WEBVTT

NOTE duration: ”00:10:22.120”

NOTE Confidence: 0.934525

00:00:00.160 --> 00:00:01.780 Thanks, everyone. I'm Dustin.

NOTE Confidence: 0.99395245

00:00:02.320 --> 00:00:03.520 I have the pleasure of

NOTE Confidence: 0.99395245

00:00:03.520 --> 00:00:04.019 introducing,

NOTE Confidence: 0.79657567

00:00:04.400 --> 00:00:05.779 doctor Henk de Fader,

NOTE Confidence: 0.9123126

00:00:06.160 --> 00:00:07.279 who'll be talking a little

NOTE Confidence: 0.9123126

00:00:07.279 --> 00:00:08.580 bit about, complimentary

NOTE Confidence: 0.9934171

00:00:09.360 --> 00:00:10.240 stuff we have on the

NOTE Confidence: 0.9934171

00:00:10.240 --> 00:00:11.059 MR side.

NOTE Confidence: 0.97834706

00:00:11.599 --> 00:00:13.360 Henk graduated from Ghent University

NOTE Confidence: 0.97834706

00:00:13.360 --> 00:00:14.559 in Belgium and earned his

NOTE Confidence: 0.97834706

00:00:14.559 --> 00:00:15.059 PhD

NOTE Confidence: 0.8236266

00:00:15.485 --> 00:00:16.224 in Idoven,

NOTE Confidence: 0.9666467

00:00:16.605 --> 00:00:18.045 University of Technology in the

NOTE Confidence: 0.9666467

00:00:18.045 --> 00:00:18.545 Netherlands.

NOTE Confidence: 0.9445587

00:00:19.085 --> 00:00:20.605 After that, he came to

NOTE Confidence: 0.9445587

00:00:20.605 --> 00:00:22.285 us, in radiology as a

NOTE Confidence: 0.9445587

00:00:22.285 --> 00:00:23.404 post doc and became an

NOTE Confidence: 0.9445587

00:00:23.404 --> 00:00:25.085 assistant professor in two thousand

NOTE Confidence: 0.9445587

00:00:25.085 --> 00:00:27.404 eighteen. His research focuses on

NOTE Confidence: 0.9445587

00:00:27.404 --> 00:00:28.384 applying advanced

NOTE Confidence: 0.86985254

00:00:28.810 --> 00:00:30.590 MR techniques to study metabolism

NOTE Confidence: 0.86985254

00:00:30.730 --> 00:00:31.390 and Vivo.

NOTE Confidence: 0.91060984

00:00:37.850 --> 00:00:38.809 Yeah. Thank you for the

NOTE Confidence: 0.91060984

00:00:38.809 --> 00:00:40.970 introduction. And, yes, indeed, I,

NOTE Confidence: 0.9651168

00:00:41.555 --> 00:00:43.795 somewhat naively accepted the challenge

NOTE Confidence: 0.9651168

00:00:43.795 --> 00:00:45.655 to talk about everything MR

NOTE Confidence: 0.88426465

00:00:46.195 --> 00:00:46.854 at Yale.

NOTE Confidence: 0.92762506

00:00:47.234 --> 00:00:48.754 And I, figured I used

NOTE Confidence: 0.92762506

00:00:48.754 --> 00:00:50.434 the list of Nobel Prizes

NOTE Confidence: 0.92762506

00:00:50.434 --> 00:00:50.934 awarded,

NOTE Confidence: 0.99255764

00:00:51.475 --> 00:00:52.675 later to MR in the

NOTE Confidence: 0.99255764

00:00:52.675 --> 00:00:53.815 past to illustrate

NOTE Confidence: 0.9593381

00:00:54.400 --> 00:00:56.160 how far MR reaches and

NOTE Confidence: 0.9593381

00:00:56.160 --> 00:00:57.760 and and is really a

NOTE Confidence: 0.9593381

00:00:57.760 --> 00:00:59.380 topic in many different fields.

NOTE Confidence: 0.9593381

00:00:59.600 --> 00:01:00.560 But, of course, today, we're

NOTE Confidence: 0.9593381

00:01:00.560 --> 00:01:01.940 gonna talk about the applications

NOTE Confidence: 0.9593381

00:01:02.080 --> 00:01:03.920 in vivo, which is, mostly

NOTE Confidence: 0.9593381

00:01:03.920 --> 00:01:06.240 MR, imaging, but also MR

NOTE Confidence: 0.9593381

00:01:06.240 --> 00:01:08.465 spectroscopic imaging. And in case

NOTE Confidence: 0.9593381

00:01:08.465 --> 00:01:09.584 you're not familiar with that,

NOTE Confidence: 0.9593381

00:01:09.584 --> 00:01:11.345 I'll quickly introduce that. So

NOTE Confidence: 0.9593381

00:01:11.345 --> 00:01:12.785 our MR images are based

NOTE Confidence: 0.9593381

00:01:12.785 --> 00:01:14.145 mostly on the detection of

NOTE Confidence: 0.9593381

00:01:14.145 --> 00:01:15.265 water signal and we have

NOTE Confidence: 0.9593381

00:01:15.265 --> 00:01:16.165 very high concentrations

NOTE Confidence: 0.9585156

00:01:16.865 --> 00:01:18.165 of water in our tissue

NOTE Confidence: 0.9585156

00:01:18.385 --> 00:01:19.825 that allows us to generate

NOTE Confidence: 0.9585156

00:01:19.825 --> 00:01:21.765 these anatomical images with

NOTE Confidence: 0.910426

00:01:22.065 --> 00:01:23.660 very sharp and lots of

NOTE Confidence: 0.9823586

00:01:24.040 --> 00:01:25.100 detail. When we detect,

NOTE Confidence: 0.9685593

00:01:25.720 --> 00:01:27.260 metabolites with MR spectroscopy,

NOTE Confidence: 0.94033897

00:01:27.800 --> 00:01:29.480 we're dealing with concentrations that

NOTE Confidence: 0.94033897

00:01:29.480 --> 00:01:31.080 are several thousand times lower.

