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1 00:00:00.000 --> 00:00:03.220 Yale podcast network.

2 00:00:03.220 --> 00:00:05.309

3 00:00:05.309 --> 00:00:08.794 Hello and welcome to another episode of the Yale Journal Biology.

4 00:00:08.794 --> 00:00:18.240 and Medicine podcast YJBM is a pubmed and index quarterly Journal edited by Yale Medicine graduate and professional students and peer reviewed by experts in the fields of biology and

5 00:00:18.240 --> 00:00:23.942 Medicine each issue of the Journal is devoted to a focused topic and through a few episodes of this podcast.

6 00:00:23.942 --> 00:00:25.841 We would take you through the past,

7 00:00:25.841 --> 00:00:28.428 present, and future of the issue subject matter.

8 00:00:28.428 --> 00:00:34.497 This episode is part of our series devoted to our September 2019 issue on organelles on your cohost Kelsie Cassell,

9 00:00:34.497 --> 00:00:36.820 a second year graduate student Epidemiology.

10 00:00:36.820 --> 00:00:44.918 And I'm a Emma carley a second year graduate student and cell biology later on will also be joined by Amelia Hallworth a third year graduate student in Microbiology.

11 00:00:44.918 --> 00:00:51.930 In this episode. We were talking exclusively about one of the organelles featured in the September 2019 issue on organelles the mitochondria.

12 00:00:51.930 --> 00:00:53.807 All cells are composed of organelles,

13 00:00:53.807 --> 00:01:00.326 which complete different functions within the cell mitochondria is a double membrane organelle known as the powerhouse of the cell,

14 00:01:00.326 --> 00:01:05.117 which is a description often perpetuated in high school biology books to help with memorization.

15 00:01:05.117 --> 00:01:08.989 However, this description is not new and it originated over 60 years ago.

16 00:01:08.989 --> 00:01:18.456 The first published manuscript to announce that mitochondria is the powerhouse of the cell was written by Doctor Phillip Siekevitz and published in the Scientific American in 1957.

17 00:01:18.456 --> 00:01:25.090 However, research on mitochondria began almost exactly a century before this powerhouse statement was made.

18 00:01:25.090 --> 00:01:29.126 Mitochondria was originally discovered by physiologist,

19 00:01:29.126 --> 00:01:32.299 Albert von Kölliker in 1857. and in 1886

20 00:01:32.299 --> 00:01:35.903 It was first coined as a bio blast by scientists.

21 00:01:35.903 --> 00:01:38.498 Richard Altman. bio blast is easily

22 00:01:38.498 --> 00:01:40.876 a better name than mitochondria,

23 00:01:40.876 --> 00:01:50.569 yet here we are. Some records also credit Altman with the discovery or at least ability to consistently recognize and characterize the mitochondria.

24 00:01:50.569 --> 00:01:57.763 Mitochondria were officially renamed as mitochondria by Carl Benda in 1898. mitochondria stems from the Greek word.

25 00:01:57.763 --> 00:02:05.394 Mitos for thread And Congress for gradual referencing the similarity in appearance to structure seen in Spermato-Genesis.

26 00:02:05.394 --> 00:02:11.650 In 1900, a super vital stain for mitochondria was discovered which is called Janus Green B. Janus

27 00:02:11.650 --> 00:02:15.777 green b changes color depending on the amount of oxygen present,

28 00:02:15.777 --> 00:02:17.780 and around it around the stain.

29 00:02:17.780 --> 00:02:20.719 It changes from blue in the presence of oxygen.

30 00:02:20.719 --> 00:02:29.155 And pink in the absence because of this that is able to indicate the presence of mitochondria as mitochondria uses oxygen and many of its cellular processes.

31 00:02:29.155 --> 00:02:32.786 Despite the discovery of a reliable stain to identify mitochondria.

32 00:02:32.786 --> 00:02:40.939 The processes behind why the stain is effective an what the underlying roll mitochondrion ourselves was not known until many years later.

33 00:02:40.939 --> 00:02:51.332 OK, So what are mitochondria doing in ourselves First off I want to dispel a myth about mitochondria so not only do high school biology textbooks.

