***Invent with Bob Langer***

**Max:** Did you see yourself as being an entrepreneur when you came out of graduate school?

**Bob:** Yeah, no, the entrepreneur part…I mean I wasn't ever thinking that way.

In fact, I was so naive I thought if we wrote papers, all these companies would use them and make products, and these were really multibillion-dollar companies and I thought “this is great”. But they didn't work very hard on the product.

So, I could see the little company you know would maybe do more than the big company because they would live or die because of it.

*\*Glimpse Jingle\**

**Monologue:** In the first episode of this series, entitled “Better Questions”, we delved into some of the factors that contributed to Bob Langer’s success as a biomedical engineer.

What we didn’t highlight, however, is his capacity for invention: the ability to convert a worthy line of scientific inquiry into a transformational technology that you and I can benefit from.

Bob’s inventive streak is exemplified by the many start-ups created based on intellectual property developed in his lab.

Tackling big problems with small companies has been a theme from his very first company founded in 1987…

**Bob:** Well the first company that I got involved in helping start was a company called Enzytech later merged to become Alkermes. Our original idea was to create microspheres that would be useful in the drug industry for drug delivery systems—that might last a long time and treat different diseases—and also in the food industry, like we developed some of the first fat substitutes and things like that.

**Monologue:** And, the Langer lab continues this theme into the present…

**Bob:** We're starting this company Vivotex to uh, it’s sort of like an intestine on a chip— a very rapid way of identifying what drugs will get good gastrointestinal absorption. So, very quickly you can identify how to make a drug get into the body and how to make it work very effectively.

**Monologue:** Asking better questions, that points a researcher in the right direction, but in the end, to deliver an answer, you must invent. And, the Langer lab has been a significant source of invention for decades. To date, the Langer lab has founded over 40 companies with a total valuation of over 20 billion dollars.

That sort of productivity and creativity - it’s sourced from somewhere. But from where?

**Monologue:** In the last episode, we identified that Bob’s early success was due in large part to a unique perspective.

As one of the few chemical engineers with first-hand exposure to the challenges facing patients in a hospital, Bob was enabled to pioneer approaches to drug delivery based on first-principles.

…but there’s more

**Monologue:** In this episode, we’ll explore contributing factors to the Langer lab’s inventive success.

 Let’s start with a familiar if not apocryphal vision of invention: the spontaneous idea brought on by a seemingly unrelated experience. Think Newton and the apple tree.

*\*Sound of object fall and impact\**

 And, actually, in Bob’s case something like this has happened…

**Bob:** one example—you know we do a lot on drug delivery systems—and one day I was watching this TV show on how they had made microchips for the computer industry.

You know they're making millions at a time and they can do all these things, and I thought gee that would be an interesting way to make a drug delivery system. So, I talked to Michael Cima who's a professor here—a friend of mine—and we started doing that, and that can you know offer opportunities for drug delivery patterns that you could never do before.

**Monologue:** But, let’s think of every day experiences that are a bit more… practical. People are always inventing brilliant things at MIT. To what extent is the Langer lab’s success a product of MIT’s unique environment?

**Bob:** Well I don't have the control experiment so I don't know.

But, M.I.T. I think is the greatest engineering institute and it's usually rated that way, and I think that that's true. And it has just great students and postdocs and other faculty.

The other thing of course for me that's been wonderful about M.I.T. if you do biomedical engineering is you're very near Harvard and the Harvard hospitals and that's probably the best medical school in the world.

A lot of what I’ll call fellows from Harvard have worked in our lab for a number of years, and so they’re M.D.s with backgrounds in ophthalmology, gastroenterology, neurosurgery, dermatology, almost everything.

So then, you're working with super engineers, super scientists, and super clinicians, all thinking out of the box and trying to work together to come up with discoveries or ideas or inventions that could have a big impact.

So MIT means to me not only MIT but the greater Boston area, which I think is a wonderful place to do work.