NOTE Confidence: 0.94033897

00:01:31.080 --> 00:01:32.120 You see all these different

NOTE Confidence: 0.94033897

00:01:32.120 --> 00:01:33.319 peaks in the spectrum. From

NOTE Confidence: 0.94033897

00:01:33.319 --> 00:01:33.959 there, we can,

NOTE Confidence: 0.86682785

00:01:34.520 --> 00:01:36.555 make maps metabolic maps. So

NOTE Confidence: 0.86682785

00:01:36.555 --> 00:01:38.095 this provide the biochemistry

NOTE Confidence: 0.8563887

00:01:38.395 --> 00:01:38.895 information,

NOTE Confidence: 0.8216408

00:01:39.435 --> 00:01:40.255 but understandably

NOTE Confidence: 0.89427763

00:01:40.875 --> 00:01:42.155 at a much lower spatial

NOTE Confidence: 0.89427763

00:01:42.155 --> 00:01:42.655 resolution,

NOTE Confidence: 0.9960312

00:01:43.115 --> 00:01:43.935 than water.

NOTE Confidence: 0.9116785

00:01:44.555 --> 00:01:46.175 So talking about the activities

NOTE Confidence: 0.9116785

00:01:46.235 --> 00:01:47.355 that happen in the Magnetic

NOTE Confidence: 0.9116785

00:01:47.355 --> 00:01:48.875 Resonance Research Center, which is

NOTE Confidence: 0.9116785

00:01:48.875 --> 00:01:50.235 under the leadership of doc

NOTE Confidence: 0.9116785

00:01:50.315 --> 00:01:51.775 Constable and doctor Ruffman,

NOTE Confidence: 0.94429183

00:01:52.120 --> 00:01:54.220 which houses about twelve faculty

NOTE Confidence: 0.94429183

00:01:54.280 --> 00:01:55.260 that all have,

NOTE Confidence: 0.96193683

00:01:55.799 --> 00:01:58.440 very actively funded research programs

NOTE Confidence: 0.96193683

00:01:58.440 --> 00:01:59.560 as you can see here.

NOTE Confidence: 0.96193683

00:01:59.560 --> 00:02:00.520 And this is really what

NOTE Confidence: 0.96193683

00:02:00.520 --> 00:02:01.500 drives the technology

NOTE Confidence: 0.98720896

00:02:02.200 --> 00:02:04.440 that, eventually becomes available to

NOTE Confidence: 0.98720896

00:02:04.440 --> 00:02:05.740 a lot of the users

NOTE Confidence: 0.97972584

00:02:06.465 --> 00:02:08.084 at Yale and and outside.

NOTE Confidence: 0.97972584

00:02:08.385 --> 00:02:10.145 So we use MRI scanners

NOTE Confidence: 0.97972584

00:02:10.145 --> 00:02:10.965 as our tool,

NOTE Confidence: 0.9819155

00:02:11.665 --> 00:02:13.585 to answer scientific questions and

NOTE Confidence: 0.9819155

00:02:13.585 --> 00:02:15.125 also try to improve diagnostics

NOTE Confidence: 0.9819155

00:02:15.264 --> 00:02:16.305 as MRI is used in

NOTE Confidence: 0.9819155

00:02:16.305 --> 00:02:17.585 the clinic. And there's even

NOTE Confidence: 0.9819155

00:02:17.585 --> 00:02:18.245 an occasional

NOTE Confidence: 0.9358194

00:02:19.290 --> 00:02:21.050 situation where the MR scanner

NOTE Confidence: 0.9358194

00:02:21.050 --> 00:02:22.910 is the therapeutic tool.

NOTE Confidence: 0.99231577

00:02:23.850 --> 00:02:25.389 This is a pretty general

NOTE Confidence: 0.92435306

00:02:25.850 --> 00:02:27.450 explanation that probably can be

NOTE Confidence: 0.92435306

00:02:27.450 --> 00:02:29.050 applied to any MR research

NOTE Confidence: 0.92435306

00:02:29.050 --> 00:02:29.550 center

NOTE Confidence: 0.83108646

00:02:30.410 --> 00:02:31.389 in the world.