34 00:02:51.332 --> 00:02:56.564 Perpetuate this idea that the mitochondria is the powerhouse of the cell,

35 00:02:56.564 --> 00:03:01.020 but they also perpetuate the idea that mitochondria are small.

36 00:03:01.020 --> 00:03:03.848 Bean shaped organelles. But in reality,

37 00:03:03.848 --> 00:03:11.129 mitochondria are dynamic structures capable of forming very extensive networks all throughout the cell.

38 00:03:11.129 --> 00:03:14.623 These mitochondria can undergo Fusion and fission events,

39 00:03:14.623 --> 00:03:17.033 so if you have a lot of fission events,

40 00:03:17.033 --> 00:03:19.383 meaning the mitochondria, breaking up,

41 00:03:19.383 --> 00:03:20.950 then if you look at them,

42 00:03:20.950 --> 00:03:23.058 they might look like little beans,

43 00:03:23.058 --> 00:03:26.735 but most of the time mitochondria are in these very amazing.

44 00:03:26.735 --> 00:03:36.039 Dynamic networks and so overall mitochondria are way more complicated than just a bunch of little bean shapes floating around inside of cells.

45 00:03:36.039 --> 00:03:43.401 So Kelsie just talked about how these organelles were first discovered and came to be known as the powerhouse of the cell.

46 00:03:43.401 --> 00:03:48.370 But what exactly does powerhouse of the cell mean at the biological level.

47 00:03:48.370 --> 00:04:00.769 This basically means that mitochondria make ATP. ATP stands for adenosine triphosphate and it's a very high energy molecule that our bodies used to store that energy that we get

48 00:04:00.769 --> 00:04:03.599 from food to be used later.

49 00:04:03.599 --> 00:04:09.759 ATP is made by a specialized group of proteins that all reside in the mitochondria.

50 00:04:09.759 --> 00:04:14.759 Most of these proteins are part of something called the electron transport chain.

51 00:04:14.759 --> 00:04:22.680 The electron transport chain uses high-energy molecules made during the breakdown of sugars in our food.

52 00:04:22.680 --> 00:04:32.629 And, combined this with oxygen to create a gradient of positively charged hydrogen ions across the membrane of the mitochondria.

53 00:04:32.629 --> 00:04:43.509 The protein ATP synthase, then uses this positively charged hydrogen gradient to make ATP from ADP and an inorganic phosphate.

54 00:04:43.509 --> 00:04:51.531 For every one molecule of the sugar glucose an 6 molecules of oxygen you can get 36 ATP so this process is very,

55 00:04:51.531 --> 00:04:57.495 very good at generating energy from the sugars and fats that are found in our food.

56 00:04:57.495 --> 00:05:03.812 Can you still make ATP if you don't have enough oxygen like when you're exercising yeah,

57 00:05:03.812 --> 00:05:08.781 so ATP synthase that very last step that happens in the mitochondria.

58 00:05:08.781 --> 00:05:13.680 Only makes 32 of the 36 ATP that you get from every glucose molecule.

59 00:05:13.680 --> 00:05:18.254 The rest come from steps that occur in the cytosol of the cell,

60 00:05:18.254 --> 00:05:21.541 which are anaerobic and don't require oxygen,

61 00:05:21.541 --> 00:05:31.762 however, as you can see you would only get 4 Atps if you were to just rely on that process so making ATP using oxygen and using all these cool

62 00:05:31.762 --> 00:05:36.550 proteins found in the mitochondria is a way more energy efficient,

63 00:05:36.550 --> 00:05:39.980 you can get lots. More energy out of your food.

64 00:05:39.980 --> 00:05:45.197 and I just wanted to take a second to talk about ATP synthase that very,

65 00:05:45.197 --> 00:05:56.391 very last step. And the formation of ATP because it's one of my favorite proteins in biology in order to make ATP this ATP synthase protein will rotate like a

66 00:05:56.391 --> 00:06:01.771 motor and it's this rotation that allows for the generation of ATP in 1997.

67 00:06:01.771 --> 00:06:13.237 Some very clever scientists from the Tokyo Institute of Technology actually design an experiment that allowed them to visualize this rotation under a microscope,

68 00:06:13.237 --> 00:06:17.449 which for me is absolutely amazing and very beautiful.

