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Demystifying mRNA Medicine: Setting the Record Straight

Announcer:
You're listening to *Innovations in Medicine* on ReachMD, sponsored by Moderna. This is a non-certified educational series produced and controlled by ReachMD and is intended for healthcare professionals only. Here's your host, Dr. Charles Turck.

Dr. Turck:
Welcome to *Innovations in Medicine* on ReachMD. I'm Dr. Charles Turck, and joining me to share how we can overcome misconceptions regarding mRNA medicine is Dr. Peter Kowalski, an HRP Funded Emerging Investigator for Health and a Senior Lecturer in Advanced Therapies at the School of Pharmacy at the University of College Cork in Ireland. Dr. Kowalski, thanks for being here today.

Dr. Kowalski:
Thank you so much. Thanks for the invitation.

Dr. Turck:
To start us off, Dr. Kowalski, what are some of the most common misconceptions around mRNA technology?

Dr. Kowalski:
So I think one of the misconceptions will be that it's a very new and untested technology that kind of suddenly emerged, and was rushed into the clinic. However, not many people actually realize that the first application of mRNA into the cells with lipid nanoparticles was actually in 1978. And the first use of this technology for vaccination was in 1993. So mRNA technology has been refined for over 20 years to ensure that it was actually ready for clinical translation when it was really crucial to be applied for COVID vaccines, for example.

And beyond COVID mRNA has already been validated or tested in clinical trials also for other types of indication like heart failure, cancers, and genetic diseases, which also not many people or even clinicians are not really aware of.

So the second misconception I think that you can hear quite often from the public side is that mRNA can change our DNA. And this is actually not true. So mRNA is a natural molecule that is present in our cells. It works by delivering the instructions, which are copied from the DNA, so our genetic materials in our cells inform the cells to produce and build proteins. So messenger RNA actually never enters the nucleus and it doesn't interact with the DNA, so there's no chance for this molecule to actually change our DNA on its own. So this is one of the common misconceptions that I could think of.

Probably the third one, maybe not that much common, but often something that is close to my heart as a scientist, and something that is quite often overlooked that when we talk about mRNA as a drug, we often think about the nucleic acids only that can enter our cells on its own and perform its function. But mRNA, it's actually quite large and hydrophilic molecules, so it likes water a lot. It's negatively charged, so it doesn't really enter the cells on its own, it's not really able to do that. It's also quite fragile, and it needs protection.

So really, to form mRNA drugs, we need another technology that was co-developed together with mRNA. And those are lipid nanoparticles that help mitigate all of those challenges that I talked about. And they are actually really an unsung hero of the mRNA success story, which a lot of people forget about.

Dr. Turck:
And why are some of the myths and misconceptions that you mentioned so prevalent?

Dr. Kowalski:

I think there's a couple of reasons for that. I think the main reason is that there was no prior drugs based on mRNA technology on the market. So obviously adopting a new technology in this particular case, limited amount of clinical data in a short timeframe, has obviously caused a lot of hesitation and skepticism from clinicians as well as from patients.

Similarly, contributing to this, a big factor that didn't help was that mRNA kind of emerged during a global pandemic. So COVID was an unknown disease and mRNA was actually going very quickly through the clinical route in those particular circumstances, which again added to the skepticism both among clinicians and patient about the potential use of mRNA as a therapeutic.

And we're living in a time where the information can spread very quickly through all sorts of channels like social media, internet, but also, the same happened with misinformation. So I think there was also a lot of misinformation about vaccines and about mRNA. But a lot of those kind of misconceptions and misinformation about vaccines kind of were also targeted towards mRNA, because that was obviously the only technology at that moment that was being developed or used for vaccination against COVID-19. I think those are three biggest reasons I think why these misconceptions have been, and still are quite prevalent.

Dr. Turck:
For those just tuning in, you're listening to *Innovations in Medicine* on ReachMD. I'm Dr. Charles Turck, and today I'm speaking with Dr. Peter Kowalski about misconceptions around mRNA medicine.

Now if we switch gears here a bit, Dr. Kowalski, what barriers exist that might be keeping both clinicians and patients from understanding mRNA medicine?

Dr. Kowalski:
So I think the high complexity of the advanced therapy medical products such as mRNA-based drugs, it's one of the factors that creates those barriers. As I mentioned before mRNA vaccines or drugs are composed not only on the RNA, but also on the drug delivery system. So kind of understanding the complexity of the whole mRNA technology and how it's used for treating diseases, it's kind of creating a little bit higher - or requires more background both from clinicians, and it's often harder to explain to the public as well, compared to some other conventional type of therapies.

Something that may add also to these complexities, that mRNA is a platform technology. That means it might be applied in many therapeutic contexts. And each of those therapeutic contexts could have its own challenges to kind of explain in that sense. So a wide array of potential applications is something also that doesn't help really understand this technology very well. And creates a bigger knowledge gap as well. If we speak about knowledge gap, we mostly learn often at school about the mRNA in very basic context is a carrier of the information and instructions to build proteins. And will not often touch on this therapeutic aspect of RNA. So it might be, I can imagine for some, hard to wrap around their heads around how the molecule that it's in all our cells suddenly becomes a molecule that can save lives.

Dr. Turck:
And with that in mind, what are some strategies we can use to help close those knowledge gaps?

Dr. Kowalski:
I think important way to - or important strategy to close those gaps is all sorts of public outreach initiatives. Like yourselves, I think that's a great example.

These initiatives, or every initiative that can help better inform clinicians and public about this new emerging technology and help demystify them correct this misinformation that is out there. Internet is actually a very important strategy to help close these knowledge gaps. Education is always important in those instances.

I think that in terms of educations, a lot has been done during the time of COVID pandemic. So there is, I think, already a better understanding among clinicians, as well as patients about the basics of mRNA technology. But this, like I said before, this technology has much more to offer. So there's still a lot of education that has to happen if we really want to adopt new types of therapies based on mRNA.

And I think a great strategy to start especially for clinicians is to try to better engage clinical scientists with investigators in academia or pharmaceutical industry at early stage of the development of messenger RNA therapies, which I think will not only close the knowledge gap, but also will really significantly benefit the development of new therapies based on mRNA drugs.

Dr. Turck:
Now looking to the future, how will closing these gaps in knowledge impact the application of mRNA medicine?

Dr. Kowalski:

So, I think that closing this gap, it's a stepping stone to improving the translation of these emerging and mRNA therapeutics, especially utilizing mRNA for strategies like gene editing, cell therapies, prophylactic vaccines and many other types of applications. So, closing this gap I think will be essential in better adoption of new emerging mRNA technologies in the clinic. And as I said before, it will definitely help develop those technologies for the future.

Dr. Turck:
Well, with those forward-looking thoughts in mind, I want to thank my guest, Dr. Peter Kowalski, for joining us to discuss how we can overcome misconceptions and barriers surrounding mRNA medicine. Dr. Kowalski, it was great speaking with you today.

Dr. Kowalski:
Likewise, thank you so much for the invitation. It was my pleasure.

Announcer:
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