NOTE Confidence: 0.948446

00:02:32.055 --> 00:02:33.575 I think where Yale sets

NOTE Confidence: 0.948446

00:02:33.575 --> 00:02:34.935 itself apart from a lot

NOTE Confidence: 0.948446

00:02:34.935 --> 00:02:36.375 of centers is,

NOTE Confidence: 0.9567033

00:02:36.694 --> 00:02:38.375 the width, like, the the

NOTE Confidence: 0.9567033

00:02:38.375 --> 00:02:39.355 range of applications

NOTE Confidence: 0.96964055

00:02:39.655 --> 00:02:41.254 where we're focusing on as

NOTE Confidence: 0.96964055

00:02:41.254 --> 00:02:42.294 well as the depth. And

NOTE Confidence: 0.96964055

00:02:42.294 --> 00:02:43.254 with that, I mean, the

NOTE Confidence: 0.96964055

00:02:43.254 --> 00:02:45.175 the extent where people go

NOTE Confidence: 0.96964055

00:02:45.175 --> 00:02:46.474 to really customize,

NOTE Confidence: 0.9939624

00:02:47.700 --> 00:02:48.360 the hardware,

NOTE Confidence: 0.98342663

00:02:48.980 --> 00:02:50.660 modify the scanners so it

NOTE Confidence: 0.98342663

00:02:50.660 --> 00:02:51.540 can do what we think

NOTE Confidence: 0.98342663

00:02:51.540 --> 00:02:52.740 it needs to do, to

NOTE Confidence: 0.98342663

00:02:52.740 --> 00:02:53.800 answer our questions.

NOTE Confidence: 0.96772003

00:02:54.340 --> 00:02:55.540 And for you to appreciate

NOTE Confidence: 0.96772003

00:02:55.540 --> 00:02:56.340 that and some of the

NOTE Confidence: 0.96772003

00:02:56.340 --> 00:02:57.540 examples I'm gonna show, I

NOTE Confidence: 0.96772003

00:02:57.540 --> 00:02:58.980 wanted to quickly go through,

NOTE Confidence: 0.983261

00:03:00.180 --> 00:03:01.460 the basic workings of an

NOTE Confidence: 0.983261

00:03:01.460 --> 00:03:03.044 MRI scanner. This would be

NOTE Confidence: 0.983261

00:03:03.044 --> 00:03:04.405 a clinical whole body scanner.

NOTE Confidence: 0.983261

00:03:04.405 --> 00:03:05.285 If you would cut that

NOTE Confidence: 0.983261

00:03:05.285 --> 00:03:06.405 open, you would see a

NOTE Confidence: 0.983261

00:03:06.405 --> 00:03:06.905 giant

NOTE Confidence: 0.9758417

00:03:07.205 --> 00:03:07.705 superconducting

NOTE Confidence: 0.93460274

00:03:08.085 --> 00:03:09.845 magnet that is always on.

NOTE Confidence: 0.93460274

00:03:09.845 --> 00:03:11.044 A little safety alert. Don't

NOTE Confidence: 0.93460274

00:03:11.044 --> 00:03:12.505 let anybody tell you differently.

NOTE Confidence: 0.93460274

00:03:12.725 --> 00:03:13.605 And then a number of

NOTE Confidence: 0.93460274

00:03:13.605 --> 00:03:13.925 other,

NOTE Confidence: 0.8338301

00:03:14.919 --> 00:03:16.680 tube like structures, all different

NOTE Confidence: 0.8338301

00:03:16.680 --> 00:03:18.280 kind of coils, gradient coils,

NOTE Confidence: 0.8338301

00:03:18.280 --> 00:03:19.560 shim coils, or the frequency

NOTE Confidence: 0.8338301

00:03:19.560 --> 00:03:20.060 coils.

NOTE Confidence: 0.94710803

00:03:20.519 --> 00:03:22.200 That's the hardware component. The

NOTE Confidence: 0.94710803

00:03:22.200 --> 00:03:24.120 software component is basically where

NOTE Confidence: 0.94710803

00:03:24.120 --> 00:03:26.519 we drive these, different hardware

NOTE Confidence: 0.94710803

00:03:26.519 --> 00:03:29.055 components, specifically those coils, in

NOTE Confidence: 0.94710803

00:03:29.055 --> 00:03:31.155 a very accurate timed way.

NOTE Confidence: 0.94710803

00:03:31.294 --> 00:03:32.495 This is how you manipulate

NOTE Confidence: 0.94710803

00:03:32.495 --> 00:03:33.235 a signal,

NOTE Confidence: 0.9921966

00:03:33.615 --> 00:03:34.735 of the MR scanner to

NOTE Confidence: 0.9921966

00:03:34.735 --> 00:03:35.695 give us the contrast that

NOTE Confidence: 0.9921966

00:03:35.695 --> 00:03:36.815 we want and the information

NOTE Confidence: 0.9921966

00:03:36.815 --> 00:03:37.715 that we want.

NOTE Confidence: 0.9132058

00:03:38.015 --> 00:03:39.635 Next up is image reconstruction

NOTE Confidence: 0.9132058

00:03:39.855 --> 00:03:41.135 and then sometimes there's also

NOTE Confidence: 0.9132058

00:03:41.135 --> 00:03:43.075 quite some post processing involved.

