WEBVTT

NOTE duration:"01:21:36"

NOTE recognizability:0.896

NOTE language:en-us

NOTE Confidence: 0.882581222

00:00:00.000 --> 00:00:01.620 But we're still going to have

NOTE Confidence: 0.882581222

00:00:01.620 --> 00:00:02.700 people joining for awhile,

NOTE Confidence: 0.882581222

00:00:02.700 --> 00:00:05.400 but I I would like to make sure that I leave.

NOTE Confidence: 0.882581222

00:00:05.400 --> 00:00:07.212 There's not much time as possible

NOTE Confidence: 0.882581222

00:00:07.212 --> 00:00:09.000 for Doctor Janik to to speak,

NOTE Confidence: 0.882581222

00:00:09.000 --> 00:00:11.796 so I will begin our introduction.

NOTE Confidence: 0.882581222

00:00:11.800 --> 00:00:14.957 Those of you who heard The Chieftains,

NOTE Confidence: 0.882581222

00:00:14.960 --> 00:00:18.986 this music was in honor of

NOTE Confidence: 0.882581222

00:00:18.986 --> 00:00:20.650 Doctor Flynn's Irish heritage,

NOTE Confidence: 0.882581222

00:00:20.650 --> 00:00:22.630 although I do think The Chieftains

NOTE Confidence: 0.882581222

00:00:22.630 --> 00:00:25.260 might be Scottish, as Jane mentioned,

NOTE Confidence: 0.882581222

00:00:25.260 --> 00:00:30.574 but the IT was still lively and Celtic, and.

NOTE Confidence: 0.882581222

00:00:30.574 --> 00:00:35.886 As as you'll hear Doctor John Patrick Flynn,

NOTE Confidence: 0.882581222

00:00:35.890 --> 00:00:39.670 who for whom this lecture is name is named,

NOTE Confidence: 0.882581222

00:00:39.670 --> 00:00:42.683 was a member of the L faculty from 1954

NOTE Confidence: 0.882581222

00:00:42.683 --> 00:00:45.539 until his retirement in July 1979,

NOTE Confidence: 0.882581222

00:00:45.539 --> 00:00:47.873 and he was really an extraordinary

NOTE Confidence: 0.882581222

00:00:47.873 --> 00:00:50.808 person who had quite a remarkable life.

NOTE Confidence: 0.882581222

00:00:50.810 --> 00:00:52.168 And so I'm going to take a

NOTE Confidence: 0.882581222

00:00:52.168 --> 00:00:53.650 little time to tell you about it.

NOTE Confidence: 0.882581222

00:00:53.650 --> 00:00:55.502 We have his daughter,

NOTE Confidence: 0.882581222

00:00:55.502 --> 00:00:57.530 Sarah Flynn, with us here today.

NOTE Confidence: 0.882581222

00:00:57.530 --> 00:00:59.360 Thank you for coming, Sarah, and.

NOTE Confidence: 0.882581222

00:00:59.360 --> 00:01:01.915 She was the one who helped me

NOTE Confidence: 0.882581222

00:01:01.915 --> 00:01:03.982 gather the information that I'm

NOTE Confidence: 0.882581222

00:01:03.982 --> 00:01:06.940 going to be sharing with you today.

NOTE Confidence: 0.882581222

00:01:06.940 --> 00:01:08.120 So first of all,

NOTE Confidence: 0.882581222

00:01:08.120 --> 00:01:09.300 I I knew Dr.

NOTE Confidence: 0.882581222

00:01:09.300 --> 00:01:11.575 Finn Flynn's work because of his focus

NOTE Confidence: 0.882581222

00:01:11.575 --> 00:01:13.765 on the neural basis of aggressive

NOTE Confidence: 0.882581222

00:01:13.765 --> 00:01:15.675 behavior and he's recognized as

NOTE Confidence: 0.882581222

00:01:15.675 --> 00:01:18.202 a pioneer in neuroscience and in

NOTE Confidence: 0.882581222

00:01:18.202 --> 00:01:20.327 general for his contribution to

NOTE Confidence: 0.882581222

00:01:20.327 --> 00:01:22.760 understanding the function of the

NOTE Confidence: 0.882581222

00:01:22.760 --> 00:01:24.760 hippocampus in the hypothalamus.

NOTE Confidence: 0.882581222

00:01:24.760 --> 00:01:28.030 He also served from 1968 to 1978

NOTE Confidence: 0.882581222

00:01:28.030 --> 00:01:30.070 as director of the Abraham Ribicoff

NOTE Confidence: 0.882581222

00:01:30.070 --> 00:01:32.010 Research facilities at the Connecticut

NOTE Confidence: 0.882581222

00:01:32.010 --> 00:01:34.170 Mental Connecticut Mental Health Center,

NOTE Confidence: 0.882581222

00:01:34.170 --> 00:01:36.922 which is where most of our basic or

NOTE Confidence: 0.882581222

00:01:36.922 --> 00:01:39.775 a large chunk of our basic science

NOTE Confidence: 0.882581222

00:01:39.775 --> 00:01:42.820 labs remain right in in proximity

NOTE Confidence: 0.882581222

00:01:42.820 --> 00:01:46.245 to our clinical research facilities,

NOTE Confidence: 0.882581222

00:01:46.250 --> 00:01:48.980 which was something that was essential

NOTE Confidence: 0.882581222

00:01:48.980 --> 00:01:50.800 for establishing the translational

NOTE Confidence: 0.882581222

00:01:50.869 --> 00:01:53.049 and collaborative nature of the

NOTE Confidence: 0.882581222

00:01:53.049 --> 00:01:54.417 department and since 1982.

NOTE Confidence: 0.882581222

00:01:54.417 --> 00:01:56.580 We've had a lecture held in his

NOTE Confidence: 0.882581222

00:01:56.647 --> 00:01:58.882 honor recognizing his quote pivotal

NOTE Confidence: 0.882581222

00:01:58.882 --> 00:02:01.117 role in establishing the central

NOTE Confidence: 0.882581222

00:02:01.185 --> 00:02:03.077 importance of basic neuroscience

NOTE Confidence: 0.882581222

00:02:03.077 --> 00:02:05.442 research as their frontier for

NOTE Confidence: 0.882581222

00:02:05.442 --> 00:02:06.596 clinical psychiatric studies.

NOTE Confidence: 0.882581222

00:02:06.596 --> 00:02:08.624 And that's a tradition that we

NOTE Confidence: 0.882581222

00:02:08.624 --> 00:02:10.269 honor today with our speaker,

NOTE Confidence: 0.882581222

00:02:10.270 --> 00:02:11.533 doctor Patricia Janik.

NOTE Confidence: 0.882581222

00:02:11.533 --> 00:02:15.030 So here's now why we had Celtic music.

NOTE Confidence: 0.882581222

00:02:15.030 --> 00:02:17.432 Doctor Flynn was born in Superior, WI.

NOTE Confidence: 0.882581222

00:02:17.432 --> 00:02:19.966 The of an Irish immigrant mother and

NOTE Confidence: 0.882581222

00:02:19.966 --> 00:02:22.281 a first generation Irish American

NOTE Confidence: 0.882581222

00:02:22.281 --> 00:02:25.311 father who worked as a railroad

NOTE Confidence: 0.882581222

00:02:25.311 --> 00:02:27.740 switchman and he studied for the priesthood.

NOTE Confidence: 0.882581222

00:02:27.740 --> 00:02:30.156 He was ordained in Rome and then he

NOTE Confidence: 0.882581222

00:02:30.156 --> 00:02:32.510 returned to the United States in 1938

NOTE Confidence: 0.882581222

00:02:32.510 --> 00:02:34.910 to Loyola University and when his

NOTE Confidence: 0.882581222

00:02:34.910 --> 00:02:37.012 superiors there decided that they

NOTE Confidence: 0.882581222

00:02:37.012 --> 00:02:39.087 needed someone to teach psychology,

NOTE Confidence: 0.882581222

00:02:39.090 --> 00:02:41.260 he volunteered to study it.

NOTE Confidence: 0.882581222

00:02:41.260 --> 00:02:42.680 And then he went out.

NOTE Confidence: 0.882581222

00:02:42.680 --> 00:02:44.871 To find the best teacher so he

NOTE Confidence: 0.882581222

00:02:44.871 --> 00:02:46.670 could actually teach his students.

NOTE Confidence: 0.882581222

00:02:46.670 --> 00:02:48.734 This led him to Columbia University

NOTE Confidence: 0.882581222

00:02:48.734 --> 00:02:50.569 and there he studied psychology

NOTE Confidence: 0.882581222

00:02:50.569 --> 00:02:52.939 and he remained in the priesthood.

NOTE Confidence: 0.882581222

00:02:52.940 --> 00:02:55.155 But throughout this time he

NOTE Confidence: 0.882581222

00:02:55.155 --> 00:02:56.927 was examining his conscience.

NOTE Confidence: 0.882581222

00:02:56.930 --> 00:02:59.390 And he ultimately resigned from the

NOTE Confidence: 0.882581222

00:02:59.390 --> 00:03:02.236 priesthood and left the church in 1944,

NOTE Confidence: 0.882581222

00:03:02.236 --> 00:03:04.766 having received his PhD in

NOTE Confidence: 0.882581222

00:03:04.766 --> 00:03:06.772 experimental psychology in 1943.

NOTE Confidence: 0.882581222

00:03:06.772 --> 00:03:11.110 In 1944, Dr Flynn went to work at Harvard,

NOTE Confidence: 0.882581222

00:03:11.110 --> 00:03:13.366 where he did war work related

NOTE Confidence: 0.882581222

00:03:13.366 --> 00:03:14.870 to aviation and audition,

NOTE Confidence: 0.882581222

00:03:14.870 --> 00:03:17.732 and in late 1945 he married

NOTE Confidence: 0.882581222

00:03:17.732 --> 00:03:19.640 a holder Isma Garvey,

NOTE Confidence: 0.882581222

00:03:19.640 --> 00:03:22.195 and she was someone who I met

NOTE Confidence: 0.882581222

00:03:22.195 --> 00:03:23.290 when I first

NOTE Confidence: 0.872659905

00:03:23.379 --> 00:03:24.767 came to to Yale,

NOTE Confidence: 0.872659905

00:03:24.770 --> 00:03:26.996 and she would come with Sarah.

NOTE Confidence: 0.872659905

00:03:27.000 --> 00:03:29.916 To listen to the lecture and she was also

NOTE Confidence: 0.872659905

00:03:29.916 --> 00:03:33.039 an incredible and remarkable individual.

NOTE Confidence: 0.872659905

00:03:33.040 --> 00:03:36.143 She was a psychologist and in 1946

NOTE Confidence: 0.872659905

00:03:36.143 --> 00:03:38.887 and she was here actually as a member

NOTE Confidence: 0.872659905

00:03:38.887 --> 00:03:41.520 of the Department of Psychiatry,

NOTE Confidence: 0.872659905

00:03:41.520 --> 00:03:44.642 first appointed in 1962 as a research

NOTE Confidence: 0.872659905

00:03:44.642 --> 00:03:47.200 assistant and then serving on the

NOTE Confidence: 0.872659905

00:03:47.200 --> 00:03:49.310 planning project for the Connecticut

NOTE Confidence: 0.872659905

00:03:49.386 --> 00:03:51.706 Mental Health Center and finally.

NOTE Confidence: 0.872659905

00:03:51.710 --> 00:03:54.830 Working closely with Doctor Boris Astrachan,

NOTE Confidence: 0.872659905

00:03:54.830 --> 00:03:58.190 who was instrumental in founding the

NOTE Confidence: 0.872659905

00:03:58.190 --> 00:03:59.965 the Connecticut Mental Health Center,

NOTE Confidence: 0.872659905

00:03:59.970 --> 00:04:02.497 she she retired as a valued member

NOTE Confidence: 0.872659905

00:04:02.497 --> 00:04:04.759 of the medical school faculty.

NOTE Confidence: 0.872659905

00:04:04.760 --> 00:04:08.304 So in 1946,

NOTE Confidence: 0.872659905

00:04:08.304 --> 00:04:09.924 Doctor Flynn was appointed head

NOTE Confidence: 0.872659905

00:04:09.924 --> 00:04:11.676 of the psychology and Statistics

NOTE Confidence: 0.872659905

00:04:11.676 --> 00:04:13.656 Division at the Naval Medical

NOTE Confidence: 0.872659905

00:04:13.656 --> 00:04:15.240 Research Institute in Bethesda,

NOTE Confidence: 0.872659905

00:04:15.240 --> 00:04:17.988 and there he began his work

NOTE Confidence: 0.872659905

00:04:17.988 --> 00:04:19.362 in physiological psychology.

NOTE Confidence: 0.872659905

00:04:19.370 --> 00:04:22.065 And here's where the story gets even

NOTE Confidence: 0.872659905

00:04:22.065 --> 00:04:23.763 more interesting despite excellent

NOTE Confidence: 0.872659905

00:04:23.763 --> 00:04:25.659 performance reviews and general

NOTE Confidence: 0.872659905

00:04:25.659 --> 00:04:28.029 acclaim by his fellow scientists.

NOTE Confidence: 0.872659905

00:04:28.030 --> 00:04:30.812 Doctor Flynn was fired in 1953,

NOTE Confidence: 0.872659905

00:04:30.812 --> 00:04:33.136 and he was deemed a risk to

NOTE Confidence: 0.872659905

00:04:33.136 --> 00:04:34.780 national security for his quote.

NOTE Confidence: 0.872659905

00:04:34.780 --> 00:04:36.880 Close and continuing association

NOTE Confidence: 0.872659905

00:04:36.880 --> 00:04:39.505 End Quote with his wife,

NOTE Confidence: 0.872659905

00:04:39.510 --> 00:04:41.934 whose name had been named before the house.

NOTE Confidence: 0.872659905

00:04:41.940 --> 00:04:44.394 A committee on UN American activities

NOTE Confidence: 0.872659905

00:04:44.394 --> 00:04:46.670 during the McCarthy ERA era.

NOTE Confidence: 0.872659905

00:04:46.670 --> 00:04:50.510 Because an error is a correct

NOTE Confidence: 0.872659905

00:04:50.510 --> 00:04:54.158 Freudian slip because of of whole,

NOTE Confidence: 0.872659905

00:04:54.160 --> 00:04:57.040 this political activities in the 1930s

NOTE Confidence: 0.872659905

00:04:57.040 --> 00:04:59.836 and early 40s and doctor Flynn was

NOTE Confidence: 0.872659905

00:04:59.836 --> 00:05:02.540 offered the chance to keep his job if

NOTE Confidence: 0.872659905

00:05:02.540 --> 00:05:05.970 he divorced and he of course declined.

NOTE Confidence: 0.872659905

00:05:05.970 --> 00:05:07.888 Over the next six months or so,

NOTE Confidence: 0.872659905

00:05:07.890 --> 00:05:10.158 he received offers of employment from

NOTE Confidence: 0.872659905

00:05:10.158 --> 00:05:12.452 colleagues across the country at 13

NOTE Confidence: 0.872659905

00:05:12.452 --> 00:05:14.550 universities, and he told his daughter,

NOTE Confidence: 0.872659905

00:05:14.550 --> 00:05:15.434 Sarah Flynn,

NOTE Confidence: 0.872659905

00:05:15.434 --> 00:05:18.086 that each time his name reached

NOTE Confidence: 0.872659905

00:05:18.086 --> 00:05:19.416 the provost's office,

NOTE Confidence: 0.872659905

00:05:19.416 --> 00:05:21.631 the colleague was informed that

NOTE Confidence: 0.872659905

00:05:21.631 --> 00:05:23.789 the university could not hire Dr.

NOTE Confidence: 0.872659905

00:05:23.790 --> 00:05:27.210 Flynn, and in September 1954,

NOTE Confidence: 0.872659905

00:05:27.210 --> 00:05:29.526 Yale hired him to work with

NOTE Confidence: 0.872659905

00:05:29.526 --> 00:05:30.684 Doctor Paul McLean,

NOTE Confidence: 0.872659905

00:05:30.690 --> 00:05:32.718 who then held a joint appointment

NOTE Confidence: 0.872659905

00:05:32.718 --> 00:05:34.434 in Physiology and Psychiatry and

NOTE Confidence: 0.872659905

00:05:34.434 --> 00:05:36.258 who was studying the limbic system.

NOTE Confidence: 0.872659905

00:05:36.260 --> 00:05:40.201 So yell was able to benefit from

NOTE Confidence: 0.872659905

00:05:40.201 --> 00:05:42.612 his neuroscience area addition

NOTE Confidence: 0.872659905

00:05:42.612 --> 00:05:46.278 in the face of strong headwinds.

NOTE Confidence: 0.872659905

00:05:46.280 --> 00:05:51.800 Come upon a learning of so.

NOTE Confidence: 0.872659905

00:05:51.800 --> 00:05:53.684 Doctor Flynn then became a member

NOTE Confidence: 0.872659905

00:05:53.684 --> 00:05:55.922 of this of the department and

NOTE Confidence: 0.872659905

00:05:55.922 --> 00:06:00.202 worked until he retired in 79 on the

NOTE Confidence: 0.872659905

00:06:00.202 --> 00:06:02.500 physiological basis of aggression

NOTE Confidence: 0.872659905

00:06:02.500 --> 00:06:06.868 and he really made a a an incredible

NOTE Confidence: 0.872659905

00:06:06.868 --> 00:06:09.420 mark on the department,

NOTE Confidence: 0.872659905

00:06:09.420 --> 00:06:11.028 and upon learning of his death,

NOTE Confidence: 0.872659905

00:06:11.030 --> 00:06:11.560 Fritz Redlich,

NOTE Confidence: 0.872659905

00:06:11.560 --> 00:06:13.415 whose chair of the Department of Psychiatry,

NOTE Confidence: 0.872659905

00:06:13.420 --> 00:06:15.400 wrote to holder Flynn at John

NOTE Confidence: 0.872659905

00:06:15.400 --> 00:06:17.778 was all I ever wanted to be.

NOTE Confidence: 0.872659905

00:06:17.780 --> 00:06:19.690 A fine scientist and teacher,

NOTE Confidence: 0.872659905

00:06:19.690 --> 00:06:21.062 and most of all,

NOTE Confidence: 0.872659905

00:06:21.062 --> 00:06:22.434 an extraordinary human being.

NOTE Confidence: 0.872659905

00:06:22.440 --> 00:06:24.080 I've always admired his courage

NOTE Confidence: 0.872659905

00:06:24.080 --> 00:06:25.844 and integrity, two virtues,

NOTE Confidence: 0.872659905

00:06:25.844 --> 00:06:28.604 high value above anything else,

NOTE Confidence: 0.872659905

00:06:28.610 --> 00:06:29.926 and similar sentiments were

NOTE Confidence: 0.872659905

00:06:29.926 --> 00:06:31.571 expressed by other colleagues both

NOTE Confidence: 0.872659905

00:06:31.571 --> 00:06:33.280 at Yale and around the world.

NOTE Confidence: 0.872659905

00:06:33.280 --> 00:06:36.367 And the last thing I want to say before

NOTE Confidence: 0.872659905

00:06:36.367 --> 00:06:39.716 I I move on is also about Sarah Flint.

NOTE Confidence: 0.872659905

00:06:39.716 --> 00:06:42.206 Generate generosity to the department.

NOTE Confidence: 0.872659905

00:06:42.210 --> 00:06:44.818 So in April 2005,

NOTE Confidence: 0.872659905

00:06:44.818 --> 00:06:46.774 Sarah donated Dr.

NOTE Confidence: 0.872659905

00:06:46.780 --> 00:06:48.464 Flynn's most prized possession,

NOTE Confidence: 0.872659905

00:06:48.464 --> 00:06:50.990 the three volume set of romantica

NOTE Confidence: 0.872659905

00:06:51.054 --> 00:06:52.218 halls fixed Judah,

NOTE Confidence: 0.872659905

00:06:52.220 --> 00:06:54.278 their system and nervioso de Lumbre.

NOTE Confidence: 0.872659905

00:06:54.280 --> 00:06:55.915 Elizabeth brought us.

NOTE Confidence: 0.872659905

00:06:55.915 --> 00:06:58.892 In the original Spanish to the

NOTE Confidence: 0.872659905

00:06:58.892 --> 00:07:00.476 Yale Medical Historical Library

NOTE Confidence: 0.872659905

00:07:00.476 --> 00:07:02.060 and inside the first

NOTE Confidence: 0.888918560555556

00:07:02.133 --> 00:07:03.978 volume is an inscription written

NOTE Confidence: 0.888918560555556

00:07:03.978 --> 00:07:07.794 by Cahal in 1910, which reads in

NOTE Confidence: 0.888918560555556

00:07:07.794 --> 00:07:09.874 translation because of the brain.

NOTE Confidence: 0.888918560555556

00:07:09.874 --> 00:07:11.980 Man is the king of Creation,

NOTE Confidence: 0.888918560555556

00:07:11.980 --> 00:07:13.842 and to clarify the structure of the

NOTE Confidence: 0.888918560555556

00:07:13.842 --> 00:07:15.782 brain is to understand why that figure

NOTE Confidence: 0.888918560555556

00:07:15.782 --> 00:07:18.248 is at the head of the animal Kingdom

NOTE Confidence: 0.888918560555556

00:07:18.248 --> 00:07:20.188 and how civilization was created.

NOTE Confidence: 0.888918560555556

00:07:20.190 --> 00:07:21.575 A sign of human superiority

NOTE Confidence: 0.888918560555556

00:07:21.575 --> 00:07:23.450 to the rest of the beings.

NOTE Confidence: 0.888918560555556

00:07:23.450 --> 00:07:25.040 This may not actually translate

NOTE Confidence: 0.888918560555556

00:07:25.040 --> 00:07:26.630 so well to the current.

NOTE Confidence: 0.888918560555556

00:07:26.630 --> 00:07:28.686 Sarah, my original idea was that I would

NOTE Confidence: 0.888918560555556

00:07:28.686 --> 00:07:30.782 not be able to take a sure step in

NOTE Confidence: 0.888918560555556

00:07:30.782 --> 00:07:32.582 the study of Physiology and pathology

NOTE Confidence: 0.888918560555556

00:07:32.582 --> 00:07:34.748 of the nervous system without knowing

NOTE Confidence: 0.888918560555556

00:07:34.748 --> 00:07:36.666 the cerebral machine with precision,

NOTE Confidence: 0.888918560555556

00:07:36.666 --> 00:07:39.399 and that the mysteries of the science

NOTE Confidence: 0.888918560555556

00:07:39.399 --> 00:07:41.723 of the spirit will only be clarified

NOTE Confidence: 0.888918560555556

00:07:41.723 --> 00:07:43.991 when all the unknowns relative to

NOTE Confidence: 0.888918560555556

00:07:43.991 --> 00:07:46.289 the chemistry of the fine structures

NOTE Confidence: 0.888918560555556

00:07:46.290 --> 00:07:48.565 of the nerve cell are cleared up.

NOTE Confidence: 0.888918560555556

00:07:48.570 --> 00:07:49.690 And luckily, of course,

NOTE Confidence: 0.888918560555556

00:07:49.690 --> 00:07:51.090 we're completely done with that,

NOTE Confidence: 0.888918560555556

00:07:51.090 --> 00:07:54.261 and Doctor Janik will will give the

NOTE Confidence: 0.888918560555556

00:07:54.261 --> 00:07:57.669 the the heading to that to that quote.

NOTE Confidence: 0.888918560555556

00:07:57.670 --> 00:07:59.850 And just to finish up,

NOTE Confidence: 0.888918560555556

00:07:59.850 --> 00:08:01.998 Doctor Flynn always took delight in

NOTE Confidence: 0.888918560555556

00:08:01.998 --> 00:08:04.128 telling the story that he acquired

NOTE Confidence: 0.888918560555556

00:08:04.128 --> 00:08:06.648 these books for $10 at a used bookstore

NOTE Confidence: 0.888918560555556

00:08:06.713 --> 00:08:11.070 in New York sometime during the 1940s.

NOTE Confidence: 0.888918560555556

00:08:11.070 --> 00:08:16.006 So I I will finish there and I I hope

NOTE Confidence: 0.888918560555556

00:08:16.006 --> 00:08:20.340 that you will now join me in welcoming.

NOTE Confidence: 0.888918560555556

00:08:20.340 --> 00:08:21.570 Sorry I will get through.

NOTE Confidence: 0.888918560555556

00:08:21.570 --> 00:08:26.338 These are 2021 lecturer in the

NOTE Confidence: 0.888918560555556

00:08:26.338 --> 00:08:27.946 Flynn Memorial Lecture series,

NOTE Confidence: 0.888918560555556

00:08:27.950 --> 00:08:32.766 Doctor Patricia Janik and so Dr Janik

NOTE Confidence: 0.888918560555556

00:08:32.770 --> 00:08:34.820 is the A Bloomberg distinguished

NOTE Confidence: 0.888918560555556

00:08:34.820 --> 00:08:36.870 professor at Johns Hopkins University

NOTE Confidence: 0.888918560555556

00:08:36.936 --> 00:08:39.046 with appointments in the Department

NOTE Confidence: 0.888918560555556

00:08:39.046 --> 00:08:41.156 of Psychological and Brain Sciences.

NOTE Confidence: 0.888918560555556

00:08:41.160 --> 00:08:43.170 And the Krieger School of Arts

NOTE Confidence: 0.888918560555556

00:08:43.170 --> 00:08:44.989 and Sciences and the Department

NOTE Confidence: 0.888918560555556

00:08:44.989 --> 00:08:47.467 of Neuroscience in the School of

NOTE Confidence: 0.888918560555556

00:08:47.467 --> 00:08:49.700 Medicine and Doctor Janik Studies.

NOTE Confidence: 0.888918560555556

00:08:49.700 --> 00:08:51.680 Neural processes of reward learning.

NOTE Confidence: 0.888918560555556

00:08:51.680 --> 00:08:53.744 And you'll hear a lot about that today.

NOTE Confidence: 0.888918560555556

00:08:53.750 --> 00:08:55.830 She's especially interested in learning

NOTE Confidence: 0.888918560555556

00:08:55.830 --> 00:08:57.078 mechanisms underlying addiction,

NOTE Confidence: 0.888918560555556

00:08:57.080 --> 00:09:00.754 which is an area where this department

NOTE Confidence: 0.888918560555556

00:09:00.754 --> 00:09:03.664 certainly has extremely strong interest.

NOTE Confidence: 0.888918560555556

00:09:03.670 --> 00:09:04.670 She earned her pH.

NOTE Confidence: 0.888918560555556

00:09:04.670 --> 00:09:04.920 D.

NOTE Confidence: 0.888918560555556

00:09:04.920 --> 00:09:06.190 From the University of California,

NOTE Confidence: 0.888918560555556

00:09:06.190 --> 00:09:06.550 Berkeley,

NOTE Confidence: 0.888918560555556

00:09:06.550 --> 00:09:08.710 and then she conducted postdoctoral research

NOTE Confidence: 0.888918560555556

00:09:08.710 --> 00:09:11.416 at Wake Forest and at the National Institute.

NOTE Confidence: 0.888918560555556

00:09:11.420 --> 00:09:15.462 And drug abuse and come in from 1999 to 2014,

NOTE Confidence: 0.888918560555556

00:09:15.462 --> 00:09:17.520 which is the period when I first

NOTE Confidence: 0.888918560555556

00:09:17.591 --> 00:09:18.679 came to know her.

NOTE Confidence: 0.888918560555556

00:09:18.680 --> 00:09:20.510 She was faculty at the University

NOTE Confidence: 0.888918560555556

00:09:20.510 --> 00:09:22.360 of California at San Francisco,

NOTE Confidence: 0.888918560555556

00:09:22.360 --> 00:09:24.719 where she was the Howard J Weinberger,

NOTE Confidence: 0.888918560555556

00:09:24.720 --> 00:09:27.395 MD endowed Chair and addiction

NOTE Confidence: 0.888918560555556

00:09:27.395 --> 00:09:28.806 research at UCSF.

NOTE Confidence: 0.888918560555556

00:09:28.806 --> 00:09:30.996 She's a pioneer in the

NOTE Confidence: 0.888918560555556

00:09:30.996 --> 00:09:33.100 identification of neural circuits,

NOTE Confidence: 0.888918560555556

00:09:33.100 --> 00:09:35.180 underlying alcohol and drug seeking,

NOTE Confidence: 0.888918560555556

00:09:35.180 --> 00:09:37.682 and her work is really spanned

NOTE Confidence: 0.888918560555556

00:09:37.682 --> 00:09:39.967 levels of investigation from the

NOTE Confidence: 0.888918560555556

00:09:39.967 --> 00:09:42.119 molecular and synaptic plasticity.

NOTE Confidence: 0.888918560555556

00:09:42.120 --> 00:09:43.807 All the way to in vivo mechanisms

NOTE Confidence: 0.888918560555556

00:09:43.807 --> 00:09:45.456 that are relevant to complex models

NOTE Confidence: 0.888918560555556

00:09:45.456 --> 00:09:46.906 that are relevant to addiction,

NOTE Confidence: 0.888918560555556

00:09:46.910 --> 00:09:49.400 and this includes alcohol and

NOTE Confidence: 0.888918560555556

00:09:49.400 --> 00:09:50.894 drug seeking relapse,

NOTE Confidence: 0.888918560555556

00:09:50.900 --> 00:09:51.848 habit learning,

NOTE Confidence: 0.888918560555556

00:09:51.848 --> 00:09:52.796 extinction learning,

NOTE Confidence: 0.888918560555556

00:09:52.796 --> 00:09:54.218 and she's used.

NOTE Confidence: 0.888918560555556

00:09:54.220 --> 00:09:55.759 Everything from electrophysiological

NOTE Confidence: 0.888918560555556

00:09:55.759 --> 00:09:57.298 approaches to neuronal

NOTE Confidence: 0.888918560555556

00:09:57.298 --> 00:09:58.837 imaging and optogenetics,

NOTE Confidence: 0.888918560555556

00:09:58.840 --> 00:10:00.716 which I'm sure you'll hear about today,

NOTE Confidence: 0.888918560555556

00:10:00.720 --> 00:10:02.388 and if you're looking for a

NOTE Confidence: 0.888918560555556

00:10:02.388 --> 00:10:03.953 resource to understand the neural

NOTE Confidence: 0.888918560555556

00:10:03.953 --> 00:10:05.557 circuitry relevant to addiction,

NOTE Confidence: 0.888918560555556

00:10:05.560 --> 00:10:07.898 you need to read her 2021 review

NOTE Confidence: 0.888918560555556

00:10:07.898 --> 00:10:09.414 on consolidating the circuit

NOTE Confidence: 0.888918560555556

00:10:09.414 --> 00:10:11.384 model for addiction that she

NOTE Confidence: 0.888918560555556

00:10:11.384 --> 00:10:12.968 wrote with Christian luescher.

NOTE Confidence: 0.888918560555556

00:10:12.970 --> 00:10:15.388 And that appears in the annual

NOTE Confidence: 0.888918560555556

00:10:15.388 --> 00:10:16.597 review of neuroscience.

NOTE Confidence: 0.879787118571429

00:10:16.600 --> 00:10:18.472 And I first met Doctor Genich through her

NOTE Confidence: 0.879787118571429

00:10:18.472 --> 00:10:20.347 roles at the Society for Neuroscience.

NOTE Confidence: 0.879787118571429

00:10:20.350 --> 00:10:22.156 She's she's done a lot for the

NOTE Confidence: 0.879787118571429

00:10:22.156 --> 00:10:23.997 society she served as reviewing editor

NOTE Confidence: 0.879787118571429

00:10:23.997 --> 00:10:25.677 at the Journal of Neuroscience.

NOTE Confidence: 0.879787118571429

00:10:25.680 --> 00:10:27.654 She's been chair of the program committee,

NOTE Confidence: 0.879787118571429

00:10:27.660 --> 00:10:30.242 probably for way too long, given kovid,

NOTE Confidence: 0.879787118571429

00:10:30.242 --> 00:10:34.099 and she's incoming secretary of the society.