69 00:06:17.449 --> 00:06:26.860 So this is one of the most elegant and beautiful molecular machines in our body in my opinion at least and it is found in the mitochondria.

70 00:06:26.860 --> 00:06:37.898 So overall this powerhouse of the cell is only one example of how mitochondria are very closely linked to our metabolism or the process by which our body builds up

71 00:06:37.898 --> 00:06:49.408 and breaks down the molecules that make up ourselves so mitochondria can all are also intimately involved in the processes that make other important biological molecules,

72 00:06:49.408 --> 00:06:54.480 including the nucleotides that make up our DNA and RNA.

73 00:06:54.480 --> 00:06:59.110 Although mitochondria are known as the powerhouse of the cell.

74 00:06:59.110 --> 00:07:06.827 They also play a role in other key cellular processes that don't necessarily have to do with metabolism.

75 00:07:06.827 --> 00:07:13.930 For example, mitochondria are really important for a pop ptosis or programmed cell death.

76 00:07:13.930 --> 00:07:19.918 A pop ptosis is a very important process that is constantly occuring in our bodies.

77 00:07:19.918 --> 00:07:23.697 A pop ptosis is really important during development.

78 00:07:23.697 --> 00:07:29.543 For example, in a developing embryo initially when limbs develop there are cells.

79 00:07:29.543 --> 00:07:41.735 In between what will eventually become each of the individual fingers and those cells need to undergo this program cell death in order to allow for each of the individual

80 00:07:41.735 --> 00:07:45.009 fingers to form in adult animals an adult.

81 00:07:45.009 --> 00:07:55.240 A pop ptosis is important to get rid of any cells that may have gotten damaged in a way that won't damage the other cells around it.

82 00:07:55.240 --> 00:08:00.875 So during a pop ptosis a group of protein cleaving enzymes essentially fancy.

83 00:08:00.875 --> 00:08:04.992 Molecular scissors that will chop up any protein around.

84 00:08:04.992 --> 00:08:14.750 It called caspases are activated an these caspases will begin to systematically breakdown proteins in the cell during apoptosis.

85 00:08:14.750 --> 00:08:24.596 And healthy cells, these cast spaces are in an inactive form so that they don't digest proteins in the cell inappropriately so they must be activated in order to function

86 00:08:24.596 --> 00:08:29.665 one of the key proteins required for the activation of caspase is is called cytochrome.

87 00:08:29.665 --> 00:08:40.730 C cytochrome C is actually part of that electron transport chain that I mentioned previously in the for when the mitochondria is performing its powerhouse of the cell roll.

88 00:08:40.730 --> 00:08:47.892 So cytochrome C is really important in one of the first steps of a pop ptosis so during apoptosis.

89 00:08:47.892 --> 00:09:00.914 The outer membrane of the mitochondria will rupture allowing for cytochrome C to be released into the cytoplasm where it can interact with and activate these caspases to allow for

90 00:09:00.914 --> 00:09:03.929 the progression of a pop ptosis.

91 00:09:03.929 --> 00:09:14.690 So essentially the mitochondria allows for a physical separation between these caspases and cytochrome C in order to prevent unnecessary cell death.

92 00:09:14.690 --> 00:09:24.846 Overall, the mitochondria are incredible organelles that are not only important as the powerhouse of the cell but are also involved in many other key cellular processes.

93 00:09:24.846 --> 00:09:28.490 You've talked a lot about what mitochondria do in ourselves.

94 00:09:28.490 --> 00:09:38.110 How do mitochondria affect us at the level of the Organism well mitochondria are really important for a lot of things you know they make the energy that we need

95 00:09:38.110 --> 00:09:40.380 in order to move on things like that.

96 00:09:40.380 --> 00:09:45.340 But one cool thing that mitochondria does is that it actually helps newborn babies.

97 00:09:45.340 --> 00:09:49.546 Keep warm through a process called non shivering thermogenesis.

98 00:09:49.546 --> 00:09:55.330 I previously mentioned that when mitochondria are acting as the powerhouse of the cell.

99 00:09:55.330 --> 00:10:06.789 The electron transport chain. We use the high-energy molecules created by breakdown of sugar along with oxygen to make a gradient of positively charged hydrogen ions.