NOTE Confidence: 0.96044064

00:03:43.520 --> 00:03:44.720 So now that you're experts

NOTE Confidence: 0.96044064

00:03:44.720 --> 00:03:46.000 on all this, let's go

NOTE Confidence: 0.96044064

00:03:46.000 --> 00:03:46.960 and look at a bunch

NOTE Confidence: 0.96044064

00:03:46.960 --> 00:03:48.960 of applications. First, in the

NOTE Confidence: 0.96044064

00:03:48.960 --> 00:03:51.520 basic science questions answering oh,

NOTE Confidence: 0.96044064

00:03:51.520 --> 00:03:52.960 we got two questions. So

NOTE Confidence: 0.96044064

00:03:52.960 --> 00:03:53.840 the first one, of course,

NOTE Confidence: 0.96044064

00:03:53.840 --> 00:03:55.440 is neuroscience, takes a big

NOTE Confidence: 0.96044064

00:03:55.440 --> 00:03:57.140 part of, the the main

NOTE Confidence: 0.9564119

00:03:58.995 --> 00:04:00.515 basic science questions, and that's

NOTE Confidence: 0.9564119

00:04:00.515 --> 00:04:01.575 because of functional,

NOTE Confidence: 0.9762723

00:04:01.875 --> 00:04:02.375 MR

NOTE Confidence: 0.95943516

00:04:02.834 --> 00:04:03.955 imaging. It's a technique that

NOTE Confidence: 0.95943516

00:04:03.955 --> 00:04:05.475 allows to detect active brain

NOTE Confidence: 0.95943516

00:04:05.475 --> 00:04:07.075 regions and allows to detect

NOTE Confidence: 0.95943516

00:04:07.075 --> 00:04:08.755 networks or how certain reaches

NOTE Confidence: 0.95943516

00:04:08.755 --> 00:04:09.575 of the brain,

NOTE Confidence: 0.91145915

00:04:10.194 --> 00:04:11.575 work in in in synchronicity.

NOTE Confidence: 0.9946639

00:04:12.350 --> 00:04:13.230 And this is just an

NOTE Confidence: 0.9946639

00:04:13.230 --> 00:04:14.510 example of how those networks

NOTE Confidence: 0.9946639

00:04:14.510 --> 00:04:15.710 can be detected. In this

NOTE Confidence: 0.9946639

00:04:15.710 --> 00:04:17.870 case, it's in, opioid use

NOTE Confidence: 0.9946639

00:04:17.870 --> 00:04:18.370 disorder.

NOTE Confidence: 0.99931026

00:04:19.230 --> 00:04:20.270 Now this can also be

NOTE Confidence: 0.99931026

00:04:20.270 --> 00:04:21.570 done in animal models.

NOTE Confidence: 0.9567865

00:04:22.270 --> 00:04:23.650 Here you see four activation

NOTE Confidence: 0.9567865

00:04:23.710 --> 00:04:25.250 maps and four different sensory,

NOTE Confidence: 0.9756592

00:04:25.870 --> 00:04:27.330 methods. So these are

NOTE Confidence: 0.9346455

00:04:27.964 --> 00:04:29.164 ranging from four paw all

NOTE Confidence: 0.9346455

00:04:29.164 --> 00:04:30.604 the way to olfactory bulb

NOTE Confidence: 0.9346455

00:04:30.604 --> 00:04:31.104 stimulation.

NOTE Confidence: 0.946682

00:04:32.845 --> 00:04:34.205 The animal systems can even

NOTE Confidence: 0.946682

00:04:34.205 --> 00:04:36.525 be combined with non MR

NOTE Confidence: 0.946682

00:04:36.525 --> 00:04:37.964 technologies. So here you see

NOTE Confidence: 0.946682

00:04:37.964 --> 00:04:39.664 a combination of the fMRI

NOTE Confidence: 0.95082015

00:04:39.964 --> 00:04:41.345 in, in mice

NOTE Confidence: 0.98198265

00:04:41.839 --> 00:04:43.279 in a setup that's compatible

NOTE Confidence: 0.98198265

00:04:43.279 --> 00:04:44.720 with NMR to also do,

NOTE Confidence: 0.98198265

00:04:44.960 --> 00:04:46.100 calcium imaging.

NOTE Confidence: 0.9552084

00:04:46.560 --> 00:04:47.680 This is still a very

NOTE Confidence: 0.9552084

00:04:47.680 --> 00:04:49.279 minimally invasive technique, so it

NOTE Confidence: 0.9552084

00:04:49.279 --> 00:04:50.339 allows for longitudinal

NOTE Confidence: 0.96052593

00:04:50.640 --> 00:04:52.560 studies as was, illustrated here

NOTE Confidence: 0.96052593

00:04:52.560 --> 00:04:54.020 in this Alzheimer model.