NOTE Confidence: 0.879787118571429

00:10:34.100 --> 00:10:36.753 She's also served on the Program Committee

NOTE Confidence: 0.879787118571429

00:10:36.753 --> 00:10:39.439 for the Research Society and Alcoholism,

NOTE Confidence: 0.879787118571429

00:10:39.440 --> 00:10:41.729 and She's been Co Chair and Chair

NOTE Confidence: 0.879787118571429

00:10:41.729 --> 00:10:43.609 of the Catecholamines and the

NOTE Confidence: 0.879787118571429

00:10:43.609 --> 00:10:44.860 Alcohol Gordon Conferences,

NOTE Confidence: 0.879787118571429

00:10:44.860 --> 00:10:46.516 so you can see that the

NOTE Confidence: 0.879787118571429

00:10:46.516 --> 00:10:47.620 influence of her work.

NOTE Confidence: 0.879787118571429

00:10:47.620 --> 00:10:50.875 In the field is extremely broad and

NOTE Confidence: 0.879787118571429

00:10:50.875 --> 00:10:52.915 I just want to close by saying that

NOTE Confidence: 0.879787118571429

00:10:52.915 --> 00:10:54.957 Doctor Janik is much more than her CV.

NOTE Confidence: 0.879787118571429

00:10:54.960 --> 00:10:57.088 She's been a mentor to leaders in the

NOTE Confidence: 0.879787118571429

00:10:57.088 --> 00:10:59.129 field who study the neurobiology of

NOTE Confidence: 0.879787118571429

00:10:59.129 --> 00:11:00.939 addiction and other behaviors that

NOTE Confidence: 0.879787118571429

00:11:00.939 --> 00:11:03.178 are relevant to psychiatric illness.

NOTE Confidence: 0.879787118571429

00:11:03.180 --> 00:11:05.596 When my own lab was trying to figure

NOTE Confidence: 0.879787118571429

00:11:05.596 --> 00:11:07.529 out issues related to experimental

NOTE Confidence: 0.879787118571429

00:11:07.529 --> 00:11:10.055 design for in vivo calcium imaging,

NOTE Confidence: 0.879787118571429

00:11:10.060 --> 00:11:12.006 Katie told me that the most important

NOTE Confidence: 0.879787118571429

00:11:12.006 --> 00:11:14.204 thing she ever learned in her scientific

NOTE Confidence: 0.879787118571429

00:11:14.204 --> 00:11:15.839 career was from Doctor Janik.

NOTE Confidence: 0.879787118571429

00:11:15.840 --> 00:11:17.660 And that is how to start with.

NOTE Confidence: 0.879787118571429

00:11:17.660 --> 00:11:19.410 Robust experimental design that gives

NOTE Confidence: 0.879787118571429

00:11:19.410 --> 00:11:21.590 you the adequate power to that's

NOTE Confidence: 0.879787118571429

00:11:21.590 --> 00:11:23.828 essential to get robust Physiology data,

NOTE Confidence: 0.879787118571429

00:11:23.830 --> 00:11:25.240 and we've certainly taken this

NOTE Confidence: 0.879787118571429

00:11:25.240 --> 00:11:26.368 to heart as well.

NOTE Confidence: 0.879787118571429

00:11:26.370 --> 00:11:28.380 So as you can tell,

NOTE Confidence: 0.879787118571429

00:11:28.380 --> 00:11:31.004 Dr Janik is a role model for many

NOTE Confidence: 0.879787118571429

00:11:31.004 --> 00:11:34.346 and she is the ideal person to give

NOTE Confidence: 0.879787118571429

00:11:34.346 --> 00:11:36.960 the Flynn Memorial lecture this year.

NOTE Confidence: 0.879787118571429

00:11:36.960 --> 00:11:39.040 So please let's welcome Dr.

NOTE Confidence: 0.879787118571429

00:11:39.040 --> 00:11:41.673 Janik and I will stop sharing and

NOTE Confidence: 0.879787118571429

00:11:41.673 --> 00:11:44.330 allow her to share her data with you.

NOTE Confidence: 0.970280178333333

00:11:46.830 --> 00:11:48.666 Thank you so much for that.

NOTE Confidence: 0.970280178333333

00:11:48.670 --> 00:11:52.030 It was such an an amazing introduction

NOTE Confidence: 0.970280178333333

00:11:52.030 --> 00:11:55.738 and I really enjoyed learning about.

NOTE Confidence: 0.970280178333333

00:11:55.740 --> 00:11:57.770 Now, Doctor Flynn and can

NOTE Confidence: 0.970280178333333

00:11:57.770 --> 00:12:00.080 you see my screen? Yes.

NOTE Confidence: 0.902419785

00:12:01.550 --> 00:12:02.298 I have to say

NOTE Confidence: 0.87350712375

00:12:02.310 --> 00:12:04.340 what it, what a deep honor it is to be

NOTE Confidence: 0.87350712375

00:12:04.403 --> 00:12:06.545 invited to give this particular lecture.

NOTE Confidence: 0.87350712375

00:12:06.550 --> 00:12:08.734 I it was such an interesting history

NOTE Confidence: 0.87350712375

00:12:08.734 --> 00:12:11.169 and I really hope that you find that

NOTE Confidence: 0.87350712375

00:12:11.169 --> 00:12:13.533 the kind of work that I talk about

NOTE Confidence: 0.87350712375

00:12:13.533 --> 00:12:15.110 today resonates with the kinds of

NOTE Confidence: 0.87350712375

00:12:15.110 --> 00:12:16.590 things that he was interested in,

NOTE Confidence: 0.87350712375

00:12:16.590 --> 00:12:19.330 so that you can see that it's a good fit.

NOTE Confidence: 0.87350712375

00:12:19.330 --> 00:12:21.358 And I I want to thank you, Marina for

NOTE Confidence: 0.87350712375

00:12:21.358 --> 00:12:23.228 the invitation and this opportunity.

NOTE Confidence: 0.87350712375

00:12:23.230 --> 00:12:26.534 And thank you for such an A.

NOTE Confidence: 0.87350712375

00:12:26.540 --> 00:12:28.880 Humbling introduction that that was really,

NOTE Confidence: 0.87350712375

00:12:28.880 --> 00:12:30.973 really so nice and I'll try my

NOTE Confidence: 0.87350712375

00:12:30.973 --> 00:12:33.301 best to live up to everything that

NOTE Confidence: 0.87350712375

00:12:33.301 --> 00:12:35.341 has been said in this talk.

NOTE Confidence: 0.87350712375

00:12:35.350 --> 00:12:38.497 So, uh, welcome to everybody and I'm

NOTE Confidence: 0.87350712375

00:12:38.497 --> 00:12:41.193 sorry I'm not meeting you today in person,

NOTE Confidence: 0.87350712375

00:12:41.200 --> 00:12:43.153 but I'm so happy to talk to you even

NOTE Confidence: 0.87350712375

00:12:43.153 --> 00:12:44.963 though we're over zoom and if any

NOTE Confidence: 0.87350712375

00:12:44.963 --> 00:12:46.500 questions come up during the talk.

NOTE Confidence: 0.87350712375

00:12:46.500 --> 00:12:49.218 I'm sure people will help me to try to

NOTE Confidence: 0.87350712375

00:12:49.218 --> 00:12:51.408 answer those since I don't think I'll

NOTE Confidence: 0.87350712375

00:12:51.408 --> 00:12:53.967 be able to see the chat very well.

NOTE Confidence: 0.87350712375

00:12:53.970 --> 00:12:56.994 OK, so I'd like to tell you about

NOTE Confidence: 0.87350712375

00:12:56.994 --> 00:12:58.290 our experiments today.

NOTE Confidence: 0.87350712375

00:12:58.290 --> 00:13:00.162 Looking at reward processing

NOTE Confidence: 0.87350712375

00:13:00.162 --> 00:13:02.034 in the nervous system,

NOTE Confidence: 0.87350712375

00:13:02.040 --> 00:13:04.108 specifically focusing on the

NOTE Confidence: 0.87350712375

00:13:04.108 --> 00:13:06.693 area called the ventral pallidum,

NOTE Confidence: 0.87350712375

00:13:06.700 --> 00:13:08.476 and I want to first tell you a

NOTE Confidence: 0.87350712375

00:13:08.476 --> 00:13:10.069 little bit about the motivation

NOTE Confidence: 0.87350712375

00:13:10.070 --> 00:13:13.014 for us in our lab in looking at

NOTE Confidence: 0.87350712375

00:13:13.014 --> 00:13:15.584 reward seeking behavior models and

NOTE Confidence: 0.87350712375

00:13:15.584 --> 00:13:18.270 the underlying neural circuitry and

NOTE Confidence: 0.87350712375

00:13:18.270 --> 00:13:20.370 what we are interested in broadly,

NOTE Confidence: 0.87350712375

00:13:20.370 --> 00:13:22.530 is what the processes are.

NOTE Confidence: 0.87350712375

00:13:22.530 --> 00:13:25.020 The determined reward seeking behavior.

NOTE Confidence: 0.87350712375

00:13:25.020 --> 00:13:27.337 Whether that reward is a food reward,

NOTE Confidence: 0.87350712375

00:13:27.340 --> 00:13:29.330 something that our nervous system

NOTE Confidence: 0.87350712375

00:13:29.330 --> 00:13:32.109 evolved to help us discover and ingest,

NOTE Confidence: 0.87350712375

00:13:32.110 --> 00:13:33.598 or whether it's a drug reward,

NOTE Confidence: 0.87350712375

00:13:33.600 --> 00:13:35.220 something that it's very important

NOTE Confidence: 0.87350712375

00:13:35.220 --> 00:13:37.325 for us to understand as we think

NOTE Confidence: 0.87350712375

00:13:37.325 --> 00:13:39.349 about how we can help individuals

NOTE Confidence: 0.87350712375

00:13:39.349 --> 00:13:41.377 with substance use disorders,

NOTE Confidence: 0.87350712375

00:13:41.380 --> 00:13:43.480 and we conceive of these processes

NOTE Confidence: 0.87350712375

00:13:43.480 --> 00:13:45.660 through the lens of psychology.

NOTE Confidence: 0.87350712375

00:13:45.660 --> 00:13:48.576 And there really are three interrelated

NOTE Confidence: 0.87350712375

00:13:48.576 --> 00:13:50.034 psychological processes that

NOTE Confidence: 0.87350712375

00:13:50.034 --> 00:13:52.018 determine at any one moment whether

NOTE Confidence: 0.87350712375

00:13:52.018 --> 00:13:54.329 an agent will seek a given reward.

NOTE Confidence: 0.87350712375

00:13:54.330 --> 00:13:55.380 And so first you have the.

NOTE Confidence: 0.87350712375

00:13:55.380 --> 00:13:56.496 Real time decision.

NOTE Confidence: 0.87350712375

00:13:56.496 --> 00:13:58.728 Will you decide to reach out

NOTE Confidence: 0.87350712375

00:13:58.728 --> 00:14:01.150 your arm and grab that hamburger?

NOTE Confidence: 0.87350712375

00:14:01.150 --> 00:14:03.110 Will the attic decide to call up

NOTE Confidence: 0.87350712375

00:14:03.110 --> 00:14:05.255 the dealer to try to get that next

NOTE Confidence: 0.87350712375

00:14:05.255 --> 00:14:07.466 fix so you have your real time

NOTE Confidence: 0.87350712375

00:14:07.466 --> 00:14:09.266 decision that's impacted critically

NOTE Confidence: 0.87350712375

00:14:09.266 --> 00:14:11.515 by your current motivational state?

NOTE Confidence: 0.87350712375

00:14:11.515 --> 00:14:12.850 Whether you're hungry,

NOTE Confidence: 0.87350712375

00:14:12.850 --> 00:14:14.185 whether you're thirsty,

NOTE Confidence: 0.87350712375

00:14:14.190 --> 00:14:16.010 whether you are a person with an

NOTE Confidence: 0.87350712375

00:14:16.010 --> 00:14:17.949 abuse disorder, whose craving drug,

NOTE Confidence: 0.87350712375

00:14:17.949 --> 00:14:20.787 your decision is is necessarily filtered

NOTE Confidence: 0.87350712375

00:14:20.787 --> 00:14:22.998 through your motivational state.

NOTE Confidence: 0.87350712375

00:14:23.000 --> 00:14:25.562 And both of these critically depend

NOTE Confidence: 0.87350712375

00:14:25.562 --> 00:14:28.030 on past experience or learning.

NOTE Confidence: 0.87350712375

00:14:28.030 --> 00:14:30.508 So your past evaluation of the

NOTE Confidence: 0.87350712375

00:14:30.508 --> 00:14:32.812 subjective effects of the rewards

NOTE Confidence: 0.87350712375

00:14:32.812 --> 00:14:35.290 that you've experienced and you're

NOTE Confidence: 0.87350712375

00:14:35.290 --> 00:14:37.190 learning about the conditions under

NOTE Confidence: 0.87350712375

00:14:37.190 --> 00:14:39.365 which you obtain those rewards is

NOTE Confidence: 0.87350712375

00:14:39.365 --> 00:14:41.297 critical for you in the future.

NOTE Confidence: 0.87350712375

00:14:41.300 --> 00:14:42.930 When you're making that decision

NOTE Confidence: 0.87350712375

00:14:42.930 --> 00:14:45.448 to get that reward so you know the

NOTE Confidence: 0.87350712375

00:14:45.448 --> 00:14:47.098 actions to take or not take,

NOTE Confidence: 0.87350712375

00:14:47.100 --> 00:14:48.966 and you understand the meaning of

NOTE Confidence: 0.87350712375

00:14:48.966 --> 00:14:50.990 the stimuli in the environment.

NOTE Confidence: 0.87350712375

00:14:50.990 --> 00:14:53.118 So we have these three interacting processes.

NOTE Confidence: 0.87350712375

00:14:53.120 --> 00:14:54.944 And we're interested in the neural

NOTE Confidence: 0.87350712375

00:14:54.944 --> 00:14:56.160 circuits that underlie them,

NOTE Confidence: 0.87350712375

00:14:56.160 --> 00:14:58.800 so we can understand decision

NOTE Confidence: 0.87350712375

00:14:58.800 --> 00:15:00.912 making both in normal

NOTE Confidence: 0.924246884666667

00:15:00.920 --> 00:15:03.026 conditions like feeding and also our

NOTE Confidence: 0.924246884666667

00:15:03.026 --> 00:15:05.808 end goal is to better understand this

NOTE Confidence: 0.924246884666667

00:15:05.808 --> 00:15:08.846 circuit so we can help explain decisions

NOTE Confidence: 0.924246884666667

00:15:08.920 --> 00:15:11.720 made by people who have substance use

NOTE Confidence: 0.924246884666667

00:15:11.720 --> 00:15:13.848 disorders or alcohol use disorders,

NOTE Confidence: 0.924246884666667

00:15:13.848 --> 00:15:16.168 because these same processes of

NOTE Confidence: 0.924246884666667

00:15:16.168 --> 00:15:18.789 course are occurring when one makes

NOTE Confidence: 0.924246884666667

00:15:18.789 --> 00:15:21.099 the decision to continue taking it.

NOTE Confidence: 0.924246884666667

00:15:21.100 --> 00:15:23.347 Drink for example, or to take another.

NOTE Confidence: 0.924246884666667

00:15:23.350 --> 00:15:25.810 Hit of that drug.

NOTE Confidence: 0.924246884666667

00:15:25.810 --> 00:15:29.149 So through many, many decades of work

NOTE Confidence: 0.924246884666667

00:15:29.149 --> 00:15:32.740 in a nonhuman animals and in humans.

NOTE Confidence: 0.924246884666667

00:15:32.740 --> 00:15:35.570 We've discovered as a field.

NOTE Confidence: 0.924246884666667

00:15:35.570 --> 00:15:37.600 A group of interconnected circuits

NOTE Confidence: 0.924246884666667

00:15:37.600 --> 00:15:40.084 that are called the canonical reward

NOTE Confidence: 0.924246884666667

00:15:40.084 --> 00:15:42.039 seeking circuit and of course.

NOTE Confidence: 0.924246884666667

00:15:42.040 --> 00:15:45.071 This circuit as many of you know

NOTE Confidence: 0.924246884666667

00:15:45.071 --> 00:15:47.270 overlaps extensively with the with the

NOTE Confidence: 0.924246884666667

00:15:47.270 --> 00:15:49.070 limbic system so something that doctor,

NOTE Confidence: 0.924246884666667

00:15:49.070 --> 00:15:51.254 Flynn would have been very well acquainted

NOTE Confidence: 0.924246884666667

00:15:51.254 --> 00:15:53.689 with and a circuit with in which he

NOTE Confidence: 0.924246884666667

00:15:53.689 --> 00:15:55.946 would have spent much of his time.

NOTE Confidence: 0.924246884666667

00:15:55.946 --> 00:15:58.250 In his research efforts.

NOTE Confidence: 0.924246884666667

00:15:58.250 --> 00:16:00.722 I'm going to focus on a subset of

NOTE Confidence: 0.924246884666667

00:16:00.722 --> 00:16:02.581 regions within this circuit here

NOTE Confidence: 0.924246884666667

00:16:02.581 --> 00:16:04.541 depicted in this cartoon schematic

NOTE Confidence: 0.924246884666667

00:16:04.541 --> 00:16:06.812 from the rodent brain where we

NOTE Confidence: 0.924246884666667

00:16:06.812 --> 00:16:08.096 see the nucleus incumbents.

NOTE Confidence: 0.924246884666667

00:16:08.100 --> 00:16:11.124 The most ventral aspect of this striatum,

NOTE Confidence: 0.924246884666667

00:16:11.130 --> 00:16:13.110 where we see its output,

NOTE Confidence: 0.924246884666667

00:16:13.110 --> 00:16:14.670 then one of its outputs,

NOTE Confidence: 0.924246884666667

00:16:14.670 --> 00:16:15.786 the ventral pallidum,

NOTE Confidence: 0.924246884666667

00:16:15.786 --> 00:16:18.018 which is analogous to globis pallidus

NOTE Confidence: 0.924246884666667

00:16:18.018 --> 00:16:20.524 in more dorsal striatal circuits and

NOTE Confidence: 0.924246884666667

00:16:20.524 --> 00:16:22.594 dopaminergic input to these regions

NOTE Confidence: 0.924246884666667

00:16:22.657 --> 00:16:24.547 from the VTA and other areas that

NOTE Confidence: 0.924246884666667

00:16:24.547 --> 00:16:26.540 we know and love like the amygdala.

NOTE Confidence: 0.924246884666667

00:16:26.540 --> 00:16:29.299 And so my lab is very interested in.

NOTE Confidence: 0.924246884666667

00:16:29.300 --> 00:16:32.660 How these reward circuits evaluate

NOTE Confidence: 0.924246884666667

00:16:32.660 --> 00:16:35.940 reward when it's being experienced?

NOTE Confidence: 0.924246884666667

00:16:35.940 --> 00:16:38.382 And then how that current evaluation

NOTE Confidence: 0.924246884666667

00:16:38.382 --> 00:16:41.024 can impact how the animals learn

NOTE Confidence: 0.924246884666667

00:16:41.024 --> 00:16:44.019 about what just happened so that it

NOTE Confidence: 0.924246884666667

00:16:44.019 --> 00:16:45.884 can impact their future behavior?

NOTE Confidence: 0.924246884666667

00:16:45.890 --> 00:16:48.778 So how are rewards processed in this circuit?

NOTE Confidence: 0.924246884666667

00:16:48.780 --> 00:16:50.803 So we're going to focus today specifically

NOTE Confidence: 0.924246884666667

00:16:50.803 --> 00:16:53.225 on trying to understand how the ventral

NOTE Confidence: 0.924246884666667

00:16:53.225 --> 00:16:55.095 pallidum contributes to that process,

NOTE Confidence: 0.924246884666667

00:16:55.100 --> 00:16:57.392 and it's much more interesting than

NOTE Confidence: 0.924246884666667

00:16:57.392 --> 00:17:00.030 perhaps we once thought few decades ago,

NOTE Confidence: 0.924246884666667

00:17:00.030 --> 00:17:01.698 the ventral pallidum historically

NOTE Confidence: 0.924246884666667

00:17:01.698 --> 00:17:03.783 has been considered somewhat of

NOTE Confidence: 0.924246884666667

00:17:03.783 --> 00:17:06.006 a way station or pass through.

NOTE Confidence: 0.924246884666667

00:17:06.010 --> 00:17:08.638 For information from this striedl region,

NOTE Confidence: 0.924246884666667

00:17:08.640 --> 00:17:09.780 the accompagnes,

NOTE Confidence: 0.924246884666667

00:17:09.780 --> 00:17:11.490 but instead increasingly,

NOTE Confidence: 0.924246884666667

00:17:11.490 --> 00:17:13.925 we're understanding that really important

NOTE Confidence: 0.924246884666667

00:17:13.925 --> 00:17:15.873 integrative processing is happening

NOTE Confidence: 0.924246884666667

00:17:15.873 --> 00:17:18.651 at the level of the ventral pallidum

NOTE Confidence: 0.924246884666667

00:17:18.651 --> 00:17:20.750 that impacts reward seeking behavior.

NOTE Confidence: 0.924246884666667

00:17:20.750 --> 00:17:23.174 So I'm going to focus in on some

NOTE Confidence: 0.924246884666667

00:17:23.174 --> 00:17:24.847 experiments conducted in the lab that

NOTE Confidence: 0.924246884666667

00:17:24.847 --> 00:17:26.744 I hope can can illuminate the function

NOTE Confidence: 0.924246884666667

00:17:26.744 --> 00:17:28.670 of the ventral pallidum for us,

NOTE Confidence: 0.924246884666667

00:17:28.670 --> 00:17:31.757 and when you wonder what a brain region does,

NOTE Confidence: 0.924246884666667

00:17:31.760 --> 00:17:33.713 of course one of the most traditional

NOTE Confidence: 0.924246884666667

00:17:33.713 --> 00:17:36.174 ways to look is to get rid of that brain.

NOTE Confidence: 0.924246884666667

00:17:36.180 --> 00:17:37.828 Region so decades ago,

NOTE Confidence: 0.924246884666667

00:17:37.828 --> 00:17:39.888 lesions of the ventral pallidum

NOTE Confidence: 0.924246884666667

00:17:39.888 --> 00:17:42.190 were shown to decrease intake of

NOTE Confidence: 0.924246884666667

00:17:42.190 --> 00:17:44.570 drugs of abuse in animal models.

NOTE Confidence: 0.924246884666667

00:17:44.570 --> 00:17:46.880 So decrease opiate self administration,

NOTE Confidence: 0.924246884666667

00:17:46.880 --> 00:17:48.980 for example.

NOTE Confidence: 0.924246884666667

00:17:48.980 --> 00:17:51.383 So that tells us this this area is very

NOTE Confidence: 0.924246884666667

00:17:51.383 --> 00:17:53.228 important for reward seeking behavior,

NOTE Confidence: 0.924246884666667

00:17:53.230 --> 00:17:55.393 but to figure out how it's very

NOTE Confidence: 0.924246884666667

00:17:55.393 --> 00:17:57.615 instructive to go in and use

NOTE Confidence: 0.924246884666667

00:17:57.615 --> 00:17:59.665 electrophysiology to record the neural

NOTE Confidence: 0.924246884666667

00:17:59.665 --> 00:18:01.785 activity during the behavior so you

NOTE Confidence: 0.924246884666667

00:18:01.785 --> 00:18:03.860 can see what the neurons care about,

NOTE Confidence: 0.924246884666667

00:18:03.860 --> 00:18:05.840 and so a number of labs have used this

NOTE Confidence: 0.924246884666667

00:18:05.892 --> 00:18:07.844 approach and I'd like to tell you about.

NOTE Confidence: 0.924246884666667

00:18:07.850 --> 00:18:09.662 Some of the data that has

NOTE Confidence: 0.924246884666667

00:18:09.662 --> 00:18:10.870 already emerged that set

NOTE Confidence: 0.92190800375

00:18:10.939 --> 00:18:13.117 up our thinking for our experiments.

NOTE Confidence: 0.92190800375

00:18:13.120 --> 00:18:17.584 So these are our data obtained from in vivo

NOTE Confidence: 0.92190800375

00:18:17.584 --> 00:18:19.638 electrophysiological recordings in rats.

NOTE Confidence: 0.92190800375

00:18:19.640 --> 00:18:20.964 So electrodes are implanted

NOTE Confidence: 0.92190800375

00:18:20.964 --> 00:18:22.288 into the ventral pallidum,

NOTE Confidence: 0.92190800375

00:18:22.290 --> 00:18:23.966 and we're measuring extracellularly.

NOTE Confidence: 0.92190800375

00:18:23.966 --> 00:18:26.480 The spike activity of nearby neurons,

NOTE Confidence: 0.92190800375

00:18:26.480 --> 00:18:27.593 and what Jocelyn,

NOTE Confidence: 0.92190800375

00:18:27.593 --> 00:18:29.819 Richard working with Howard Fields found,

NOTE Confidence: 0.92190800375

00:18:29.820 --> 00:18:33.096 is that neurons in the ventral pallidum

NOTE Confidence: 0.92190800375

00:18:33.096 --> 00:18:35.806 care about cues that tell the animal

NOTE Confidence: 0.92190800375

00:18:35.806 --> 00:18:37.850 it has an opportunity to get reward,

NOTE Confidence: 0.92190800375

00:18:37.850 --> 00:18:39.943 and so here we see an average

NOTE Confidence: 0.92190800375

00:18:39.943 --> 00:18:41.859 increase in activity when the animal.

NOTE Confidence: 0.92190800375

00:18:41.860 --> 00:18:43.016 Here's a Q, but.

NOTE Confidence: 0.92190800375

00:18:43.016 --> 00:18:45.165 The increase in activity is much bigger

NOTE Confidence: 0.92190800375

00:18:45.165 --> 00:18:46.905 when the animals actually motivated

NOTE Confidence: 0.92190800375

00:18:46.905 --> 00:18:49.429 to press a lever to get the reward,

NOTE Confidence: 0.92190800375

00:18:49.430 --> 00:18:51.630 so the the larger signal is from trials

NOTE Confidence: 0.92190800375

00:18:51.630 --> 00:18:53.917 when animals press the lever to get reward

NOTE Confidence: 0.92190800375

00:18:53.917 --> 00:18:56.049 and the smaller signals when they fail to.

NOTE Confidence: 0.92190800375

00:18:56.050 --> 00:18:58.498 So motivation already is coming into

NOTE Confidence: 0.92190800375

00:18:58.498 --> 00:19:01.446 play and modulating the way the ventral

NOTE Confidence: 0.92190800375

00:19:01.446 --> 00:19:03.526 pallidal neurons respond to cues.

NOTE Confidence: 0.92190800375

00:19:03.530 --> 00:19:06.092 The valence of a reward also modulates

NOTE Confidence: 0.92190800375

00:19:06.092 --> 00:19:08.390 responses in the ventral pallidum.

NOTE Confidence: 0.92190800375

00:19:08.390 --> 00:19:09.750 So, as you might predict,

NOTE Confidence: 0.92190800375

00:19:09.750 --> 00:19:12.254 given the data I told you about lesions,

NOTE Confidence: 0.92190800375

00:19:12.260 --> 00:19:13.600 the ventral pallidum cares

NOTE Confidence: 0.92190800375

00:19:13.600 --> 00:19:15.610 about the nature of the reward.

NOTE Confidence: 0.92190800375

00:19:15.610 --> 00:19:17.440 So in this example from Kendall

NOTE Confidence: 0.92190800375

00:19:17.440 --> 00:19:19.619 at all this this classic paper,

NOTE Confidence: 0.92190800375

00:19:19.620 --> 00:19:21.858 we see examples from 1 neuron

NOTE Confidence: 0.92190800375

00:19:21.858 --> 00:19:23.970 and its response to two QS.

NOTE Confidence: 0.92190800375

00:19:23.970 --> 00:19:26.266 One is a Q that predicts something good,

NOTE Confidence: 0.92190800375

00:19:26.270 --> 00:19:28.106 sucrose solution and one is a

NOTE Confidence: 0.92190800375

00:19:28.106 --> 00:19:29.679 cue that predicts something the

NOTE Confidence: 0.92190800375

00:19:29.679 --> 00:19:31.425 animal doesn't like a salty taste.

NOTE Confidence: 0.92190800375

00:19:31.430 --> 00:19:33.278 We see the neuron has a big

NOTE Confidence: 0.92190800375

00:19:33.278 --> 00:19:34.539 increase in firing to the.

NOTE Confidence: 0.92190800375

00:19:34.540 --> 00:19:34.949 Q.

NOTE Confidence: 0.92190800375

00:19:34.949 --> 00:19:36.176 Predicting something good

NOTE Confidence: 0.92190800375

00:19:36.176 --> 00:19:38.630 and not to the salt Q.

NOTE Confidence: 0.92190800375

00:19:38.630 --> 00:19:40.712 But if we use pharmacology to

NOTE Confidence: 0.92190800375

00:19:40.712 --> 00:19:42.500 deplete the subjects of salt,

NOTE Confidence: 0.92190800375

00:19:42.500 --> 00:19:45.524 so we'd make them desire salt and want salt.

NOTE Confidence: 0.92190800375

00:19:45.530 --> 00:19:47.750 We see suddenly that this neuron

NOTE Confidence: 0.92190800375

00:19:47.750 --> 00:19:49.653 now responds with an increase

NOTE Confidence: 0.92190800375

00:19:49.653 --> 00:19:51.747 in activity to the salt Q.

NOTE Confidence: 0.92190800375

00:19:51.750 --> 00:19:54.174 Reminiscent of the response to the sucrose Q.

NOTE Confidence: 0.92190800375

00:19:54.180 --> 00:19:57.438 So this is a clue that the Q responses

NOTE Confidence: 0.92190800375

00:19:57.438 --> 00:19:59.923 responses in the VP are sensitive to

NOTE Confidence: 0.92190800375

00:19:59.923 --> 00:20:02.461 the valence of the reward the animal

NOTE Confidence: 0.92190800375

00:20:02.461 --> 00:20:05.274 is going to get, so it cares about.

NOTE Confidence: 0.92190800375

00:20:05.274 --> 00:20:06.618 Motivational state it cares

NOTE Confidence: 0.92190800375

00:20:06.618 --> 00:20:08.677 about the valence of the reward.

NOTE Confidence: 0.92190800375

00:20:08.680 --> 00:20:09.566 And interestingly,

NOTE Confidence: 0.92190800375

00:20:09.566 --> 00:20:12.224 in this work from bullies Lab,

NOTE Confidence: 0.92190800375

00:20:12.230 --> 00:20:14.315 it also cares about what's

NOTE Confidence: 0.92190800375

00:20:14.315 --> 00:20:16.400 actually happening in real time.

NOTE Confidence: 0.92190800375

00:20:16.400 --> 00:20:18.129 So here we see an example of

NOTE Confidence: 0.92190800375

00:20:18.129 --> 00:20:20.118 data from a paper recording from

NOTE Confidence: 0.92190800375

00:20:20.118 --> 00:20:22.093 neurons in the ventral pallidum

NOTE Confidence: 0.92190800375

00:20:22.093 --> 00:20:24.552 in subjects that receive the queue

NOTE Confidence: 0.92190800375

00:20:24.552 --> 00:20:26.156 that predicts sucrose reward.

NOTE Confidence: 0.92190800375

00:20:26.160 --> 00:20:27.816 The neurons respond to the queue,

NOTE Confidence: 0.92190800375

00:20:27.820 --> 00:20:29.770 and they respond to the reward.

NOTE Confidence: 0.92190800375

00:20:29.770 --> 00:20:32.322 But if on some trials you omit reward

NOTE Confidence: 0.92190800375

00:20:32.322 --> 00:20:35.045 that you see that there is a decrease.

NOTE Confidence: 0.92190800375

00:20:35.050 --> 00:20:37.090 In firing by these neurons,

NOTE Confidence: 0.92190800375

00:20:37.090 --> 00:20:39.268 this tells us that neurons have

NOTE Confidence: 0.92190800375

00:20:39.268 --> 00:20:41.547 an expectation of the reward that

NOTE Confidence: 0.92190800375

00:20:41.547 --> 00:20:43.809 they should receive after the Q.