100 00:10:06.789 --> 00:10:12.902 So during non shivering thermogenesis specifically in the Brown adipose tissue of infants.

101 00:10:12.902 --> 00:10:15.453 There is the protein called uncouple.

102 00:10:15.453 --> 00:10:26.537 Ng protein that will prevent this positively charged hydrogen ion gradient from being used to make ATP and instead it will be used to generate heat so you said that

103 00:10:26.537 --> 00:10:36.879 oxygen is required to make the hydrogen ion gradient used to make ATP or heat is non shivering thermogenesis affected if a baby doesn't get enough oxygen.

104 00:10:36.879 --> 00:10:48.897 Yeah, so babies who don't get enough oxygen can't actually do non shivering thermogenesis so along with all the other side effects that you would have from having low oxygen,

105 00:10:48.897 --> 00:11:01.736 they can't properly regulate their body temperature so there are chemicals that are capable of performing the same function as uncouple Ng protein performs in the Brown adipose tissue of

106 00:11:01.736 --> 00:11:15.116 these babies. These molecules are called Uncouplers in 1933 and Uncoupler called 24 dinitrophenyl or DMP was found to

cause significant weight loss in adults.

107 00:11:15.116 --> 00:11:25.759 The rationale behind this drug is that DNP essentially makes it very difficult for your body to build up ATP because DNP is.

108 00:11:25.759 --> 00:11:28.004 Causing this hydrogen ion gradient.

109 00:11:28.004 --> 00:11:36.105 That's built inside of your Modoc Andrea to be used to make heat instead of to be used to make ATP so your body has to breakdown.

110 00:11:36.105 --> 00:11:43.147 A lot more fats and sugars that you can zoom in your diet in order to get the amount of ATP that it needs sense,

111 00:11:43.147 --> 00:11:47.139 so much of it is being turned into heat.

112 00:11:47.139 --> 00:11:51.873 So this sounds like a miracle drug and you may be asking yourself.

113 00:11:51.873 --> 00:11:55.970 Why isn't everybody taking this who has issues with wait?

114 00:11:55.970 --> 00:11:59.927 Why haven't? Why hasn't this solved obesity in America.

115 00:11:59.927 --> 00:12:03.600 Unfortunately, this is too good to be true in 1938.

116 00:12:03.600 --> 00:12:14.549 DNP was labeled as extremely dangerous and not fit for human consumption by the FDA there is a major problem with this drug that you may have picked up on

117 00:12:14.549 --> 00:12:17.870 since the energy from food is turned into heat.

118 00:12:17.870 --> 00:12:26.990 Instead of ATP there's an increase in body temperature that can lead to acute toxicity and death as a result of this hyperthermia.

119 00:12:26.990 --> 00:12:33.543 Is there a Safeway for the young couple hours to be used as a weight loss drug well regardless of?

120 00:12:33.543 --> 00:12:41.352 What uncoupler you use you're going to get this increase in temperature that's just the fundamentals of how it works,

121 00:12:41.352 --> 00:12:46.549 so you would have to pick a dose of uncoupler that would allow for A.

122 00:12:46.549 --> 00:12:54.029 Amount of You know hyperthermia that wouldn't kill you.

123 00:12:54.029 --> 00:13:00.889 But then you have to ask you know is the amount of weight loss that you get from this low level of the drug.

124 00:13:00.889 --> 00:13:04.370 Worth it a man also.

125 00:13:04.370 --> 00:13:11.370 Sense it's very easy to take too many of these drugs.

126 00:13:11.370 --> 00:13:20.460 To prevent this hyperthermia side effect and so would be very easy for people to take too much of this drug and.

127 00:13:20.460 --> 00:13:26.090 Have very dire extreme side effects.

128 00:13:26.090 --> 00:13:31.057 So Emma has covered how mitochondria very important organelles within eukaryotic cells,

129 00:13:31.057 --> 00:13:37.945 but to make things even more interesting mitochondria were once their own cells separate from your from eukaryotic cells.

130 00:13:37.945 --> 00:13:45.529 The process by which mitochondria became part of ourselves that we know them now is known as an diesem endosymbiosis.