NOTE Confidence: 0.8185183

00:04:56.240 --> 00:04:57.060 Those were

NOTE Confidence: 0.95717543

00:04:57.974 --> 00:04:59.495 mapping networks in the brain

NOTE Confidence: 0.95717543

00:04:59.495 --> 00:05:01.014 based on the function, but

NOTE Confidence: 0.95717543

00:05:01.014 --> 00:05:02.375 we can also purely use

NOTE Confidence: 0.95717543

00:05:02.375 --> 00:05:04.375 the anatomy itself. Here's an

NOTE Confidence: 0.95717543

00:05:04.375 --> 00:05:05.895 example of fiber tracking. That's

NOTE Confidence: 0.95717543

00:05:05.895 --> 00:05:07.495 a post processing method that

NOTE Confidence: 0.95717543

00:05:07.495 --> 00:05:09.254 relies on diffusion weighted MRI

NOTE Confidence: 0.95717543

00:05:09.254 --> 00:05:11.115 data, and this was applied,

NOTE Confidence: 0.9495765

00:05:11.820 --> 00:05:13.020 in a in a project

NOTE Confidence: 0.9495765

00:05:13.020 --> 00:05:14.860 focused on neurodevelopment. And, again,

NOTE Confidence: 0.9495765

00:05:14.860 --> 00:05:16.080 leveraging the noninvasiveness

NOTE Confidence: 0.96707916

00:05:16.460 --> 00:05:17.820 of MRI, you can see

NOTE Confidence: 0.96707916

00:05:17.820 --> 00:05:19.100 that these data were acquired

NOTE Confidence: 0.96707916

00:05:19.100 --> 00:05:21.180 during different gestational stages all

NOTE Confidence: 0.96707916

00:05:21.180 --> 00:05:22.779 the way from fetuses to

NOTE Confidence: 0.96707916

00:05:22.779 --> 00:05:23.279 neonates.

NOTE Confidence: 0.9605885

00:05:24.214 --> 00:05:25.654 And this is also possible

NOTE Confidence: 0.9605885

00:05:25.654 --> 00:05:27.355 in animal studies as well.

NOTE Confidence: 0.9605885

00:05:27.495 --> 00:05:28.955 Same kind of data, different,

NOTE Confidence: 0.77651477

00:05:29.815 --> 00:05:30.775 illustrate or,

NOTE Confidence: 0.99407583

00:05:31.335 --> 00:05:31.835 visualization.

NOTE Confidence: 0.9918976

00:05:32.615 --> 00:05:33.915 This is now an example

NOTE Confidence: 0.9918976

00:05:34.135 --> 00:05:35.895 of using an MRI scanner

NOTE Confidence: 0.9918976

00:05:35.895 --> 00:05:37.720 as a therapeutic tool. This

NOTE Confidence: 0.9918976

00:05:37.720 --> 00:05:39.660 is real time fMRI neurofeedback.

NOTE Confidence: 0.9949083

00:05:40.120 --> 00:05:41.480 This involves a,

NOTE Confidence: 0.9380404

00:05:42.200 --> 00:05:43.900 task study in the scanner,

NOTE Confidence: 0.95439756

00:05:44.440 --> 00:05:46.040 and the signal is super

NOTE Confidence: 0.95439756

00:05:46.040 --> 00:05:47.480 quickly processed that can be

NOTE Confidence: 0.95439756

00:05:47.480 --> 00:05:49.100 presented to the patient itself.

NOTE Confidence: 0.95439756

00:05:49.160 --> 00:05:50.360 Basically, you see your own

NOTE Confidence: 0.95439756

00:05:50.360 --> 00:05:51.725 brain at work, and this

NOTE Confidence: 0.95439756

00:05:51.725 --> 00:05:52.605 is a tool that's been

NOTE Confidence: 0.95439756

00:05:52.605 --> 00:05:54.705 used mostly in psychiatric diseases

NOTE Confidence: 0.95439756

00:05:54.845 --> 00:05:55.745 to retrain,

NOTE Confidence: 0.93812823

00:05:56.205 --> 00:05:56.705 certain,

NOTE Confidence: 0.89706564

00:05:58.125 --> 00:05:59.665 responses to certain stimuli.

NOTE Confidence: 0.9220341

00:06:00.764 --> 00:06:01.805 Now let's focus a bit

NOTE Confidence: 0.9220341

00:06:01.805 --> 00:06:03.404 more on diagnostic imaging that

NOTE Confidence: 0.9220341

00:06:03.404 --> 00:06:04.605 we're trying to improve. So

NOTE Confidence: 0.9220341

00:06:04.605 --> 00:06:05.565 here you see an example

NOTE Confidence: 0.9220341

00:06:05.565 --> 00:06:06.900 of cardiac imaging with a

NOTE Confidence: 0.9220341

00:06:06.900 --> 00:06:07.800 a short axis

NOTE Confidence: 0.9425956

00:06:08.100 --> 00:06:09.860 image to the heart. This

NOTE Confidence: 0.9425956

00:06:09.860 --> 00:06:10.919 specific application

NOTE Confidence: 0.9879062

00:06:11.300 --> 00:06:11.800 mapped

NOTE Confidence: 0.93789214

00:06:12.500 --> 00:06:14.259 the parameter, a magnetic parameter

NOTE Confidence: 0.93789214

00:06:14.259 --> 00:06:15.460 in the blood and that

NOTE Confidence: 0.93789214

00:06:15.460 --> 00:06:17.560 resulted in an improved biomarker

NOTE Confidence: 0.93789214

00:06:17.699 --> 00:06:19.800 for detection of pulmonary hypertension,

NOTE Confidence: 0.9684221

00:06:20.224 --> 00:06:21.264 something that I was told

NOTE Confidence: 0.9684221

00:06:21.264 --> 00:06:23.044 is pretty hard to diagnose

NOTE Confidence: 0.8970787

00:06:23.504 --> 00:06:24.004 noninvasively.