NOTE Confidence: 0.92190800375

00:20:43.810 --> 00:20:45.970 This is reminiscent of a negative

NOTE Confidence: 0.92190800375

00:20:45.970 --> 00:20:47.694 reward prediction error signal that

NOTE Confidence: 0.92190800375

00:20:47.694 --> 00:20:50.335 many of you may be familiar with from

NOTE Confidence: 0.92190800375

00:20:50.335 --> 00:20:52.300 thinking about how dopamine neurons

NOTE Confidence: 0.92190800375

00:20:52.374 --> 00:20:55.279 respond when expected reward fails to arrive.

NOTE Confidence: 0.92190800375

00:20:55.280 --> 00:20:57.650 So together these give us important

NOTE Confidence: 0.92190800375

00:20:57.650 --> 00:21:00.157 clues that neurons in the ventral

NOTE Confidence: 0.92190800375

00:21:00.157 --> 00:21:01.865 pallidum respond to cues.

NOTE Confidence: 0.92190800375

00:21:01.870 --> 00:21:03.030 They respond to reward,

NOTE Confidence: 0.92190800375

00:21:03.030 --> 00:21:05.270 and they do so in interesting manners.

NOTE Confidence: 0.92190800375

00:21:05.270 --> 00:21:07.010 They care about the motivational state.

NOTE Confidence: 0.92190800375

00:21:07.010 --> 00:21:09.250 They care about the valence of the reward,

NOTE Confidence: 0.906665728571428

00:21:09.250 --> 00:21:11.308 how much the subject likes the reward,

NOTE Confidence: 0.906665728571428

00:21:11.310 --> 00:21:13.800 and they have some sort of

NOTE Confidence: 0.906665728571428

00:21:13.800 --> 00:21:14.630 expectation information.

NOTE Confidence: 0.906665728571428

00:21:14.630 --> 00:21:15.682 They care about what's

NOTE Confidence: 0.906665728571428

00:21:15.682 --> 00:21:16.734 happening in real time.

NOTE Confidence: 0.906665728571428

00:21:16.740 --> 00:21:19.140 If the reward arrives or not.

NOTE Confidence: 0.906665728571428

00:21:19.140 --> 00:21:21.258 So these and many other lovely

NOTE Confidence: 0.906665728571428

00:21:21.258 --> 00:21:24.022 studies set the stage for the kinds

NOTE Confidence: 0.906665728571428

00:21:24.022 --> 00:21:26.147 of questions that David Ottenheimer,

NOTE Confidence: 0.906665728571428

00:21:26.150 --> 00:21:27.650 a graduate student in the lab,

NOTE Confidence: 0.906665728571428

00:21:27.650 --> 00:21:30.254 wanted to ask when he wondered about

NOTE Confidence: 0.906665728571428

00:21:30.254 --> 00:21:32.826 the details of how the outcomes

NOTE Confidence: 0.906665728571428

00:21:32.826 --> 00:21:35.592 themselves are processed by the neurons.

NOTE Confidence: 0.906665728571428

00:21:35.600 --> 00:21:36.434 In ventral pallidum.

NOTE Confidence: 0.906665728571428

00:21:36.434 --> 00:21:38.790 So David was a graduate student in my lab.

NOTE Confidence: 0.906665728571428

00:21:38.790 --> 00:21:40.920 He's now a postdoc in the

NOTE Confidence: 0.906665728571428

00:21:40.920 --> 00:21:42.340 Steinmetz and Stuber Labs,

NOTE Confidence: 0.906665728571428

00:21:42.340 --> 00:21:44.601 and he was aided through all of

NOTE Confidence: 0.906665728571428

00:21:44.601 --> 00:21:46.674 this with by Doctor Joslin Richard,

NOTE Confidence: 0.906665728571428

00:21:46.674 --> 00:21:49.560 when she was a senior scientist in the lab.

NOTE Confidence: 0.906665728571428

00:21:49.560 --> 00:21:52.199 She was our resident ventral pallidum expert.

NOTE Confidence: 0.906665728571428

00:21:52.200 --> 00:21:54.330 Doctor Richard now runs her own

NOTE Confidence: 0.906665728571428

00:21:54.330 --> 00:21:56.689 lab at the University of Minnesota,

NOTE Confidence: 0.906665728571428

00:21:56.690 --> 00:21:58.590 so together they designed a

NOTE Confidence: 0.906665728571428

00:21:58.590 --> 00:22:01.000 series of studies to allow them

NOTE Confidence: 0.906665728571428

00:22:01.000 --> 00:22:03.586 to understand better how ventral

NOTE Confidence: 0.906665728571428

00:22:03.586 --> 00:22:06.118 pallidum neurons encode natural.

NOTE Confidence: 0.906665728571428

00:22:06.120 --> 00:22:09.403 Word outcomes and so that David was

NOTE Confidence: 0.906665728571428

00:22:09.403 --> 00:22:11.950 interested in doing these studies

NOTE Confidence: 0.906665728571428

00:22:11.950 --> 00:22:15.088 in the setting of multiple rewards.

NOTE Confidence: 0.906665728571428

00:22:15.090 --> 00:22:17.185 Because eventually we'd like to

NOTE Confidence: 0.906665728571428

00:22:17.185 --> 00:22:19.280 understand how agents make choices

NOTE Confidence: 0.906665728571428

00:22:19.346 --> 00:22:21.656 among rewards because we'd like to apply

NOTE Confidence: 0.906665728571428

00:22:21.656 --> 00:22:24.300 this in the future to drug addiction.

NOTE Confidence: 0.906665728571428

00:22:24.300 --> 00:22:27.620 How to agents choose drugs or other rewards.

NOTE Confidence: 0.906665728571428

00:22:27.620 --> 00:22:31.070 So David began with very simple.

NOTE Confidence: 0.906665728571428

00:22:31.070 --> 00:22:32.745 Experimental designs where he could

NOTE Confidence: 0.906665728571428

00:22:32.745 --> 00:22:34.835 look at the activity of ventral

NOTE Confidence: 0.906665728571428

00:22:34.835 --> 00:22:36.620 pallidal neurons when rats were

NOTE Confidence: 0.906665728571428

00:22:36.620 --> 00:22:38.510 receiving more than one reward.

NOTE Confidence: 0.906665728571428

00:22:38.510 --> 00:22:41.366 So in this very initial simple design,

NOTE Confidence: 0.906665728571428

00:22:41.370 --> 00:22:42.842 he implanted electrodes into

NOTE Confidence: 0.906665728571428

00:22:42.842 --> 00:22:44.682 the ventral pallidum of rats,

NOTE Confidence: 0.906665728571428

00:22:44.690 --> 00:22:46.598 recorded extracellular spike activity.

NOTE Confidence: 0.906665728571428

00:22:46.598 --> 00:22:48.983 These are waveforms of example

NOTE Confidence: 0.906665728571428

00:22:48.983 --> 00:22:50.579 neurons that he recorded,

NOTE Confidence: 0.906665728571428

00:22:50.580 --> 00:22:51.830 and here's again our cartoon

NOTE Confidence: 0.906665728571428

00:22:51.830 --> 00:22:52.830 of the ventral pallidum.

NOTE Confidence: 0.906665728571428

00:22:52.830 --> 00:22:55.656 So the electrode tips are residing in the VP,

NOTE Confidence: 0.906665728571428

00:22:55.660 --> 00:22:58.915 and he exposed subjects to

NOTE Confidence: 0.906665728571428

00:22:58.915 --> 00:23:01.519 two different rewards liquid.

NOTE Confidence: 0.906665728571428

00:23:01.520 --> 00:23:03.104 Sucrose and maltodextrin.

NOTE Confidence: 0.906665728571428

00:23:03.104 --> 00:23:05.216 These are both carbohydrates,

NOTE Confidence: 0.906665728571428

00:23:05.220 --> 00:23:06.058 calorically equivalent,

NOTE Confidence: 0.906665728571428

00:23:06.058 --> 00:23:09.410 and that we know rats like they will

NOTE Confidence: 0.906665728571428

00:23:09.481 --> 00:23:12.120 drink then avidly and he exposed them

NOTE Confidence: 0.906665728571428

00:23:12.120 --> 00:23:14.859 to these rewards in recording sessions,

NOTE Confidence: 0.906665728571428

00:23:14.860 --> 00:23:17.062 and the rewards were delivered randomly

NOTE Confidence: 0.906665728571428

00:23:17.062 --> 00:23:19.245 so the animal didn't know which

NOTE Confidence: 0.906665728571428

00:23:19.245 --> 00:23:21.527 reward was coming on any given trial.

NOTE Confidence: 0.906665728571428

00:23:21.530 --> 00:23:21.975 Specifically,

NOTE Confidence: 0.906665728571428

00:23:21.975 --> 00:23:25.535 he played the queue so white noise Q,

NOTE Confidence: 0.906665728571428

00:23:25.540 --> 00:23:26.814 and when the animal heard the cue,

NOTE Confidence: 0.906665728571428

00:23:26.820 --> 00:23:29.340 the animal knew it could go to the port

NOTE Confidence: 0.906665728571428

00:23:29.340 --> 00:23:31.660 when it put its snout in the reward.

NOTE Confidence: 0.906665728571428

00:23:31.660 --> 00:23:33.064 Port Reward was delivered,

NOTE Confidence: 0.906665728571428

00:23:33.064 --> 00:23:35.170 and then there's an Inter trial

NOTE Confidence: 0.906665728571428

00:23:35.233 --> 00:23:36.803 interval and that occurs again

NOTE Confidence: 0.906665728571428

00:23:36.803 --> 00:23:39.108 and so the the reward cannot be

NOTE Confidence: 0.906665728571428

00:23:39.108 --> 00:23:40.440 predicted by the queue.

NOTE Confidence: 0.906665728571428

00:23:40.440 --> 00:23:42.687 The animal has to actually wait till

NOTE Confidence: 0.906665728571428

00:23:42.687 --> 00:23:44.541 the reward squirt it out before

NOTE Confidence: 0.906665728571428

00:23:44.541 --> 00:23:46.459 it knows what it's getting so we

NOTE Confidence: 0.906665728571428

00:23:46.521 --> 00:23:48.276 can compare the neural response

NOTE Confidence: 0.906665728571428

00:23:48.276 --> 00:23:49.680 to these two rewards.

NOTE Confidence: 0.906665728571428

00:23:49.680 --> 00:23:51.048 There's an interesting feature

NOTE Confidence: 0.906665728571428

00:23:51.048 --> 00:23:53.320 about these two rewards and that is,

NOTE Confidence: 0.906665728571428

00:23:53.320 --> 00:23:56.176 although rats love both of them,

NOTE Confidence: 0.906665728571428

00:23:56.180 --> 00:23:57.652 if you give them a full bottle of

NOTE Confidence: 0.906665728571428

00:23:57.652 --> 00:23:59.360 one or the other on their homepage,

NOTE Confidence: 0.906665728571428

00:23:59.360 --> 00:24:00.820 they'll drink it all up.

NOTE Confidence: 0.906665728571428

00:24:00.820 --> 00:24:02.446 If you give them two bottles.

NOTE Confidence: 0.906665728571428

00:24:02.450 --> 00:24:03.428 One with sucrose,

NOTE Confidence: 0.906665728571428

00:24:03.428 --> 00:24:05.710 one with maltodextrin at the same time,

NOTE Confidence: 0.906665728571428

00:24:05.710 --> 00:24:08.150 most rats prefer the sucrose,

NOTE Confidence: 0.906665728571428

00:24:08.150 --> 00:24:09.692 and that's what I'm showing here

NOTE Confidence: 0.906665728571428

00:24:09.692 --> 00:24:11.785 in this behavioral data figure.

NOTE Confidence: 0.906665728571428

00:24:11.785 --> 00:24:14.222 This shows the preference subjects

NOTE Confidence: 0.906665728571428

00:24:14.222 --> 00:24:15.550 have for sucrose over

NOTE Confidence: 0.906665728571428

00:24:15.550 --> 00:24:17.210 maltodextrin when tested in the

NOTE Confidence: 0.8566711805

00:24:17.269 --> 00:24:18.609 home cage when they just

NOTE Confidence: 0.8566711805

00:24:18.609 --> 00:24:19.949 have big bottles of both,

NOTE Confidence: 0.8566711805

00:24:19.950 --> 00:24:21.940 they'll drink more of the

NOTE Confidence: 0.8566711805

00:24:21.940 --> 00:24:23.532 sucrose than multidex turn.

NOTE Confidence: 0.8566711805

00:24:23.540 --> 00:24:25.280 However, in this behavioral session

NOTE Confidence: 0.8566711805

00:24:25.280 --> 00:24:27.800 where we're giving A Q and then

NOTE Confidence: 0.8566711805

00:24:27.800 --> 00:24:29.600 squirting out maltodextrin or sucrose

NOTE Confidence: 0.8566711805

00:24:29.600 --> 00:24:32.030 and they have to drink it in order

NOTE Confidence: 0.8566711805

00:24:32.030 --> 00:24:33.753 to have the next trial happen,

NOTE Confidence: 0.8566711805

00:24:33.753 --> 00:24:36.351 we see that the licking behavior

NOTE Confidence: 0.8566711805

00:24:36.351 --> 00:24:38.684 when they're consuming the different

NOTE Confidence: 0.8566711805

00:24:38.684 --> 00:24:40.608 rewards is almost identical.

NOTE Confidence: 0.8566711805

00:24:40.610 --> 00:24:42.038 So we're left with a nice,

NOTE Confidence: 0.8566711805

00:24:42.040 --> 00:24:44.284 very simple behavioral model where their

NOTE Confidence: 0.8566711805

00:24:44.284 --> 00:24:47.090 preference for the two rewards is different.

NOTE Confidence: 0.8566711805

00:24:47.090 --> 00:24:49.176 We know that based on these

NOTE Confidence: 0.8566711805

00:24:49.176 --> 00:24:50.600 long term drinking studies,

NOTE Confidence: 0.8566711805

00:24:50.600 --> 00:24:53.066 but their motor behavior during this

NOTE Confidence: 0.8566711805

00:24:53.066 --> 00:24:55.810 particular very simple task is very similar,

NOTE Confidence: 0.8566711805

00:24:55.810 --> 00:24:57.434 so that gives us a nice way to

NOTE Confidence: 0.8566711805

00:24:57.434 --> 00:24:59.361 see what the signal related to the

NOTE Confidence: 0.8566711805

00:24:59.361 --> 00:25:00.821 preference might be when we're

NOTE Confidence: 0.8566711805

00:25:00.880 --> 00:25:02.668 basically making sure that the motor

NOTE Confidence: 0.8566711805

00:25:02.668 --> 00:25:04.249 behavior is not that different,

NOTE Confidence: 0.8566711805

00:25:04.249 --> 00:25:06.194 because that could motor behavior

NOTE Confidence: 0.8566711805

00:25:06.194 --> 00:25:08.125 could be an explanation for

NOTE Confidence: 0.8566711805

00:25:08.125 --> 00:25:09.695 some differences that we see.

NOTE Confidence: 0.8566711805

00:25:09.700 --> 00:25:11.144 So in the face.

NOTE Confidence: 0.8566711805

00:25:11.144 --> 00:25:12.949 In this very simple behavior,

NOTE Confidence: 0.8566711805

00:25:12.950 --> 00:25:14.966 what David found when he recorded from

NOTE Confidence: 0.8566711805

00:25:14.966 --> 00:25:17.010 many neurons in the ventral pallidum,

NOTE Confidence: 0.8566711805

00:25:17.010 --> 00:25:19.176 many individual neurons is that there's

NOTE Confidence: 0.8566711805

00:25:19.176 --> 00:25:22.124 a big difference in the way the neuron

NOTE Confidence: 0.8566711805

00:25:22.124 --> 00:25:23.924 signal which reward they received.

NOTE Confidence: 0.8566711805

00:25:23.930 --> 00:25:27.115 So here I'm showing the average activity

NOTE Confidence: 0.8566711805

00:25:27.115 --> 00:25:30.180 of 205 neurons that were sensitive to

NOTE Confidence: 0.8566711805

00:25:30.180 --> 00:25:32.630 reward based on statistical analysis.

NOTE Confidence: 0.8566711805

00:25:32.630 --> 00:25:34.966 If we divide the trials into those in

NOTE Confidence: 0.8566711805

00:25:34.966 --> 00:25:37.789 which the animal receives sucrose and orange,

NOTE Confidence: 0.8566711805

00:25:37.790 --> 00:25:40.800 or maltodextrin in this pink purple color.

NOTE Confidence: 0.8566711805

00:25:40.800 --> 00:25:43.072 We see an average very large increase in

NOTE Confidence: 0.8566711805

00:25:43.072 --> 00:25:45.010 activity when the animals are drinking.

NOTE Confidence: 0.8566711805

00:25:45.010 --> 00:25:47.730 The sucrose 0 is the time that rewards

NOTE Confidence: 0.8566711805

00:25:47.730 --> 00:25:49.660 delivered the first few seconds,

NOTE Confidence: 0.8566711805

00:25:49.660 --> 00:25:51.837 first three to four seconds is when

NOTE Confidence: 0.8566711805

00:25:51.837 --> 00:25:53.140 they're actually lapping it up.

NOTE Confidence: 0.8566711805

00:25:53.140 --> 00:25:56.084 We see a much lower response by the

NOTE Confidence: 0.8566711805

00:25:56.084 --> 00:25:58.708 population when maltodextrin is received.

NOTE Confidence: 0.8566711805

00:25:58.710 --> 00:26:00.677 These heat maps here show you the

NOTE Confidence: 0.8566711805

00:26:00.677 --> 00:26:02.358 activity of the individual neurons

NOTE Confidence: 0.8566711805

00:26:02.358 --> 00:26:04.288 that make up these averages,

NOTE Confidence: 0.8566711805

00:26:04.290 --> 00:26:06.626 so again we have the same time course

NOTE Confidence: 0.8566711805

00:26:06.626 --> 00:26:09.454 and each row is the color coded map of

NOTE Confidence: 0.8566711805

00:26:09.454 --> 00:26:11.558 the spike intensity from that neuron

NOTE Confidence: 0.8566711805

00:26:11.558 --> 00:26:14.134 arranged by most intense to less intense.

NOTE Confidence: 0.8566711805

00:26:14.140 --> 00:26:16.228 And you can see here by I many,

NOTE Confidence: 0.8566711805

00:26:16.230 --> 00:26:17.770 many neurons are showing an

NOTE Confidence: 0.8566711805

00:26:17.770 --> 00:26:19.310 increase at this exact time,

NOTE Confidence: 0.8566711805

00:26:19.310 --> 00:26:21.697 and it's much less present and sometimes

NOTE Confidence: 0.8566711805

00:26:21.697 --> 00:26:24.598 even more of a decrease for maltodextrin.

NOTE Confidence: 0.8566711805

00:26:24.600 --> 00:26:26.959 So the populations in the ventral pallidum

NOTE Confidence: 0.8566711805

00:26:26.959 --> 00:26:29.179 encode these two rewards differently.

NOTE Confidence: 0.8566711805

00:26:29.180 --> 00:26:31.460 Although the drinking behavior similar the

NOTE Confidence: 0.8566711805

00:26:31.460 --> 00:26:33.720 preference these subjects have is different,

NOTE Confidence: 0.8566711805

00:26:33.720 --> 00:26:37.086 and that may be what is we're seeing here.

NOTE Confidence: 0.8566711805

00:26:37.090 --> 00:26:37.530 Alternatively,

NOTE Confidence: 0.8566711805

00:26:37.530 --> 00:26:39.290 you might propose will.

NOTE Confidence: 0.8566711805

00:26:39.290 --> 00:26:42.468 Sucrose is a very important natural sugar.

NOTE Confidence: 0.8566711805

00:26:42.470 --> 00:26:45.116 Maybe neurons in the brain are set

NOTE Confidence: 0.8566711805

00:26:45.116 --> 00:26:48.060 up already to fire in a very specific

NOTE Confidence: 0.8566711805

00:26:48.060 --> 00:26:50.820 way to sucrose as as it taste it.

NOTE Confidence: 0.8566711805

00:26:50.820 --> 00:26:53.081 So it could be that these responses

NOTE Confidence: 0.8566711805

00:26:53.081 --> 00:26:55.227 are fixed and that they really

NOTE Confidence: 0.8566711805

00:26:55.227 --> 00:26:56.699 depend on the rewards.

NOTE Confidence: 0.8566711805

00:26:56.700 --> 00:26:59.260 So David tried to think of a way to to

NOTE Confidence: 0.8566711805

00:26:59.334 --> 00:27:02.012 examine that so to do that he repeated

NOTE Confidence: 0.8566711805

00:27:02.012 --> 00:27:04.778 the same behavioral procedure but he

NOTE Confidence: 0.8566711805

00:27:04.778 --> 00:27:07.396 swapped water for sucrose. So now.

NOTE Confidence: 0.8566711805

00:27:07.396 --> 00:27:10.004 He's going to give the animals up.

NOTE Confidence: 0.8566711805

00:27:10.004 --> 00:27:10.852 Interleaved sessions,

NOTE Confidence: 0.8566711805

00:27:10.852 --> 00:27:13.820 when they receive sucrose or water after

NOTE Confidence: 0.8566711805

00:27:13.886 --> 00:27:16.646 the queue and you could see their behavior.

NOTE Confidence: 0.850628229285714

00:27:16.650 --> 00:27:18.425 In fact, they're licking behavior

NOTE Confidence: 0.850628229285714

00:27:18.425 --> 00:27:20.200 is different from water because

NOTE Confidence: 0.850628229285714

00:27:20.256 --> 00:27:21.840 they're not water restricted.

NOTE Confidence: 0.850628229285714

00:27:21.840 --> 00:27:24.784 So they don't really want water very much

NOTE Confidence: 0.850628229285714

00:27:24.790 --> 00:27:28.612 and what he saw neurally is a switch in

NOTE Confidence: 0.850628229285714

00:27:28.612 --> 00:27:31.052 the way neurons encoded maltodextrin.

NOTE Confidence: 0.850628229285714

00:27:31.060 --> 00:27:33.268 So remember the activity for Maltodextrin

NOTE Confidence: 0.850628229285714

00:27:33.268 --> 00:27:35.868 was much lower than for sucrose when

NOTE Confidence: 0.850628229285714

00:27:35.868 --> 00:27:38.360 those were the two rewards being compared.

NOTE Confidence: 0.850628229285714

00:27:38.360 --> 00:27:40.670 But now when we are comparing maltodextrin

NOTE Confidence: 0.850628229285714

00:27:40.670 --> 00:27:43.340 and water as the animals taste each one,

NOTE Confidence: 0.850628229285714

00:27:43.340 --> 00:27:45.545 we see a relative increase in the

NOTE Confidence: 0.850628229285714

00:27:45.545 --> 00:27:47.083 response from maltodextrin and a

NOTE Confidence: 0.850628229285714

00:27:47.083 --> 00:27:48.697 decrease in the response for water.

NOTE Confidence: 0.850628229285714

00:27:48.700 --> 00:27:50.368 And you could see that very

NOTE Confidence: 0.850628229285714

00:27:50.368 --> 00:27:51.820 clearly in these heat maps.

NOTE Confidence: 0.850628229285714

00:27:51.820 --> 00:27:54.750 Here's a sucrose here's water,

NOTE Confidence: 0.850628229285714

00:27:54.750 --> 00:27:57.165 but most interesting focus on

NOTE Confidence: 0.850628229285714

00:27:57.165 --> 00:27:59.097 maltodextrin relatively low activity

NOTE Confidence: 0.850628229285714

00:27:59.097 --> 00:28:01.239 across the population now very.

NOTE Confidence: 0.850628229285714

00:28:01.240 --> 00:28:04.300 High activity across the population.

NOTE Confidence: 0.850628229285714

00:28:04.300 --> 00:28:06.456 So this readout is not fixed based

NOTE Confidence: 0.850628229285714

00:28:06.456 --> 00:28:08.880 on the the actual chemical nature of

NOTE Confidence: 0.850628229285714

00:28:08.880 --> 00:28:11.708 the taste it so instead it it seems

NOTE Confidence: 0.850628229285714

00:28:11.708 --> 00:28:14.172 as if perhaps it relates more to the

NOTE Confidence: 0.850628229285714

00:28:14.180 --> 00:28:17.480 animal's current preference for example.

NOTE Confidence: 0.850628229285714

00:28:17.480 --> 00:28:19.699 And we can see very exactly similar

NOTE Confidence: 0.850628229285714

00:28:19.699 --> 00:28:21.805 results if we run a behavioral

NOTE Confidence: 0.850628229285714

00:28:21.805 --> 00:28:24.450 session with all three liquid's

NOTE Confidence: 0.850628229285714

00:28:24.450 --> 00:28:27.050 randomly presented after the Q,

NOTE Confidence: 0.850628229285714

00:28:27.050 --> 00:28:30.038 2 hour rats and we see a much higher

NOTE Confidence: 0.850628229285714

00:28:30.038 --> 00:28:32.982 average neural response to sucrose medium

NOTE Confidence: 0.850628229285714

00:28:32.982 --> 00:28:36.350 for maltodextrin and big decrease for water.

NOTE Confidence: 0.850628229285714

00:28:36.350 --> 00:28:38.898 So so there there's a ranking in

NOTE Confidence: 0.850628229285714

00:28:38.898 --> 00:28:40.983 the neural activity that fits what

NOTE Confidence: 0.850628229285714

00:28:40.983 --> 00:28:43.880 we might think of as the ranking of

NOTE Confidence: 0.850628229285714

00:28:43.880 --> 00:28:45.908 the animal subjective preference.

NOTE Confidence: 0.850628229285714

00:28:45.910 --> 00:28:47.548 So that's one way we could.

NOTE Confidence: 0.850628229285714

00:28:47.550 --> 00:28:49.236 We could wonder about what the

NOTE Confidence: 0.850628229285714

00:28:49.236 --> 00:28:50.810 signal means for the animal.

NOTE Confidence: 0.850628229285714

00:28:50.810 --> 00:28:53.826 Is this just a readout of the animal's

NOTE Confidence: 0.850628229285714

00:28:53.826 --> 00:28:55.380 current subjective preference?

NOTE Confidence: 0.850628229285714

00:28:55.380 --> 00:28:57.390 Another idea that David had when

NOTE Confidence: 0.850628229285714

00:28:57.390 --> 00:28:59.682 looking at this is that this signal

NOTE Confidence: 0.850628229285714

00:28:59.682 --> 00:29:01.747 also could be a readout of a

NOTE Confidence: 0.850628229285714

00:29:01.820 --> 00:29:03.660 difference from the animals,

NOTE Confidence: 0.850628229285714

00:29:03.660 --> 00:29:05.756 expectation of reward value.

NOTE Confidence: 0.850628229285714

00:29:05.756 --> 00:29:08.376 So each time the animal,

NOTE Confidence: 0.850628229285714

00:29:08.380 --> 00:29:10.000 here's the queue and is going

NOTE Confidence: 0.850628229285714

00:29:10.000 --> 00:29:11.820 to the port to get reward,

NOTE Confidence: 0.850628229285714

00:29:11.820 --> 00:29:13.710 it doesn't know which rewards coming,

NOTE Confidence: 0.850628229285714

00:29:13.710 --> 00:29:16.566 so it would have the same

NOTE Confidence: 0.850628229285714

00:29:16.566 --> 00:29:17.994 average reward expectation.

NOTE Confidence: 0.850628229285714

00:29:18.000 --> 00:29:20.992 And then the animal might receive a reward

NOTE Confidence: 0.850628229285714

00:29:20.992 --> 00:29:23.688 better than average worse than average,

NOTE Confidence: 0.850628229285714

00:29:23.690 --> 00:29:24.380 you know,

NOTE Confidence: 0.850628229285714

00:29:24.380 --> 00:29:26.105 just slightly better than average.

NOTE Confidence: 0.850628229285714

00:29:26.110 --> 00:29:28.707 So this might also map onto what

NOTE Confidence: 0.850628229285714

00:29:28.707 --> 00:29:31.207 you might predict you would see

NOTE Confidence: 0.850628229285714

00:29:31.207 --> 00:29:32.947 with an expectation signal.

NOTE Confidence: 0.850628229285714

00:29:32.950 --> 00:29:34.973 So we were very interested in trying

NOTE Confidence: 0.850628229285714

00:29:34.973 --> 00:29:37.464 to figure out how could we tell the

NOTE Confidence: 0.850628229285714

00:29:37.464 --> 00:29:39.426 difference between a signal that might

NOTE Confidence: 0.850628229285714

00:29:39.426 --> 00:29:41.823 tell us something about if the animals

NOTE Confidence: 0.850628229285714

00:29:41.823 --> 00:29:45.274 using it to to read out violations of

NOTE Confidence: 0.850628229285714

00:29:45.274 --> 00:29:48.634 expectations or alterations of expectation.

NOTE Confidence: 0.850628229285714

00:29:48.640 --> 00:29:50.481 Or is the animal just using the

NOTE Confidence: 0.850628229285714

00:29:50.481 --> 00:29:51.500 signal to read up?

NOTE Confidence: 0.850628229285714

00:29:51.500 --> 00:29:51.734 Yes,

NOTE Confidence: 0.850628229285714

00:29:51.734 --> 00:29:53.138 this is what I like best.

NOTE Confidence: 0.850628229285714

00:29:53.140 --> 00:29:54.310 This is what I like worse.

NOTE Confidence: 0.89675105

00:29:57.230 --> 00:29:59.414 And this is basically a repeat

NOTE Confidence: 0.89675105

00:29:59.414 --> 00:30:01.769 of what I have just said.

NOTE Confidence: 0.89675105

00:30:01.770 --> 00:30:04.234 So the the way in which David decided

NOTE Confidence: 0.89675105

00:30:04.234 --> 00:30:06.356 to tackle this was to collaborate

NOTE Confidence: 0.89675105

00:30:06.356 --> 00:30:08.516 with the lab of Jeremiah Cohen,

NOTE Confidence: 0.89675105

00:30:08.520 --> 00:30:10.540 also at Johns Hopkins University,

NOTE Confidence: 0.89675105

00:30:10.540 --> 00:30:13.636 and his then MD PhD student Bill Albari.

NOTE Confidence: 0.89675105

00:30:13.640 --> 00:30:16.405 And so Jeremiah and Bella had been

NOTE Confidence: 0.89675105

00:30:16.405 --> 00:30:19.120 using quantitative models to try

NOTE Confidence: 0.89675105

00:30:19.120 --> 00:30:21.640 to explain the activity of neurons

NOTE Confidence: 0.89675105

00:30:21.640 --> 00:30:24.080 and what what they care about.

NOTE Confidence: 0.89675105

00:30:24.080 --> 00:30:26.429 And so in this way you might use a

NOTE Confidence: 0.89675105

00:30:26.429 --> 00:30:28.000 quantitative model and try to fit

NOTE Confidence: 0.89675105

00:30:28.000 --> 00:30:29.573 the firing rate of given neurons

NOTE Confidence: 0.89675105

00:30:29.573 --> 00:30:31.693 to aspects of your model to try to.

NOTE Confidence: 0.89675105

00:30:31.700 --> 00:30:34.976 Understand what those neurons are encoding,

NOTE Confidence: 0.89675105

00:30:34.980 --> 00:30:37.572 and so this is what Belal and David

NOTE Confidence: 0.89675105

00:30:37.572 --> 00:30:39.342 together in collaboration did to

NOTE Confidence: 0.89675105

00:30:39.342 --> 00:30:41.799 ask if there was any impact of

NOTE Confidence: 0.89675105

00:30:41.873 --> 00:30:44.309 expectations on firing at the time

NOTE Confidence: 0.89675105

00:30:44.309 --> 00:30:46.606 the animals drinking the reward and

NOTE Confidence: 0.89675105

00:30:46.606 --> 00:30:49.270 the way they did this was to look

NOTE Confidence: 0.89675105

00:30:49.346 --> 00:30:52.272 at the to the canonical Rescorla

NOTE Confidence: 0.89675105

00:30:52.272 --> 00:30:56.274 Wagner model that that tells us how

NOTE Confidence: 0.89675105

00:30:56.274 --> 00:30:58.954 predictions are updated by experience.