131 00:13:45.529 --> 00:13:49.153 Following the discovery that mitochondria had their own DNA in the 1960s,

132 00:13:49.153 --> 00:13:54.639 the first work theorizing that mitochondria originated separately from the human cells was put forth.

133 00:13:54.639 --> 00:14:02.591 In 1967, Lynn Margulis proposed that in this proposed the endosymbiotic theory for the integration of mitochondria in human cells.

134 00:14:02.591 --> 00:14:11.879 The endosymbiotic theory states that mitochondria were early bacterial remnants that were engulfed by early eukaryotic cells around 1 billion years ago,

135 00:14:11.879 --> 00:14:20.802 so do you know? How long it took scientists to fully accept this theory in her report doctor margolis put forth multiple theories for Endo Symbio.

136 00:14:20.802 --> 00:14:22.259 Sis and the human cell,

137 00:14:22.259 --> 00:14:24.870 she stated that maybe eukaryotic flagellum.

138 00:14:24.870 --> 00:14:29.932 Or Basil bodies of flagella and the mitotic apparatus were also due to endosymbiosis.

139 00:14:29.932 --> 00:14:33.466 However, not all of her endosymbiotic theories were widely.

140 00:14:33.466 --> 00:14:36.450 Where is widely accepted as mitochondria?

141 00:14:36.450 --> 00:14:41.246 Namely, because no genome has been found for the flagella to support this theory.

142 00:14:41.246 --> 00:14:51.075 Interestingly, the paper in which he first proposed this called on the origin and my toasting cells was said to be rejected by 15 journals before being accepted in the

143 00:14:51.075 --> 00:15:02.892 Journal theoretical theoretical biology identifying the jeans in mitochondria and plastids is what has allowed the confirmation that these are now included in the eukaryotic cell through endosymbiosis.

144 00:15:02.892 --> 00:15:06.460 There was significant debate in the 70s and 80s over weather.

145 00:15:06.460 --> 00:15:09.381 There was an origin from within or origin from,

146 00:15:09.381 --> 00:15:12.607 without so this means like did did these organelles.

147 00:15:12.607 --> 00:15:21.980 Origin originate within the cell originate outside of the cell and it appears that in the late 80s and early 90s consensus converged around mitochondria,

148 00:15:21.980 --> 00:15:33.820 originating outside of the cell and this was especially clear after the full genome was able to be sequenced and we were able to construct phylogenetic trees to prove this.

149 00:15:33.820 --> 00:15:40.965 So Interestingly there are actually some eukaryotic cells that can function without mitochondria.

150 00:15:40.965 --> 00:15:45.193 So, although these mitochondria are incredibly important,

151 00:15:45.193 --> 00:15:50.590 it turns out that it's possible for you carry outs to exist without them.

152 00:15:50.590 --> 00:15:53.578 In 2012, a group of scientists sequence,

153 00:15:53.578 --> 00:15:55.913 the whole genome of a protozoa,

154 00:15:55.913 --> 00:15:59.850 which is a category of single celled eukaryotic cells.

155 00:15:59.850 --> 00:16:01.830 This part is Oh is called?

156 00:16:01.830 --> 00:16:14.715 Mono sercombe noise and I apologize to those scientists for my butchering of the name so this Organism belongs to a group of eukaryotes called oxy monads and this group

157 00:16:14.715 --> 00:16:18.831 of eukaryotes live in the gut of wood eating insects,

158 00:16:18.831 --> 00:16:24.625 such as termites and a pair appear to play a role in the digestion of wood,

159 00:16:24.625 --> 00:16:34.350 which is wild so these scientists found that mono circum noise has no trace of any jeans that encode mitochondrial proteins.

160 00:16:34.350 --> 00:16:42.229 Instead, they identified components that would allow this you carry out to perform anaerobic respiration,

161 00:16:42.229 --> 00:16:45.500 which is oxygen independent ATP production.

162 00:16:45.500 --> 00:16:52.413 Additionally, mitochondria are involved in assembling something called iron sulfur clusters,

163 00:16:52.413 --> 00:16:58.899 which are important in the function of certain proteins within eukaryotic cells.

164 00:16:58.899 --> 00:17:03.190 And these scientists found that.