NOTE Confidence: 0.9332315

00:06:25.425 --> 00:06:26.625 And now an example where

NOTE Confidence: 0.9332315

00:06:26.625 --> 00:06:27.985 we go even further. So

NOTE Confidence: 0.9332315

00:06:27.985 --> 00:06:29.585 here, novel hardware as well

NOTE Confidence: 0.9332315

00:06:29.585 --> 00:06:30.085 as,

NOTE Confidence: 0.93457156

00:06:30.544 --> 00:06:32.085 software as well as reconstruction

NOTE Confidence: 0.86765295

00:06:32.544 --> 00:06:34.224 are are modified. So remember

NOTE Confidence: 0.86765295

00:06:34.224 --> 00:06:35.870 these these structures, these tube

NOTE Confidence: 0.86765295

00:06:35.870 --> 00:06:37.150 like structures in the MR

NOTE Confidence: 0.86765295

00:06:37.150 --> 00:06:39.389 scanner, gradient coils. Now this

NOTE Confidence: 0.86765295

00:06:39.389 --> 00:06:40.690 is the gradient coil

NOTE Confidence: 0.93846077

00:06:41.389 --> 00:06:43.150 over here. Looks completely different,

NOTE Confidence: 0.93846077

00:06:43.150 --> 00:06:44.350 but it allows for very

NOTE Confidence: 0.93846077

00:06:44.350 --> 00:06:44.850 high

NOTE Confidence: 0.8995881

00:06:45.229 --> 00:06:46.750 gradient being applied to the

NOTE Confidence: 0.8995881

00:06:46.750 --> 00:06:47.250 prostate

NOTE Confidence: 0.935548

00:06:47.955 --> 00:06:49.875 And, suddenly, these images that

NOTE Confidence: 0.935548

00:06:49.875 --> 00:06:51.074 would not be possible within

NOTE Confidence: 0.935548

00:06:51.074 --> 00:06:52.695 a regular MRI scanner become

NOTE Confidence: 0.935548

00:06:52.755 --> 00:06:54.275 high quality and increase the

NOTE Confidence: 0.935548

00:06:54.275 --> 00:06:56.455 detection of, prostate cancer.

NOTE Confidence: 0.94248265

00:06:57.555 --> 00:06:58.514 It can go even go

NOTE Confidence: 0.94248265

00:06:58.514 --> 00:06:59.635 further. Here, the shape of

NOTE Confidence: 0.94248265

00:06:59.635 --> 00:07:01.154 the magnet is completely different

NOTE Confidence: 0.94248265

00:07:01.154 --> 00:07:02.430 than what we're used to.

NOTE Confidence: 0.94248265

00:07:02.430 --> 00:07:03.949 So here, they envision a,

NOTE Confidence: 0.94248265

00:07:04.270 --> 00:07:05.710 point of care, kind of

NOTE Confidence: 0.94248265

00:07:05.710 --> 00:07:06.930 an MRI seat,

NOTE Confidence: 0.95793283

00:07:08.110 --> 00:07:09.630 with the idea that, could

NOTE Confidence: 0.95793283

00:07:09.630 --> 00:07:10.850 be used for lower abdominal

NOTE Confidence: 0.90154874

00:07:11.710 --> 00:07:13.009 imaging. And the same work,

NOTE Confidence: 0.95908433

00:07:13.310 --> 00:07:14.370 led to the

NOTE Confidence: 0.89464396

00:07:15.664 --> 00:07:16.785 to the project where the

NOTE Confidence: 0.89464396

00:07:16.785 --> 00:07:18.225 focus is on an affordable

NOTE Confidence: 0.89464396

00:07:18.225 --> 00:07:20.085 breast MRI scanner, which mentioned

NOTE Confidence: 0.89464396

00:07:20.145 --> 00:07:21.764 before. This is a future

NOTE Confidence: 0.9355966

00:07:23.745 --> 00:07:24.944 illustration of how this could

NOTE Confidence: 0.9355966

00:07:24.944 --> 00:07:26.544 look and, again, completely different

NOTE Confidence: 0.9355966

00:07:26.544 --> 00:07:27.925 way of looking at magnets,

NOTE Confidence: 0.97422504

00:07:28.710 --> 00:07:31.210 and dedicated to, the specific

NOTE Confidence: 0.97422504

00:07:31.270 --> 00:07:31.770 application.

NOTE Confidence: 0.9470094

00:07:33.030 --> 00:07:34.170 Here we see an overview

NOTE Confidence: 0.9470094

00:07:34.230 --> 00:07:35.210 of high quality,

NOTE Confidence: 0.9298947

00:07:35.750 --> 00:07:37.430 proton MRI combined with lots

NOTE Confidence: 0.9298947

00:07:37.430 --> 00:07:38.650 of structural MRI.

