



1  
00:00:01,167 --> 00:00:02,535  
>> The focus of attention

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00:00:02,535 --> 00:00:05,304  
for science aboard the  
International Space Station is

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00:00:05,304 --> 00:00:08,841  
from NASA's Marshall Flight  
Space Center in Huntsville,

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00:00:08,841 --> 00:00:13,345  
Alabama, and standing  
by there is Lori Meggs

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00:00:13,345 --> 00:00:15,881  
and she has an update for us.

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00:00:15,881 --> 00:00:17,283  
Lori, you have some results

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00:00:17,283 --> 00:00:21,020  
on some exercise  
experiments on board, huh?

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00:00:22,254 --> 00:00:23,456  
>> Lori Meggs: That's right.

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00:00:23,456 --> 00:00:25,825  
Do we run differently in  
space than we do on earth?

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00:00:25,825 --> 00:00:27,526  
Well, the answer  
may surprise you.

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00:00:27,526 --> 00:00:29,762  
A study called Treadmill  
Kinematics looked

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00:00:29,762 --> 00:00:33,899  
into how astronauts run on a  
treadmill on the Space Station.

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00:00:33,899 --> 00:00:36,202  
I recently spoke  
with or ran with?

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00:00:36,202 --> 00:00:40,673  
No, I spoke with principal  
investigator to learn more.

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00:00:40,673 --> 00:00:44,910  
>> The idea behind the study  
was to collect motion capture

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00:00:44,910 --> 00:00:48,814  
and ground reaction force data  
from astronauts as they exercise

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00:00:48,814 --> 00:00:51,851  
on the Space Station in  
order for us to be able

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00:00:51,851 --> 00:00:54,587  
to quantify these and  
then compare those motions

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00:00:54,587 --> 00:00:56,355  
to how they're performed  
on earth.

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00:00:56,355 --> 00:00:58,124  
>> Lori Meggs: So how did  
it actually work on station?

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00:00:58,124 --> 00:00:59,525  
>> It was very simple actually.

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00:00:59,525 --> 00:01:03,095

All we wanted to do was capture  
data during an actual exercise

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00:01:03,095 --> 00:01:04,797

session for the astronauts.

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00:01:04,797 --> 00:01:08,000

We collected data six times  
from each of our subjects

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00:01:08,000 --> 00:01:10,302

and essentially all they  
did was place a video camera

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00:01:10,302 --> 00:01:13,606

up to view the side while  
they performed their exercise

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00:01:13,606 --> 00:01:14,773

and the treadmill that's

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00:01:14,773 --> 00:01:17,109

on the Space Station  
automatically captures the

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00:01:17,109 --> 00:01:18,677

ground reaction force data.

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00:01:18,677 --> 00:01:20,412

So we would down  
link the video data,

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00:01:20,412 --> 00:01:21,947

down link the ground  
reaction force data

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00:01:21,947 --> 00:01:25,217

and then we would start

computing what the peak forces

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00:01:25,217 --> 00:01:27,253  
were and what the joint  
motion patterns were.

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00:01:27,253 --> 00:01:28,888  
It's very straightforward.

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00:01:28,888 --> 00:01:31,123  
>> Lori Meggs: How many  
subjects did you end up with?

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00:01:31,123 --> 00:01:34,760  
>> We had 8 subjects;  
7 males and 1 female.

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00:01:34,760 --> 00:01:36,362  
>> Lori Meggs: So tell me  
do we have results yet?

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00:01:36,362 --> 00:01:37,630  
>> We do have results.

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00:01:37,630 --> 00:01:39,732  
There's a couple of things  
that are very interesting.

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00:01:39,732 --> 00:01:42,801  
The first is that the running  
style or the running motion

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00:01:42,801 --> 00:01:46,438  
that we use in space is pretty  
much the exact same running

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00:01:46,438 --> 00:01:48,407  
motion that we use  
on the ground.

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00:01:48,407 --> 00:01:51,377

So people run in zero  
gravity the same as they run

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00:01:51,377 --> 00:01:54,013

in 1 gravity even though  
they have to wear a harness

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00:01:54,013 --> 00:01:57,049

and a bunch of that  
connects them to the floor.

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00:01:57,049 --> 00:01:59,185

On the surface, that  
may be a so what?

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00:01:59,185 --> 00:02:00,553

Well, there's a big so what.

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00:02:00,553 --> 00:02:03,923

First of all the exercise that  
they do on earth we can say

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00:02:03,923 --> 00:02:05,658

that the way they're going  
to move in space is going

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00:02:05,658 --> 00:02:09,128

to be the same so we can start  
to have better confidence

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00:02:09,128 --> 00:02:13,299

that the way we exercise or the  
way we prescribe our exercise

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00:02:13,299 --> 00:02:16,535

on earth would be the same as  
in space, but more importantly

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00:02:16,535 --> 00:02:19,805  
and this is where motor control  
experts may be interested we

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00:02:19,805 --> 00:02:23,042  
have things in our body  
that we use for control

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00:02:23,042 --> 00:02:25,477  
such as the [inaudible]  
that rely on gravity.