165 00:17:03.190 --> 00:17:16.212 This you carry out has a different system for most eukaryotes to assemble these iron sulfur clusters and that this assembly process more similarly resembles the process found in prokaryotic

166 00:17:16.212 --> 00:17:19.571 cells such as bacteria, So what about our cells.

167 00:17:19.571 --> 00:17:23.683 I know red blood cells don't have any don't have a nucleus,

168 00:17:23.683 --> 00:17:31.566 but do they have mitochondria as Emma has alluded to research on mitochondria has only increased overtime in 2016,

169 00:17:31.566 --> 00:17:41.926 it surpassed the nucleus? As the organelle with the most medical publications per year of large part of why mitochondria is still so heavily studied with in biology and medicine

170 00:17:41.926 --> 00:17:47.445 is because mitochondrial DNA is associated with many physiological processes and disease states.

171 00:17:47.445 --> 00:17:54.897 Certain mitochondrial DNA haplogroups, which are groups of single nucleotide polymorphism are associated with longevity longevity.

172 00:17:54.897 --> 00:18:00.529 Athletic performance adaptation to high altitude and neurodegenerative disorders like Alzheimer's,

173 00:18:00.529 --> 00:18:03.089 and Parkinson's, and mask an.

174 00:18:03.089 --> 00:18:06.329 An macular degeneration to list a few.

175 00:18:06.329 --> 00:18:09.776 Mitochondrial DNA is discussed in many areas of science,

176 00:18:09.776 --> 00:18:14.672 partly because it is a line of DNA that is carried their own maternal ancestors.

177 00:18:14.672 --> 00:18:18.903 We know that we acquired genetic components from both of our parents.

178 00:18:18.903 --> 00:18:30.146 However, sperm only provides nucleus DNA an not the mitochondrial DNA so the organelles issue technically focused on all organelles where there any other editor picks that you wanted to

179 00:18:30.146 --> 00:18:35.405 mention? Yeah, so it was actually so when I read through all the papers in this issue.

180 00:18:35.405 --> 00:18:37.279 It was really a standing to me.

181 00:18:37.279 --> 00:18:50.386 How large the mitochondria loomed even over manuscripts that weren't about mitochondria so two of my favorite editors picks one of them was about lipid droplets in the management of

182 00:18:50.386 --> 00:18:53.539 cellular stress and that one was by.

183 00:18:53.539 --> 00:18:56.538 Eva jargon Tony Peten. Um,

184 00:18:56.538 --> 00:19:00.548 which I knew I knew nothing about lipid droplets prior to reading.

185 00:19:00.548 --> 00:19:12.277 This manuscript, but a substantial part of this manuscript actually also focused on mitochondria and how these lipid droplets are interacting with mitochondria to deal with energy storage and the

186 00:19:12.277 --> 00:19:15.190 amount of data being stored in the cell.

187 00:19:15.190 --> 00:19:27.200 And then the other manuscript that I really liked was an English mania and they are parasite that gets into your cell and then forms a vacuole in which they

188 00:19:27.200 --> 00:19:33.319 grow and this manuscript was looking at the proteins that were on this parasite.

189 00:19:33.319 --> 00:19:38.031 Parasite vacuole membrane and how this is affecting this parasite host interaction,

190 00:19:38.031 --> 00:19:44.594 which on the face of it doesn't really seem to be about mitochondria and I don't think they actually mentioned them.

191 00:19:44.594 --> 00:19:47.960 But as someone who also studies and intracellular parasite.

192 00:19:47.960 --> 00:19:51.156 I thought this was very cool and in my case in Coxiella,

193 00:19:51.156 --> 00:20:01.028 which is what I study not leishmania mitochondria are incredibly important to the infection process and whether this is able to happen or not because both the parasite and the

194 00:20:01.028 --> 00:20:04.170 host still need energy so that was another editors pick.

195 00:20:04.170 --> 00:20:06.863 And then the final editors pick,

196 00:20:06.863 --> 00:20:11.269 was about localization of a protein into the nucleus,

197 00:20:11.269 --> 00:20:15.920 which is part of the nucleus where ribosomes are created.

198 00:20:15.920 --> 00:20:18.326 This one doesn't have a whole lot to do with mitochondria,

199 00:20:18.326 --> 00:20:20.380 but it was also pretty cool.