NOTE Confidence: 0.89675105

00:30:58.960 --> 00:31:01.662 And so this is the reward prediction

NOTE Confidence: 0.89675105

00:31:01.662 --> 00:31:03.924 error framework that many of you

NOTE Confidence: 0.89675105

00:31:03.924 --> 00:31:05.994 are familiar with and in this

NOTE Confidence: 0.89675105

00:31:05.994 --> 00:31:08.195 framework the expected value and

NOTE Confidence: 0.89675105

00:31:08.195 --> 00:31:11.020 animal holds for upcoming reward.

NOTE Confidence: 0.89675105

00:31:11.020 --> 00:31:12.607 Is updated iteratively,

NOTE Confidence: 0.89675105

00:31:12.607 --> 00:31:15.781 so with every experience based on

NOTE Confidence: 0.89675105

00:31:15.781 --> 00:31:18.492 whether the rewarded receives mattress,

NOTE Confidence: 0.89675105

00:31:18.492 --> 00:31:20.732 that or is better, or is worse,

NOTE Confidence: 0.89675105

00:31:20.732 --> 00:31:22.076 and so that's where we have

NOTE Confidence: 0.89675105

00:31:22.076 --> 00:31:23.556 positive prediction error if it's

NOTE Confidence: 0.89675105

00:31:23.556 --> 00:31:25.014 better than expected, no change.

NOTE Confidence: 0.89675105

00:31:25.014 --> 00:31:26.676 If it's the same as expected,

NOTE Confidence: 0.89675105

00:31:26.680 --> 00:31:28.312 negative prediction error is what you

NOTE Confidence: 0.89675105

00:31:28.312 --> 00:31:30.300 get is worse than what you thought,

NOTE Confidence: 0.89675105

00:31:30.300 --> 00:31:34.367 and through the use of this canonical.

NOTE Confidence: 0.89675105

00:31:34.370 --> 00:31:37.260 Way of explaining what the

NOTE Confidence: 0.89675105

00:31:37.260 --> 00:31:40.590 activity of a neuron might be,

NOTE Confidence: 0.89675105

00:31:40.590 --> 00:31:44.145 we can compare that with a much simpler idea,

NOTE Confidence: 0.89675105

00:31:44.150 --> 00:31:46.310 which is that the readout at the time,

NOTE Confidence: 0.89675105

00:31:46.310 --> 00:31:47.912 the animals drinking that reward just

NOTE Confidence: 0.89675105

00:31:47.912 --> 00:31:49.370 reflects a difference in outcome.

NOTE Confidence: 0.89675105

00:31:49.370 --> 00:31:51.209 A binary difference,

NOTE Confidence: 0.89675105

00:31:51.209 --> 00:31:53.048 sucrose versus maltodextrin?

NOTE Confidence: 0.89675105

00:31:53.050 --> 00:31:55.680 Or is this bike activity that we see at the

NOTE Confidence: 0.89675105

00:31:55.750 --> 00:31:58.446 time of reward unrelated to either of these?

NOTE Confidence: 0.89675105

00:31:58.450 --> 00:31:58.848 Of course,

NOTE Confidence: 0.89675105

00:31:58.848 --> 00:32:00.440 we already have an idea that many of

NOTE Confidence: 0.89675105

00:32:00.487 --> 00:32:01.927 the neurons do care about rewards,

NOTE Confidence: 0.89675105

00:32:01.930 --> 00:32:04.600 so we don't expect that that that will be a.

NOTE Confidence: 0.89675105

00:32:04.600 --> 00:32:06.980 Huge contributor so you can take this

NOTE Confidence: 0.89675105

00:32:06.980 --> 00:32:09.389 bike activity of neurons through time.

NOTE Confidence: 0.89675105

00:32:09.390 --> 00:32:10.401 Trial by trial.

NOTE Confidence: 0.89675105

00:32:10.401 --> 00:32:13.160 Look at how the neuron responds to the

NOTE Confidence: 0.89675105

00:32:13.160 --> 00:32:15.470 reward and see if its activity matches

NOTE Confidence: 0.89675105

00:32:15.470 --> 00:32:18.357 just a real time difference in outcome.

NOTE Confidence: 0.89675105

00:32:18.360 --> 00:32:20.453 Or does it actually account for what

NOTE Confidence: 0.89675105

00:32:20.453 --> 00:32:22.314 the animal received a trial before

NOTE Confidence: 0.89675105

00:32:22.314 --> 00:32:23.819 trial before the trial before,

NOTE Confidence: 0.89675105

00:32:23.820 --> 00:32:25.836 as in a Rescorla Wagner model,

NOTE Confidence: 0.89675105

00:32:25.840 --> 00:32:28.416 and I wouldn't be saying this if

NOTE Confidence: 0.89675105

00:32:28.416 --> 00:32:30.636 we hadn't indeed found a group

NOTE Confidence: 0.89675105

00:32:30.636 --> 00:32:32.604 of neurons that does care about

NOTE Confidence: 0.89675105

00:32:32.604 --> 00:32:34.608 what reward the animal received.

NOTE Confidence: 0.89675105

00:32:34.610 --> 00:32:36.782 The trial before the trial that

NOTE Confidence: 0.89675105

00:32:36.782 --> 00:32:38.230 they're experiencing that reward.

NOTE Confidence: 0.89675105

00:32:38.230 --> 00:32:39.220 In other words,

NOTE Confidence: 0.89675105

00:32:39.220 --> 00:32:40.870 there's an impact of experience.

NOTE Confidence: 0.89675105

00:32:40.870 --> 00:32:43.299 So in about 20% of these neurons

NOTE Confidence: 0.89675105

00:32:43.299 --> 00:32:46.165 that fire at the time of reward

NOTE Confidence: 0.89675105

00:32:46.165 --> 00:32:48.350 showed an impact of expectation,

NOTE Confidence: 0.89675105

00:32:48.350 --> 00:32:50.950 another slightly more than 20%,

NOTE Confidence: 0.89675105

00:32:50.950 --> 00:32:53.008 were just encoding the current outcome.

NOTE Confidence: 0.89675105

00:32:53.010 --> 00:32:54.690 This ones better, that was worse,

NOTE Confidence: 0.89675105

00:32:54.690 --> 00:32:56.610 and that was relatively stable.

NOTE Confidence: 0.89675105

00:32:56.610 --> 00:32:58.794 And then there were neurons that didn't

NOTE Confidence: 0.89675105

00:32:58.794 --> 00:33:00.668 care about either of those things,

NOTE Confidence: 0.9162103975

00:33:00.670 --> 00:33:03.078 and you can now look at the neural

NOTE Confidence: 0.9162103975

00:33:03.078 --> 00:33:04.799 activity of these different.

NOTE Confidence: 0.9162103975

00:33:04.800 --> 00:33:07.012 Classes we now divided up our neurons

NOTE Confidence: 0.9162103975

00:33:07.012 --> 00:33:09.092 that respond to rewarding to these

NOTE Confidence: 0.9162103975

00:33:09.092 --> 00:33:11.628 two classes and get a nice feel for

NOTE Confidence: 0.9162103975

00:33:11.628 --> 00:33:13.540 what this actually might look like.

NOTE Confidence: 0.9162103975

00:33:13.540 --> 00:33:15.808 So here are the neurons that were the reward

NOTE Confidence: 0.9162103975

00:33:15.808 --> 00:33:17.528 prediction error neurons they cared about.

NOTE Confidence: 0.9162103975

00:33:17.530 --> 00:33:19.274 What happened trial before

NOTE Confidence: 0.9162103975

00:33:19.274 --> 00:33:21.454 divide it up just into.

NOTE Confidence: 0.9162103975

00:33:21.460 --> 00:33:23.680 The simplest kind of way of

NOTE Confidence: 0.9162103975

00:33:23.680 --> 00:33:25.160 thinking about this trials,

NOTE Confidence: 0.9162103975

00:33:25.160 --> 00:33:27.930 in which animals get sucrose.

NOTE Confidence: 0.9162103975

00:33:27.930 --> 00:33:29.994 After a trial when they got

NOTE Confidence: 0.9162103975

00:33:29.994 --> 00:33:32.000 maltodextrin so better than expected,

NOTE Confidence: 0.9162103975

00:33:32.000 --> 00:33:34.340 that's this very tall yellow peak.

NOTE Confidence: 0.9162103975

00:33:34.340 --> 00:33:36.368 Trials when animals got

NOTE Confidence: 0.9162103975

00:33:36.368 --> 00:33:37.889 sucrose after sucrose.

NOTE Confidence: 0.9162103975

00:33:37.890 --> 00:33:39.930 Trials when animals got multi dextrin.

NOTE Confidence: 0.9162103975

00:33:39.930 --> 00:33:42.175 After maltodextrin and trials when

NOTE Confidence: 0.9162103975

00:33:42.175 --> 00:33:44.420 animals got maltodextrin after sucrose

NOTE Confidence: 0.9162103975

00:33:44.482 --> 00:33:46.794 so much worse than they thought and you

NOTE Confidence: 0.9162103975

00:33:46.794 --> 00:33:49.280 can see this big modulation of firing.

NOTE Confidence: 0.9162103975

00:33:49.280 --> 00:33:51.230 That depends on what just happened.

NOTE Confidence: 0.9162103975

00:33:51.230 --> 00:33:52.834 So that matches this.

NOTE Confidence: 0.9162103975

00:33:52.834 --> 00:33:54.037 This quantitative assessment

NOTE Confidence: 0.9162103975

00:33:54.037 --> 00:33:55.790 and the current outcome.

NOTE Confidence: 0.9162103975

00:33:55.790 --> 00:33:58.891 Neurons show much less or no modulation

NOTE Confidence: 0.9162103975

00:33:58.891 --> 00:34:01.685 around expectation and is quite flat

NOTE Confidence: 0.9162103975

00:34:01.685 --> 00:34:04.005 for the unmodulated neurons obviously,

NOTE Confidence: 0.9162103975

00:34:04.010 --> 00:34:06.106 and we can do this same analysis in

NOTE Confidence: 0.9162103975

00:34:06.106 --> 00:34:08.098 R3 reward tasks and find the same.

NOTE Confidence: 0.9162103975

00:34:08.100 --> 00:34:10.330 Outcome where there's a portion

NOTE Confidence: 0.9162103975

00:34:10.330 --> 00:34:12.780 of neurons that encode some kind

NOTE Confidence: 0.9162103975

00:34:12.780 --> 00:34:14.430 of expectation signal looks like

NOTE Confidence: 0.9162103975

00:34:14.430 --> 00:34:15.800 a reward prediction error,

NOTE Confidence: 0.9162103975

00:34:15.800 --> 00:34:17.534 and even more neurons do this

NOTE Confidence: 0.9162103975

00:34:17.534 --> 00:34:19.553 when you have this larger dynamic

NOTE Confidence: 0.9162103975

00:34:19.553 --> 00:34:21.157 range across the rewards,

NOTE Confidence: 0.9162103975

00:34:21.160 --> 00:34:22.288 the animals experiencing,

NOTE Confidence: 0.9162103975

00:34:22.288 --> 00:34:24.168 which is kind of interesting,

NOTE Confidence: 0.9162103975

00:34:24.170 --> 00:34:26.746 we can again get an intuitive feel

NOTE Confidence: 0.9162103975

00:34:26.746 --> 00:34:29.616 for how this maps onto neural activity

NOTE Confidence: 0.9162103975

00:34:29.616 --> 00:34:32.860 by looking at subsets of the neurons.

NOTE Confidence: 0.9162103975

00:34:32.860 --> 00:34:33.721 In this case,

NOTE Confidence: 0.9162103975

00:34:33.721 --> 00:34:36.171 if we just look at the neurons that

NOTE Confidence: 0.9162103975

00:34:36.171 --> 00:34:38.409 are seem to encode and expectation.

NOTE Confidence: 0.9162103975

00:34:38.410 --> 00:34:40.895 Signal and categorize them based

NOTE Confidence: 0.9162103975

00:34:40.895 --> 00:34:42.883 on the calculated error.

NOTE Confidence: 0.9162103975

00:34:42.890 --> 00:34:44.078 Was it very positive?

NOTE Confidence: 0.9162103975

00:34:44.078 --> 00:34:46.579 Was there no error signal on that trial?

NOTE Confidence: 0.9162103975

00:34:46.580 --> 00:34:48.729 Was there a negative error signal on

NOTE Confidence: 0.9162103975

00:34:48.729 --> 00:34:52.026 that trial and use eight categories for that?

NOTE Confidence: 0.9162103975

00:34:52.030 --> 00:34:54.290 We can see this beautiful

NOTE Confidence: 0.9162103975

00:34:54.290 --> 00:34:56.604 distribution of signals along the

NOTE Confidence: 0.9162103975

00:34:56.604 --> 00:34:58.989 most positive reward prediction error,

NOTE Confidence: 0.9162103975

00:34:58.990 --> 00:35:01.450 little error and negative error.

NOTE Confidence: 0.9162103975

00:35:01.450 --> 00:35:03.714 So this gives us a sort of intuitive

NOTE Confidence: 0.9162103975

00:35:03.714 --> 00:35:05.779 way to think about how firing

NOTE Confidence: 0.9162103975

00:35:05.779 --> 00:35:07.915 happening at the time of reward

NOTE Confidence: 0.9162103975

00:35:07.987 --> 00:35:09.767 can actually be telling us.

NOTE Confidence: 0.9162103975

00:35:09.770 --> 00:35:12.026 Think about what the animal expects,

NOTE Confidence: 0.9162103975

00:35:12.030 --> 00:35:14.970 not just what is this particular

NOTE Confidence: 0.9162103975

00:35:14.970 --> 00:35:17.930 reward as far as identity.

NOTE Confidence: 0.9162103975

00:35:17.930 --> 00:35:20.121 So this this was really exciting to

NOTE Confidence: 0.9162103975

00:35:20.121 --> 00:35:22.979 us to find this kind of signal and BP.

NOTE Confidence: 0.9162103975

00:35:22.980 --> 00:35:24.726 We're very used to thinking about

NOTE Confidence: 0.9162103975

00:35:24.726 --> 00:35:25.890 these kinds of expectations.

NOTE Confidence: 0.9162103975

00:35:25.890 --> 00:35:27.210 Signals in dopamine neurons,

NOTE Confidence: 0.9162103975

00:35:27.210 --> 00:35:29.190 and we hadn't been expecting to

NOTE Confidence: 0.9162103975

00:35:29.248 --> 00:35:31.173 see this kind of thing in ventral

NOTE Confidence: 0.9162103975

00:35:31.173 --> 00:35:31.998 pallidum at all,

NOTE Confidence: 0.9162103975

00:35:32.000 --> 00:35:33.729 which we thought would be more just

NOTE Confidence: 0.9162103975

00:35:33.729 --> 00:35:35.730 a basic readout. This is good.

NOTE Confidence: 0.9162103975

00:35:35.730 --> 00:35:38.418 This is bad in real time.

NOTE Confidence: 0.9162103975

00:35:38.420 --> 00:35:40.940 So because we saw these signals that

NOTE Confidence: 0.9162103975

00:35:40.940 --> 00:35:43.290 match what are teaching signals,

NOTE Confidence: 0.9162103975

00:35:43.290 --> 00:35:45.786 signals that are updated over time

NOTE Confidence: 0.9162103975

00:35:45.786 --> 00:35:48.010 and reflect what subjects expect,

NOTE Confidence: 0.9162103975

00:35:48.010 --> 00:35:50.062 David wondered if he could find

NOTE Confidence: 0.9162103975

00:35:50.062 --> 00:35:52.843 any way to see if the animal's

NOTE Confidence: 0.9162103975

00:35:52.843 --> 00:35:55.385 behavior changed based on what the

NOTE Confidence: 0.9162103975

00:35:55.385 --> 00:35:58.640 error signal was on a given trial.

NOTE Confidence: 0.9162103975

00:35:58.640 --> 00:36:00.944 So we have to say that the procedure

NOTE Confidence: 0.9162103975

00:36:00.944 --> 00:36:02.792 that he designed was not designed

NOTE Confidence: 0.9162103975

00:36:02.792 --> 00:36:05.086 to see a lot of rich behavior

NOTE Confidence: 0.9162103975

00:36:05.086 --> 00:36:07.600 was designed to have the animals

NOTE Confidence: 0.9162103975

00:36:07.600 --> 00:36:08.857 behavior very similar.

NOTE Confidence: 0.871961503571429

00:36:08.860 --> 00:36:11.058 Each trial. Indeed, you saw that when

NOTE Confidence: 0.871961503571429

00:36:11.058 --> 00:36:13.248 we were looking at the licking rate,

NOTE Confidence: 0.871961503571429

00:36:13.250 --> 00:36:15.854 but David did still videotape the animal,

NOTE Confidence: 0.871961503571429

00:36:15.860 --> 00:36:18.996 so he went back and analyzed their behavior.

NOTE Confidence: 0.871961503571429

00:36:19.000 --> 00:36:20.757 This is what the Chamber looks like.

NOTE Confidence: 0.871961503571429

00:36:20.760 --> 00:36:22.152 A typical rat chamber,

NOTE Confidence: 0.871961503571429

00:36:22.152 --> 00:36:25.080 and where the animals can enter reward port.

NOTE Confidence: 0.871961503571429

00:36:25.080 --> 00:36:27.088 You know when the queues on and drink

NOTE Confidence: 0.871961503571429

00:36:27.088 --> 00:36:28.907 the reward and there's an interest.

NOTE Confidence: 0.871961503571429

00:36:28.910 --> 00:36:30.114 Inter trial interval you

NOTE Confidence: 0.871961503571429

00:36:30.114 --> 00:36:31.318 know they wander around.

NOTE Confidence: 0.871961503571429

00:36:31.320 --> 00:36:32.616 They might do. A little grooming,

NOTE Confidence: 0.871961503571429

00:36:32.620 --> 00:36:33.922 might hang out by the port

NOTE Confidence: 0.871961503571429

00:36:33.922 --> 00:36:35.120 waiting for the next month.

NOTE Confidence: 0.871961503571429

00:36:35.120 --> 00:36:37.388 Typical behavior that the rat behaviors

NOTE Confidence: 0.871961503571429

00:36:37.388 --> 00:36:39.933 among us are used to seeing what

NOTE Confidence: 0.871961503571429

00:36:39.933 --> 00:36:42.166 David found when he looked at the

NOTE Confidence: 0.871961503571429

00:36:42.234 --> 00:36:44.789 behavior in detail that on trials when

NOTE Confidence: 0.871961503571429

00:36:44.789 --> 00:36:47.513 animals had just received the reward,

NOTE Confidence: 0.871961503571429

00:36:47.513 --> 00:36:49.677 they liked better sucrose.

NOTE Confidence: 0.871961503571429

00:36:49.680 --> 00:36:50.616 Right after that,

NOTE Confidence: 0.871961503571429

00:36:50.616 --> 00:36:53.150 the animal tended to hang around the port,

NOTE Confidence: 0.871961503571429

00:36:53.150 --> 00:36:55.470 waiting presumably for more sucrose.

NOTE Confidence: 0.871961503571429

00:36:55.470 --> 00:36:57.668 If the animal had just received maltodextrin,

NOTE Confidence: 0.871961503571429

00:36:57.670 --> 00:37:00.046 they tended to wander off more.

NOTE Confidence: 0.871961503571429

00:37:00.050 --> 00:37:01.710 It's not a huge effect.

NOTE Confidence: 0.871961503571429

00:37:01.710 --> 00:37:02.870 We can look at this.

NOTE Confidence: 0.871961503571429

00:37:02.870 --> 00:37:04.758 This is sort of a way to map

NOTE Confidence: 0.871961503571429

00:37:04.758 --> 00:37:05.750 individual animal behavior.

NOTE Confidence: 0.871961503571429

00:37:05.750 --> 00:37:06.995 Looking at a cartoon of

NOTE Confidence: 0.871961503571429

00:37:06.995 --> 00:37:08.240 the square of the chamber,

NOTE Confidence: 0.871961503571429

00:37:08.240 --> 00:37:09.710 it's not a huge effect,

NOTE Confidence: 0.871961503571429

00:37:09.710 --> 00:37:12.118 but you see more color and more black.

NOTE Confidence: 0.871961503571429

00:37:12.120 --> 00:37:14.954 X is away from the port when

NOTE Confidence: 0.871961503571429

00:37:14.954 --> 00:37:17.130 it's post maltodextrin sucrose,

NOTE Confidence: 0.871961503571429

00:37:17.130 --> 00:37:19.780 and this is statistically significant.

NOTE Confidence: 0.871961503571429

00:37:19.780 --> 00:37:21.474 We see the same pattern when we

NOTE Confidence: 0.871961503571429

00:37:21.474 --> 00:37:23.160 have the three rewards together.

NOTE Confidence: 0.871961503571429

00:37:23.160 --> 00:37:24.222 After receiving water,

NOTE Confidence: 0.871961503571429

00:37:24.222 --> 00:37:25.992 they're more likely to be

NOTE Confidence: 0.871961503571429

00:37:25.992 --> 00:37:27.280 further from the port,

NOTE Confidence: 0.871961503571429

00:37:27.280 --> 00:37:30.654 so it's very simple measure of how

NOTE Confidence: 0.871961503571429

00:37:30.654 --> 00:37:32.942 their future behavior is impacted

NOTE Confidence: 0.871961503571429

00:37:32.942 --> 00:37:35.580 by the the the the validation

NOTE Confidence: 0.871961503571429

00:37:35.580 --> 00:37:38.080 of their expectation or getting

NOTE Confidence: 0.871961503571429

00:37:38.080 --> 00:37:40.619 something less than they expected.

NOTE Confidence: 0.871961503571429

00:37:40.620 --> 00:37:42.003 Simple small effect,

NOTE Confidence: 0.871961503571429

00:37:42.003 --> 00:37:45.230 but can we manipulate it by changing

NOTE Confidence: 0.871961503571429

00:37:45.312 --> 00:37:47.898 these neurons and how they fire?

NOTE Confidence: 0.871961503571429

00:37:47.900 --> 00:37:50.140 So this was the setting for an

NOTE Confidence: 0.871961503571429

00:37:50.140 --> 00:37:51.500 optogenetic experiment at David,

NOTE Confidence: 0.871961503571429

00:37:51.500 --> 00:37:52.840 then performed getting together

NOTE Confidence: 0.871961503571429

00:37:52.840 --> 00:37:55.157 with Tabatha Kim and Kurt Fraser to

NOTE Confidence: 0.871961503571429

00:37:55.157 --> 00:37:56.914 graduate students in the lab at that

NOTE Confidence: 0.871961503571429

00:37:56.914 --> 00:37:58.624 time had now moved on to Charles

NOTE Confidence: 0.871961503571429

00:37:58.624 --> 00:38:00.725 River and to post up with stuff on

NOTE Confidence: 0.871961503571429

00:38:00.725 --> 00:38:02.930 the mouth and so they simply asked

NOTE Confidence: 0.871961503571429

00:38:03.001 --> 00:38:05.166 if they express general adoption.

NOTE Confidence: 0.871961503571429

00:38:05.170 --> 00:38:06.990 Excited Tori option in neurons

NOTE Confidence: 0.871961503571429

00:38:06.990 --> 00:38:09.242 in the ventral pallidum and then

NOTE Confidence: 0.871961503571429

00:38:09.242 --> 00:38:10.698 make those neurons fire.

NOTE Confidence: 0.871961503571429

00:38:10.700 --> 00:38:13.116 By shining light on them at the time,

NOTE Confidence: 0.871961503571429

00:38:13.120 --> 00:38:14.792 the animals ingesting reward,

NOTE Confidence: 0.871961503571429

00:38:14.792 --> 00:38:16.882 can they impact the behavior

NOTE Confidence: 0.871961503571429

00:38:16.882 --> 00:38:19.070 after the animal got the reward?

NOTE Confidence: 0.871961503571429

00:38:19.070 --> 00:38:19.346 How?

NOTE Confidence: 0.871961503571429

00:38:19.346 --> 00:38:21.002 How much the animals likely to

NOTE Confidence: 0.871961503571429

00:38:21.002 --> 00:38:22.419 hang out by the port?

NOTE Confidence: 0.871961503571429

00:38:22.420 --> 00:38:24.534 That's so if you excite the neurons,

NOTE Confidence: 0.871961503571429

00:38:24.540 --> 00:38:25.896 you'd expect to see the animals

NOTE Confidence: 0.871961503571429

00:38:25.896 --> 00:38:27.429 hang close to the port right

NOTE Confidence: 0.871961503571429

00:38:27.429 --> 00:38:28.879 after you've excited the neurons.

NOTE Confidence: 0.871961503571429

00:38:28.880 --> 00:38:29.370 Alternatively,

NOTE Confidence: 0.871961503571429

00:38:29.370 --> 00:38:32.310 if you express an inhibitory option

NOTE Confidence: 0.871961503571429

00:38:32.310 --> 00:38:34.846 in ventral pallidum so that you

NOTE Confidence: 0.871961503571429

00:38:34.846 --> 00:38:37.149 can inhibit BP neuron firing at the

NOTE Confidence: 0.871961503571429

00:38:37.226 --> 00:38:39.536 time they're drinking the reward,

NOTE Confidence: 0.871961503571429

00:38:39.540 --> 00:38:41.012 you'd expect to make.

NOTE Confidence: 0.871961503571429

00:38:41.012 --> 00:38:43.649 The animal more likely to be away

NOTE Confidence: 0.871961503571429

00:38:43.649 --> 00:38:46.380 from the court after that sort

NOTE Confidence: 0.871961503571429

00:38:46.380 --> 00:38:48.620 of inhibition of BP,

NOTE Confidence: 0.871961503571429

00:38:48.620 --> 00:38:50.336 and so that's the kind of

NOTE Confidence: 0.871961503571429

00:38:50.336 --> 00:38:51.480 experiment that they designed.

NOTE Confidence: 0.871961503571429

00:38:51.480 --> 00:38:53.832 This is just a cartoon by lateral

NOTE Confidence: 0.871961503571429

00:38:53.832 --> 00:38:56.176 inhibition of BP neurons is going to

NOTE Confidence: 0.871961503571429

00:38:56.176 --> 00:38:58.680 occur at the time of reward delivery

NOTE Confidence: 0.871961503571429

00:38:58.680 --> 00:39:01.260 or unilateral excitation of DP.

NOTE Confidence: 0.871961503571429

00:39:01.260 --> 00:39:03.378 Neurons will occur at the time

NOTE Confidence: 0.871961503571429

00:39:03.378 --> 00:39:04.437 of reward delivery.

NOTE Confidence: 0.905507280833333

00:39:04.440 --> 00:39:05.900 So for this experiment the

NOTE Confidence: 0.905507280833333

00:39:05.900 --> 00:39:08.099 reward is the same in all trials,

NOTE Confidence: 0.905507280833333

00:39:08.100 --> 00:39:11.150 it's sucrose, but the optogenetic.

NOTE Confidence: 0.905507280833333

00:39:11.150 --> 00:39:12.398 Activation or inhibition will

NOTE Confidence: 0.905507280833333

00:39:12.398 --> 00:39:14.730 just occur on half of the trials,

NOTE Confidence: 0.905507280833333

00:39:14.730 --> 00:39:16.906 so that lets you see if your change

NOTE Confidence: 0.905507280833333

00:39:16.906 --> 00:39:19.213 in neural activity is affecting the

NOTE Confidence: 0.905507280833333

00:39:19.213 --> 00:39:21.333 animals behavior independent of the

NOTE Confidence: 0.905507280833333

00:39:21.333 --> 00:39:23.290 specific taste of the reward, etc.

NOTE Confidence: 0.905507280833333

00:39:23.290 --> 00:39:25.110 So you hold the those aspects of

NOTE Confidence: 0.905507280833333

00:39:25.110 --> 00:39:26.838 the reward constant and see if

NOTE Confidence: 0.905507280833333

00:39:26.838 --> 00:39:28.560 you're turning up or turning down

NOTE Confidence: 0.905507280833333

00:39:28.621 --> 00:39:30.191 of the neural activity impacts

NOTE Confidence: 0.905507280833333

00:39:30.191 --> 00:39:32.123 their behavior as you would expect,

NOTE Confidence: 0.905507280833333

00:39:32.123 --> 00:39:34.241 and that is exactly what they

NOTE Confidence: 0.905507280833333

00:39:34.241 --> 00:39:35.890 observed in this Chamber.

NOTE Confidence: 0.905507280833333

00:39:35.890 --> 00:39:38.410 That reward port is here on the right side,

NOTE Confidence: 0.905507280833333

00:39:38.410 --> 00:39:41.315 on trials in which BP was activated.

NOTE Confidence: 0.905507280833333

00:39:41.320 --> 00:39:42.964 The subject tends to hang out

NOTE Confidence: 0.905507280833333

00:39:42.964 --> 00:39:44.060 closer to the port,

NOTE Confidence: 0.905507280833333

00:39:44.060 --> 00:39:46.692 so a lower value here than on

NOTE Confidence: 0.905507280833333

00:39:46.692 --> 00:39:48.970 trials where the subject was not

NOTE Confidence: 0.905507280833333

00:39:48.970 --> 00:39:50.895 did not receive VP activation,

NOTE Confidence: 0.905507280833333

00:39:50.900 --> 00:39:53.054 so it's a within subject within

NOTE Confidence: 0.905507280833333

00:39:53.054 --> 00:39:54.974 session comparison and we see

NOTE Confidence: 0.905507280833333

00:39:54.974 --> 00:39:56.638 the opposite with inhibition.

NOTE Confidence: 0.905507280833333

00:39:56.640 --> 00:39:59.024 They tend to be further away if you

NOTE Confidence: 0.905507280833333

00:39:59.024 --> 00:40:01.448 inhibit while they're consuming the reward,

NOTE Confidence: 0.905507280833333

00:40:01.450 --> 00:40:04.551 so this these are reliable effects but

NOTE Confidence: 0.905507280833333

00:40:04.551 --> 00:40:07.219 granted relatively small in this procedure,

NOTE Confidence: 0.905507280833333

00:40:07.220 --> 00:40:09.040 not really used to.

NOTE Confidence: 0.905507280833333

00:40:09.040 --> 00:40:11.770 Think about how this impacts decisions,

NOTE Confidence: 0.905507280833333

00:40:11.770 --> 00:40:13.834 but because we saw the signal

NOTE Confidence: 0.905507280833333

00:40:13.834 --> 00:40:14.866 in this behavior,

NOTE Confidence: 0.905507280833333

00:40:14.870 --> 00:40:17.118 we wanted to see if we could find

NOTE Confidence: 0.905507280833333

00:40:17.118 --> 00:40:19.408 any evidence that an expectation

NOTE Confidence: 0.905507280833333

00:40:19.408 --> 00:40:21.130 reward prediction, like signal,

NOTE Confidence: 0.905507280833333

00:40:21.130 --> 00:40:23.130 impacted future behavior and this

NOTE Confidence: 0.905507280833333

00:40:23.130 --> 00:40:25.248 evidence was there and so that

NOTE Confidence: 0.905507280833333

00:40:25.248 --> 00:40:26.946 was really exciting to us and

NOTE Confidence: 0.905507280833333

00:40:26.946 --> 00:40:29.051 lead the stage for our continued

NOTE Confidence: 0.905507280833333

00:40:29.051 --> 00:40:31.080 experiment that I'll tell you about.

NOTE Confidence: 0.905507280833333

00:40:31.080 --> 00:40:33.240 Right now I'm going to take a quick

NOTE Confidence: 0.905507280833333

00:40:33.240 --> 00:40:35.569 interim summary and this also be a good time,

NOTE Confidence: 0.905507280833333

00:40:35.570 --> 00:40:37.770 if anyone.

NOTE Confidence: 0.905507280833333

00:40:37.770 --> 00:40:41.506 Wants me to clarify something that I've said.

