you're interested in?

495
00:24:24,059 --> 00:24:26,820
Sylvain Costes: The one we've been looking
at a lot is liver.

496
00:24:26,820 --> 00:24:32,309
The reason no one wanted to look at liver
is because it's not a tissue that's been showing

497
00:24:32,309 --> 00:24:34,039
very much response.

498
00:24:34,039 --> 00:24:39,159
Having said that, we actually now have a publication
being prepared on that topic showing that

499
00:24:39,159 --> 00:24:41,910
actually there is some real changes in the
liver in space.

500
00:24:41,910 --> 00:24:42,910
Host: Really?

501
00:24:42,910 --> 00:24:44,700
Sylvain Costes: Which is surprising.

502
00:24:44,700 --> 00:24:49,690
There was one study before that had suggested
there was a change in a longer duration from

503
00:24:49,690 --> 00:24:51,080
space shuttle samples.

504
00:24:51,080 --> 00:24:55,950
And now the study we're preparing actually
is showing that on the ISS as well, the same

505
00:24:55,950 --> 00:25:01,321
strain of mice called C57 are showing some
kind of a change in the liver over a 30-day

506
00:25:01,321 --> 00:25:02,370
course in space.

507
00:25:02,370 --> 00:25:05,090
Host: That could be important for human astronauts.

508
00:25:05,090 --> 00:25:06,090
Sylvain Costes: Absolutely.

509
00:25:06,090 --> 00:25:10,960
The big question is -- The problem with animal
system is that you have to remember that we

510
00:25:10,960 --> 00:25:14,860
work with one strain, which means that all
the data is coming from one single strain,

511
00:25:14,860 --> 00:25:21,169
which is the equivalent of -- When you work
on one strain of mice, you're looking at identical

512
00:25:21,169 --> 00:25:22,169
twins, if you want.

513
00:25:22,169 --> 00:25:22,900
Host: Yeah.

514

00:25:22,900 --> 00:25:23,580
Right.

515
00:25:23,580 --> 00:25:27,000
Sylvain Costes: So you have no idea of how
genetic variance is affecting this response.

516
00:25:27,010 --> 00:25:28,010
Host: Okay.

517
00:25:28,010 --> 00:25:30,390
Sylvain Costes: What you see in one strand
may not be seen in another strand.

518
00:25:30,390 --> 00:25:31,390
Host: Yeah.

519
00:25:31,390 --> 00:25:32,920
Sylvain Costes: And so that's one of the big
challenges with the animal work.

520
00:25:32,920 --> 00:25:33,920
Host: I see.

521
00:25:33,920 --> 00:25:37,179
Sylvain Costes: That's a caveat, and that's
why insects are pretty cool, because with

522
00:25:37,179 --> 00:25:41,070
insects you can actually have a bunch of different
genetic backgrounds in one experiment.

523
00:25:41,070 --> 00:25:42,480
Host: More easily, more of them.

524
00:25:42,480 --> 00:25:43,480
They're smaller.

525
00:25:43,480 --> 00:25:44,480

Sylvain Costes: That's right.

526
00:25:44,480 --> 00:25:46,860
So you see, this is the art of science.

527
00:25:46,860 --> 00:25:51,929
It's like how do you use each model to their
best -- Are you optimizing the usage of these

528
00:25:51,929 --> 00:25:52,929
animals?

529
00:25:52,929 --> 00:25:53,929
Host: Yeah, put them to their best use.

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00:25:53,929 --> 00:25:54,929
Yeah.

531
00:25:54,929 --> 00:25:55,929
Sylvain Costes: Right.

532
00:25:55,929 --> 00:25:59,550
Rodents are great because they're very close
to us genetically, but that's the limitation.

533
00:25:59,550 --> 00:26:04,720
Insects are great because like Drosophila,
you can have a huge spectrum of genetic differences

534
00:26:04,720 --> 00:26:10,460
and you can have many of them, but then they're
much further away from us than a mammal.

535
00:26:10,460 --> 00:26:11,460
Host: Yeah.

536
00:26:11,460 --> 00:26:12,460
Right.

537
00:26:12,460 --> 00:26:13,920
Sylvain Costes: And then we put all this information
together.

