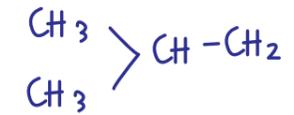
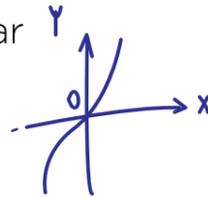


Benjamin Shapiro is President and co-founder of the biotech company, Otomagnetics, and Joint Professor in the Fischell Department of Bioengineering and the Institute for Systems Research at the University of Maryland. We're funding his research work on a new way to deliver medicines to the ear

Scientifically speaking...



I got phone calls from colleagues who were clinicians, saying, "We can't get medicine through to the inner ear, can you help us?"

The inner ear is protected by a 'blood labyrinth' barrier, in that it's separated from the bloodstream by cellular barriers. If you take medicines orally, very little of the drug gets into the cochlea. Or, if you place a drug in the middle ear, some diffuses into the cochlea, but not much - and the distribution isn't very uniform.

Unlike prior magnetic delivery systems, we can magnetically inject. Magnetic injection allows us to deliver therapy easily and effectively, compared to the methods clinicians are using now. Our patented device functions like a syringe, but the needle is replaced by magnetic forces; we quickly get pretty uniform distribution into the cochlea. We found that even existing steroids - such as prednisolone, that have been on the shelves for 30-plus years - if they're delivered effectively, you can see a big benefit. You can have the best drug in the world but, if it's not where it needs to be, that's not sufficient.

We're going after a lot of key hearing loss conditions - and tinnitus. We've done work on treating noise-induced hearing loss (in animal models); on delivering therapy to suppress tinnitus... and protecting hearing from chemotherapy regimens, which are known to damage hearing. We can deliver a concentrated precise dose of a drug to the cochlear to protect the hearing without interrupting the action of the chemotherapy anywhere else. We're delivering the therapy only where it needs to go. The next key stage is to bring this to patients.

In terms of time management, my wife and I have a colour-coded joint calendar so we can see each other! More seriously, my roles as professor and biotech entrepreneur are complementary - Otomagnetics grew out of our work at the University of Maryland. The university has really fostered innovation and start-up companies. Our goal is to have therapies that improve patients' lives - I think that's the definition of a bioengineering department. The university has licensed the technology



I care about this. Over the last five years, I've put my heart and soul into translating technologies from my lab to patients

that was invented exclusively to Otomagnetics. A university's not going to bring technology all the way to patients - that's something a company has to do.

I care about this. Over the last five years, I've put my heart and soul into translating technologies from my lab to patients.

I started out as an aerospace engineer!

As a kid, I thought that designing aeroplanes was cool. That lasted all the way to one quarter through my undergraduate degree, then I got into research. My interests shifted towards system control - being able to manipulate things to put them in the right place.

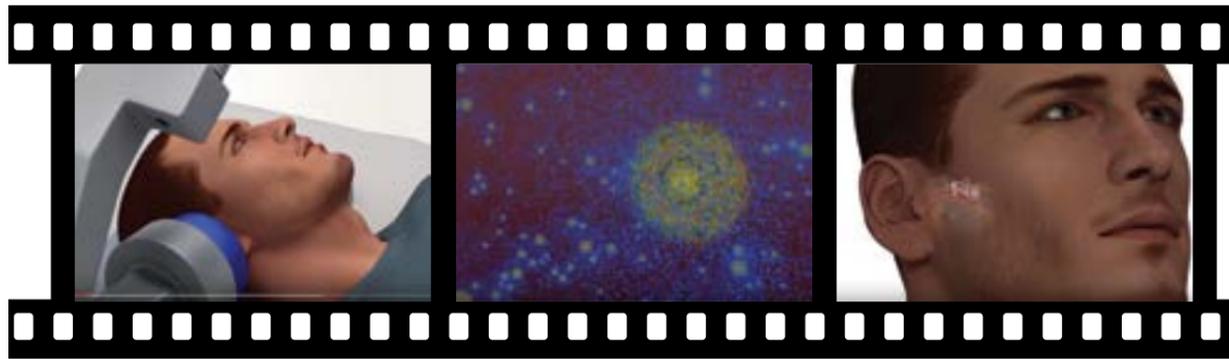
I moved from applications that were only engineering, like aerospace, to applications that included biology.

I found it fascinating - this combination of biology and engineering. Developing technologies for patients, and developing technologies that could make people's lives better. That's an exciting thing. How can you not wake up in the morning and be happy about doing something like that? I want to see my stuff in hospitals and clinics; I don't just want journal articles that I can point to.

You really have to work closely with clinicians and talk to their patients.

Clinicians who work with children, people who work in different therapies for different ear conditions - and friends and family, too. I have friends who say, "I have tinnitus, when will this be available?" It's a real quality of life issue. My colleague's wife went deaf in one ear. She said, "I did all the things I was supposed to do, and I still went deaf in one ear?" You have to





Above: Some stills from the short Otomagnetics magnetic injection technology animated film. See it on YouTube: <http://youtu.be/1go9HYjMIFk>



know not only why patients need it, but also what your options for care are. When does this present? What's your therapeutic 'window' for being able to treat this? Why doesn't the current treatment work? How can we fix it?

Unless you work these things out, you might not know how to treat actual patients... it'll only be theoretical.

Funding from Action on Hearing Loss helped us jump-start the company.

Together with support from the State of Maryland, we were able to do a lot of the initial laboratory work showing magnetic delivery works.

We are starting a formal collaboration with one major pharmaceutical company and are in discussions with others. Pharma companies and sophisticated investors look at an investment by Action on Hearing Loss and see it as a vote of confidence by an organisation that's expert in hearing. We can point to you and say, "Look, *the* hearing loss charity in the UK has provided help - it believes in this." That's impact, in the UK and outside the UK.

The 'ear space' is heating up. Some of these large pharmaceutical companies are realising that there's a patient need and a pretty large patient population - most people will get age-related hearing loss, and there's tinnitus, noise-related



hearing loss, hearing loss due to chemo... they are starting to recognise the emerging market.

By ten years from now, we're aiming to be delivering therapy to patients to better treat hearing-related conditions. We hope to be helping cure them or partially restoring their hearing, suppressing their tinnitus, and protecting their hearing from chemotherapy regimens. My ultimate goal is to improve lives. There are steps to take and challenges to meet, but it's clear we can better deliver therapy to the cochlea. We'll get there.

Ben would like to acknowledge the other members of the team;

Didier Depireux, Otomagnetics cofounder and Institute for Systems Research, University of Maryland

Ting Pau Oei, Executive Chairman, Otomagnetics

Mika Shimoji, Senior Life Scientist, Otomagnetics

Mohammed Shukoor, Product Development, Otomagnetics

David Beylin, Business Development, Otomagnetics cofounder

Jerome Lewis, Nanoparticle Development Advisor, Otomagnetics

Find out more about hearing research at actiononhearingloss.co.uk/research

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