NOTE Confidence: 0.905507280833333

00:40:41.510 --> 00:40:43.510 So I wanted to just say from these.

NOTE Confidence: 0.905507280833333

00:40:43.510 --> 00:40:45.729 So far we've learned that the signal

NOTE Confidence: 0.905507280833333

00:40:45.729 --> 00:40:48.315 in VP that responds to reward is

NOTE Confidence: 0.905507280833333

00:40:48.315 --> 00:40:50.270 sensitive to pass reward history

NOTE Confidence: 0.905507280833333

00:40:50.270 --> 00:40:52.689 and can provide a reward prediction

NOTE Confidence: 0.905507280833333

00:40:52.689 --> 00:40:55.290 error signal to update the animals.

NOTE Confidence: 0.905507280833333

00:40:55.290 --> 00:40:57.850 Expected value of reward.

NOTE Confidence: 0.905507280833333

00:40:57.850 --> 00:40:59.290 And So what we would like to know,

NOTE Confidence: 0.905507280833333

00:40:59.290 --> 00:41:01.775 of course, is, are these signals used?

NOTE Confidence: 0.905507280833333

00:41:01.780 --> 00:41:04.768 Do they interact with decision processes?

NOTE Confidence: 0.905507280833333

00:41:04.770 --> 00:41:06.828 Can they impact the actions animals make?

NOTE Confidence: 0.905507280833333

00:41:06.830 --> 00:41:08.630 'cause that's ultimately what we

NOTE Confidence: 0.905507280833333

00:41:08.630 --> 00:41:11.494 want to explain how our choices made,

NOTE Confidence: 0.905507280833333

00:41:11.494 --> 00:41:14.831 what's going on in the brain when

NOTE Confidence: 0.905507280833333

00:41:14.831 --> 00:41:17.656 the animal evaluates the options?

NOTE Confidence: 0.905507280833333

00:41:17.660 --> 00:41:19.130 Question yes please.

NOTE Confidence: 0.9494952525

00:41:20.330 --> 00:41:22.230 That's really beautifully done.

NOTE Confidence: 0.9494952525

00:41:22.230 --> 00:41:24.453 I was wondering if you've

NOTE Confidence: 0.9494952525

00:41:24.453 --> 00:41:26.198 looked at what happens with.

NOTE Confidence: 0.9494952525

00:41:26.200 --> 00:41:28.660 Obviously, this is a learning signal.

NOTE Confidence: 0.9494952525

00:41:28.660 --> 00:41:31.760 What if it's a pharmacologic reward that

NOTE Confidence: 0.9494952525

00:41:31.760 --> 00:41:34.880 is sensitive to to tolerance effects?

NOTE Confidence: 0.9494952525

00:41:34.880 --> 00:41:38.290 Or you know any sort of reduction?

NOTE Confidence: 0.9321093225

00:41:38.300 --> 00:41:40.668 What happens to these neurons and to behavior

NOTE Confidence: 0.849466579

00:41:40.680 --> 00:41:42.160 'cause ya'll animal moved away

NOTE Confidence: 0.849466579

00:41:42.160 --> 00:41:43.640 when they were not getting,

NOTE Confidence: 0.849466579

00:41:43.640 --> 00:41:45.044 you know, beautiful extinction.

NOTE Confidence: 0.849466579

00:41:45.044 --> 00:41:47.150 But that is not obviously what

NOTE Confidence: 0.849466579

00:41:47.216 --> 00:41:48.965 we see when when people are

NOTE Confidence: 0.849466579

00:41:48.965 --> 00:41:50.390 beginning not even addicted.

NOTE Confidence: 0.849466579

00:41:50.390 --> 00:41:52.720 Just beginning to come

NOTE Confidence: 0.856978722

00:41:52.750 --> 00:41:55.456 to start to really like and

NOTE Confidence: 0.856978722

00:41:55.456 --> 00:41:57.260 escalate their their use.

NOTE Confidence: 0.856978722

00:41:57.260 --> 00:41:58.570 Yeah, that's a great question.

NOTE Confidence: 0.856978722

00:41:58.570 --> 00:42:00.466 So what we have not done yet is

NOTE Confidence: 0.856978722

00:42:00.466 --> 00:42:02.284 is used Ivy drug, for example,

NOTE Confidence: 0.856978722

00:42:02.284 --> 00:42:04.853 or even alcohol in this exact model.

NOTE Confidence: 0.856978722

00:42:04.860 --> 00:42:06.972 And we we we need to do that

NOTE Confidence: 0.856978722

00:42:06.972 --> 00:42:09.080 because here we are beginning to

NOTE Confidence: 0.856978722

00:42:09.080 --> 00:42:10.975 define for ourselves what these

NOTE Confidence: 0.856978722

00:42:10.975 --> 00:42:13.227 neurons are doing to natural reward.

NOTE Confidence: 0.856978722

00:42:13.230 --> 00:42:14.815 And when natural reward choices

NOTE Confidence: 0.856978722

00:42:14.815 --> 00:42:15.449 are occurring.

NOTE Confidence: 0.856978722

00:42:15.450 --> 00:42:18.280 But the critical question is how are

NOTE Confidence: 0.856978722

00:42:18.280 --> 00:42:20.611 these processes altered when that reward?

NOTE Confidence: 0.856978722

00:42:20.611 --> 00:42:22.830 Is a drug reward that has pharmacological

NOTE Confidence: 0.856978722

00:42:22.883 --> 00:42:24.573 properties that are quite different

NOTE Confidence: 0.856978722

00:42:24.573 --> 00:42:26.590 and there is important data from,

NOTE Confidence: 0.856978722

00:42:26.590 --> 00:42:27.360 for example,

NOTE Confidence: 0.856978722

00:42:27.360 --> 00:42:29.285 Megan Creed and Christian looser,

NOTE Confidence: 0.856978722

00:42:29.290 --> 00:42:33.292 showing that drugs like cocaine change

NOTE Confidence: 0.856978722

00:42:33.292 --> 00:42:36.082 synaptic efficacy between, for example,

NOTE Confidence: 0.856978722

00:42:36.082 --> 00:42:38.986 the accompagnes and ventral pallidal neurons.

NOTE Confidence: 0.856978722

00:42:38.990 --> 00:42:41.524 So there are chronic effects of drugs

NOTE Confidence: 0.856978722

00:42:41.524 --> 00:42:44.472 on the way that these neurons should

NOTE Confidence: 0.856978722

00:42:44.472 --> 00:42:47.142 be activated and should be firing

NOTE Confidence: 0.856978722

00:42:47.150 --> 00:42:48.812 and and so finding that intersection

NOTE Confidence: 0.856978722

00:42:48.812 --> 00:42:51.146 and studying that was, is it?

NOTE Confidence: 0.856978722

00:42:51.146 --> 00:42:51.759 Ago.

NOTE Confidence: 0.935188366842105

00:42:55.170 --> 00:42:58.720 OK so I'm gonna go on and tell you about

NOTE Confidence: 0.935188366842105

00:42:58.808 --> 00:43:01.863 the next reward behavioral procedure

NOTE Confidence: 0.935188366842105

00:43:01.863 --> 00:43:05.222 where David extended this work to try

NOTE Confidence: 0.935188366842105

00:43:05.222 --> 00:43:07.046 to understand how these signals are.

NOTE Confidence: 0.935188366842105

00:43:07.050 --> 00:43:09.310 Even if these signals matter.

NOTE Confidence: 0.935188366842105

00:43:09.310 --> 00:43:11.086 As far as the choices the animals make,

NOTE Confidence: 0.935188366842105

00:43:11.090 --> 00:43:14.204 and so he again turns to the notion of.

NOTE Confidence: 0.935188366842105

00:43:14.210 --> 00:43:15.758 Reward choice, so you need more

NOTE Confidence: 0.935188366842105

00:43:15.758 --> 00:43:17.579 than one reward at the same time

NOTE Confidence: 0.935188366842105

00:43:17.579 --> 00:43:19.280 and to provide a setting where he

NOTE Confidence: 0.935188366842105

00:43:19.335 --> 00:43:20.940 could try to understand choice.

NOTE Confidence: 0.935188366842105

00:43:20.940 --> 00:43:22.794 He thought it would make the

NOTE Confidence: 0.935188366842105

00:43:22.794 --> 00:43:24.941 most sense to make the animals

NOTE Confidence: 0.935188366842105

00:43:24.941 --> 00:43:27.046 choices change through the session

NOTE Confidence: 0.935188366842105

00:43:27.046 --> 00:43:29.100 by changing their motivation.

NOTE Confidence: 0.935188366842105

00:43:29.100 --> 00:43:31.896 He was interested in understanding how

NOTE Confidence: 0.935188366842105

00:43:31.896 --> 00:43:33.760 motivational state impacts choice.

NOTE Confidence: 0.935188366842105

00:43:33.760 --> 00:43:36.350 And I was very interested in this

NOTE Confidence: 0.935188366842105

00:43:36.350 --> 00:43:38.145 because motivational state and how

NOTE Confidence: 0.935188366842105

00:43:38.145 --> 00:43:40.301 it might be relieved by rewards you

NOTE Confidence: 0.935188366842105

00:43:40.301 --> 00:43:42.756 choose is a nice analogy for eventually

NOTE Confidence: 0.935188366842105

00:43:42.756 --> 00:43:44.874 thinking about how drug craving may

NOTE Confidence: 0.935188366842105

00:43:44.874 --> 00:43:47.076 operate within the system and how

NOTE Confidence: 0.935188366842105

00:43:47.076 --> 00:43:49.080 taking drugs may reduce craving.

NOTE Confidence: 0.935188366842105

00:43:49.080 --> 00:43:50.907 And then what happens in the brain.

NOTE Confidence: 0.935188366842105

00:43:50.910 --> 00:43:52.246 So that's the Longview.

NOTE Confidence: 0.935188366842105

00:43:52.246 --> 00:43:53.916 But in the short view,

NOTE Confidence: 0.935188366842105

00:43:53.920 --> 00:43:56.435 David wanted to ask specifically

NOTE Confidence: 0.935188366842105

00:43:56.435 --> 00:43:58.447 about motivational state shifts

NOTE Confidence: 0.935188366842105

00:43:58.447 --> 00:44:01.400 and how they may impact animals

NOTE Confidence: 0.935188366842105

00:44:01.400 --> 00:44:03.770 decision making through this system.

NOTE Confidence: 0.935188366842105

00:44:03.770 --> 00:44:06.118 Where we're recording expected

NOTE Confidence: 0.935188366842105

00:44:06.118 --> 00:44:08.466 reward and reward preference,

NOTE Confidence: 0.935188366842105

00:44:08.470 --> 00:44:10.346 and so he's doing this in the

NOTE Confidence: 0.935188366842105

00:44:10.346 --> 00:44:12.328 face of a shift in thirst.

NOTE Confidence: 0.935188366842105

00:44:12.330 --> 00:44:13.685 So obviously whether you choose

NOTE Confidence: 0.935188366842105

00:44:13.685 --> 00:44:15.339 food or water will depend on

NOTE Confidence: 0.935188366842105

00:44:15.339 --> 00:44:16.569 if you're hungry or thirsty,

NOTE Confidence: 0.935188366842105

00:44:16.570 --> 00:44:18.546 so this is a a kind of motivational

NOTE Confidence: 0.935188366842105

00:44:18.546 --> 00:44:20.433 shift that has great relevance to

NOTE Confidence: 0.935188366842105

00:44:20.433 --> 00:44:22.098 the natural functioning of this

NOTE Confidence: 0.935188366842105

00:44:22.098 --> 00:44:23.999 circuit and that we thought would

NOTE Confidence: 0.935188366842105

00:44:23.999 --> 00:44:25.504 help us understand the natural

NOTE Confidence: 0.935188366842105

00:44:25.510 --> 00:44:27.082 functioning of this circuit.

NOTE Confidence: 0.935188366842105

00:44:27.082 --> 00:44:29.440 So David developed what he called

NOTE Confidence: 0.935188366842105

00:44:29.505 --> 00:44:31.277 the dynamic preference task.

NOTE Confidence: 0.935188366842105

00:44:31.280 --> 00:44:33.836 So this task is very simple.

NOTE Confidence: 0.935188366842105

00:44:33.840 --> 00:44:36.948 Some animals are choosing between sucrose

NOTE Confidence: 0.935188366842105

00:44:36.948 --> 00:44:40.549 and water reward by pressing a lever.

NOTE Confidence: 0.935188366842105

00:44:40.550 --> 00:44:42.338 They begin each day,

NOTE Confidence: 0.935188366842105

00:44:42.338 --> 00:44:44.573 thirsty and within the session

NOTE Confidence: 0.935188366842105

00:44:44.573 --> 00:44:46.858 they assuaged their thirst.

NOTE Confidence: 0.935188366842105

00:44:46.860 --> 00:44:48.708 And within this session,

NOTE Confidence: 0.935188366842105

00:44:48.708 --> 00:44:50.556 besides the choice trials,

NOTE Confidence: 0.935188366842105

00:44:50.560 --> 00:44:53.212 it's critical that David also had

NOTE Confidence: 0.935188366842105

00:44:53.212 --> 00:44:55.548 forced choice trials where throughout

NOTE Confidence: 0.935188366842105

00:44:55.548 --> 00:44:58.506 time the animals had to experience

NOTE Confidence: 0.935188366842105

00:44:58.506 --> 00:45:00.434 water and experienced sucrose

NOTE Confidence: 0.935188366842105

00:45:00.434 --> 00:45:03.010 so that he could monitor the VP

NOTE Confidence: 0.935188366842105

00:45:03.010 --> 00:45:05.094 signals to that through the session,

NOTE Confidence: 0.935188366842105

00:45:05.094 --> 00:45:07.878 and so this will become clear when I

NOTE Confidence: 0.935188366842105

00:45:07.878 --> 00:45:09.984 explain again how this procedure works.

NOTE Confidence: 0.935188366842105

00:45:09.990 --> 00:45:13.140 So animals rats are in the

NOTE Confidence: 0.935188366842105

00:45:13.140 --> 00:45:14.982 behavioral chamber, their electrodes,

NOTE Confidence: 0.935188366842105

00:45:14.982 --> 00:45:16.850 and their ventral pallidum 60.

NOTE Confidence: 0.935188366842105

00:45:16.850 --> 00:45:18.530 Percent of the trials they receive

NOTE Confidence: 0.935188366842105

00:45:18.530 --> 00:45:20.557 over an hour and a half are the

NOTE Confidence: 0.935188366842105

00:45:20.557 --> 00:45:22.460 same as what we talked about before.

NOTE Confidence: 0.935188366842105

00:45:22.460 --> 00:45:24.595 There's a queue that tells them go

NOTE Confidence: 0.935188366842105

00:45:24.595 --> 00:45:26.826 to the reward port and 50% of the

NOTE Confidence: 0.935188366842105

00:45:26.826 --> 00:45:28.444 time they get sucrose. 50% water.

NOTE Confidence: 0.935188366842105

00:45:28.444 --> 00:45:29.088 It's randomized.

NOTE Confidence: 0.935188366842105

00:45:29.088 --> 00:45:31.250 They don't know what it will be.

NOTE Confidence: 0.935188366842105

00:45:31.250 --> 00:45:33.284 These are the forced choice trials

NOTE Confidence: 0.935188366842105

00:45:33.284 --> 00:45:35.428 they have to complete this to go

NOTE Confidence: 0.935188366842105

00:45:35.428 --> 00:45:36.638 on to the next trial.

NOTE Confidence: 0.935188366842105

00:45:36.640 --> 00:45:38.782 40% of the time they hear a cue that

NOTE Confidence: 0.935188366842105

00:45:38.782 --> 00:45:40.496 tells them it's a choice trial.

NOTE Confidence: 0.935188366842105

00:45:40.500 --> 00:45:42.418 They get to pick if they get.

NOTE Confidence: 0.935188366842105

00:45:42.420 --> 00:45:44.640 If they receive sucrose or water

NOTE Confidence: 0.935188366842105

00:45:44.640 --> 00:45:46.580 by pressing the relevant lover.

NOTE Confidence: 0.935188366842105

00:45:46.580 --> 00:45:48.070 So we have a mix.

NOTE Confidence: 0.935188366842105

00:45:48.070 --> 00:45:49.726 Of these outcome choice trials where

NOTE Confidence: 0.935188366842105

00:45:49.726 --> 00:45:52.030 we can see their behavioral preference,

NOTE Confidence: 0.935188366842105

00:45:52.030 --> 00:45:54.802 what do they want at that moment in time?

NOTE Confidence: 0.935188366842105

00:45:54.810 --> 00:45:56.562 And we also have the forest

NOTE Confidence: 0.935188366842105

00:45:56.562 --> 00:45:57.730 trials where we can't

NOTE Confidence: 0.941335286875

00:45:57.799 --> 00:46:00.247 see their preference from their behavior,

NOTE Confidence: 0.941335286875

00:46:00.250 --> 00:46:02.914 but instead we can look at how their

NOTE Confidence: 0.941335286875

00:46:02.914 --> 00:46:05.067 neurons respond to the two rewards and

NOTE Confidence: 0.941335286875

00:46:05.067 --> 00:46:07.494 see if it changes as their choices change.

NOTE Confidence: 0.941335286875

00:46:07.494 --> 00:46:10.276 So we use both of these kinds of

NOTE Confidence: 0.941335286875

00:46:10.276 --> 00:46:12.640 trials to get important behavioral and

NOTE Confidence: 0.941335286875

00:46:12.640 --> 00:46:15.036 neural data that we want to relate.

NOTE Confidence: 0.941335286875

00:46:15.040 --> 00:46:16.948 And what you see behaviourally when

NOTE Confidence: 0.941335286875

00:46:16.948 --> 00:46:19.459 you look at the responses of a rat

NOTE Confidence: 0.941335286875

00:46:19.459 --> 00:46:21.648 in this kind of procedure is that

NOTE Confidence: 0.941335286875

00:46:21.648 --> 00:46:23.468 they start out choosing water.

NOTE Confidence: 0.941335286875

00:46:23.470 --> 00:46:25.000 That's the long purple lines.

NOTE Confidence: 0.941335286875

00:46:25.000 --> 00:46:26.788 This is session time and the

NOTE Confidence: 0.941335286875

00:46:26.788 --> 00:46:28.524 number of trials which makes sense.

NOTE Confidence: 0.941335286875

00:46:28.524 --> 00:46:29.701 They're thirsty, they're going to

NOTE Confidence: 0.941335286875

00:46:29.701 --> 00:46:31.370 press on the water level quite a bit,

NOTE Confidence: 0.941335286875

00:46:31.370 --> 00:46:32.558 and as they get less thirsty,

NOTE Confidence: 0.941335286875

00:46:32.560 --> 00:46:35.409 they'll press on the water level less.

NOTE Confidence: 0.941335286875

00:46:35.410 --> 00:46:37.300 They'll press on the sucrose level

NOTE Confidence: 0.941335286875

00:46:37.300 --> 00:46:39.660 lever a few times in the beginning,

NOTE Confidence: 0.941335286875

00:46:39.660 --> 00:46:41.788 but that increases overtime

NOTE Confidence: 0.941335286875

00:46:41.788 --> 00:46:44.384 as they become less thirsty,

NOTE Confidence: 0.941335286875

00:46:44.384 --> 00:46:47.863 so there's a shift in their choices,

NOTE Confidence: 0.941335286875

00:46:47.870 --> 00:46:50.183 and you can graph that with this green line,

NOTE Confidence: 0.941335286875

00:46:50.190 --> 00:46:52.310 which shows their relative preference.

NOTE Confidence: 0.941335286875

00:46:52.310 --> 00:46:54.242 The short black lines tell us

NOTE Confidence: 0.941335286875

00:46:54.242 --> 00:46:56.150 when the forced trials occurred,

NOTE Confidence: 0.941335286875

00:46:56.150 --> 00:46:58.398 so you see they're forced to sample sucrose

NOTE Confidence: 0.941335286875

00:46:58.398 --> 00:47:00.549 and water throughout the whole session,

NOTE Confidence: 0.941335286875

00:47:00.550 --> 00:47:03.049 and we see there be choice behavior

NOTE Confidence: 0.941335286875

00:47:03.049 --> 00:47:04.630 through these choice trials.

NOTE Confidence: 0.941335286875

00:47:04.630 --> 00:47:06.280 So in all of the subjects.

NOTE Confidence: 0.941335286875

00:47:06.280 --> 00:47:08.440 Used in this study that I'll talk about.

NOTE Confidence: 0.941335286875

00:47:08.440 --> 00:47:11.569 We see a similar shift in preference

NOTE Confidence: 0.941335286875

00:47:11.569 --> 00:47:13.600 through the behavioral session,

NOTE Confidence: 0.941335286875

00:47:13.600 --> 00:47:15.736 so as they become less thirsty,

NOTE Confidence: 0.941335286875

00:47:15.740 --> 00:47:17.860 they tend to just respond for the supers,

NOTE Confidence: 0.941335286875

00:47:17.860 --> 00:47:20.029 which makes sense.

NOTE Confidence: 0.941335286875

00:47:20.030 --> 00:47:23.246 So we see this behavioral shift.

NOTE Confidence: 0.941335286875

00:47:23.250 --> 00:47:25.476 What about the neurons in the

NOTE Confidence: 0.941335286875

00:47:25.476 --> 00:47:27.746 VP and so to to address this,

NOTE Confidence: 0.941335286875

00:47:27.750 --> 00:47:30.792 David looked again at this response

NOTE Confidence: 0.941335286875

00:47:30.792 --> 00:47:33.924 to reward that VP neurons emit,

NOTE Confidence: 0.941335286875

00:47:33.930 --> 00:47:36.054 so he's looking at this time

NOTE Confidence: 0.941335286875

00:47:36.054 --> 00:47:38.140 period just after reward delivery.

NOTE Confidence: 0.941335286875

00:47:38.140 --> 00:47:41.318 When many neurons fire spikes when they

NOTE Confidence: 0.941335286875

00:47:41.318 --> 00:47:44.992 get reward and he's using now a general

NOTE Confidence: 0.941335286875

00:47:44.992 --> 00:47:48.170 little mini linear excuse me model to

NOTE Confidence: 0.941335286875

00:47:48.170 --> 00:47:51.180 try to understand which aspect of of.

NOTE Confidence: 0.941335286875

00:47:51.180 --> 00:47:51.693 Uhm,

NOTE Confidence: 0.941335286875

00:47:51.693 --> 00:47:55.284 the the design best captures how neurons

NOTE Confidence: 0.941335286875

00:47:55.284 --> 00:47:58.877 fire through session time trial by trial.

NOTE Confidence: 0.941335286875

00:47:58.880 --> 00:48:00.568 Do they just tend to show a difference?

NOTE Confidence: 0.941335286875

00:48:00.570 --> 00:48:03.198 Reflective of the difference in outcome?

NOTE Confidence: 0.941335286875

00:48:03.200 --> 00:48:04.792 Sucrose versus water that's

NOTE Confidence: 0.941335286875

00:48:04.792 --> 00:48:06.384 relatively stable over time.

NOTE Confidence: 0.941335286875

00:48:06.390 --> 00:48:08.466 Do they just show a decrement

NOTE Confidence: 0.941335286875

00:48:08.466 --> 00:48:09.850 or increase in activity?

NOTE Confidence: 0.941335286875

00:48:09.850 --> 00:48:12.490 They start satiety as you move through time.

NOTE Confidence: 0.941335286875

00:48:12.490 --> 00:48:14.255 Or is there an interaction

NOTE Confidence: 0.941335286875

00:48:14.255 --> 00:48:15.667 between these two processes?

NOTE Confidence: 0.941335286875

00:48:15.670 --> 00:48:17.740 And by looking at this statistically,

NOTE Confidence: 0.941335286875

00:48:17.740 --> 00:48:19.408 David founded sizeable proportion

NOTE Confidence: 0.941335286875

00:48:19.408 --> 00:48:21.493 of neurons that care about.

NOTE Confidence: 0.941335286875

00:48:21.500 --> 00:48:23.019 Both of these at the same time,

NOTE Confidence: 0.941335286875

00:48:23.020 --> 00:48:25.120 so their activity fits best.

NOTE Confidence: 0.941335286875

00:48:25.120 --> 00:48:27.104 Changing preference through time,

NOTE Confidence: 0.941335286875

00:48:27.104 --> 00:48:30.800 so some something to do with satiety.

NOTE Confidence: 0.941335286875

00:48:30.800 --> 00:48:34.478 Presumably something to do with preference.

NOTE Confidence: 0.941335286875

00:48:34.480 --> 00:48:35.568 And that makes sense.

NOTE Confidence: 0.941335286875

00:48:35.568 --> 00:48:36.928 'cause that's what happens to

NOTE Confidence: 0.941335286875

00:48:36.928 --> 00:48:38.464 the behavior with the behavior

NOTE Confidence: 0.941335286875

00:48:38.464 --> 00:48:40.276 switches as you move through time.

NOTE Confidence: 0.941335286875

00:48:40.280 --> 00:48:41.972 The animals preference for

NOTE Confidence: 0.941335286875

00:48:41.972 --> 00:48:44.087 water versus sucrose switches as

NOTE Confidence: 0.941335286875

00:48:44.087 --> 00:48:45.898 they become less thirsty,

NOTE Confidence: 0.941335286875

00:48:45.900 --> 00:48:47.340 and so here on the left,

NOTE Confidence: 0.941335286875

00:48:47.340 --> 00:48:49.628 if you can see this might be hard,

NOTE Confidence: 0.941335286875

00:48:49.630 --> 00:48:52.814 but I'll describe it for you is just

NOTE Confidence: 0.941335286875

00:48:52.814 --> 00:48:55.547 an example to show 1 neuron firing

NOTE Confidence: 0.941335286875

00:48:55.547 --> 00:48:58.803 in a very typical way for the whole

NOTE Confidence: 0.941335286875

00:48:58.803 --> 00:49:00.828 population through the session.

NOTE Confidence: 0.941335286875

00:49:00.830 --> 00:49:03.170 So at the beginning we have

NOTE Confidence: 0.941335286875

00:49:03.170 --> 00:49:04.730 neuron spiking at session.

NOTE Confidence: 0.8900720348

00:49:04.730 --> 00:49:06.781 The first trials and at the end

NOTE Confidence: 0.8900720348

00:49:06.781 --> 00:49:08.712 the last trials and these shaded

NOTE Confidence: 0.8900720348

00:49:08.712 --> 00:49:11.022 areas are the times when the animals

NOTE Confidence: 0.8900720348

00:49:11.088 --> 00:49:13.268 drinking sucrose or drinking water.

NOTE Confidence: 0.8900720348

00:49:13.270 --> 00:49:15.742 These are the times analyzed and you can

NOTE Confidence: 0.8900720348

00:49:15.742 --> 00:49:18.616 see that as the animal first gets sucrose,

NOTE Confidence: 0.8900720348

00:49:18.616 --> 00:49:20.588 you see moderate spiking.

NOTE Confidence: 0.8900720348

00:49:20.590 --> 00:49:22.330 That increases overtime when

NOTE Confidence: 0.8900720348

00:49:22.330 --> 00:49:24.505 the animal first gets water,

NOTE Confidence: 0.8900720348

00:49:24.510 --> 00:49:26.250 you see a lot of spiking.

NOTE Confidence: 0.8900720348

00:49:26.250 --> 00:49:28.062 That really decreases overtime.

NOTE Confidence: 0.8900720348

00:49:28.062 --> 00:49:31.726 If you look at this same kind of

NOTE Confidence: 0.8900720348

00:49:31.726 --> 00:49:34.743 feature overtime for all of the neurons.

NOTE Confidence: 0.8900720348

00:49:34.750 --> 00:49:37.048 Plotted here in these two figures,

NOTE Confidence: 0.8900720348

00:49:37.050 --> 00:49:39.336 with the sessions divided into quarters,

NOTE Confidence: 0.8900720348

00:49:39.340 --> 00:49:40.278 quarter 1234,

NOTE Confidence: 0.8900720348

00:49:40.278 --> 00:49:44.030 you see that the mean reward response to

NOTE Confidence: 0.8900720348

00:49:44.124 --> 00:49:47.687 sucrose is moderate and then gets bigger.

NOTE Confidence: 0.8900720348

00:49:47.690 --> 00:49:50.175 You see that the mean response to

NOTE Confidence: 0.8900720348

00:49:50.175 --> 00:49:52.463 water starts big and positive and

NOTE Confidence: 0.8900720348

00:49:52.463 --> 00:49:54.378 gets smaller and more negative

NOTE Confidence: 0.8900720348

00:49:54.378 --> 00:49:56.360 as the session goes on.

NOTE Confidence: 0.8900720348

00:49:56.360 --> 00:49:58.440 So you can see this much more easily

NOTE Confidence: 0.8900720348

00:49:58.440 --> 00:50:00.822 if we think about the mean here

NOTE Confidence: 0.8900720348

00:50:00.822 --> 00:50:02.617 over quarters for sucrose versus

NOTE Confidence: 0.8900720348

00:50:02.687 --> 00:50:04.920 water in this final graph down here,

NOTE Confidence: 0.8900720348

00:50:04.920 --> 00:50:06.580 the bend firing rate,

NOTE Confidence: 0.8900720348

00:50:06.580 --> 00:50:10.242 we can see the increase in activity for

NOTE Confidence: 0.8900720348

00:50:10.242 --> 00:50:13.433 sucrose overtime in one session and

NOTE Confidence: 0.8900720348

00:50:13.433 --> 00:50:16.744 the decrease in mean activity for water.

NOTE Confidence: 0.8900720348

00:50:16.750 --> 00:50:18.544 So this is interesting because we

NOTE Confidence: 0.8900720348

00:50:18.544 --> 00:50:20.396 see that the neural activity sort

NOTE Confidence: 0.8900720348

00:50:20.396 --> 00:50:22.190 of shifts more excited for water

NOTE Confidence: 0.8900720348

00:50:22.190 --> 00:50:23.410 in the beginning,

NOTE Confidence: 0.8900720348

00:50:23.410 --> 00:50:26.448 more excited for sucrose at the end.

NOTE Confidence: 0.8900720348

00:50:26.450 --> 00:50:28.397 And so does the animals preference, right?

NOTE Confidence: 0.8900720348

00:50:28.397 --> 00:50:30.966 The preference of the animus shift similarly.

NOTE Confidence: 0.8900720348

00:50:30.970 --> 00:50:32.764 But another thing to note is

NOTE Confidence: 0.8900720348

00:50:32.764 --> 00:50:34.869 this isn't like a mirror image.

NOTE Confidence: 0.8900720348

00:50:34.870 --> 00:50:37.678 These two curves are exactly symmetrical.

NOTE Confidence: 0.8900720348

00:50:37.680 --> 00:50:40.120 This water line really decreases,

NOTE Confidence: 0.8900720348

00:50:40.120 --> 00:50:42.360 and the sucrose mine is kind of flat,

NOTE Confidence: 0.8900720348

00:50:42.360 --> 00:50:44.375 so this was pretty interesting

NOTE Confidence: 0.8900720348

00:50:44.375 --> 00:50:46.187 and I just thought, well,

NOTE Confidence: 0.8900720348

00:50:46.187 --> 00:50:47.369 that's the way the data are,

NOTE Confidence: 0.8900720348

00:50:47.370 --> 00:50:50.100 but given David's beautiful more sort

NOTE Confidence: 0.8900720348

00:50:50.100 --> 00:50:52.094 of quantitative mind, he thought,

NOTE Confidence: 0.8900720348

00:50:52.094 --> 00:50:52.718 well, what?

NOTE Confidence: 0.8900720348

00:50:52.718 --> 00:50:54.980 How can I explain that particular shape?

NOTE Confidence: 0.8900720348

00:50:54.980 --> 00:50:56.765 Is there a way I can characterize?

NOTE Confidence: 0.8900720348

00:50:56.770 --> 00:50:59.175 That quantitatively and he started

NOTE Confidence: 0.8900720348

00:50:59.175 --> 00:51:02.136 thinking about whether this reward signal

NOTE Confidence: 0.8900720348

00:51:02.136 --> 00:51:05.004 that signaling a reward prediction error.