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00:02:25,477 --> 00:02:27,947  
These data suggest  
that either when we're

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00:02:27,947 --> 00:02:29,415  
in zero gravity we turn

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00:02:29,415 --> 00:02:31,951  
that information off  
or we override it.

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00:02:31,951 --> 00:02:34,420  
So, it's not an important  
control mechanism,

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00:02:34,420 --> 00:02:37,056  
and I think for people  
studying how the brain works

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00:02:37,056 --> 00:02:39,792  
and how the brain controls  
motion this is a really big

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00:02:39,792 --> 00:02:43,662  
study or really big result  
because in the past most

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00:02:43,662 --> 00:02:45,397

of these studies where  
people have tried to look

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00:02:45,397 --> 00:02:48,300

at how gravity affects motion  
have really been focusing

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00:02:48,300 --> 00:02:50,769

on smaller motions like  
reaching and grabbing something

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00:02:50,769 --> 00:02:53,839

and this is the only time that  
we have a large scale amount

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00:02:53,839 --> 00:02:56,875

of data with a pretty  
large motion like running

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00:02:56,875 --> 00:02:59,044

where you've got multiple  
joints moving very quickly.

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00:02:59,044 --> 00:03:00,613

To me it was pretty amazing

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00:03:00,613 --> 00:03:04,516

that the people pretty much  
run the same exact way in space

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00:03:04,516 --> 00:03:05,718

as they do on the ground.

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00:03:05,718 --> 00:03:07,786

>> Lori Meggs: What are  
the earth applications

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00:03:07,786 --> 00:03:09,054

for this experiment?

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00:03:09,054 --> 00:03:11,323

>> We had to collect some pretty sophisticated data

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00:03:11,323 --> 00:03:12,758

in a very difficult location

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00:03:12,758 --> 00:03:16,562

and we developed some ways using single camera video

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00:03:16,562 --> 00:03:19,665

and being able to convert that data into coordinates

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00:03:19,665 --> 00:03:22,501

that we could compute joint angles with.

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00:03:22,501 --> 00:03:24,903

These are techniques that could be used by practitioners

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00:03:24,903 --> 00:03:27,439

in any area where they can't afford

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00:03:27,439 --> 00:03:30,776

or they can't bring a \$100,000 motion capture system

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00:03:30,776 --> 00:03:32,311

to where they are doing their data collection.

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00:03:32,311 --> 00:03:35,881

They could do what we did for sports or for rehab

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00:03:35,881 --> 00:03:36,915  
or anything like that.

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00:03:36,915 --> 00:03:38,484  
So we've developed  
some methodologies

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00:03:38,484 --> 00:03:40,819  
that could be useful for  
people on the ground.

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00:03:40,819 --> 00:03:42,221  
>> Lori Meggs: Anything else  
you want to say about it?

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00:03:42,221 --> 00:03:44,356  
>> Yeah, the ground reaction  
force data that's the other part

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00:03:44,356 --> 00:03:48,260  
this is what's really important  
for the exercise efficiency.

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00:03:48,260 --> 00:03:51,397  
What we find is that the  
exercise forces that you get

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00:03:51,397 --> 00:03:53,532  
in zero G are much  
less than in 1 G,

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00:03:53,532 --> 00:03:55,200  
but they increase with speed.

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00:03:55,200 --> 00:03:57,202  
So, what we want and would

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00:03:57,202 --> 00:03:59,438  
like our astronauts  
to do is run faster.

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00:03:59,438 --> 00:04:02,474

If we can have faster running,  
maybe they do interval training

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00:04:02,474 --> 00:04:05,110

where they run fast and  
rest and run fast and rest,

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00:04:05,110 --> 00:04:08,247

they could get a better  
response for their bone growth

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00:04:08,247 --> 00:04:11,450

than if they run in slower speed  
for a longer period of time.

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00:04:11,450 --> 00:04:12,451

>> Lori Meggs: What's  
the reaction to that

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00:04:12,451 --> 00:04:14,620

when you tell an  
astronaut run faster?

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00:04:14,620 --> 00:04:15,654

[Laughter]

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00:04:15,654 --> 00:04:17,056

>> Some of them they  
think that's great

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00:04:17,056 --> 00:04:19,491

because they're runners; some  
of them maybe aren't so excited

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00:04:19,491 --> 00:04:21,994

because that's not their  
favorite sort of exercise,

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00:04:21,994 --> 00:04:23,629

but we're hoping that  
we can show these data

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00:04:23,629 --> 00:04:24,730

to the astronauts now.

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00:04:24,730 --> 00:04:26,498

So, instead of us  
just saying run faster

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00:04:26,498 --> 00:04:29,768

because we think it's good,  
we can show them run faster

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00:04:29,768 --> 00:04:32,271

because we know it's good.

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00:04:32,271 --> 00:04:34,173

>> Lori Meggs: And if you would  
like to find out more about this

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00:04:34,173 --> 00:04:36,842

and other human research  
investigations,

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00:04:36,842 --> 00:04:40,212

go to [nasa.gov slash station](http://nasa.gov/station).

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00:04:40,212 --> 00:04:42,715

We have an astronaut  
there at the helm today,

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00:04:42,715 --> 00:04:45,584

a [inaudible] operation's  
director T.J. Cramer [phonetic]