NOTE Confidence: 0.8961622

00:07:39.190 --> 00:07:40.550 This is a project very

NOTE Confidence: 0.8961622

00:07:40.550 --> 00:07:42.390 hard on acquisition and then

NOTE Confidence: 0.8961622

00:07:42.390 --> 00:07:42.890 reconstruction

NOTE Confidence: 0.9197912

00:07:43.414 --> 00:07:45.014 to improve the quality of

NOTE Confidence: 0.9197912

00:07:45.014 --> 00:07:46.854 of these data. And another

NOTE Confidence: 0.9197912

00:07:46.854 --> 00:07:48.375 approach also in MRSI, we

NOTE Confidence: 0.9197912

00:07:48.375 --> 00:07:49.574 again use a different type

NOTE Confidence: 0.9197912

00:07:49.574 --> 00:07:51.095 of hardware. This looks like

NOTE Confidence: 0.9197912

00:07:51.095 --> 00:07:53.335 the same tunnel stripe, like

NOTE Confidence: 0.9197912

00:07:53.335 --> 00:07:54.854 structure, but trust me, there's

NOTE Confidence: 0.9197912

00:07:54.854 --> 00:07:56.134 a completely different way to

NOTE Confidence: 0.9197912

00:07:56.134 --> 00:07:57.835 apply all these different gradients

NOTE Confidence: 0.82746667

00:07:58.360 --> 00:08:00.220 and manipulate the magnetic field

NOTE Confidence: 0.8021169

00:08:00.600 --> 00:08:02.380 and basically allowing for,

NOTE Confidence: 0.9589688

00:08:03.160 --> 00:08:04.760 high data quality in areas

NOTE Confidence: 0.9589688

00:08:04.760 --> 00:08:05.500 that otherwise

NOTE Confidence: 0.9130377

00:08:05.800 --> 00:08:07.720 are not really used for

NOTE Confidence: 0.9130377

00:08:07.720 --> 00:08:08.220 spectroscopic

NOTE Confidence: 0.99698305

00:08:08.520 --> 00:08:09.020 imaging.

NOTE Confidence: 0.92963684

00:08:10.504 --> 00:08:11.784 This is now an an

NOTE Confidence: 0.92963684

00:08:11.784 --> 00:08:14.264 interesting combination where proton MRI

NOTE Confidence: 0.92963684

00:08:14.264 --> 00:08:16.025 is applied preclinically but in

NOTE Confidence: 0.92963684

00:08:16.025 --> 00:08:17.544 combination with a contrast agent,

NOTE Confidence: 0.92963684

00:08:17.544 --> 00:08:18.745 and it's a contrast agent

NOTE Confidence: 0.92963684

00:08:18.745 --> 00:08:19.884 itself that is detected.

NOTE Confidence: 0.964896

00:08:20.264 --> 00:08:21.784 This contrast agent provides a

NOTE Confidence: 0.964896

00:08:21.784 --> 00:08:23.784 readout of extracellular pH. So

NOTE Confidence: 0.964896

00:08:23.784 --> 00:08:24.824 now you can make these

NOTE Confidence: 0.964896

00:08:24.824 --> 00:08:25.724 pH maps,

NOTE Confidence: 0.96333957

00:08:26.440 --> 00:08:28.060 characterizing the tumor microenvironment

NOTE Confidence: 0.930088

00:08:28.440 --> 00:08:29.400 as is done in in

NOTE Confidence: 0.930088

00:08:29.400 --> 00:08:30.759 several of these animal models

NOTE Confidence: 0.930088

00:08:30.759 --> 00:08:31.879 of cancer as well as,

NOTE Confidence: 0.930088

00:08:32.120 --> 00:08:33.019 kidney disease.

NOTE Confidence: 0.98581374

00:08:33.320 --> 00:08:34.620 And when this is combined

NOTE Confidence: 0.9139315

00:08:35.720 --> 00:08:37.740 with yet another method simultaneously

NOTE Confidence: 0.9943954

00:08:38.200 --> 00:08:39.260 imaging sodium,

NOTE Confidence: 0.9907168

00:08:39.575 --> 00:08:40.695 We now get maps that

NOTE Confidence: 0.9907168

00:08:40.695 --> 00:08:41.654 are based on,

NOTE Confidence: 0.8773584

00:08:42.214 --> 00:08:43.575 to the acidity map, the

NOTE Confidence: 0.8773584

00:08:43.575 --> 00:08:45.095 pH based map, as well

NOTE Confidence: 0.8773584

00:08:45.095 --> 00:08:46.475 as the salinity map.

NOTE Confidence: 0.9356707

00:08:46.934 --> 00:08:48.295 Two aspects that they're linked

NOTE Confidence: 0.9356707

00:08:48.295 --> 00:08:49.975 to, a phenotype of brain

NOTE Confidence: 0.9356707

00:08:49.975 --> 00:08:51.735 tumors, one being more invasive,

NOTE Confidence: 0.9356707

00:08:51.735 --> 00:08:53.400 one being more proliferative. And

NOTE Confidence: 0.9356707

00:08:53.400 --> 00:08:54.360 the idea is that this

NOTE Confidence: 0.9356707

00:08:54.360 --> 00:08:55.660 could be guiding therapy.

NOTE Confidence: 0.9665735

00:08:55.960 --> 00:08:56.460 Oops.

NOTE Confidence: 0.96984136

00:08:57.240 --> 00:08:57.900 Oh, boy.

NOTE Confidence: 0.9272826

00:09:00.360 --> 00:09:01.640 Since these tumors go to

NOTE Confidence: 0.9272826

00:09:01.640 --> 00:09:03.000 different cycle of,

NOTE Confidence: 0.9998294

00:09:03.480 --> 00:09:03.980 proliferation

NOTE Confidence: 0.9911071

00:09:04.280 --> 00:09:05.420 as well as invasion.

NOTE Confidence: 0.9349265

00:09:06.040 --> 00:09:06.940 Tumor slides.