NOTE Confidence: 0.8900720348

00:51:05.010 --> 00:51:06.910 Could it contain more information

NOTE Confidence: 0.8900720348

00:51:06.910 --> 00:51:09.137 than just something related to what

NOTE Confidence: 0.8900720348

00:51:09.137 --> 00:51:11.249 reward did I get on the last trial?

NOTE Confidence: 0.8900720348

00:51:11.250 --> 00:51:14.466 Could it also reflect the value of the

NOTE Confidence: 0.8900720348

00:51:14.466 --> 00:51:17.816 whole task as the animals becoming sated?

NOTE Confidence: 0.8900720348

00:51:17.820 --> 00:51:18.169 So,

NOTE Confidence: 0.8900720348

00:51:18.169 --> 00:51:20.263 so every every both rewards will

NOTE Confidence: 0.8900720348

00:51:20.263 --> 00:51:22.239 become less valuable in some sense,

NOTE Confidence: 0.8900720348

00:51:22.240 --> 00:51:25.510 as the animals becoming less thirsty.

NOTE Confidence: 0.8900720348

00:51:25.510 --> 00:51:28.190 So I I really thought this was a

NOTE Confidence: 0.8900720348

00:51:28.190 --> 00:51:30.503 beautiful insight that he had and he

NOTE Confidence: 0.8900720348

00:51:30.503 --> 00:51:33.150 developed based on his prior work with Bill.

NOTE Confidence: 0.8900720348

00:51:33.150 --> 00:51:35.593 All models again to fit to the

NOTE Confidence: 0.8900720348

00:51:35.593 --> 00:51:38.529 activity of each neuron to see which

NOTE Confidence: 0.8900720348

00:51:38.529 --> 00:51:40.794 kind of quantitative model best

NOTE Confidence: 0.8900720348

00:51:40.794 --> 00:51:42.995 explained the way the neurons fired

NOTE Confidence: 0.8900720348

00:51:42.995 --> 00:51:45.543 and on the left you see the firing

NOTE Confidence: 0.8900720348

00:51:45.543 --> 00:51:47.580 rate in a session of an example

NOTE Confidence: 0.8900720348

00:51:47.649 --> 00:51:49.842 neuron just to remind us it's the

NOTE Confidence: 0.8900720348

00:51:49.842 --> 00:51:51.858 increase in response to sucrose at

NOTE Confidence: 0.8900720348

00:51:51.858 --> 00:51:54.310 at the top that orangey red line

NOTE Confidence: 0.8900720348

00:51:54.310 --> 00:51:56.500 is moderate and there's a sharp.

NOTE Confidence: 0.8900720348

00:51:56.500 --> 00:51:58.560 More dramatic decrease in responding

NOTE Confidence: 0.8900720348

00:51:58.560 --> 00:52:01.058 to water in this blueish purple

NOTE Confidence: 0.8900720348

00:52:01.058 --> 00:52:03.565 line and so you can ask if just

NOTE Confidence: 0.8900720348

00:52:03.565 --> 00:52:05.449 a simple straight line satiety.

NOTE Confidence: 0.8900720348

00:52:05.450 --> 00:52:07.630 Does that explain best the

NOTE Confidence: 0.8900720348

00:52:07.630 --> 00:52:09.374 way the firing changes?

NOTE Confidence: 0.8900720348

00:52:09.380 --> 00:52:11.265 Is the firing explained best

NOTE Confidence: 0.8900720348

00:52:11.265 --> 00:52:13.150 by a preference switch that

NOTE Confidence: 0.887304820869565

00:52:13.219 --> 00:52:15.374 it would be perfectly symmetrical

NOTE Confidence: 0.887304820869565

00:52:15.374 --> 00:52:18.269 preferences just from you know zero to 1?

NOTE Confidence: 0.887304820869565

00:52:18.270 --> 00:52:20.790 Or what about both of these together?

NOTE Confidence: 0.887304820869565

00:52:20.790 --> 00:52:22.558 And so for David,

NOTE Confidence: 0.887304820869565

00:52:22.558 --> 00:52:24.768 that's just a linear combination.

NOTE Confidence: 0.887304820869565

00:52:24.770 --> 00:52:27.086 Of models describing both of these,

NOTE Confidence: 0.887304820869565

00:52:27.090 --> 00:52:29.596 and then when you combine these literally,

NOTE Confidence: 0.887304820869565

00:52:29.600 --> 00:52:31.670 it looks like this and you know you can

NOTE Confidence: 0.887304820869565

00:52:31.670 --> 00:52:33.910 see where I'm going because already the

NOTE Confidence: 0.887304820869565

00:52:33.910 --> 00:52:36.127 model shape looks similar to the neural

NOTE Confidence: 0.887304820869565

00:52:36.127 --> 00:52:37.837 shapes that we've been looking at.

NOTE Confidence: 0.887304820869565

00:52:37.840 --> 00:52:39.415 And so here again, is the model.

NOTE Confidence: 0.887304820869565

00:52:39.420 --> 00:52:41.895 When he looked at each neuron and fit its

NOTE Confidence: 0.887304820869565

00:52:41.895 --> 00:52:43.999 activity to these three different models,

NOTE Confidence: 0.887304820869565

00:52:44.000 --> 00:52:46.682 he finds that the best fit

NOTE Confidence: 0.887304820869565

00:52:46.682 --> 00:52:49.160 model is this mixed model.

NOTE Confidence: 0.887304820869565

00:52:49.160 --> 00:52:51.098 What this means is most neurons

NOTE Confidence: 0.887304820869565

00:52:51.098 --> 00:52:53.299 seem to care about both satiety,

NOTE Confidence: 0.887304820869565

00:52:53.300 --> 00:52:56.177 so movement through the session in time

NOTE Confidence: 0.887304820869565

00:52:56.177 --> 00:52:59.078 and their current preference for reward,

NOTE Confidence: 0.887304820869565

00:52:59.080 --> 00:53:01.940 which one they're liking better.

NOTE Confidence: 0.887304820869565

00:53:01.940 --> 00:53:03.524 So that's pretty cool.

NOTE Confidence: 0.887304820869565

00:53:03.524 --> 00:53:05.630 So, So what David showed us is

NOTE Confidence: 0.887304820869565

00:53:05.630 --> 00:53:07.650 that it's not just the immediate

NOTE Confidence: 0.887304820869565

00:53:07.650 --> 00:53:10.086 difference in reward value that is

NOTE Confidence: 0.887304820869565

00:53:10.086 --> 00:53:12.039 being reflected in this activity,

NOTE Confidence: 0.887304820869565

00:53:12.040 --> 00:53:15.645 but there's also an impact of satiety.

NOTE Confidence: 0.887304820869565

00:53:15.650 --> 00:53:18.950 So this was all analyzed based

NOTE Confidence: 0.887304820869565

00:53:18.950 --> 00:53:21.454 on forced trial data, right?

NOTE Confidence: 0.887304820869565

00:53:21.454 --> 00:53:23.582 'cause we're looking at how the animal

NOTE Confidence: 0.887304820869565

00:53:23.582 --> 00:53:25.948 responds to the reward through session time.

NOTE Confidence: 0.887304820869565

00:53:25.950 --> 00:53:28.050 But we have all of these choice

NOTE Confidence: 0.887304820869565

00:53:28.050 --> 00:53:30.173 trials for the animals making its

NOTE Confidence: 0.887304820869565

00:53:30.173 --> 00:53:32.098 own decision about which reward

NOTE Confidence: 0.887304820869565

00:53:32.098 --> 00:53:34.530 it wants at that given time,

NOTE Confidence: 0.887304820869565

00:53:34.530 --> 00:53:36.605 and what David wondered is,

NOTE Confidence: 0.887304820869565

00:53:36.610 --> 00:53:39.340 do these responses of the neurons

NOTE Confidence: 0.887304820869565

00:53:39.340 --> 00:53:42.270 that tell us how much the animal,

NOTE Confidence: 0.887304820869565

00:53:42.270 --> 00:53:44.610 what the animal thinks about the

NOTE Confidence: 0.887304820869565

00:53:44.690 --> 00:53:47.270 reward relative to its expectation,

NOTE Confidence: 0.887304820869565

00:53:47.270 --> 00:53:49.178 does that have anything to do

NOTE Confidence: 0.887304820869565

00:53:49.178 --> 00:53:50.132 with their behavior?

NOTE Confidence: 0.887304820869565

00:53:50.140 --> 00:53:51.108 Because in the end,

NOTE Confidence: 0.887304820869565

00:53:51.108 --> 00:53:53.352 we'd like to try to get an understanding

NOTE Confidence: 0.887304820869565

00:53:53.352 --> 00:53:55.548 of how these systems impact choice.

NOTE Confidence: 0.887304820869565

00:53:55.550 --> 00:53:57.406 That's our eventual goal.

NOTE Confidence: 0.887304820869565

00:53:57.406 --> 00:54:00.190 So the way that David decided

NOTE Confidence: 0.887304820869565

00:54:00.281 --> 00:54:01.969 to think about that.

NOTE Confidence: 0.887304820869565

00:54:01.970 --> 00:54:04.784 Was to look at the animals behavior.

NOTE Confidence: 0.887304820869565

00:54:04.790 --> 00:54:06.150 Good idea to do first.

NOTE Confidence: 0.887304820869565

00:54:06.150 --> 00:54:08.790 Here are three rat examples on the left.

NOTE Confidence: 0.887304820869565

00:54:08.790 --> 00:54:11.106 You're looking at the animals choice

NOTE Confidence: 0.887304820869565

00:54:11.106 --> 00:54:12.650 behavior through the session.

NOTE Confidence: 0.887304820869565

00:54:12.650 --> 00:54:14.582 The purple bars on the bottom are

NOTE Confidence: 0.887304820869565

00:54:14.582 --> 00:54:16.035 when the animal chooses water

NOTE Confidence: 0.887304820869565

00:54:16.035 --> 00:54:18.009 they do a lot at the beginning,

NOTE Confidence: 0.887304820869565

00:54:18.010 --> 00:54:18.856 last moving forward,

NOTE Confidence: 0.887304820869565

00:54:18.856 --> 00:54:21.182 and then they shift and tend to choose

NOTE Confidence: 0.887304820869565

00:54:21.182 --> 00:54:23.268 sucrose more as session time goes on.

NOTE Confidence: 0.887304820869565

00:54:23.270 --> 00:54:25.160 So you can plot the preference curve.

NOTE Confidence: 0.887304820869565

00:54:25.160 --> 00:54:25.870 For sucrose,

NOTE Confidence: 0.887304820869565

00:54:25.870 --> 00:54:27.645 the preference curve for water

NOTE Confidence: 0.887304820869565

00:54:27.645 --> 00:54:29.100 and you see this.

NOTE Confidence: 0.887304820869565

00:54:29.100 --> 00:54:31.820 This kind of function and you can see

NOTE Confidence: 0.887304820869565

00:54:31.820 --> 00:54:34.280 that example for three different rats.

NOTE Confidence: 0.887304820869565

00:54:34.280 --> 00:54:37.346 When David looked at the neural

NOTE Confidence: 0.887304820869565

00:54:37.346 --> 00:54:40.509 estimates for this mixed model that

NOTE Confidence: 0.887304820869565

00:54:40.509 --> 00:54:43.587 came from what he calculated here,

NOTE Confidence: 0.887304820869565

00:54:43.590 --> 00:54:45.378 it came from these forced trials

NOTE Confidence: 0.887304820869565

00:54:45.378 --> 00:54:47.759 and tried on a trial by trial

NOTE Confidence: 0.887304820869565

00:54:47.759 --> 00:54:49.629 to estimate what the animal's

NOTE Confidence: 0.887304820869565

00:54:49.629 --> 00:54:51.790 preference was just based on the

NOTE Confidence: 0.887304820869565

00:54:51.790 --> 00:54:53.806 neural activity for a given neuron.

NOTE Confidence: 0.887304820869565

00:54:53.810 --> 00:54:55.310 Then averaging that across

NOTE Confidence: 0.887304820869565

00:54:55.310 --> 00:54:57.560 all neurons from a given rat,

NOTE Confidence: 0.887304820869565

00:54:57.560 --> 00:54:59.140 you get these preference curves,

NOTE Confidence: 0.887304820869565

00:54:59.140 --> 00:55:01.840 and they're just remarkably similar.

NOTE Confidence: 0.887304820869565

00:55:01.840 --> 00:55:04.108 You don't even need all the beautiful

NOTE Confidence: 0.887304820869565

00:55:04.108 --> 00:55:05.922 statistics to tell you the neurons

NOTE Confidence: 0.887304820869565

00:55:05.922 --> 00:55:07.728 are giving the same readout of

NOTE Confidence: 0.887304820869565

00:55:07.728 --> 00:55:09.569 what the animals preferences,

NOTE Confidence: 0.887304820869565

00:55:09.570 --> 00:55:12.006 moment by moment as the decision

NOTE Confidence: 0.887304820869565

00:55:12.006 --> 00:55:13.224 the animal makes.

NOTE Confidence: 0.887304820869565

00:55:13.230 --> 00:55:16.282 So this is a really nice correlation

NOTE Confidence: 0.887304820869565

00:55:16.282 --> 00:55:18.982 that helps us build on the idea

NOTE Confidence: 0.887304820869565

00:55:18.982 --> 00:55:21.070 that this signal is important for

NOTE Confidence: 0.93921235

00:55:21.145 --> 00:55:23.417 the animals future decision, and.

NOTE Confidence: 0.93921235

00:55:23.417 --> 00:55:24.845 That's what these graphs

NOTE Confidence: 0.93921235

00:55:24.845 --> 00:55:26.630 here on the right support.

NOTE Confidence: 0.93921235

00:55:26.630 --> 00:55:29.246 If you look at the correlation for each

NOTE Confidence: 0.93921235

00:55:29.246 --> 00:55:32.071 neuron of its activity with the animals

NOTE Confidence: 0.93921235

00:55:32.071 --> 00:55:34.171 preference for neurons like that.

NOTE Confidence: 0.93921235

00:55:34.180 --> 00:55:36.322 Were weighted within this mixed model

NOTE Confidence: 0.93921235

00:55:36.322 --> 00:55:38.279 that care about outcome in time.

NOTE Confidence: 0.93921235

00:55:38.280 --> 00:55:39.978 We see that correlation is very

NOTE Confidence: 0.93921235

00:55:39.978 --> 00:55:42.240 close to one for very many of them.

NOTE Confidence: 0.93921235

00:55:42.240 --> 00:55:44.580 If you ask from the neural

NOTE Confidence: 0.93921235

00:55:44.580 --> 00:55:47.098 activity when in time this switch

NOTE Confidence: 0.93921235

00:55:47.098 --> 00:55:49.720 point might be for each neuron.

NOTE Confidence: 0.93921235

00:55:49.720 --> 00:55:53.020 Many neurons that care about outcome

NOTE Confidence: 0.93921235

00:55:53.020 --> 00:55:55.935 by time give you a very close

NOTE Confidence: 0.93921235

00:55:55.935 --> 00:55:57.750 estimation of the actual trial.

NOTE Confidence: 0.93921235

00:55:57.750 --> 00:55:59.460 So the switch point is zero.

NOTE Confidence: 0.93921235

00:55:59.460 --> 00:56:02.516 You can see many or within 20 trials.

NOTE Confidence: 0.93921235

00:56:02.520 --> 00:56:03.488 So, quantitatively,

NOTE Confidence: 0.93921235

00:56:03.488 --> 00:56:06.392 we've got a really nice agreement

NOTE Confidence: 0.93921235

00:56:06.392 --> 00:56:08.714 between neural activity with the

NOTE Confidence: 0.93921235

00:56:08.714 --> 00:56:10.849 animal actually decides to do.

NOTE Confidence: 0.93921235

00:56:10.850 --> 00:56:13.482 So that led save it again to turn

NOTE Confidence: 0.93921235

00:56:13.482 --> 00:56:15.683 to optogenetics to see if he

NOTE Confidence: 0.93921235

00:56:15.683 --> 00:56:17.528 could manipulate the system and

NOTE Confidence: 0.93921235

00:56:17.528 --> 00:56:19.308 manipulate the subjects choice.

NOTE Confidence: 0.93921235

00:56:19.310 --> 00:56:21.596 And this is the final little bit of data,

NOTE Confidence: 0.93921235

00:56:21.600 --> 00:56:24.156 bit of data that I'll be showing you and

NOTE Confidence: 0.93921235

00:56:24.156 --> 00:56:26.530 then we can discuss this as you wish.

NOTE Confidence: 0.93921235

00:56:26.530 --> 00:56:29.482 So now David wants to see if by

NOTE Confidence: 0.93921235

00:56:29.482 --> 00:56:31.242 controlling ventral pallidal neuron

NOTE Confidence: 0.93921235

00:56:31.242 --> 00:56:34.068 activity he can impact their choice,

NOTE Confidence: 0.93921235

00:56:34.070 --> 00:56:37.166 so so he has optimal control.

NOTE Confidence: 0.93921235

00:56:37.170 --> 00:56:39.508 He's now not going to make the

NOTE Confidence: 0.93921235

00:56:39.508 --> 00:56:41.268 animals thirsty, he's just going to.

NOTE Confidence: 0.93921235

00:56:41.268 --> 00:56:43.416 Go back to the situation where they're

NOTE Confidence: 0.93921235

00:56:43.416 --> 00:56:45.686 choosing between sucrose and maltodextrin.

NOTE Confidence: 0.93921235

00:56:45.690 --> 00:56:47.720 This is a situation when they're not

NOTE Confidence: 0.93921235

00:56:47.720 --> 00:56:49.336 thirsty and their behavior through

NOTE Confidence: 0.93921235

00:56:49.336 --> 00:56:51.412 the session tends to be relatively

NOTE Confidence: 0.93921235

00:56:51.412 --> 00:56:53.550 stable and he wants the behavior

NOTE Confidence: 0.93921235

00:56:53.550 --> 00:56:55.644 to be relatively stable because now

NOTE Confidence: 0.93921235

00:56:55.644 --> 00:56:57.786 he must to go in and try to change

NOTE Confidence: 0.93921235

00:56:57.857 --> 00:57:00.363 it by messing with the BP reward

NOTE Confidence: 0.93921235

00:57:00.363 --> 00:57:01.437 prediction error signal.

NOTE Confidence: 0.93921235

00:57:01.440 --> 00:57:04.360 So what he's going to do is express

NOTE Confidence: 0.93921235

00:57:04.360 --> 00:57:05.907 channelrhodopsin in ventral palatal

NOTE Confidence: 0.93921235

00:57:05.907 --> 00:57:08.139 neurons and shine light on them

NOTE Confidence: 0.93921235

00:57:08.139 --> 00:57:10.983 to force them to fire every time

NOTE Confidence: 0.93921235

00:57:10.983 --> 00:57:12.607 the animal drinks maltodextrin.

NOTE Confidence: 0.93921235

00:57:12.610 --> 00:57:14.605 And in the procedure that he uses,

NOTE Confidence: 0.93921235

00:57:14.610 --> 00:57:17.472 there's going to be forced choice

NOTE Confidence: 0.93921235

00:57:17.472 --> 00:57:20.266 trials so he can continue to make

NOTE Confidence: 0.93921235

00:57:20.266 --> 00:57:22.427 them drink maltodextrin paired with

NOTE Confidence: 0.93921235

00:57:22.427 --> 00:57:24.950 stimulation and choice trials so we

NOTE Confidence: 0.93921235

00:57:24.950 --> 00:57:27.388 know what the animal actually would

NOTE Confidence: 0.93921235

00:57:27.388 --> 00:57:30.006 prefer to drink at any given time.

NOTE Confidence: 0.93921235

00:57:30.010 --> 00:57:32.110 First. Animals are well trained.

NOTE Confidence: 0.93921235

00:57:32.110 --> 00:57:34.780 Then there is a session of

NOTE Confidence: 0.93921235

00:57:34.780 --> 00:57:35.670 optogenetic manipulation,

NOTE Confidence: 0.93921235

00:57:35.670 --> 00:57:36.898 so well trained animals.

NOTE Confidence: 0.93921235

00:57:36.898 --> 00:57:39.549 And this is just a diagram of when

NOTE Confidence: 0.93921235

00:57:39.549 --> 00:57:40.668 the stimulation occurs.

NOTE Confidence: 0.93921235

00:57:40.670 --> 00:57:43.254 So at the time that the animals actually

NOTE Confidence: 0.93921235

00:57:43.254 --> 00:57:44.852 drinking maltodextrin and we can talk

NOTE Confidence: 0.93921235

00:57:44.852 --> 00:57:46.719 about that more if you want to later.

NOTE Confidence: 0.93921235

00:57:46.720 --> 00:57:49.890 So if you look at baseline here on the right,

NOTE Confidence: 0.93921235

00:57:49.890 --> 00:57:52.326 a well trained animals prefer sucrose

NOTE Confidence: 0.93921235

00:57:52.326 --> 00:57:54.510 based on their choice trials.

NOTE Confidence: 0.93921235

00:57:54.510 --> 00:57:56.162 The press the lever to get sucrose

NOTE Confidence: 0.93921235

00:57:56.162 --> 00:57:58.412 most of the time and the blue dots are

NOTE Confidence: 0.93921235

00:57:58.412 --> 00:58:00.202 the subjects in which were expressing

NOTE Confidence: 0.93921235

00:58:00.202 --> 00:58:02.077 channelrhodopsin the Gray dots or

NOTE Confidence: 0.93921235

00:58:02.077 --> 00:58:04.314 subjects expressing the empty vector GFP.

NOTE Confidence: 0.93921235

00:58:04.314 --> 00:58:06.522 Both animals get laser shining in

NOTE Confidence: 0.93921235

00:58:06.522 --> 00:58:08.950 their brain, but the great author.

NOTE Confidence: 0.93921235

00:58:08.950 --> 00:58:09.750 Our control.

NOTE Confidence: 0.93921235

00:58:09.750 --> 00:58:11.078 In the test session,

NOTE Confidence: 0.93921235

00:58:11.078 --> 00:58:13.070 the next day after baseline were

NOTE Confidence: 0.93921235

00:58:13.138 --> 00:58:15.922 stimulating every time the subject gets

NOTE Confidence: 0.93921235

00:58:15.922 --> 00:58:18.225 less preferred reward maltodextrin and

NOTE Confidence: 0.93921235

00:58:18.225 --> 00:58:20.899 what you see is it shifts preference

NOTE Confidence: 0.93921235

00:58:20.899 --> 00:58:23.182 towards maltodextrin on the choice trials.

NOTE Confidence: 0.93921235

00:58:23.182 --> 00:58:25.450 So what does that actually look

NOTE Confidence: 0.92219158

00:58:25.525 --> 00:58:26.809 like through time?

NOTE Confidence: 0.92219158

00:58:26.810 --> 00:58:29.624 Here is one session, the test session.

NOTE Confidence: 0.92219158

00:58:29.630 --> 00:58:31.770 And here's the smoothed preference

NOTE Confidence: 0.92219158

00:58:31.770 --> 00:58:34.840 based on liver choice for each rat

NOTE Confidence: 0.92219158

00:58:34.840 --> 00:58:37.408 Gray or the controls relatively stable.

NOTE Confidence: 0.92219158

00:58:37.410 --> 00:58:39.696 They mostly want sucrose and blue.

NOTE Confidence: 0.92219158

00:58:39.700 --> 00:58:41.782 Are these experimental animals where we've

NOTE Confidence: 0.92219158

00:58:41.782 --> 00:58:43.890 shifted the preference to maltodextrin,

NOTE Confidence: 0.92219158

00:58:43.890 --> 00:58:46.658 and you can see it's a gradual effect

NOTE Confidence: 0.92219158

00:58:46.658 --> 00:58:48.770 that accrues through experience,

NOTE Confidence: 0.92219158

00:58:48.770 --> 00:58:49.922 so it's not that the first

NOTE Confidence: 0.92219158

00:58:49.922 --> 00:58:50.690 time you stimulate it,

NOTE Confidence: 0.92219158

00:58:50.690 --> 00:58:51.782 they immediately shift.

NOTE Confidence: 0.92219158

00:58:51.782 --> 00:58:53.966 This is congruent with the idea.

NOTE Confidence: 0.92219158

00:58:53.970 --> 00:58:55.540 But it's a learning response.

NOTE Confidence: 0.92219158

00:58:55.540 --> 00:58:57.190 You're sending them a signal that

NOTE Confidence: 0.92219158

00:58:57.190 --> 00:58:59.040 that reward is better than expected.

NOTE Confidence: 0.92219158

00:58:59.040 --> 00:59:01.110 So maybe you should change what

NOTE Confidence: 0.92219158

00:59:01.110 --> 00:59:03.050 you do on upcoming trials.

NOTE Confidence: 0.92219158

00:59:03.050 --> 00:59:04.988 And also congruent with the idea

NOTE Confidence: 0.92219158

00:59:04.988 --> 00:59:07.450 that this is a learning signal.

NOTE Confidence: 0.92219158

00:59:07.450 --> 00:59:10.015 This behavior change does last

NOTE Confidence: 0.92219158

00:59:10.015 --> 00:59:12.067 until the next day.

NOTE Confidence: 0.92219158

00:59:12.070 --> 00:59:15.805 So the test day is the day of optogenetic

NOTE Confidence: 0.92219158

00:59:15.805 --> 00:59:17.610 manipulation Recovery day one.

NOTE Confidence: 0.92219158

00:59:17.610 --> 00:59:19.416 We just see what their choices are

NOTE Confidence: 0.92219158

00:59:19.416 --> 00:59:21.421 and you can see that their choices

NOTE Confidence: 0.92219158

00:59:21.421 --> 00:59:23.173 still tend to be more towards

NOTE Confidence: 0.92219158

00:59:23.233 --> 00:59:24.737 maltodextrins then they weren't

NOTE Confidence: 0.92219158

00:59:24.737 --> 00:59:26.993 baseline and this changes over time

NOTE Confidence: 0.92219158

00:59:27.000 --> 00:59:28.962 as we no longer ascending that

NOTE Confidence: 0.92219158

00:59:28.962 --> 00:59:31.324 fake signal that we could send

NOTE Confidence: 0.92219158

00:59:31.324 --> 00:59:33.288 with the optogenetic manipulation.

NOTE Confidence: 0.92219158

00:59:33.290 --> 00:59:36.034 So this is a first step to providing

NOTE Confidence: 0.92219158

00:59:36.034 --> 00:59:38.818 some evidence that this signal can

NOTE Confidence: 0.92219158

00:59:38.818 --> 00:59:41.320 impact the animals future choice.

NOTE Confidence: 0.92219158

00:59:41.320 --> 00:59:43.318 So if you look at their.

NOTE Confidence: 0.92219158

00:59:43.320 --> 00:59:46.410 Latency's to choose levers in the

NOTE Confidence: 0.92219158

00:59:46.410 --> 00:59:47.832 optogenetic stimulation experiment,

NOTE Confidence: 0.92219158

00:59:47.832 --> 00:59:50.538 you find that overtime they tend

NOTE Confidence: 0.92219158

00:59:50.538 --> 00:59:52.740 to choose maltodextrin more,

NOTE Confidence: 0.92219158

00:59:52.740 --> 00:59:54.516 and on trials choice trials when

NOTE Confidence: 0.92219158

00:59:54.516 --> 00:59:56.440 they're going to choose maltodextrin,

NOTE Confidence: 0.92219158

00:59:56.440 --> 00:59:58.225 their latency to go to the lever

NOTE Confidence: 0.92219158

00:59:58.225 --> 01:00:00.010 to make that choice is faster,

NOTE Confidence: 0.92219158

01:00:00.010 --> 01:00:02.649 so we see this change in behavior

NOTE Confidence: 0.92219158

01:00:02.649 --> 01:00:05.118 that matches what you would expect.

NOTE Confidence: 0.92219158

01:00:05.120 --> 01:00:07.766 For this. This kind of signal.

NOTE Confidence: 0.92219158

01:00:07.770 --> 01:00:09.970 So what I told you is that initially

NOTE Confidence: 0.92219158

01:00:09.970 --> 01:00:12.446 we see a signal in the ventral

NOTE Confidence: 0.92219158

01:00:12.446 --> 01:00:14.301 pallidum when animals are actually

NOTE Confidence: 0.92219158

01:00:14.374 --> 01:00:16.490 experiencing reward ingesting it.

NOTE Confidence: 0.92219158

01:00:16.490 --> 01:00:18.794 That seems to match their relative

NOTE Confidence: 0.92219158

01:00:18.794 --> 01:00:20.710 preference at that current time,

NOTE Confidence: 0.92219158

01:00:20.710 --> 01:00:23.174 and if you analyze that spike activity

NOTE Confidence: 0.92219158

01:00:23.174 --> 01:00:25.426 relative to the current time and

NOTE Confidence: 0.92219158

01:00:25.426 --> 01:00:27.682 the reward period just before that,

NOTE Confidence: 0.92219158

01:00:27.690 --> 01:00:28.650 and just before that,

NOTE Confidence: 0.92219158

01:00:28.650 --> 01:00:29.610 and just before that,

NOTE Confidence: 0.92219158

01:00:29.610 --> 01:00:30.579 IE reward history,

NOTE Confidence: 0.92219158

01:00:30.579 --> 01:00:33.649 you see that at least a subset of these

NOTE Confidence: 0.92219158

01:00:33.649 --> 01:00:35.863 care about reward history and what

NOTE Confidence: 0.92219158

01:00:35.863 --> 01:00:38.389 they instead are signaling is a reward.

NOTE Confidence: 0.92219158

01:00:38.390 --> 01:00:40.298 Prediction error is what I just

NOTE Confidence: 0.92219158

01:00:40.298 --> 01:00:42.220 got better than I expected.

NOTE Confidence: 0.92219158

01:00:42.220 --> 01:00:44.424 The same or worse.

NOTE Confidence: 0.92219158

01:00:44.424 --> 01:00:47.179 And so these same signals,

NOTE Confidence: 0.92219158

01:00:47.180 --> 01:00:49.625 these moment by moment reward

NOTE Confidence: 0.92219158

01:00:49.625 --> 01:00:52.070 prediction error signals also care

NOTE Confidence: 0.92219158

01:00:52.151 --> 01:00:54.976 about the current motivational state.

NOTE Confidence: 0.92219158

01:00:54.980 --> 01:00:57.194 They're also able to integrate the

NOTE Confidence: 0.92219158

01:00:57.194 --> 01:00:59.504 larger change in value that might

NOTE Confidence: 0.92219158

01:00:59.504 --> 01:01:01.796 happen as your motivational state is

NOTE Confidence: 0.92219158

01:01:01.796 --> 01:01:03.989 changing as you get less thirsty.

NOTE Confidence: 0.92219158

01:01:03.990 --> 01:01:04.752 And hypothetically,

NOTE Confidence: 0.92219158

01:01:04.752 --> 01:01:07.419 in other situations we haven't tried yet,

NOTE Confidence: 0.92219158

01:01:07.420 --> 01:01:07.825 right?

NOTE Confidence: 0.92219158

01:01:07.825 --> 01:01:10.255 As your craving might be reduced

NOTE Confidence: 0.92219158

01:01:10.255 --> 01:01:12.010 as you ingest drugs.

NOTE Confidence: 0.92219158

01:01:12.010 --> 01:01:15.489 As hunger changes as you eat etc and

NOTE Confidence: 0.92219158

01:01:15.489 --> 01:01:17.512 so these signals that occur at the

NOTE Confidence: 0.92219158

01:01:17.512 --> 01:01:19.688 time the animals ingesting reward,

NOTE Confidence: 0.92219158

01:01:19.690 --> 01:01:21.640 they affect their future behavior.

NOTE Confidence: 0.92219158

01:01:21.640 --> 01:01:25.259 As we saw in that very simple.

