
BENEFITS FOR HUMANITY
HOPE CRYSTALLIZES

1
00:00:00,506 --> 00:00:12,586
[Music]

2
00:00:13,086 --> 00:00:16,746
>> DMD or Duchenne muscular
dystrophy is the most common

3
00:00:16,826 --> 00:00:18,956
muscle disease affecting
young boys;

4
00:00:19,026 --> 00:00:21,426
it affects about 1 in 3,600.

5
00:00:21,426 --> 00:00:24,536
It's an incurable
condition, and it results

6
00:00:24,606 --> 00:00:30,376
in really muscle weakness that
worsens over a boy's lifetime.

7
00:00:30,376 --> 00:00:33,956
Typically, boys lose their
ability to walk around age 12.

8
00:00:34,306 --> 00:00:36,726
As boys go through adolescence,

9
00:00:37,246 --> 00:00:40,346
they have usually additional
complications related

10
00:00:40,346 --> 00:00:44,196
to their lung or pulmonary
health, as well as more often

11
00:00:44,196 --> 00:00:46,836
than not will develop cardiac

disease, heart disease,

12
00:00:47,426 --> 00:00:50,496
and fortunately most boys
will pass away in their 20s

13
00:00:50,496 --> 00:00:53,976
from complications such as
pneumonia, or heart failure.

14
00:00:54,516 --> 00:01:01,546
[Music]

15
00:01:02,046 --> 00:01:04,156
In order to combat
diseases like this we have

16
00:01:04,156 --> 00:01:06,856
to study the structure of
proteins that are associated

17
00:01:07,016 --> 00:01:08,186
with that particular disease.

18
00:01:08,486 --> 00:01:12,416
In order to do that, we first
must crystallize the protein,

19
00:01:12,416 --> 00:01:15,896
and that crystal is
basically millions of copies

20
00:01:15,896 --> 00:01:19,696
of that same protein aligned
like a row of bricks on a wall,

21
00:01:19,936 --> 00:01:20,916
but in three dimensions.

22

00:01:20,916 --> 00:01:23,776
>> But here's the problem,
when we try to grow a crystal

23
00:01:23,776 --> 00:01:27,606
on earth gravity can affect the
way the molecules become aligned

24
00:01:27,706 --> 00:01:28,836
on the crystal's surface

25
00:01:28,916 --> 00:01:32,816
and that affects the overall
quality of the crystal.

26
00:01:32,816 --> 00:01:35,776
>> The ideal environment to grow
a more perfect crystal would be

27
00:01:35,776 --> 00:01:38,806
a lab that we could have up
in space orbiting the globe

28
00:01:39,106 --> 00:01:41,136
so that we are free
of earth's gravity.

29
00:01:41,796 --> 00:01:43,136
Luckily we have one of those

30
00:01:43,136 --> 00:01:44,796
with the International
Space Station.

31
00:01:46,616 --> 00:01:51,546
>> Since 2003, the Japan
Aerospace Exploration Agency has

32
00:01:51,616 --> 00:01:53,946
conducted more than 16 sessions

33
00:01:53,946 --> 00:01:57,306
of the protein crystal growth
experiments onboard the

34
00:01:57,306 --> 00:01:58,656
International Space Station.

35
00:01:59,496 --> 00:02:02,316
>> In microgravity the
crystals grow much more slowly,

36
00:02:02,516 --> 00:02:06,186
but the molecules have more
time to get perfectly arranged

37
00:02:06,186 --> 00:02:07,456
on the surface of the crystal,

38
00:02:07,456 --> 00:02:09,226
and that gives us
much better data.

39
00:02:11,576 --> 00:02:14,496
>> One of the most promising
results has been gained

40
00:02:14,566 --> 00:02:19,536
by studying a protein associated
with Duchenne muscular disorder.

41
00:02:20,036 --> 00:02:22,986
>> Studying this protein
that [inaudible] discovery

42
00:02:24,056 --> 00:02:26,756
like a key fitting into
a key hole we are able

43

00:02:27,126 --> 00:02:31,176
to design the graph that
perfectly binds to this protein.

44
00:02:31,856 --> 00:02:35,526
>> By knowing the shape of that
key hole we can tailor make a

45
00:02:35,606 --> 00:02:38,956
drug to fit into a specific
location of the protein.

46
00:02:39,336 --> 00:02:45,296
>> What this means is we may
be able to slow the disease

47
00:02:45,406 --> 00:02:49,266
by half instead of
being in a wheelchair

48
00:02:49,466 --> 00:02:55,616
at 12 we might be able
to push that age to 25.

49
00:02:57,056 --> 00:03:00,616
Instead of being
dependent upon this vision

50
00:03:00,796 --> 00:03:05,096
at 20 years old you
live to be 40.

51
00:03:05,356 --> 00:03:10,776
What are we talking about is
potentially doubling the life

52
00:03:10,916 --> 00:03:16,236
span of many of the
DMD patients.

53

00:03:17,206 --> 00:03:22,546
And it's all because of such
a [inaudible] afforded to us

54
00:03:23,286 --> 00:03:25,636
by the International
Space Station.

55
00:03:26,246 --> 00:03:28,436
>> This research is
really just in its infancy;

56
00:03:28,646 --> 00:03:30,196
there are literally thousands

57
00:03:30,196 --> 00:03:32,676
of other proteins who's
structures we need to determine,

58
00:03:33,306 --> 00:03:35,196
and the International
Space Station is going

59
00:03:35,196 --> 00:03:38,326
to provide a platform where we
can hopefully grow much better

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00:03:38,386 --> 00:03:41,306
crystals that will allow us to
get structures and to learn more

61
00:03:41,306 --> 00:03:44,056
about how these molecules
function in our body,

62
00:03:44,386 --> 00:03:46,176
in bacteria, or in viruses.

63
00:03:47,126 --> 00:03:49,186
We're doing this research

not just for ourselves

64
00:03:49,186 --> 00:03:51,246
or our children, but
for generations to come.

65
00:03:51,776 --> 00:03:53,076
Many of the protein structures

66
00:03:53,176 --> 00:03:55,136
that will be determined
wouldn't be possible

67
00:03:55,326 --> 00:03:56,896
without the International
Space Station.

68
00:03:57,516 --> 00:04:06,546
[Music]

69
00:04:07,046 --> 00:04:08,866
>> I'm hoping that those
trials will be successful,

70
00:04:09,146 --> 00:04:11,866
that they will tell
us yes there is a way

71
00:04:11,906 --> 00:04:14,546
that we can keep
these boys stronger

72
00:04:14,546 --> 00:04:15,826
for a longer period of time.

73
00:04:15,956 --> 00:04:18,006
That we can help their
heart and pulmonary function

74

00:04:18,006 --> 00:04:20,246
and that they can live longer;
that they can grow up and go