200 00:20:20.380 --> 00:20:27.269 Awesome it's so cool to hear all the wide range of topics that you can have in this issue and it's crazy,

201 00:20:27.269 --> 00:20:31.819 that so many of them somehow can be related back to the mitochondria.

202 00:20:31.819 --> 00:20:34.160 Actually, while we're on the topic.

203 00:20:34.160 --> 00:20:36.630 I have one more. I want to spotlight,

204 00:20:36.630 --> 00:20:43.065 which was rose at all in this paper as I mentioned mitochondria are not just static little kidney.

205 00:20:43.065 --> 00:20:50.779 Bean shaped things they have these really complicated networks and they're constantly moving around and doing things.

206 00:20:50.779 --> 00:20:57.807 And so this one paper by rose at all is looking at the proteins that are required for making this Fusion and vision happen.

207 00:20:57.807 --> 00:21:04.609 I'm really goes into a lot of detail about those proteins and is also talking about Fusion and vision and chloroplasts,

208 00:21:04.609 --> 00:21:06.537 which we didn't talk about today,

209 00:21:06.537 --> 00:21:09.597 so if you're interested in that that's another paper.

210 00:21:09.597 --> 00:21:12.261 You could read awesome. I as a cell biologist.

211 00:21:12.261 --> 00:21:18.140 I think that watching mitochondria Fusion and vision is super cool love those microscopy docs.

212 00:21:18.140 --> 00:21:25.335 So we have one more question for you so why were you interested in working on a Yale Journal Biology.

213 00:21:25.335 --> 00:21:33.095 In Madison issue that is specific to organelles so I had mentioned that my work is an intracellular bacteria.

214 00:21:33.095 --> 00:21:40.008 Coxiella and on how it's interacting with the host so that's I really like a lot of Cell Biology,

215 00:21:40.008 --> 00:21:41.419 a lot of my papers.

216 00:21:41.419 --> 00:21:49.529 I read in a lot of the things I think about our very much cell biology related even though I am a microbiologist.

217 00:21:49.529 --> 00:21:57.003 Um and so when we decided we wanted to When would you be on voted that we wanted to do an issue on organelles it was when I was very

218 00:21:57.003 --> 00:21:58.464 interested in and I mean.

219 00:21:58.464 --> 00:22:00.488 I also had the spare time to do it,

220 00:22:00.488 --> 00:22:02.847 so that was how I ended up on this issue,

221 00:22:02.847 --> 00:22:07.400 so thank you for joining us and for walking us through your issue and thank you.

222 00:22:07.400 --> 00:22:12.121 Mo for contributing your great followed biology background to this special episode.

223 00:22:12.121 --> 00:22:19.258 There are many other people behind this podcast that you might never get a chance to hear so we like to thank the Yale school.

224 00:22:19.258 --> 00:22:21.786 medicine from being our home for YJBM,

225 00:22:21.786 --> 00:22:24.539 the podcast. We like to thank the Yale broadcast.

226 00:22:24.539 --> 00:22:29.734 Center for hope with recording editing and publishing are podcasts shout out to Ryan McEvoy.

227 00:22:29.734 --> 00:22:31.744 Thank you to the YJBM editor board,

228 00:22:31.744 --> 00:22:33.532 especially our editor in chief,

229 00:22:33.532 --> 00:22:39.676 which is also Amelia Hallworth and that also includes Devon Washe in deputy editors for the organelles issue,

230 00:22:39.676 --> 00:22:42.301 which were Amelia Hallworth and John Ventura.

231 00:22:42.301 --> 00:22:48.111 Finally, thanks to you. Our viewers for turning into for tuning into this episode of the YJBM podcast.

232 00:22:48.111 --> 00:22:54.700 We love your feedback and questions so feel free to tell us your thoughts and by emailing us at YJBM at yale.edu.

233 00:22:54.700 --> 00:22:56.271 If you enjoyed our podcasts,

234 00:22:56.271 --> 00:22:59.307 please share a podcast on SoundCloud or Apple podcasts.

235 00:22:59.307 --> 00:22:59.849 Thank you.

236 00:22:59.849 --> 00:23:02.086