NOTE Confidence: 0.92219158

01:01:25.260 --> 01:01:27.500 A measure of how close you are to the port,

NOTE Confidence: 0.92219158

01:01:27.500 --> 01:01:28.616 and as we saw in this,

NOTE Confidence: 0.92219158

01:01:28.620 --> 01:01:30.712 perhaps more informative choice

NOTE Confidence: 0.92219158

01:01:30.712 --> 01:01:33.327 procedure where animals are choosing

NOTE Confidence: 0.92219158

01:01:33.327 --> 01:01:35.517 which lever to push in order

NOTE Confidence: 0.92219158

01:01:35.517 --> 01:01:37.107 to get the reward that

NOTE Confidence: 0.9222073612

01:01:37.182 --> 01:01:38.807 they want at that time.

NOTE Confidence: 0.9222073612

01:01:38.810 --> 01:01:40.430 And so the big question,

NOTE Confidence: 0.9222073612

01:01:40.430 --> 01:01:41.850 of course, is what?

NOTE Confidence: 0.9222073612

01:01:41.850 --> 01:01:43.625 What do these signals mean

NOTE Confidence: 0.9222073612

01:01:43.625 --> 01:01:45.690 for the circuit as a whole?

NOTE Confidence: 0.9222073612

01:01:45.690 --> 01:01:47.679 So if I go back to the statement that

NOTE Confidence: 0.9222073612

01:01:47.679 --> 01:01:49.974 I made at the beginning that usually

NOTE Confidence: 0.9222073612

01:01:49.974 --> 01:01:51.955 the ventral pallidum was the more

NOTE Confidence: 0.9222073612

01:01:51.955 --> 01:01:53.985 boring area that was just the output.

NOTE Confidence: 0.9222073612

01:01:53.990 --> 01:01:55.890 For the fantastically interesting

NOTE Confidence: 0.9222073612

01:01:55.890 --> 01:01:57.550 nucleus incumbents, of course,

NOTE Confidence: 0.9222073612

01:01:57.550 --> 01:01:59.325 the nucleus of Cummins is

NOTE Confidence: 0.9222073612

01:01:59.325 --> 01:02:00.035 fantastically interesting.

NOTE Confidence: 0.9222073612

01:02:00.040 --> 01:02:01.912 But these are big excitatory signals

NOTE Confidence: 0.9222073612

01:02:01.912 --> 01:02:03.813 in the ventral pallidum unlikely to

NOTE Confidence: 0.9222073612

01:02:03.813 --> 01:02:05.607 be driven by the Gabaergic medium.

NOTE Confidence: 0.9222073612

01:02:05.610 --> 01:02:08.388 Spiny neurons of the nucleus accumbens,

NOTE Confidence: 0.9222073612

01:02:08.390 --> 01:02:09.306 and when we look.

NOTE Confidence: 0.9222073612

01:02:09.306 --> 01:02:10.451 And David didn't record in

NOTE Confidence: 0.9222073612

01:02:10.451 --> 01:02:11.539 the comments as well.

NOTE Confidence: 0.9222073612

01:02:11.540 --> 01:02:12.660 When we look there,

NOTE Confidence: 0.9222073612

01:02:12.660 --> 01:02:14.759 we don't see the large numbers of

NOTE Confidence: 0.9222073612

01:02:14.759 --> 01:02:16.195 neurons representing this reward

NOTE Confidence: 0.9222073612

01:02:16.195 --> 01:02:18.270 prediction error in the same way,

NOTE Confidence: 0.9222073612

01:02:18.270 --> 01:02:20.878 so it's a it's a signal can built

NOTE Confidence: 0.9222073612

01:02:20.878 --> 01:02:24.006 here in the VP most likely by

NOTE Confidence: 0.9222073612

01:02:24.006 --> 01:02:25.800 integrating various inputs important

NOTE Confidence: 0.9222073612

01:02:25.800 --> 01:02:28.320 new work from Megan Creed's lab at

NOTE Confidence: 0.9222073612

01:02:28.320 --> 01:02:30.753 Saint Louis in Saint Louis showed

NOTE Confidence: 0.9222073612

01:02:30.753 --> 01:02:32.808 that projections from the ventral

NOTE Confidence: 0.9222073612

01:02:32.808 --> 01:02:34.577 pallidum back to the nucleus.

NOTE Confidence: 0.9222073612

01:02:34.580 --> 01:02:35.834 Incumbents in fact,

NOTE Confidence: 0.9222073612

01:02:35.834 --> 01:02:38.342 might be really important when animals

NOTE Confidence: 0.9222073612

01:02:38.342 --> 01:02:40.719 are making decisions to consume.

NOTE Confidence: 0.9222073612

01:02:40.720 --> 01:02:41.530 Rewards so,

NOTE Confidence: 0.9222073612

01:02:41.530 --> 01:02:44.365 so the VP has a really interesting

NOTE Confidence: 0.9222073612

01:02:44.365 --> 01:02:45.956 relationship with the rest

NOTE Confidence: 0.9222073612

01:02:45.956 --> 01:02:47.444 of the reward circuitry,

NOTE Confidence: 0.9222073612

01:02:47.450 --> 01:02:50.346 their inputs to to BTI and VTA projects,

NOTE Confidence: 0.9222073612

01:02:50.350 --> 01:02:51.208 to ventral pallidum,

NOTE Confidence: 0.9222073612

01:02:51.208 --> 01:02:51.780 and so,

NOTE Confidence: 0.9222073612

01:02:51.780 --> 01:02:53.916 so how these signals that we

NOTE Confidence: 0.9222073612

01:02:53.916 --> 01:02:56.095 identified fit in with the rest

NOTE Confidence: 0.9222073612

01:02:56.095 --> 01:02:58.147 of the activity of the reward

NOTE Confidence: 0.9222073612

01:02:58.147 --> 01:03:00.229 circuit is a really important.

NOTE Confidence: 0.9222073612

01:03:00.230 --> 01:03:02.372 Future direction as well as trying

NOTE Confidence: 0.9222073612

01:03:02.372 --> 01:03:04.747 to map how the circuit response

NOTE Confidence: 0.9222073612

01:03:04.747 --> 01:03:07.369 to natural reward with how it

NOTE Confidence: 0.9222073612

01:03:07.369 --> 01:03:09.409 might respond to drug reward.

NOTE Confidence: 0.9222073612

01:03:09.410 --> 01:03:10.454 Because, as mentioned,

NOTE Confidence: 0.9222073612

01:03:10.454 --> 01:03:12.890 your eventual goal is to try to

NOTE Confidence: 0.9222073612

01:03:12.963 --> 01:03:14.319 understand these interactive

NOTE Confidence: 0.9222073612

01:03:14.319 --> 01:03:16.579 processes and how they modulate

NOTE Confidence: 0.9222073612

01:03:16.579 --> 01:03:18.969 in humans are seeking of things.

NOTE Confidence: 0.9222073612

01:03:18.970 --> 01:03:21.721 We should seek our food rewards and

NOTE Confidence: 0.9222073612

01:03:21.721 --> 01:03:24.690 think and seeking of rewards that in

NOTE Confidence: 0.9222073612

01:03:24.690 --> 01:03:28.370 some individuals can become unhealthy.

NOTE Confidence: 0.9222073612

01:03:28.370 --> 01:03:30.750 So I think I'll I'll stop there

NOTE Confidence: 0.9222073612

01:03:30.750 --> 01:03:32.250 with just thinking again.

NOTE Confidence: 0.9222073612

01:03:32.250 --> 01:03:35.060 The lab members that participated

NOTE Confidence: 0.9222073612

01:03:35.060 --> 01:03:36.672 in this work,

NOTE Confidence: 0.9222073612

01:03:36.672 --> 01:03:40.046 and I identified David and Jocelyn early.

NOTE Confidence: 0.9222073612

01:03:40.050 --> 01:03:42.206 They're really the main drivers of this.

NOTE Confidence: 0.9222073612

01:03:42.210 --> 01:03:43.974 I also showed Jude members of

NOTE Confidence: 0.9222073612

01:03:43.974 --> 01:03:45.720 Jeremiah coincide that were important,

NOTE Confidence: 0.9222073612

01:03:45.720 --> 01:03:47.856 but I want to thank the lab in

NOTE Confidence: 0.9222073612

01:03:47.856 --> 01:03:50.019 general for all of their input for

NOTE Confidence: 0.9222073612

01:03:50.019 --> 01:03:52.014 this work and lab meetings and

NOTE Confidence: 0.9222073612

01:03:52.014 --> 01:03:53.859 and helping one another conduct

NOTE Confidence: 0.9222073612

01:03:53.859 --> 01:03:55.786 all of the experiments that I

NOTE Confidence: 0.9222073612

01:03:55.786 --> 01:03:57.124 want to thank funding from NIH,

NOTE Confidence: 0.9222073612

01:03:57.130 --> 01:03:57.670 of course,

NOTE Confidence: 0.9222073612

01:03:57.670 --> 01:03:58.750 and I want to.

NOTE Confidence: 0.9222073612

01:03:58.750 --> 01:04:01.123 Thank you all very much for giving

NOTE Confidence: 0.9222073612

01:04:01.123 --> 01:04:03.303 me the opportunity to talk about

NOTE Confidence: 0.9222073612

01:04:03.303 --> 01:04:04.763 this basic neuroscience research

NOTE Confidence: 0.9222073612

01:04:04.763 --> 01:04:07.202 and I hope it gives us all some

NOTE Confidence: 0.9222073612

01:04:07.202 --> 01:04:09.337 ideas about how we can think about

NOTE Confidence: 0.9222073612

01:04:09.337 --> 01:04:11.027 basic nice neuroscience work and

NOTE Confidence: 0.9222073612

01:04:11.027 --> 01:04:13.730 how it can tell us about the human

NOTE Confidence: 0.9222073612

01:04:13.730 --> 01:04:15.650 condition and how we doing basic

NOTE Confidence: 0.9222073612

01:04:15.650 --> 01:04:17.768 neuroscience work can learn and shape

NOTE Confidence: 0.9222073612

01:04:17.768 --> 01:04:20.750 what we do based on the human condition.

NOTE Confidence: 0.9222073612

01:04:20.750 --> 01:04:21.670 So thanks very much.

NOTE Confidence: 0.913032607222222

01:04:24.180 --> 01:04:26.520 Thank you so much, I'm really

NOTE Confidence: 0.913032607222222

01:04:26.520 --> 01:04:29.205 enjoyed that and I have encouraged

NOTE Confidence: 0.913032607222222

01:04:29.205 --> 01:04:32.313 the trainees to ask questions first

NOTE Confidence: 0.913032607222222

01:04:32.320 --> 01:04:34.540 if there's any trainees out there.

NOTE Confidence: 0.913032607222222

01:04:34.540 --> 01:04:37.366 Doctor Taylor is a trainee of

NOTE Confidence: 0.913032607222222

01:04:37.366 --> 01:04:39.779 course lifelong but may not qualify,

NOTE Confidence: 0.913032607222222

01:04:39.779 --> 01:04:43.280 so I would like to start with with a trainee,

NOTE Confidence: 0.913032607222222

01:04:43.280 --> 01:04:45.952 but if not we can we can get

NOTE Confidence: 0.913032607222222

01:04:45.952 --> 01:04:48.090 to questions from UN trainees.

NOTE Confidence: 0.6206374

01:04:50.780 --> 01:04:52.230 Doctor Taylor's training

NOTE Confidence: 0.84640145

01:04:54.610 --> 01:04:56.856 all right? Well then that seems appropriate.

NOTE Confidence: 0.87042520375

01:04:56.860 --> 01:04:57.350 Doctor Taylor.

NOTE Confidence: 0.87042520375

01:04:57.350 --> 01:04:58.820 Why don't you kick us off?

NOTE Confidence: 0.87042520375

01:04:58.820 --> 01:05:03.201 I have questions too. Sorry, I come.

NOTE Confidence: 0.87042520375

01:05:03.201 --> 01:05:05.868 If a trainee wants to interrupt me,

NOTE Confidence: 0.87042520375

01:05:05.870 --> 01:05:07.520 please go ahead.

NOTE Confidence: 0.87042520375

01:05:07.520 --> 01:05:11.925 That was a beautiful talk as always Patricia.

NOTE Confidence: 0.87042520375

01:05:11.925 --> 01:05:15.810 So I have a question which is

NOTE Confidence: 0.87042520375

01:05:15.810 --> 01:05:20.374 sort of how dynamic do you think

NOTE Confidence: 0.87042520375

01:05:20.374 --> 01:05:24.160 these VP responses are in that.

NOTE Confidence: 0.87042520375

01:05:24.160 --> 01:05:27.730 I wonder whether you would see

NOTE Confidence: 0.87042520375

01:05:27.730 --> 01:05:30.522 similar VP signals related to

NOTE Confidence: 0.87042520375

01:05:30.522 --> 01:05:33.460 expectation and prediction error.

NOTE Confidence: 0.87042520375

01:05:33.460 --> 01:05:36.484 If you in your experiment initially

NOTE Confidence: 0.87042520375

01:05:36.484 --> 01:05:38.500 looked at sucrose preference

NOTE Confidence: 0.87042520375

01:05:38.586 --> 01:05:41.441 compared to something that was

NOTE Confidence: 0.87042520375

01:05:41.441 --> 01:05:43.154 actually slightly aversive,

NOTE Confidence: 0.87042520375

01:05:43.160 --> 01:05:45.660 like a salt solution,

NOTE Confidence: 0.87042520375

01:05:45.660 --> 01:05:48.785 but then made the animals

NOTE Confidence: 0.87042520375

01:05:48.790 --> 01:05:53.230 physiologically salt induced the salt,

NOTE Confidence: 0.87042520375

01:05:53.230 --> 01:05:56.119 a salt state for that reward.

NOTE Confidence: 0.87042520375

01:05:56.120 --> 01:06:00.026 Would you see the VP neurons suddenly

NOTE Confidence: 0.87042520375

01:06:00.026 --> 01:06:03.209 switch over to tracking the?

NOTE Confidence: 0.87042520375

01:06:03.210 --> 01:06:05.058 The salt, uhm?

NOTE Confidence: 0.9554099425

01:06:05.500 --> 01:06:08.540 Yeah, yeah, I I think so and so.

NOTE Confidence: 0.9554099425

01:06:08.540 --> 01:06:11.840 So although this is a history

NOTE Confidence: 0.9554099425

01:06:11.840 --> 01:06:13.630 dependent signal that follows this

NOTE Confidence: 0.9554099425

01:06:13.689 --> 01:06:15.915 reward prediction error kind of model,

NOTE Confidence: 0.9554099425

01:06:15.920 --> 01:06:18.768 we think it's not model free but it's

NOTE Confidence: 0.9554099425

01:06:18.768 --> 01:06:21.414 more model based in that the subject

NOTE Confidence: 0.9554099425

01:06:21.414 --> 01:06:25.740 can update it on the fly and so so you

NOTE Confidence: 0.9554099425

01:06:25.740 --> 01:06:28.787 know in in this procedure animals start

NOTE Confidence: 0.9554099425

01:06:28.787 --> 01:06:32.224 each day thirsty and then become sated.

NOTE Confidence: 0.9554099425

01:06:32.230 --> 01:06:34.240 Their response to in a different

NOTE Confidence: 0.9554099425

01:06:34.240 --> 01:06:36.000 procedure where there's a water

NOTE Confidence: 0.9554099425

01:06:36.000 --> 01:06:38.178 predictive cue their response to the

NOTE Confidence: 0.9554099425

01:06:38.178 --> 01:06:40.218 water predictive cue is very high

NOTE Confidence: 0.9554099425

01:06:40.218 --> 01:06:41.988 at the beginning of each session,

NOTE Confidence: 0.9554099425

01:06:41.990 --> 01:06:44.132 even though it's very low by the

NOTE Confidence: 0.9554099425

01:06:44.132 --> 01:06:46.522 end of the session when thirst is

NOTE Confidence: 0.9554099425

01:06:46.522 --> 01:06:48.262 is no longer a drive.

NOTE Confidence: 0.9554099425

01:06:48.270 --> 01:06:48.936 So so there.

NOTE Confidence: 0.9554099425

01:06:48.936 --> 01:06:50.857 I'm not sure if I'm getting to exactly

NOTE Confidence: 0.9554099425

01:06:50.857 --> 01:06:53.319 what what your question was, but it's a.

NOTE Confidence: 0.9554099425

01:06:53.319 --> 01:06:55.137 It's a super dynamic system and

NOTE Confidence: 0.9554099425

01:06:55.137 --> 01:06:56.920 I think immediately impacted

NOTE Confidence: 0.9554099425

01:06:56.920 --> 01:06:59.060 by the animals expectations,

NOTE Confidence: 0.9554099425

01:06:59.060 --> 01:07:02.525 and it doesn't necessarily have to accrue.

NOTE Confidence: 0.9554099425

01:07:02.530 --> 01:07:04.094 Overtime it's impacted by

NOTE Confidence: 0.9554099425

01:07:04.094 --> 01:07:05.658 what happens over time,

NOTE Confidence: 0.9554099425

01:07:05.660 --> 01:07:08.372 but also can be directed by a more

NOTE Confidence: 0.9554099425

01:07:08.372 --> 01:07:12.214 sort of cognitive, a goal directed.

NOTE Confidence: 0.9554099425

01:07:12.214 --> 01:07:13.730 Uh, evaluation.

NOTE Confidence: 0.6166265

01:07:15.900 --> 01:07:16.810 List Europe.

NOTE Confidence: 0.929409916

01:07:18.820 --> 01:07:20.428 Thank you for that amazing talk

NOTE Confidence: 0.929409916

01:07:20.428 --> 01:07:21.919 and I'm curious 'cause we've

NOTE Confidence: 0.929409916

01:07:21.919 --> 01:07:23.387 been talking about expectation,

NOTE Confidence: 0.929409916

01:07:23.390 --> 01:07:24.696 but most of the signal that

NOTE Confidence: 0.929409916

01:07:24.696 --> 01:07:26.260 you've been presenting is

NOTE Confidence: 0.929409916

01:07:26.260 --> 01:07:28.080 during the reward consumption.

NOTE Confidence: 0.929409916

01:07:28.080 --> 01:07:29.627 So do you see anything when the

NOTE Confidence: 0.929409916

01:07:29.627 --> 01:07:31.244 queue is present that indicates the

NOTE Confidence: 0.929409916

01:07:31.244 --> 01:07:32.744 outcome that they're expecting before

NOTE Confidence: 0.929409916

01:07:32.744 --> 01:07:34.408 they can compute the prediction

NOTE Confidence: 0.87532847

01:07:34.420 --> 01:07:36.700 error? Yeah, that's a great question.

NOTE Confidence: 0.87532847

01:07:36.700 --> 01:07:38.518 So in this particular set of

NOTE Confidence: 0.87532847

01:07:38.518 --> 01:07:40.560 studies that I told you about

NOTE Confidence: 0.87532847

01:07:40.560 --> 01:07:42.455 the queues were not informative.

NOTE Confidence: 0.87532847

01:07:42.460 --> 01:07:44.580 As far as the identity of the reward,

NOTE Confidence: 0.87532847

01:07:44.580 --> 01:07:47.015 so we didn't find very

NOTE Confidence: 0.87532847

01:07:47.015 --> 01:07:48.476 much expectations signal.

NOTE Confidence: 0.87532847

01:07:48.480 --> 01:07:49.593 In those cues,

NOTE Confidence: 0.87532847

01:07:49.593 --> 01:07:52.190 but David ran a variation in this

NOTE Confidence: 0.87532847

01:07:52.268 --> 01:07:54.623 dynamic thirst task where there

NOTE Confidence: 0.87532847

01:07:54.623 --> 01:07:56.978 were accused that came before

NOTE Confidence: 0.87532847

01:07:57.061 --> 01:07:59.490 each of the rewards in the forest

NOTE Confidence: 0.87532847

01:07:59.490 --> 01:08:01.824 trials of a water Q&A sucrose Q,

NOTE Confidence: 0.87532847

01:08:01.824 --> 01:08:04.241 and in that case the reward prediction

NOTE Confidence: 0.87532847

01:08:04.241 --> 01:08:05.925 error like signaling transferred

NOTE Confidence: 0.87532847

01:08:05.925 --> 01:08:09.039 to the queue as you would predict,

NOTE Confidence: 0.87532847

01:08:09.040 --> 01:08:11.350 and so that expectation related

NOTE Confidence: 0.87532847

01:08:11.350 --> 01:08:13.440 response was mostly there in

NOTE Confidence: 0.87532847

01:08:13.440 --> 01:08:15.890 the in the way that the animal

NOTE Confidence: 0.87532847

01:08:15.890 --> 01:08:17.238 responded to the queue.

NOTE Confidence: 0.87532847

01:08:17.240 --> 01:08:20.000 So that's that's a great question.

NOTE Confidence: 0.87532847

01:08:20.000 --> 01:08:20.530 Al

NOTE Confidence: 0.913256071428571

01:08:22.060 --> 01:08:23.796 hi, thanks so much for the talk.

NOTE Confidence: 0.913256071428571

01:08:23.800 --> 01:08:25.660 I was really struck by your result

NOTE Confidence: 0.913256071428571

01:08:25.660 --> 01:08:28.128 that about heterogeneity in terms

NOTE Confidence: 0.913256071428571

01:08:28.128 --> 01:08:30.950 of value versus RPE signals in

NOTE Confidence: 0.913256071428571

01:08:30.950 --> 01:08:33.190 the ventral pallidum, especially

NOTE Confidence: 0.933677535

01:08:33.200 --> 01:08:35.615 given this kind of ongoing

NOTE Confidence: 0.933677535

01:08:35.615 --> 01:08:37.594 discussion about whether a Cummins

NOTE Confidence: 0.933677535

01:08:37.594 --> 01:08:39.106 concentration of dopamine represents

NOTE Confidence: 0.716693086

01:08:39.120 --> 01:08:41.260 a value or RPE signal,

NOTE Confidence: 0.716693086

01:08:41.260 --> 01:08:44.500 and in particular. Some

NOTE Confidence: 0.774157

01:08:44.510 --> 01:08:45.820 recent work of Sam Gershman,

NOTE Confidence: 0.774157

01:08:45.820 --> 01:08:47.338 and now, which is showing that

NOTE Confidence: 0.774157

01:08:47.338 --> 01:08:48.770 you can maybe reconcile these

NOTE Confidence: 0.774157

01:08:48.770 --> 01:08:51.542 approaches by having a kind of RP

NOTE Confidence: 0.774157

01:08:51.542 --> 01:08:53.432 signal with sensory feedback that

NOTE Confidence: 0.89370191

01:08:53.550 --> 01:08:55.510 looks like a value signal.

NOTE Confidence: 0.89370191

01:08:55.510 --> 01:08:57.534 And so I guess I was just served as an

NOTE Confidence: 0.883696619090909

01:08:57.550 --> 01:08:58.609 open ended question.

NOTE Confidence: 0.883696619090909

01:08:58.609 --> 01:09:00.727 Wondering whether you think that this

NOTE Confidence: 0.883696619090909

01:09:00.727 --> 01:09:02.640 heterogeneity in the ventral pallidum

NOTE Confidence: 0.883696619090909

01:09:02.640 --> 01:09:05.050 might somehow either resolve this

NOTE Confidence: 0.883696619090909

01:09:05.050 --> 01:09:07.264 discrepancy or correspond to as well

NOTE Confidence: 0.883696619090909

01:09:07.264 --> 01:09:10.100 the concentration of dopamine dynamics.

NOTE Confidence: 0.883696619090909

01:09:10.100 --> 01:09:12.308 Yeah, that's a great question and

NOTE Confidence: 0.883696619090909

01:09:12.308 --> 01:09:14.869 my short answer is is I I don't

NOTE Confidence: 0.883696619090909

01:09:14.869 --> 01:09:17.490 know so it is true that this system

NOTE Confidence: 0.883696619090909

01:09:17.490 --> 01:09:20.035 is highly interconnected with the

NOTE Confidence: 0.883696619090909

01:09:20.035 --> 01:09:22.515 canonical dopamine neurons in the VTA.

NOTE Confidence: 0.883696619090909

01:09:22.515 --> 01:09:25.070 So VP neurons project back to the VTA,

NOTE Confidence: 0.883696619090909

01:09:25.070 --> 01:09:27.982 both to dopamine neurons but also to

NOTE Confidence: 0.883696619090909

01:09:27.982 --> 01:09:30.169 the GABA interneurons and the VTA.

NOTE Confidence: 0.883696619090909

01:09:30.170 --> 01:09:32.626 Dopamine neurons do send a projection to VP,

NOTE Confidence: 0.883696619090909

01:09:32.630 --> 01:09:34.688 so there's some interaction in the

NOTE Confidence: 0.883696619090909

01:09:34.688 --> 01:09:36.732 creation of these kinds of dopamine

NOTE Confidence: 0.883696619090909

01:09:36.732 --> 01:09:39.148 signals that that we think about as far

NOTE Confidence: 0.883696619090909

01:09:39.210 --> 01:09:41.664 as our PE and. What exactly are they?

NOTE Confidence: 0.883696619090909

01:09:41.664 --> 01:09:44.100 Are they communicating to the incumbents?

NOTE Confidence: 0.883696619090909

01:09:44.100 --> 01:09:44.835 Uh, so I.

NOTE Confidence: 0.883696619090909

01:09:44.835 --> 01:09:46.550 I don't know how that's all gonna

NOTE Confidence: 0.883696619090909

01:09:46.607 --> 01:09:48.607 workout as far as trying to see if

NOTE Confidence: 0.883696619090909

01:09:48.607 --> 01:09:50.468 there's a separable value signal or

NOTE Confidence: 0.883696619090909

01:09:50.468 --> 01:09:52.804 whether it's really going to be able

NOTE Confidence: 0.883696619090909

01:09:52.804 --> 01:09:55.876 to be understood all as a readout of

NOTE Confidence: 0.883696619090909

01:09:55.876 --> 01:09:58.929 online changes in what the animal

NOTE Confidence: 0.883696619090909

01:09:58.929 --> 01:10:00.993 is actually actually receiving.

NOTE Confidence: 0.883696619090909

01:10:01.000 --> 01:10:02.656 So I think that's something that's

NOTE Confidence: 0.883696619090909

01:10:02.656 --> 01:10:04.020 still left to work out.

NOTE Confidence: 0.883696619090909

01:10:04.020 --> 01:10:07.060 So really interesting sort of not a problem,

NOTE Confidence: 0.883696619090909

01:10:07.060 --> 01:10:08.995 and the communication between the

NOTE Confidence: 0.883696619090909

01:10:08.995 --> 01:10:10.543 VP and the incumbents.

NOTE Confidence: 0.883696619090909

01:10:10.550 --> 01:10:12.244 Is also going to be a factor.

NOTE Confidence: 0.883696619090909

01:10:12.250 --> 01:10:13.849 Presumably so, uhm.

NOTE Confidence: 0.883696619090909

01:10:13.849 --> 01:10:17.580 I like the direction of your question

NOTE Confidence: 0.883696619090909

01:10:17.675 --> 01:10:21.766 because it forces these results have

NOTE Confidence: 0.883696619090909

01:10:21.766 --> 01:10:24.756 forced me and all this forces us to

NOTE Confidence: 0.883696619090909

01:10:24.756 --> 01:10:26.389 not think of reward prediction error

NOTE Confidence: 0.883696619090909

01:10:26.389 --> 01:10:28.791 is just here in this group of dopamine

NOTE Confidence: 0.883696619090909

01:10:28.791 --> 01:10:30.945 neurons and then medium spiny neurons.

NOTE Confidence: 0.883696619090909

01:10:30.950 --> 01:10:32.900 Maybe all are transmitting expected value

NOTE Confidence: 0.883696619090909

01:10:32.900 --> 01:10:35.239 and this area does this in this area.

NOTE Confidence: 0.883696619090909

01:10:35.240 --> 01:10:37.274 Does that and instead you know

NOTE Confidence: 0.883696619090909

01:10:37.274 --> 01:10:39.292 these systems are all interconnected

NOTE Confidence: 0.883696619090909

01:10:39.292 --> 01:10:41.600 and these variables seem to be

NOTE Confidence: 0.883696619090909

01:10:41.600 --> 01:10:43.320 represented to greater or lesser

NOTE Confidence: 0.883696619090909

01:10:43.381 --> 01:10:45.189 degrees throughout the circuit.

NOTE Confidence: 0.883696619090909

01:10:45.190 --> 01:10:48.270 So beautiful work from the U2 lab,

NOTE Confidence: 0.883696619090909

01:10:48.270 --> 01:10:49.076 in fact,

NOTE Confidence: 0.883696619090909

01:10:49.076 --> 01:10:51.494 has shown has shown that really

NOTE Confidence: 0.883696619090909

01:10:51.494 --> 01:10:52.890 painstaking recording studies,

NOTE Confidence: 0.883696619090909

01:10:52.890 --> 01:10:55.886 so it's it's going to be harder

NOTE Confidence: 0.883696619090909

01:10:55.886 --> 01:10:58.220 to figure out than then.

NOTE Confidence: 0.883696619090909

01:10:58.220 --> 01:11:00.596 I would dream when we want to make a

NOTE Confidence: 0.883696619090909

01:11:00.596 --> 01:11:02.800 nice model where everything is only

NOTE Confidence: 0.883696619090909

01:11:02.800 --> 01:11:05.076 just very very separable and in a

NOTE Confidence: 0.883696619090909

01:11:05.076 --> 01:11:07.559 separate kind of neuron and separate place.

NOTE Confidence: 0.883696619090909

01:11:07.560 --> 01:11:09.180 But that's a nice challenge.

NOTE Confidence: 0.883696619090909

01:11:09.180 --> 01:11:10.764 There's work to do it for the future.

NOTE Confidence: 0.8874942125

01:11:12.700 --> 01:11:14.716 Ralph, I'm going to ask a quick question

NOTE Confidence: 0.8874942125

01:11:14.716 --> 01:11:16.617 from the chat and then over to you.

NOTE Confidence: 0.8874942125

01:11:16.620 --> 01:11:19.602 Media Naseer says rats prefer water

NOTE Confidence: 0.8874942125

01:11:19.602 --> 01:11:21.590 over sucrose when dehydrated.

NOTE Confidence: 0.8874942125

01:11:21.590 --> 01:11:23.620 However, some people prefer sugary

NOTE Confidence: 0.8874942125

01:11:23.620 --> 01:11:26.250 soft drinks over water when thirsty.

NOTE Confidence: 0.8874942125

01:11:26.250 --> 01:11:27.550 Is there a mechanistic

NOTE Confidence: 0.8874942125

01:11:27.550 --> 01:11:28.850 difference in this situation?

NOTE Confidence: 0.92638313625

01:11:30.320 --> 01:11:32.288 That's a great question, and one I I

NOTE Confidence: 0.92638313625

01:11:32.288 --> 01:11:34.199 don't know the answer to and I would.

NOTE Confidence: 0.92638313625

01:11:34.200 --> 01:11:36.816 I guess I would immediately wonder

NOTE Confidence: 0.92638313625

01:11:36.816 --> 01:11:40.072 about the role of long term experience

NOTE Confidence: 0.92638313625

01:11:40.072 --> 01:11:43.436 in humans for going for the sugary

NOTE Confidence: 0.92638313625

01:11:43.436 --> 01:11:46.248 soft drink to relieve thirst and

NOTE Confidence: 0.92638313625

01:11:46.248 --> 01:11:48.576 and whether we could model that.

NOTE Confidence: 0.92638313625

01:11:48.580 --> 01:11:51.261 By the way we expose our rats

NOTE Confidence: 0.92638313625

01:11:51.261 --> 01:11:53.130 to these different rewards.

NOTE Confidence: 0.92638313625

01:11:53.130 --> 01:11:54.798 Overtime probably someone working

NOTE Confidence: 0.92638313625

01:11:54.798 --> 01:11:56.883 more in the nutrition field

NOTE Confidence: 0.92638313625

01:11:56.883 --> 01:11:58.737 maybe has already done that,

NOTE Confidence: 0.92638313625

01:11:58.740 --> 01:12:00.060 so that answer might be known

NOTE Confidence: 0.92638313625

01:12:00.060 --> 01:12:01.369 and I just don't know it.

NOTE Confidence: 0.92638313625

01:12:01.370 --> 01:12:04.136 I think that's a great question.

