WEBVTT

00:00:06.339 --> 00:00:08.758 - Epilepsy in the past

00:00:08.758 --> 00:00:13.138 20 years increasingly has been thought of as a network disease,

00:00:13.138 --> 00:00:17.851 and that's important because our brain works

00:00:17.892 --> 00:00:19.352 on the basis of networks,

00:00:19.352 --> 00:00:24.065 and so how do you solve the problem of a disease

00:00:24.065 --> 00:00:27.694 that is mitigated by a network?

00:00:27.777 --> 00:00:30.780 Well, it needs a multidisciplinary team.

00:00:33.992 --> 00:00:38.204 - Yale Clinical Neuroscience Neuroanalytics Research Group or YNN,

00:00:38.204 --> 00:00:42.208 is focused on the study of network brain disorders,

00:00:42.208 --> 00:00:43.668 primarily epilepsy.

00:00:44.544 --> 00:00:47.297 - So we have basically three different disciplines.

00:00:47.297 --> 00:00:51.760 One part of the group studies the structure or brain anatomy,

00:00:51.801 --> 00:00:56.097 then the other groups studies the electrical activity in the brain,

00:00:56.097 --> 00:01:00.018 and then my part is to study the chemistry of certain brain regions,

00:01:00.060 --> 00:01:04.898 and then we will integrate it in order to find better biomarkers.

00:01:04.939 --> 00:01:08.234 - We draw on neurology,

00:01:09.027 --> 00:01:12.322 neurosurgery, neuroscience, computer science,

00:01:12.614 --> 00:01:15.867 electrical engineering, computer engineering, mathematics

00:01:15.867 --> 00:01:19.162 to try and understand the complex phenomenon that we are studying,

00:01:19.162 --> 00:01:22.916 the signals that we are studying, and then to be able to monitor

00:01:22.916 --> 00:01:28.129 and modulate them and build the devices that will control the brain networks.

00:01:32.008 --> 00:01:34.177 - My role primarily has been

00:01:34.177 --> 00:01:38.181 in defining the structure through our Yale Brain Atlas.

00:01:38.181 --> 00:01:41.392 It divides the brain into 690 parcels.

00:01:41.476 --> 00:01:43.812 Each parcel is enumerated and named.

00:01:43.812 --> 00:01:47.857 But once you have partially the brain,

00:01:48.066 --> 00:01:53.363 then you can take each of those parcels and superimpose a function.

00:01:54.030 --> 00:01:57.075 - One example of a device that we built using this

00:01:57.075 --> 00:02:01.746 is the neuroprobe, an award winning device that we built in the lab

00:02:02.080 --> 00:02:06.793 that monitors intracranial pressure, intracranial temperature,

00:02:06.793 --> 00:02:10.088 brain tissue, oxygen, and intracranial EEG,

00:02:10.088 --> 00:02:12.757 all within a single multimodal probe,

00:02:13.049 --> 00:02:17.595 and which is meant for use for traumatic brain injury in the neuro-ICU.

00:02:18.346 --> 00:02:20.765 - To put together electrophysiology

00:02:20.765 --> 00:02:26.104 structure and function from the atlas and then the new field.

00:02:26.437 --> 00:02:29.607 It's not a new field, but it's a new application of that field,

00:02:29.649 --> 00:02:32.527 the biochemistry of the brain that Dr. Eid brings.

00:02:32.527 --> 00:02:39.075 You have a more complete picture of the brain structure, function, relationships.

00:02:39.075 --> 00:02:42.162 - What I use is a method called mass spectrometry

00:02:42.412 --> 00:02:45.498 is a really advanced method that is very sensitive.

00:02:45.540 --> 00:02:50.003 You can detect really low levels of chemicals in any kind of body fluid.

00:02:50.211 --> 00:02:54.174 So the way we use it is we have samples from the patients.

00:02:54.215 --> 00:02:59.220 These are brain samples, saliva samples, sweat samples with an analyst

00:02:59.470 --> 00:03:00.930 with this mass spectrometry,

00:03:00.930 --> 00:03:05.185 and the advantage is it really allows us to analyze

00:03:05.185 --> 00:03:09.814 many chemicals all at once in many, many samples from the same patients.

00:03:10.648 --> 00:03:13.693 We have analyzed some patients.

00:03:13.693 --> 00:03:18.239 We are still in the early stages, but we are seeing chemicals

00:03:18.239 --> 00:03:22.869 that may be increased when the patient is at high risk for having a seizure.

00:03:22.911 --> 00:03:29.334 - Seizures are modulated by the time of day and by cycles,

00:03:29.334 --> 00:03:34.047 and these cycles may be 20 days or 30 days of integration.

00:03:34.088 --> 00:03:38.009 We are trying to better understand what motivates these cycles.

00:03:39.469 --> 00:03:43.806 - By combining the electrical signal with a chemical signal,

00:03:43.848 --> 00:03:48.102 We hope to have a much stronger predictor of when they will have a seizure.

00:03:48.228 --> 00:03:53.566 So we are using various methods - machine learning, AI - to identify groups

00:03:53.566 --> 00:03:58.613 of chemicals and of electrical signatures that will really forecast a seizure.

00:03:58.613 --> 00:04:00.281 - And then if we can understand them,

00:04:00.281 --> 00:04:02.909 then we could better treat the patient.

00:04:07.705 --> 00:04:11.417 - All of this is about therapeutics for the patient.

00:04:11.459 --> 00:04:15.338 Can we resect you know, can we identify the network?

00:04:15.338 --> 00:04:17.382 Can we modulate the network?

00:04:17.382 --> 00:04:23.471 How can we decide which of the chemistry electrophysiology

00:04:23.471 --> 00:04:27.850 functional issues are most important, or how do they interact together

00:04:27.850 --> 00:04:33.773 in a single patient at a single time to optimize therapy for that patient?

00:04:33.940 --> 00:04:39.028 - So the big picture is to take what we're learning from epilepsy

00:04:39.070 --> 00:04:43.866 and to translate it to other chronic diseases in people,

00:04:43.866 --> 00:04:47.036 and especially to cyclical or episodic diseases.

00:04:47.078 --> 00:04:48.329 There are many of them.

00:04:48.329 --> 00:04:51.499 You have migrant attacks, cluster headaches,

00:04:51.624 --> 00:04:56.212 mood disorders, even addiction that comes and goes.

00:04:57.797 --> 00:05:02.510 - In the longer term, we would like to create algorithms and devices

00:05:02.510 --> 00:05:04.929 that could forecast episodes

00:05:04.929 --> 00:05:09.475 in order to tailor the treatment for the individual.