NOTE Confidence: 0.9929712

00:09:09.065 --> 00:09:10.665 Yale has always been at

NOTE Confidence: 0.9929712

00:09:10.665 --> 00:09:12.585 the forefront of using stable

NOTE Confidence: 0.9929712

00:09:12.585 --> 00:09:14.524 isotopes combined with MR spectroscopy

NOTE Confidence: 0.8717339

00:09:14.825 --> 00:09:15.485 to study,

NOTE Confidence: 0.96766305

00:09:16.505 --> 00:09:18.265 metabolism in vivo. Here's an

NOTE Confidence: 0.96766305

00:09:18.265 --> 00:09:19.785 example of using thirteen c

NOTE Confidence: 0.96766305

00:09:19.785 --> 00:09:20.684 labeled acetate.

NOTE Confidence: 0.953586

00:09:21.300 --> 00:09:23.380 The context is alcohol dependence

NOTE Confidence: 0.953586

00:09:23.380 --> 00:09:24.500 and recovery. I'm not gonna

NOTE Confidence: 0.953586

00:09:24.500 --> 00:09:25.800 go into detail of that.

NOTE Confidence: 0.953586

00:09:25.860 --> 00:09:26.900 I just wanna show that

NOTE Confidence: 0.953586

00:09:26.900 --> 00:09:28.900 these are are very complex

NOTE Confidence: 0.953586

00:09:28.900 --> 00:09:30.340 studies, but very rich in

NOTE Confidence: 0.953586

00:09:30.340 --> 00:09:30.840 information.

NOTE Confidence: 0.9677141

00:09:31.460 --> 00:09:32.420 And while I'm kind of

NOTE Confidence: 0.9677141

00:09:32.420 --> 00:09:34.179 grouping these into diagnostics, that

NOTE Confidence: 0.9677141

00:09:34.179 --> 00:09:35.300 doesn't really make sense because

NOTE Confidence: 0.9677141

00:09:35.300 --> 00:09:36.179 this is about a two

NOTE Confidence: 0.9677141

00:09:36.179 --> 00:09:37.315 hour scan. So this is

NOTE Confidence: 0.9677141

00:09:37.315 --> 00:09:39.495 definitely a basic science, approach.

NOTE Confidence: 0.9885251

00:09:40.595 --> 00:09:41.475 This is a little bit

NOTE Confidence: 0.9885251

00:09:41.475 --> 00:09:43.554 different for, the last iteration

NOTE Confidence: 0.9885251

00:09:43.554 --> 00:09:44.775 where we now use deuterium

NOTE Confidence: 0.9885251

00:09:44.835 --> 00:09:45.975 as a stable isotope.

NOTE Confidence: 0.97172225

00:09:46.275 --> 00:09:47.475 This is a lot easier

NOTE Confidence: 0.97172225

00:09:47.475 --> 00:09:48.929 than the thirteen c studies.

NOTE Confidence: 0.97172225

00:09:48.929 --> 00:09:50.130 So here, we do have

NOTE Confidence: 0.97172225

00:09:50.130 --> 00:09:51.410 the ambition to make something

NOTE Confidence: 0.97172225

00:09:51.410 --> 00:09:52.929 that is possible in a

NOTE Confidence: 0.97172225

00:09:52.929 --> 00:09:55.110 clinical setting. So our application

NOTE Confidence: 0.97172225

00:09:55.250 --> 00:09:57.190 in patients includes just drinking

NOTE Confidence: 0.97172225

00:09:57.490 --> 00:09:59.030 the deuterium labeled tracer,

NOTE Confidence: 0.97493887

00:09:59.410 --> 00:10:01.170 mapping the glucose metabolism in

NOTE Confidence: 0.97493887

00:10:01.170 --> 00:10:02.370 forty five minutes, as you

NOTE Confidence: 0.97493887

00:10:02.370 --> 00:10:03.570 can see illustrated here in

NOTE Confidence: 0.97493887

00:10:03.570 --> 00:10:04.985 these brain tumors. But even

NOTE Confidence: 0.97493887

00:10:04.985 --> 00:10:06.184 a forty five minute scan

NOTE Confidence: 0.97493887

00:10:06.184 --> 00:10:07.464 is too long, so now

NOTE Confidence: 0.97493887

00:10:07.464 --> 00:10:09.385 the acquisitions are actually interleaved

NOTE Confidence: 0.97493887

00:10:09.385 --> 00:10:10.904 with the anatomical MRI so

NOTE Confidence: 0.97493887

00:10:10.904 --> 00:10:12.105 that there's no extra time

NOTE Confidence: 0.97493887

00:10:12.105 --> 00:10:13.804 needed in, such a scan.

NOTE Confidence: 0.9688691

00:10:14.934 --> 00:10:16.694 Okay. I thank you for

NOTE Confidence: 0.9688691

00:10:16.694 --> 00:10:17.814 sticking with me to this

NOTE Confidence: 0.9688691

00:10:17.814 --> 00:10:18.874 fire hose delivery

NOTE Confidence: 0.93092805

00:10:19.254 --> 00:10:20.874 of all these different technologies,

NOTE Confidence: 0.93092805

00:10:20.934 --> 00:10:21.894 and, thank you for your

NOTE Confidence: 0.93092805

00:10:21.894 --> 00:10:22.120 time.