

- hello I'm Matt Galloway and this is the current podcast you know it sounds like something maybe an episode of Star Trek a group of scientists is calling for a halt in research that could lead to something called Mirror life the scientists worry that the synthetic organisms that uh uh create these mirror molecules in this field of research could present an unprecedented risk to all life on Earth that sounds rather serious Kate adamala is one of the scientists a synthetic biologist founder of the build a cell initiative and
- genetics professor at the University of Minnesota she's in Minneapolis Kate good morning good morning let's start with the basics what do you do what is a synthetic biologist um synthetic biologist is someone who makes things out of biology that biology doesn't naturally do and we do that so we can expand that diversity of what we can get out of biology better medicine better drugs better ways of making molecules basically making anything that a natural biology didn't think of doing and so like the MRNA vaccine during the co pandemic is an
- example of that right yes that's one of our poster child examples of a successful synthetic biology project okay so now that we understand that what is what is mirror Life mirror life is the idea that you could make a cell that looks exactly like a normal bacteria cell but all molecules in that cell would be pointing the opposite direction so every biological molecule points one way or the other it it has a physical conformation in space and there are two possible confirmations for every molecule and life is very particular
- about what direction all our molecules point it there is one conformation that all life uses and it's possible to imagine making a cell where all molecules point the exactly opposite direction that's why we call it mirror life because it would be like a molecule that looks at self in a mirror you told the New York Times this is inherently incredibly cool this idea what is what is cool about it to you it's cool because it would create an second Tree of Life um all life that exists on Earth right now came from the same Roots came
- from the same tree of life it's all related and if we were able to make mirror life we would be able to literally build or grow a second tree of life it would be one of the biggest scientific discoveries you can ever think of it's creating another life form why would somebody want to do that because we we wanted to do that for the same reasons why we don't want to do it right now so we thought that it would be a great medicine

we thought that because immune system wouldn't freak out about it we would be able to make

- cell-based Therapeutics that would not create adverse immune response and we also could use it for biom manufacturing we could use it to make molecules with Biology in bioreactors that are not susceptible to external contaminations because we thought that it would be orthogonal to viruses to predators and these are exactly the reasons why now we understand we shouldn't be making it because it wouldn't only be silent to immune system when we want it it would always be silent to immune system so it could be a pathogen that we couldn't
- fight and it could also be if if released into the environment it could just grow Predators wouldn't care about it viruses wouldn't care about it so it would grow uncontrollably because it doesn't exist in the natural world yes and the natural world doesn't know about it because everything in the natural world relies on this concept of molecules pointing the right way everything you sense um with your molecular sensors with your receptors on your cells has to be of the right confirmation has to point the right way
- to be detected and if it's pointing the wrong way it just won't be detected so the worst case scenario about this I mean it does sound like some sort of Doomsday scenario is that it could end all life on Earth is that correct it would take over all life on Earth it would grow uncontrollably it would grow persistently and we would have no way of eating it fighting it um in the environment so the consequences for the environment could be catastrophic and that's why we think this should not happen this should not
- be made how unusual is it for scientists to stop themselves to hammer the breaks on Research In This Way unfortunately it's very unusual um as far as we know we're the first group of scientists that are were actively working on this huge project that now are saying we should not be doing it um I think there should be happening more people who do research should also be looking at Safety and Security considerations more often and we're hoping this is a start of something bigger than just this project that people who do research will start
- considering more the consequences and you know perhaps will be hearing more about different projects that are being stopped internally from the ground up by people that are actually doing it how difficult was

it for you to get to this place I mean scientists will often push for more research you yourself in that letter that you wrote calling for the halt in this said that life is fascinatingly mysterious and that in part is why you got into this work so how difficult was it for you capture captivated by that mysterious nature of

- of the work to suddenly say you know what this is actually too dangerous and we can't do this it was easy Once I understood the consequences but I'm still sad about it || I still think I would love to do it because it's just so inherently fascinating it would be the biggest scientific discovery I can ever think of but I also have a self-preservation Instinct I don't want to do it because I understand that this could potentially be catastrophic what sort of reaction have you had from others in the scientific Community for calling for |
- mean it's not just a pause or slowing down this research you just said the research shouldn't go forward at all yes we believe it shouldn't go forward at all because there is no way to do it safely um we the the responses we were getting are mostly positive people agree with the premise of it that yes this should not happen um some people point out that we're too far away from actually being able to make mirror life to even make a big deal out of it and there is this concept called information security is you don't want to talk about
- threats because then someone else can bypass your safeguards and go and actually do it because you know because they're stupid because they're evil um we stupid or evil or that or that they see that it could be a huge Discovery um it could be a huge Discovery but there's no way to do it safely and that's why you know I still believe this should would be a huge Discovery but there is no way to do it safely and I think that should be the priority we we we're obviously driven by curiosity driven by applications we want
- to do the cool things but we also want to do it safely that's the main driving force of science is to make people's lives better not worse do you worry about the evil person doing this if somebody goes Rogue this is you said this would be one of the the greatest scientific discoveries of all time do you worry that somebody would just go Rogue and do it anyway that's the advantage of us talking about it so early right now the technology is not quite there yet for one person to go and make a mirror cell this was a very
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Dynamic area of research a lot of people were working on it and we still don't have all the technologies that we need to make a mirror cell and that's why we chose to speak up right now because we're hoping that if we stop work right now we will never get close enough that one Rog actor or even State Rog actor could actually reach it it needs this huge Community effort and if most of the community agrees not to do it then a single person who decides to do it for whatever reason is not going to be able to because the technology just is not