538
00:26:13,920 --> 00:26:19,330
The idea, again, as we move forward with technology,
we expect to see some new algorithm that will

539
00:26:19,330 --> 00:26:25,330
be able to make these bridges between the
different species and come up with some real

540
00:26:25,330 --> 00:26:28,720
response from space and understand better
how space affects us.

541
00:26:28,720 --> 00:26:29,860
Host: Yeah. Right. Okay.

542
00:26:29,860 --> 00:26:36,220
So take the results from those studies happening
in space, look at the data in a broad way

543
00:26:36,230 --> 00:26:37,230
and draw conclusions?

544
00:26:37,230 --> 00:26:38,320
Sylvain Costes: Absolutely.

545
00:26:38,320 --> 00:26:39,320
Host: Okay.

546
00:26:39,320 --> 00:26:40,320
That's super interesting.

547
00:26:40,320 --> 00:26:41,040
Sylvain Costes: It is. Right?

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00:26:41,040 --> 00:26:42,180
Host: Yeah, cool.

549
00:26:42,180 --> 00:26:45,360
Sylvain Costes: 10 years from now, we can
go back and see what we discover.

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00:26:45,360 --> 00:26:49,460
But I think there's going to be a lot of discovery
by the scientific community through this database.

551
00:26:49,460 --> 00:26:50,460
Host: Yeah, no doubt.

552
00:26:50,460 --> 00:26:55,940
The other thing I love about the space station
biology experiments is it's not just for space

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00:26:55,940 --> 00:26:56,940
applications.

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00:26:56,940 --> 00:27:01,159
But everything we learn about human health
from that can be applied down here potentially.

555
00:27:01,159 --> 00:27:02,600
Sylvain Costes: Absolutely.

556
00:27:02,600 --> 00:27:04,410
That's a great point, thanks for raising it.

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00:27:04,410 --> 00:27:09,040
Because we're discovering this as we -- One
of the things we're doing right now at GeneLab

558
00:27:09,040 --> 00:27:15,640
is as we are generating those preprocess file
for opening the door to a bigger community

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00:27:15,640 --> 00:27:20,650
that don't need to do all this processing
that we can provide to them, we're discovering

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00:27:20,650 --> 00:27:23,010
some confronting factors in the sample.

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00:27:23,010 --> 00:27:28,420
For instance, if you modify the carbon dioxide
level in the cage of an animal -- I don't

562
00:27:28,420 --> 00:27:33,380
know if you know that, but carbon dioxide
levels are different in space because it tends

563
00:27:33,380 --> 00:27:34,380
to be higher.

564
00:27:34,380 --> 00:27:35,380
Host: Really?

565
00:27:35,380 --> 00:27:37,590
Sylvain Costes: For the longest time, we thought
that there was no impact because they were

566
00:27:37,590 --> 00:27:39,360
still pretty low level.

567
00:27:39,360 --> 00:27:43,800
Now with the GeneLab data, what we're discovering
is that when you do a ground control and you

568
00:27:43,800 --> 00:27:48,590
increase the carbon dioxide to the level that
you have in space on the space station, we

569
00:27:48,590 --> 00:27:51,530
do see some [unintelligible] natures in the
gene.

570
00:27:51,530 --> 00:27:52,850
Host: It has an impact then.

571
00:27:52,850 --> 00:27:54,340
Sylvain Costes: It has an impact.

572
00:27:54,340 --> 00:27:56,210
Now again, you have to be careful.

573
00:27:56,210 --> 00:27:59,580
RNA level is just one very small piece of
the puzzle.

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00:27:59,580 --> 00:28:04,100
You may have a change at the RNA level but
not at the protein level, which is what's

575
00:28:04,100 --> 00:28:05,770
more relevant, I would say, physiologically.

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00:28:05,770 --> 00:28:10,179
It's like the final signal is turning to an
actual protein.

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00:28:10,179 --> 00:28:13,130
There are caveats in everything we do.

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00:28:13,130 --> 00:28:17,630
But it's really telling us that, yeah, those
carbon dioxide have an impact.

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00:28:17,630 --> 00:28:21,990
It's not maybe picked up -- Physiological
changes are maybe not picked up by it.

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00:28:21,990 --> 00:28:22,990
Host: Okay, yeah.