NOTE Confidence: 0.92638313625

01:12:04.140 --> 01:12:06.138 Ralph, go ahead.

NOTE Confidence: 0.92638313625

01:12:06.140 --> 01:12:07.704 Trisha really like these

NOTE Confidence: 0.92638313625

01:12:07.704 --> 01:12:09.130 experiments and great data.

NOTE Confidence: 0.8771184825

01:12:09.400 --> 01:12:11.128 I have a question

NOTE Confidence: 0.8797689

01:12:11.140 --> 01:12:14.204 I guess about the maltodextrin and and what.

NOTE Confidence: 0.896369645

01:12:14.870 --> 01:12:16.670 Is this is this purely sensory?

NOTE Confidence: 0.896369645

01:12:16.670 --> 01:12:17.622 Is it post ingestive?

NOTE Confidence: 0.896369645

01:12:17.622 --> 01:12:19.340 I know the answer is probably both,

NOTE Confidence: 0.896369645

01:12:19.340 --> 01:12:21.115 but I guess I'm interested

NOTE Confidence: 0.896369645

01:12:21.115 --> 01:12:22.046 because maltodextrins are

NOTE Confidence: 0.896369645

01:12:22.046 --> 01:12:23.126 sort of a tricky thing.

NOTE Confidence: 0.896369645

01:12:23.130 --> 01:12:24.170 It's not very sweet,

NOTE Confidence: 0.896369645

01:12:24.170 --> 01:12:25.386 but of course you can't detect

NOTE Confidence: 0.896369645

01:12:25.386 --> 01:12:26.850 it at high concentrations.

NOTE Confidence: 0.896369645

01:12:26.850 --> 01:12:27.540 I can't remember

NOTE Confidence: 0.79494786

01:12:27.550 --> 01:12:30.286 from from David early paper how

NOTE Confidence: 0.79494786

01:12:30.290 --> 01:12:31.850 high it was, and if you know

NOTE Confidence: 0.79494786

01:12:31.850 --> 01:12:33.500 that Jamaican detector at least

NOTE Confidence: 0.870325631764706

01:12:33.510 --> 01:12:35.124 taste it. And of course some

NOTE Confidence: 0.870325631764706

01:12:35.124 --> 01:12:36.547 of the signals you're seeing

NOTE Confidence: 0.870325631764706

01:12:36.547 --> 01:12:38.299 or so fast is clearly something

NOTE Confidence: 0.841295649

01:12:38.310 --> 01:12:40.494 century. But I wonder if over the session

NOTE Confidence: 0.841295649

01:12:40.494 --> 01:12:42.140 they're learning. It has a really

NOTE Confidence: 0.86341530375

01:12:42.270 --> 01:12:44.150 it gets broken down so quickly into glucose.

NOTE Confidence: 0.86341530375

01:12:44.150 --> 01:12:45.090 It's guys seeing indexes.

NOTE Confidence: 0.86341530375

01:12:45.090 --> 01:12:46.582 Is higher than sucrose, right?

NOTE Confidence: 0.86341530375

01:12:46.582 --> 01:12:48.444 So it should be really fast post

NOTE Confidence: 0.86341530375

01:12:48.450 --> 01:12:50.418 ingestive signals and so I wonder

NOTE Confidence: 0.86341530375

01:12:50.418 --> 01:12:52.750 how you how you think about that.

NOTE Confidence: 0.838073193076923

01:12:52.750 --> 01:12:55.690 I think, uh, so David more than

NOTE Confidence: 0.838073193076923

01:12:55.690 --> 01:12:58.829 me really did the important work.

NOTE Confidence: 0.838073193076923

01:12:58.830 --> 01:13:00.342 All you train is out there of

NOTE Confidence: 0.838073193076923

01:13:00.342 --> 01:13:01.978 looking at all the old literature,

NOTE Confidence: 0.838073193076923

01:13:01.980 --> 01:13:04.085 including all the old animal

NOTE Confidence: 0.838073193076923

01:13:04.085 --> 01:13:05.769 behavior literature where people

NOTE Confidence: 0.838073193076923

01:13:05.769 --> 01:13:08.242 have done a lot of work comparing

NOTE Confidence: 0.838073193076923

01:13:08.242 --> 01:13:10.340 tastants and looking at preference.

NOTE Confidence: 0.838073193076923

01:13:10.340 --> 01:13:12.116 Ways to measure preference in assessed

NOTE Confidence: 0.838073193076923

01:13:12.116 --> 01:13:13.490 preference in rodents and so.

NOTE Confidence: 0.838073193076923

01:13:13.490 --> 01:13:15.594 So he he looked carefully at that when

NOTE Confidence: 0.838073193076923

01:13:15.594 --> 01:13:17.807 he chose maltodextrin as a comparison.

NOTE Confidence: 0.838073193076923

01:13:17.810 --> 01:13:19.714 So I think it's a good comparison,

NOTE Confidence: 0.838073193076923

01:13:19.720 --> 01:13:20.551 but we can't.

NOTE Confidence: 0.838073193076923

01:13:20.551 --> 01:13:22.213 It's very difficult to get two

NOTE Confidence: 0.838073193076923

01:13:22.213 --> 01:13:23.957 things that are exactly the same,

NOTE Confidence: 0.838073193076923

01:13:23.960 --> 01:13:26.336 but different, and so in that you know

NOTE Confidence: 0.838073193076923

01:13:26.336 --> 01:13:28.543 in fact that's impossible, right?

NOTE Confidence: 0.838073193076923

01:13:28.543 --> 01:13:31.527 So one thing I can say is that,

NOTE Confidence: 0.838073193076923

01:13:31.530 --> 01:13:33.245 at least for the signal in the

NOTE Confidence: 0.838073193076923

01:13:33.245 --> 01:13:34.770 way that David's looking at it,

NOTE Confidence: 0.838073193076923

01:13:34.770 --> 01:13:38.144 there isn't a change through the session

NOTE Confidence: 0.838073193076923

01:13:38.150 --> 01:13:40.560 in the circumstance when animals.

NOTE Confidence: 0.838073193076923

01:13:40.560 --> 01:13:42.294 Thirsty so there.

NOTE Confidence: 0.838073193076923

01:13:42.294 --> 01:13:43.450 Waters stated,

NOTE Confidence: 0.838073193076923

01:13:43.450 --> 01:13:45.235 and they're just choosing between

NOTE Confidence: 0.838073193076923

01:13:45.235 --> 01:13:47.636 the two rewards that might show that

NOTE Confidence: 0.838073193076923

01:13:47.636 --> 01:13:49.828 there's a big impact of the way that

NOTE Confidence: 0.838073193076923

01:13:49.891 --> 01:13:51.961 that these are is post ingestive

NOTE Confidence: 0.838073193076923

01:13:51.961 --> 01:13:53.727 effects of sucrose versus maltodextrin.

NOTE Confidence: 0.838073193076923

01:13:53.727 --> 01:13:57.120 So so at least on the face of it,

NOTE Confidence: 0.838073193076923

01:13:57.120 --> 01:13:59.353 based on the analysis of this signal

NOTE Confidence: 0.838073193076923

01:13:59.353 --> 01:14:01.220 there during the reward period,

NOTE Confidence: 0.838073193076923

01:14:01.220 --> 01:14:02.249 there's nothing obvious.

NOTE Confidence: 0.838073193076923

01:14:02.249 --> 01:14:04.307 Maybe there are other ways that

NOTE Confidence: 0.838073193076923

01:14:04.307 --> 01:14:06.459 he could look at the signals more

NOTE Confidence: 0.838073193076923

01:14:06.459 --> 01:14:08.729 carefully to see if there is feedback,

NOTE Confidence: 0.838073193076923

01:14:08.730 --> 01:14:09.206 because.

NOTE Confidence: 0.838073193076923

01:14:09.206 --> 01:14:11.110 And as you know,

NOTE Confidence: 0.838073193076923

01:14:11.110 --> 01:14:13.054 you know there's a big literature

NOTE Confidence: 0.838073193076923

01:14:13.054 --> 01:14:17.000 on how post ingestive impacts of

NOTE Confidence: 0.838073193076923

01:14:17.000 --> 01:14:18.984 food impact functioning within

NOTE Confidence: 0.838073193076923

01:14:18.984 --> 01:14:20.319 the striedl circuits that that

NOTE Confidence: 0.838073193076923

01:14:20.319 --> 01:14:21.909 we all know and love so much.

NOTE Confidence: 0.838073193076923

01:14:21.910 --> 01:14:23.038 So I I would,

NOTE Confidence: 0.838073193076923

01:14:23.038 --> 01:14:25.590 I wouldn't say there's not an interaction.

NOTE Confidence: 0.838073193076923

01:14:25.590 --> 01:14:25.890 I.

NOTE Confidence: 0.838073193076923

01:14:25.890 --> 01:14:27.390 I think there probably is,

NOTE Confidence: 0.838073193076923

01:14:27.390 --> 01:14:28.566 but at least for the signal

NOTE Confidence: 0.838073193076923

01:14:28.566 --> 01:14:29.350 that he's looking at,

NOTE Confidence: 0.838073193076923

01:14:29.350 --> 01:14:32.000 he didn't note anything obvious.

NOTE Confidence: 0.838073193076923

01:14:32.000 --> 01:14:32.480 Text.

NOTE Confidence: 0.9806579

01:14:34.550 --> 01:14:36.278 I have a quick question

NOTE Confidence: 0.9806579

01:14:36.278 --> 01:14:38.188 or maybe not so quick.

NOTE Confidence: 0.818468543846154

01:14:38.190 --> 01:14:41.892 The VP is a surprisingly large

NOTE Confidence: 0.818468543846154

01:14:41.892 --> 01:14:44.360 and heterogeneous structure and

NOTE Confidence: 0.818468543846154

01:14:44.464 --> 01:14:46.792 so I have a couple of questions.

NOTE Confidence: 0.818468543846154

01:14:46.792 --> 01:14:48.582 One is from your recordings.

NOTE Confidence: 0.818468543846154

01:14:48.590 --> 01:14:52.682 Can you determine the cell types

NOTE Confidence: 0.818468543846154

01:14:52.682 --> 01:14:55.876 that are responding based on their

NOTE Confidence: 0.818468543846154

01:14:55.876 --> 01:14:58.168 firing patterns or some kind of

NOTE Confidence: 0.818468543846154

01:14:58.168 --> 01:15:00.230 algorithms that let you know about,

NOTE Confidence: 0.818468543846154

01:15:00.230 --> 01:15:02.686 let's say cholinergic neurons

NOTE Confidence: 0.818468543846154

01:15:02.686 --> 01:15:05.756 versus other types of neurons?

NOTE Confidence: 0.818468543846154

01:15:05.760 --> 01:15:08.566 And then here on top and then

NOTE Confidence: 0.818468543846154

01:15:08.566 --> 01:15:10.706 the other question is around

NOTE Confidence: 0.818468543846154

01:15:10.706 --> 01:15:12.898 a sub sections of the VP.

NOTE Confidence: 0.818468543846154

01:15:12.900 --> 01:15:14.993 Whether you see these kinds of responses

NOTE Confidence: 0.818468543846154

01:15:14.993 --> 01:15:16.400 uniformly throughout the structure,

NOTE Confidence: 0.818468543846154

01:15:16.400 --> 01:15:18.360 or whether the anterior versus

NOTE Confidence: 0.818468543846154

01:15:18.360 --> 01:15:20.320 the posterior is more responsive

NOTE Confidence: 0.818468543846154

01:15:20.386 --> 01:15:22.130 to these value measurements.

NOTE Confidence: 0.934005198666667

01:15:23.670 --> 01:15:25.662 Those are great questions because it's

NOTE Confidence: 0.934005198666667

01:15:25.662 --> 01:15:28.329 known that as as many of you may know,

NOTE Confidence: 0.934005198666667

01:15:28.330 --> 01:15:30.130 the VP contains a lot of

NOTE Confidence: 0.934005198666667

01:15:30.130 --> 01:15:31.330 kinds of different neurons.

NOTE Confidence: 0.934005198666667

01:15:31.330 --> 01:15:33.600 It's it's mostly Gabaergic neurons,

NOTE Confidence: 0.934005198666667

01:15:33.600 --> 01:15:36.180 but there are neurons that release

NOTE Confidence: 0.934005198666667

01:15:36.180 --> 01:15:37.470 glutamate cholinergic neurons.

NOTE Confidence: 0.934005198666667

01:15:37.470 --> 01:15:39.806 It's a mix, and it's an area that

NOTE Confidence: 0.934005198666667

01:15:39.806 --> 01:15:41.793 doesn't have easily discernible

NOTE Confidence: 0.934005198666667

01:15:41.793 --> 01:15:43.127 boundaries necessarily.

NOTE Confidence: 0.934005198666667

01:15:43.130 --> 01:15:44.768 So when people work with it

NOTE Confidence: 0.934005198666667

01:15:44.768 --> 01:15:46.800 in in the rat and the road,

NOTE Confidence: 0.934005198666667

01:15:46.800 --> 01:15:48.230 it's a little bit difficult.

NOTE Confidence: 0.934005198666667

01:15:48.230 --> 01:15:51.272 So one way that David went about that that

NOTE Confidence: 0.934005198666667

01:15:51.272 --> 01:15:54.279 gets to your second point is he tried to.

NOTE Confidence: 0.934005198666667

01:15:54.280 --> 01:15:55.330 Positional has electrodes

NOTE Confidence: 0.934005198666667

01:15:55.330 --> 01:15:57.080 in sort of a central,

NOTE Confidence: 0.934005198666667

01:15:57.080 --> 01:15:58.181 not very anterior,

NOTE Confidence: 0.934005198666667

01:15:58.181 --> 01:16:00.383 not very posterior and operating medial,

NOTE Confidence: 0.934005198666667

01:16:00.390 --> 01:16:01.222 not very lateral area.

NOTE Confidence: 0.934005198666667

01:16:01.222 --> 01:16:02.762 So he could just be in the

NOTE Confidence: 0.934005198666667

01:16:02.762 --> 01:16:03.957 middle of the canonical BP,

NOTE Confidence: 0.934005198666667

01:16:03.960 --> 01:16:05.934 at least as described on Atlas is.

NOTE Confidence: 0.934005198666667

01:16:05.940 --> 01:16:07.228 So that's not necessarily

NOTE Confidence: 0.934005198666667

01:16:07.228 --> 01:16:08.516 what you might want,

NOTE Confidence: 0.934005198666667

01:16:08.520 --> 01:16:12.112 but he did not see variation based on

NOTE Confidence: 0.934005198666667

01:16:12.112 --> 01:16:14.439 electrode placement with his signals.

NOTE Confidence: 0.934005198666667

01:16:14.440 --> 01:16:16.648 Had he gone very far anterior

NOTE Confidence: 0.934005198666667

01:16:16.648 --> 01:16:18.540 posterior to search for that,

NOTE Confidence: 0.934005198666667

01:16:18.540 --> 01:16:21.242 he might have seen that because there

NOTE Confidence: 0.934005198666667

01:16:21.242 --> 01:16:23.396 is work emerging from other labs,

NOTE Confidence: 0.934005198666667

01:16:23.396 --> 01:16:24.724 including the Berridge lab.

NOTE Confidence: 0.934005198666667

01:16:24.730 --> 01:16:27.142 Showing that there the VP plays

NOTE Confidence: 0.934005198666667

01:16:27.142 --> 01:16:29.661 different roles in behavior when you

NOTE Confidence: 0.934005198666667

01:16:29.661 --> 01:16:32.169 are more anterior versus more posterior.

NOTE Confidence: 0.934005198666667

01:16:32.170 --> 01:16:33.815 So that's an important issue

NOTE Confidence: 0.934005198666667

01:16:33.815 --> 01:16:35.901 that that we've not looked at as

NOTE Confidence: 0.934005198666667

01:16:35.901 --> 01:16:37.728 far as cell types in the rat.

NOTE Confidence: 0.934005198666667

01:16:37.730 --> 01:16:40.145 So not having the the beauty of

NOTE Confidence: 0.934005198666667

01:16:40.145 --> 01:16:42.697 the transgenic mouse to let let us

NOTE Confidence: 0.934005198666667

01:16:42.697 --> 01:16:44.502 access different cell types easily,

NOTE Confidence: 0.934005198666667

01:16:44.510 --> 01:16:45.776 like Gabaergic cells,

NOTE Confidence: 0.934005198666667

01:16:45.776 --> 01:16:47.111 glutamatergic cells, etc.

NOTE Confidence: 0.934005198666667

01:16:47.111 --> 01:16:49.566 We can't say for sure.

NOTE Confidence: 0.934005198666667

01:16:49.570 --> 01:16:52.438 The area that he implanted his

NOTE Confidence: 0.934005198666667

01:16:52.438 --> 01:16:55.300 electrodes and his mostly Gabaergic.

NOTE Confidence: 0.934005198666667

01:16:55.300 --> 01:16:57.694 When we you there is a small

NOTE Confidence: 0.934005198666667

01:16:57.694 --> 01:16:58.720 a glutamatergic population,

NOTE Confidence: 0.934005198666667

01:16:58.720 --> 01:16:59.025 though,

NOTE Confidence: 0.934005198666667

01:16:59.025 --> 01:17:00.550 for example that people studied

NOTE Confidence: 0.934005198666667

01:17:00.550 --> 01:17:02.649 that has a critical behavioral role.

NOTE Confidence: 0.934005198666667

01:17:02.650 --> 01:17:05.569 When we use waveform shape and other

NOTE Confidence: 0.934005198666667

01:17:05.569 --> 01:17:07.224 neuro physiological characteristics to

NOTE Confidence: 0.934005198666667

01:17:07.224 --> 01:17:09.604 try to cluster neurons into different types,

NOTE Confidence: 0.934005198666667

01:17:09.610 --> 01:17:10.600 we get mostly,

NOTE Confidence: 0.934005198666667

01:17:10.600 --> 01:17:11.260 you know,

NOTE Confidence: 0.934005198666667

01:17:11.260 --> 01:17:13.780 big amorphous cluster that we presume

NOTE Confidence: 0.934005198666667

01:17:13.780 --> 01:17:15.918 is largely these canonical Gabaergic

NOTE Confidence: 0.934005198666667

01:17:15.918 --> 01:17:18.627 neurons and a smaller cluster that we

NOTE Confidence: 0.934005198666667

01:17:18.627 --> 01:17:21.378 guess could be the glutamatergic neurons,

NOTE Confidence: 0.934005198666667

01:17:21.380 --> 01:17:24.020 because it tends to signal very

NOTE Confidence: 0.934005198666667

01:17:24.020 --> 01:17:25.780 differently from the Gabaergic.

NOTE Confidence: 0.934005198666667

01:17:25.780 --> 01:17:26.091 Iran,

NOTE Confidence: 0.934005198666667

01:17:26.091 --> 01:17:28.579 so it doesn't show any of the same

NOTE Confidence: 0.934005198666667

01:17:28.579 --> 01:17:30.144 kinds of signals that I've just

NOTE Confidence: 0.934005198666667

01:17:30.144 --> 01:17:31.952 talked to you about, but we can't.

NOTE Confidence: 0.934005198666667

01:17:31.952 --> 01:17:33.222 And unless we do something

NOTE Confidence: 0.934005198666667

01:17:33.222 --> 01:17:34.510 you know more rigorous,

NOTE Confidence: 0.934005198666667

01:17:34.510 --> 01:17:35.754 something genetic like using

NOTE Confidence: 0.934005198666667

01:17:35.754 --> 01:17:37.620 viruses somehow in the rat to

NOTE Confidence: 0.934005198666667

01:17:37.682 --> 01:17:38.886 access the different populations

NOTE Confidence: 0.934005198666667

01:17:38.886 --> 01:17:41.070 or redo the work in the house.

NOTE Confidence: 0.934005198666667

01:17:41.070 --> 01:17:42.480 We really can't say for sure,

NOTE Confidence: 0.934005198666667

01:17:42.480 --> 01:17:44.839 and we've not even begun to think

NOTE Confidence: 0.934005198666667

01:17:44.839 --> 01:17:47.530 about or touch on the cholinergic.

NOTE Confidence: 0.934005198666667

01:17:47.530 --> 01:17:48.499 Aspects of this?

NOTE Confidence: 0.934005198666667

01:17:48.499 --> 01:17:51.290 I'm ashamed to admit in front of Marina,

NOTE Confidence: 0.729416466666667

01:17:51.640 --> 01:17:56.090 oh, that's OK. Are there any other questions?

NOTE Confidence: 0.729416466666667

01:17:56.090 --> 01:17:58.178 I don't see anything else in the track chat.

NOTE Confidence: 0.75193547125

01:18:00.820 --> 01:18:04.044 If not one more please or I'm Joe.

NOTE Confidence: 0.592878958

01:18:06.980 --> 01:18:09.860 So I actually have to.

NOTE Confidence: 0.592878958

01:18:09.860 --> 01:18:11.685 I guess it's more related

NOTE Confidence: 0.592878958

01:18:11.685 --> 01:18:12.780 to technical questions.

NOTE Confidence: 0.592878958

01:18:12.780 --> 01:18:16.590 One was that when you used

NOTE Confidence: 0.592878958

01:18:16.590 --> 01:18:19.429 optogenetics that you injected.

NOTE Confidence: 0.592878958

01:18:19.430 --> 01:18:21.530 Inhibitory virus bilaterally.

NOTE Confidence: 0.592878958

01:18:21.530 --> 01:18:25.660 But you injected unilateral for the stimulus.

NOTE Confidence: 0.592878958

01:18:25.660 --> 01:18:27.739 So I was wondering why there is

NOTE Confidence: 0.592878958

01:18:27.739 --> 01:18:30.124 difference used by letter for

NOTE Confidence: 0.592878958

01:18:30.124 --> 01:18:32.614 inhibitory and Union letter for

NOTE Confidence: 0.592878958

01:18:32.614 --> 01:18:35.338 stimulus and the second one was.

NOTE Confidence: 0.592878958

01:18:35.340 --> 01:18:38.280 So all the dopamine signals were measured

NOTE Confidence: 0.8600155625

01:18:38.290 --> 01:18:40.890 during the first trial for the

NOTE Confidence: 0.8600155625

01:18:40.890 --> 01:18:42.685 second half of the experiments.

NOTE Confidence: 0.8600155625

01:18:42.685 --> 01:18:45.006 And do you think there will be

NOTE Confidence: 0.8600155625

01:18:45.006 --> 01:18:46.338 difference if you measure the

NOTE Confidence: 0.825760248

01:18:46.540 --> 01:18:48.750 signals during the free trials?

NOTE Confidence: 0.825760248

01:18:48.750 --> 01:18:50.019 Because Brett doesn't.

NOTE Confidence: 0.825760248

01:18:50.019 --> 01:18:52.134 No, what they're going to

NOTE Confidence: 0.825760248

01:18:52.134 --> 01:18:54.169 get when they press the.

NOTE Confidence: 0.825760248

01:18:54.170 --> 01:18:57.338 Or ignore spoke or pistol ever?

NOTE Confidence: 0.825760248

01:18:57.340 --> 01:18:59.110 Yes, those are both good questions

NOTE Confidence: 0.910630422857143

01:18:59.140 --> 01:19:00.274 I I think I would do that.

NOTE Confidence: 0.910630422857143

01:19:00.280 --> 01:19:02.170 The second one first and that is

NOTE Confidence: 0.910630422857143

01:19:02.170 --> 01:19:04.400 so in the in the forced trials.

NOTE Confidence: 0.910630422857143

01:19:04.400 --> 01:19:06.596 The rat doesn't know what reward it will get,

NOTE Confidence: 0.910630422857143

01:19:06.600 --> 01:19:09.600 so that's when we see these big signals.

NOTE Confidence: 0.910630422857143

01:19:09.600 --> 01:19:10.728 That are very different,

NOTE Confidence: 0.910630422857143

01:19:10.728 --> 01:19:12.138 but in the free trials,

NOTE Confidence: 0.910630422857143

01:19:12.140 --> 01:19:13.592 when the animal presses

NOTE Confidence: 0.910630422857143

01:19:13.592 --> 01:19:15.044 the lever for sucrose.

NOTE Confidence: 0.910630422857143

01:19:15.050 --> 01:19:17.346 He or she knows that that that it's

NOTE Confidence: 0.910630422857143

01:19:17.346 --> 01:19:20.148 about to drink sucrose in the in the port.

NOTE Confidence: 0.910630422857143

01:19:20.150 --> 01:19:22.302 So expectation already reduces

NOTE Confidence: 0.910630422857143

01:19:22.302 --> 01:19:24.346 that signal because he knows

NOTE Confidence: 0.910630422857143

01:19:24.346 --> 01:19:25.956 already what's going to happen,

NOTE Confidence: 0.910630422857143

01:19:25.960 --> 01:19:27.898 so that that's a great question,

NOTE Confidence: 0.910630422857143

01:19:27.900 --> 01:19:29.860 and one reason why we didn't look

NOTE Confidence: 0.910630422857143

01:19:29.860 --> 01:19:31.648 at those signals in great detail

NOTE Confidence: 0.910630422857143

01:19:31.648 --> 01:19:33.133 through the session is because

NOTE Confidence: 0.910630422857143

01:19:33.133 --> 01:19:35.386 by the time you get to the end of

NOTE Confidence: 0.910630422857143

01:19:35.386 --> 01:19:37.151 the session is really only enough

NOTE Confidence: 0.910630422857143

01:19:37.151 --> 01:19:38.936 data from the sucrose trials.

NOTE Confidence: 0.910630422857143

01:19:38.940 --> 01:19:40.120 The beginning of the session.

NOTE Confidence: 0.910630422857143

01:19:40.120 --> 01:19:41.184 There's really only enough

NOTE Confidence: 0.910630422857143

01:19:41.184 --> 01:19:42.514 data for the water trials,

NOTE Confidence: 0.910630422857143

01:19:42.520 --> 01:19:44.005 but it would be interesting

NOTE Confidence: 0.910630422857143

01:19:44.005 --> 01:19:45.193 still to show those.

NOTE Confidence: 0.910630422857143

01:19:45.200 --> 01:19:46.844 Think about those more and I

NOTE Confidence: 0.910630422857143

01:19:46.844 --> 01:19:48.520 think that's a nice question,

NOTE Confidence: 0.910630422857143

01:19:48.520 --> 01:19:50.375 and it might be interesting to look

NOTE Confidence: 0.910630422857143

01:19:50.375 --> 01:19:52.153 at the neural activity around the

NOTE Confidence: 0.910630422857143

01:19:52.153 --> 01:19:54.309 lever press for example so that there

NOTE Confidence: 0.910630422857143

01:19:54.372 --> 01:19:56.160 are other other time periods that

NOTE Confidence: 0.910630422857143

01:19:56.160 --> 01:19:57.959 I think I would be interested in.

NOTE Confidence: 0.910630422857143

01:19:57.960 --> 01:19:59.958 Knowing what are those neurons doing

NOTE Confidence: 0.910630422857143

01:19:59.958 --> 01:20:01.800 during those other time periods?

NOTE Confidence: 0.910630422857143

01:20:01.800 --> 01:20:03.672 The first question you asked is

NOTE Confidence: 0.910630422857143

01:20:03.672 --> 01:20:04.920 about the optogenetics procedure

NOTE Confidence: 0.910630422857143

01:20:04.969 --> 01:20:06.577 and so this is just something

NOTE Confidence: 0.910630422857143

01:20:06.577 --> 01:20:08.090 away that we've typically done it,

NOTE Confidence: 0.910630422857143

01:20:08.090 --> 01:20:10.344 and it's probably mostly out of convenience.

NOTE Confidence: 0.910630422857143

01:20:10.350 --> 01:20:12.175 So when you're activating neurons

NOTE Confidence: 0.910630422857143

01:20:12.175 --> 01:20:14.535 you usually can change the animal's

NOTE Confidence: 0.910630422857143

01:20:14.535 --> 01:20:15.469 behavior with.

NOTE Confidence: 0.910630422857143

01:20:15.470 --> 01:20:17.258 Optogenetics because it's such

NOTE Confidence: 0.910630422857143

01:20:17.258 --> 01:20:19.493 a strong and artificial approach

NOTE Confidence: 0.910630422857143

01:20:19.493 --> 01:20:21.707 usually can change the behavior by

NOTE Confidence: 0.910630422857143

01:20:21.707 --> 01:20:24.039 impacting the brain just on one side,

NOTE Confidence: 0.910630422857143

01:20:24.040 --> 01:20:25.882 and it's easier for the experimenter

NOTE Confidence: 0.910630422857143

01:20:25.882 --> 01:20:27.677 because then there's only one connection

NOTE Confidence: 0.910630422857143

01:20:27.677 --> 01:20:29.483 that they need to make with the.

NOTE Confidence: 0.910630422857143

01:20:29.490 --> 01:20:31.426 With the Rotary joint and all of this,

NOTE Confidence: 0.910630422857143

01:20:31.430 --> 01:20:33.440 but when you're inhibiting in a

NOTE Confidence: 0.910630422857143

01:20:33.440 --> 01:20:35.476 particular brain region a lot of

NOTE Confidence: 0.910630422857143

01:20:35.476 --> 01:20:37.378 times behavior is still not greatly

NOTE Confidence: 0.910630422857143

01:20:37.378 --> 01:20:39.517 impacted or even almost normal if the

NOTE Confidence: 0.910630422857143

01:20:39.517 --> 01:20:42.346 other side of the brain is still functioning,

NOTE Confidence: 0.910630422857143

01:20:42.346 --> 01:20:46.070 so to avoid a possible outcome like that.

NOTE Confidence: 0.910630422857143

01:20:46.070 --> 01:20:46.844 For inhibition,

NOTE Confidence: 0.910630422857143

01:20:46.844 --> 01:20:49.940 people often will do it bilaterally and try

NOTE Confidence: 0.910630422857143

01:20:50.008 --> 01:20:52.825 to inhibit in both both sides of the brain.

NOTE Confidence: 0.910630422857143

01:20:52.830 --> 01:20:53.943 So it's it's.

NOTE Confidence: 0.910630422857143

01:20:53.943 --> 01:20:55.427 It's really just a.

NOTE Confidence: 0.910630422857143

01:20:55.430 --> 01:20:57.180 Experimental practicality

NOTE Confidence: 0.942304115

01:20:58.120 --> 01:20:59.940 thank you so much, sure.

NOTE Confidence: 0.8202534

01:21:02.960 --> 01:21:06.835 OK. Well, I I want to thank

NOTE Confidence: 0.8202534

01:21:06.835 --> 01:21:08.630 you again for a great lecture.

NOTE Confidence: 0.8202534

01:21:08.630 --> 01:21:10.592 Thank you all for being here

NOTE Confidence: 0.8202534

01:21:10.592 --> 01:21:12.382 and for your great questions

NOTE Confidence: 0.8202534

01:21:12.382 --> 01:21:14.830 and let's thank Dr Janik again.

NOTE Confidence: 0.8202534

01:21:14.830 --> 01:21:16.356 And for those of you who are

NOTE Confidence: 0.8202534

01:21:16.356 --> 01:21:17.633 having who are trainees who

NOTE Confidence: 0.8202534

01:21:17.633 --> 01:21:19.048 are having lunch with her,

NOTE Confidence: 0.8202534

01:21:19.050 --> 01:21:22.270 you should have the the link to

NOTE Confidence: 0.8202534

01:21:22.270 --> 01:21:25.830 the other zoom room and I hope

NOTE Confidence: 0.8202534

01:21:25.830 --> 01:21:28.606 you'll move over to that room to

NOTE Confidence: 0.8202534

01:21:28.606 --> 01:21:30.690 talk with Doctor Genich further.

NOTE Confidence: 0.8202534

01:21:30.690 --> 01:21:31.798 Thanks I wanna thank.

NOTE Confidence: 0.9208700175

01:21:32.130 --> 01:21:33.426 I want to thank you all so much.

NOTE Confidence: 0.9208700175

01:21:33.430 --> 01:21:34.702 This was really a pleasure and

NOTE Confidence: 0.9208700175

01:21:34.702 --> 01:21:36.000 thanks for your great questions.