- there you cannot do it alone so just finally what happens now with this idea I mean the idea exists in people's mind but does it just go in some sort of box and you bury it in the ground and it's never heard from again I hope we will hear about it because I hope we will have robust discussions about two things one is how do we actually make it not happen so we we're already having some of those discussions how does international law apply to it um how do we AG make everyone agree to not do it never touch it again and also we're having
- discussions about what we can do because mirror life is a very narrow example it's just one example of what we can do with those kind of molecules and there are many different things that we can do that are still safe we can still get some of those benefits of the drugs and biom manufacturing platforms just without that living mirror cell and we're having a lot of discussions about it right now on how do we actually do it what do we do that is safe so I hope we'll be hearing about it because it's a cool topic just not a living mirror cell
- this is so interesting the process of it but also just kind of wrapping your mind around stopping something rather than proceeding with something Kate thank you very much thank you Kate adamala is a synthetic biologist and genetics professor at the University of Minnesota my next guest is an ethicist who has weighed in on many biomedical advances over the past few decades Henry T gley is a Stanford law and ethics Professor chair of the steering committee the center for biomedical ethics and the author of the book
- crisper people the science and ethics of editing humans he's in Stanford California good morning to you good morning what do you make of this this call by scientists not to pause not to slow down research but to to to completely stop and Outlaw the research that could lead to the creation of mirror life so I think the call is an excellent thing I'm very much in support of it I would note it is fairly narrow as Kate said near the end of

her interview it's to not make a living cell using this approach they do call for

- continued research with mere molecules and they do leave open the possibility that there may be evidence that this isn't as as unsafe safe as it currently appears to be but I think this is a a really responsible thing I will note though that it is not the first time that scientists have done this I was going to ask I mean part of this the Intrigue around this is sure the mirror cells but it's also the fact that scientists themselves are saying this is too dangerous for all of us we need to to to nip this in the bud when has this
- happened before this coming February will be the 50th anniversary of the asilar meeting on recombinant DNA this was a meeting called by scientists who were working on the very first ways to move DNA from one organism to another they were able to do that successfully and then they got worried what happens if we move something into a a bacterium into an ecoli and it turns out to be dangerous and it gets out and it hurts people so they called for a moratorium and they held a big meeting at a conference center in montere California
- called a camar where they said you know we shouldn't do this unless or until we discover we're confident that it can be done safely that led ultimately the moratorium held it led ultimately to some regulations both in the United States and around the world and the tool has been used for the last 45 50 years but there was that pause while people stopped to say is this going to be safe or not that's I think the most famous example there's a there's another more recent example that's a little less um little less successful Jennifer DNA the
- UC Berkeley scientist who invent who was one one of the people who led to the discovery of crisper a method for editing DNA uh back in early 19 uh early 2015 called a small meeting to talk about the possible consequences of using it to edit human genomes edit human DNA that meeting led to an article on science which led to an initiative by the American nationaly of Science and the Royal Society of Britain which led to a bunch of different International organizations opining on whether and how this should be done there was a
- consensus that it shouldn't be done that really arose from DNA herself starting point uh to say I'm worried about what this what could this could be used for the bad news is a rogue scientist did go ahead and do it a

Chinese scientist named H Jan qu announced in November of 2018 that two babies had been born whose embryos he had edited now I think he expected to be a hero instead he was viewed as a villain the Chinese government sentenced him to 3 years in prison many countries have outlawed this and no one has done it

- since then but there is the possibility of Rogues going ahead probably not in this case for the reasons Kate pointed out this is too hard too complicated too many moving Parts too much money involved so this one I'm less worried about but there are areas where even a consensus of scientists can't necessarily stop a stop research from happening how do you go about regulating that I mean are there whether it's um self-regulation or International organizations to oversee this to say this is what we have decided
- is in the best interest of all of us yeah and that's really hard um at the national level you can do it or the regional level like the European Union internationally international law is very slow treaties are very hard to get and it's very hard to get clear treaties that are well enforced look at something like the nuclear non-proliferation treaty big deal that hasn't worked perfectly I think efforts by groups of scientists by scientific organizations like nationally the Canadian Academy and among others can help set guidelines
- that will create a culture that will say do this don't this don't do this funding agencies should be involved journals high impact journals should be involved even even in the face of remarkable Temptation again if you go back to to the crisper story he did think he was going to be seen as a hero I mean he was portrayed as a villain but he thought he was going to that he would be hailed as somebody who had had this remarkable breakthrough that that has to be incredibly tempting I I think he still believes that I think he sees
- himself as Galilea who will be Vindicated in the future he's wrong um but the Temptation will be strong but remember there not that many going to be that many cases where a single Rogue can do that and I think this particular area of mirror life is one where the single Rogue actor is not going to be able to to do very much so do do you see this as part of a story of of unintended consequences in some ways that we create something that we don't think of of the long tale of it so I think this is the good side of that story I think this is
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the story of we start to create something but then we do start thinking about the long tale and we decide you know we really shouldn't do this if you think back over the last hundred and some odd years probably the biggest change in our world has been made by the automobile it's changed everything about how we live it's changed our air it's changing our climate but nobody stopped 120 years ago and said huh this Model T what's this going to do to us uh today we are I think more sensitive to that are we perfectly sensitive to it no are

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we perfectly able to predict the future certainly not but we're paying more attention and I think that's a great thing this is a good news story in some ways then I think so yeah this is really really interesting I'm glad to have the chance to talk to you about it thank you very much thank you Henry T Gley is a Stanford law professor director of the Center for Law and Bioscience also chair of the steering committee of the center for Biomed Ethics he was in Stanford California [Music]