581

00:28:22,990 --> 00:28:26,110
Sylvain Costes: But those very sensitive molecular
tools can pick up those features.

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00:28:26,110 --> 00:28:27,110
Host: Right.

583
00:28:27,110 --> 00:28:32,909
So that's an example where GeneLab is allowing
you to discover that it's very complex, the

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00:28:32,909 --> 00:28:37,510
interactions between environment and DNA and
proteins produced.

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00:28:37,510 --> 00:28:38,510
Sylvain Costes: Exactly.

586
00:28:38,510 --> 00:28:39,730
Host: And you're teasing that apart.

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00:28:39,730 --> 00:28:40,730
Right?

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00:28:40,730 --> 00:28:41,730
Sylvain Costes: Right.

589
00:28:41,730 --> 00:28:43,220
Because back to the carbon dioxide example.

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00:28:43,220 --> 00:28:46,770
You could imagine a situation on earth where
we are exposed to a high level of carbon dioxide.

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00:28:46,770 --> 00:28:49,669
No one would ever study this stuff because
no one would ever think of that.

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00:28:49,669 --> 00:28:55,350

But it turns out that [this] is clearly putting
their fingers on one thing that maybe suggesting

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00:28:55,350 --> 00:28:59,620
more and more studies even by other investigators.

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00:28:59,620 --> 00:29:01,190
What are those signatures?

595
00:29:01,190 --> 00:29:05,200
What are those changes in the RNA will do
on the long term?

596
00:29:05,200 --> 00:29:08,900
Is there a situation on earth where you get
a low carbon dioxide level and they should

597
00:29:08,900 --> 00:29:09,900
be concerned about it?

598
00:29:09,900 --> 00:29:15,820
It is really going much more beyond space.

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00:29:15,820 --> 00:29:23,350
People being bedridden for like a month is
the equivalent of being in microgravity [as]

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00:29:23,350 --> 00:29:25,870
one of the classic models.

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00:29:25,870 --> 00:29:29,120
Microgravity can tell us about bone loss and
things like this.

602
00:29:29,120 --> 00:29:30,120
Host: That's right.

603
00:29:30,120 --> 00:29:32,380
Sylvain Costes: There are a lot of parallels

between what's happening in space.

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00:29:32,380 --> 00:29:35,950
You can think of space as an accelerator of
aging, in a way.

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00:29:35,950 --> 00:29:37,360
That's the way I look at it often.

606
00:29:37,360 --> 00:29:42,320
And so I think everything we're discovering
on those data will be relevant for humans

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00:29:42,320 --> 00:29:43,470
on earth as well.

608
00:29:43,470 --> 00:29:44,659
Host: Fascinating.

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00:29:44,659 --> 00:29:50,260
I like the way earlier you described NASA
as the custodian of data about biology and

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00:29:50,260 --> 00:29:52,070
physiology and health in space.

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00:29:52,070 --> 00:29:57,480
It sounds like you're making that easier to
use and accessible to more people.

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00:29:57,480 --> 00:29:58,750
Sylvain Costes: That's what we're trying to
do.

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00:29:58,750 --> 00:29:59,750
Host: Wonderful.

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00:29:59,750 --> 00:30:00,750
Excellent.

615
00:30:00,750 --> 00:30:02,169
This was super fascinating.

616
00:30:02,169 --> 00:30:06,330
I think for a lot of people it's surprising,
first of all, that NASA does biology, and

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00:30:06,330 --> 00:30:11,159
then that they can take a look at this data
and maybe use it themselves in their labs

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00:30:11,159 --> 00:30:12,159
or at home.

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00:30:12,159 --> 00:30:13,270
So thank you for sharing that with us.

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00:30:13,270 --> 00:30:16,740
Sylvain Costes: No, thank you for highlighting
GeneLab.

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00:30:16,740 --> 00:30:21,600
Anyone who is listening, feel free to come
to genelab.nasa.gov.

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00:30:21,600 --> 00:30:22,400
Host: Awesome.

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00:30:22,419 --> 00:30:26,549
Also online, we are @NASAAmes.

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00:30:26,549 --> 00:30:31,140
We can take any questions for Sylvain about
GeneLab with the hashtag #NASASiliconValley.