**Monologue:** So, he has an interdisciplinary lab. That’s a lot to coordinate. Bob must be a super manager with tons of tricks to share, right?

**Bob:** I think people would say we probably run a very loose operation. it's not terribly structured.

We have a couple people who are senior who helped me on different things and they help supervise people too.

But it's kind of a loose organization aimed at solving big problems. It's very interactive, interdisciplinary. And I think everybody learns from each other, myself included. So you know we have people with about 10 different disciplines. You know we have a number of medical doctors who are doing research. We have biologists, we have chemical engineers, material scientists, physicists, electrical engineers, mechanical engineers, almost everything.

**Monologue:** So, the Langer lab is not really a top-down organization. But, it’s huge at around 100 members. Maybe scale plays a role?

**Bob:** I mean and I certainly wasn't ever my idea that I want to have a big lab or a small lab I really didn't think about it. I just thought about you know what problems we wanted to solve.

And I think one of the things that's happened particularly in the last say 10 to 15 years is that fortunately for us you know a number of the things that we've done have led to either directly or indirectly new products that end up helping people —most of the time in medicine.

And because of that we would have places like the Gates Foundation and Bill Gates himself, The Juvenile Diabetes foundation and other foundations, companies call up and say gee we'd like to give you funding to do work in this general area or that general area. And I felt that those were really good things to do that we could help the world through research on if we did it.

**Monologue:** One big factor could be the shotgun effects of attacking the right problems - by solving one big problem you actually solve many big problems.

**Bob:**  I wouldn’t say that’s an active approach, but I do think it happens for a couple of reasons. One, is if you are trying to solve something or go into an area that hasn't been gone into much before you do need to invent new tools and things like that that can help you. And so, it very well may happen that you'll come up with things that you need to solve the first problem, but you may end up coming up with something important on the way to get there that could be very important in its own right.

 I also think that the fact that our lab as I mentioned is very interdisciplinary, has just so many different types of people in it. I mean it leads to things that you know maybe new applications for certain technologies or just new ideas in general about what we might do, that that that that interdisciplinary has been very significant.

**Monologue:** Let’s take a look at the people: post-docs, graduate students, they all have relatively short tenures - maybe the fast turnover of the Langer lab—which brings fresh insights and ambitions— leads to rapid innovation?

**Bob:**  I really don't know. You know one of the great things about M.I.T. you have these incredibly bright students and postdocs come here. And I think that having them that that's been to me the key thing.

Inherently, I think that is going to mean high turnover. I mean every place, every one of the top academic institutions that I think of does have high turnover…

…and in a way, that's a good thing for the people because you don't… you know like even for me like I was a postdoc but I probably wouldn't have been good if I was a postdoc my whole life.

And I think that's true for everybody. So that, you know, people advance.. can take the kinds of things that they maybe learned here with me and you know expand them. You know it's a huge multiplier effect when that happens.

**Monologue:** Okay, jot that down. The people matter, but we already knew that.

Let’s go deeper — how does he select new team members?

Does he simply select those most knowledgeable in an area targeted for new research?

**Bob:** I would say I do that a little but probably not a lot. In fact, when we recruit people or hire people usually the criteria I use is that they'd be great. I mean that may sound simplistic but I would rather have somebody who's great than somebody who is just good at discipline X or somebody who's great rather than good at discipline Y.

**Monologue:** You want great people - like what, high output? Lots of publications, things like that?

Bob: I think it's people who are very bright, who are very driven, who asked big questions themselves, who want to make a difference in the world, who are doing what they're doing not because they have to but because they want to, who are curious, all those kinds of things.

**Monologue:** So, it seems as if there’s no one major factor. Having a big, interdisciplinary lab focused on medical technology in the heart of Boston doesn’t hurt. Getting the pick of the litter when it comes to recruiting scientists and engineers — that doesn’t hurt either.

But, somehow that’s not a satisfying answer, because funding, great schooling, high intellect — all of these components are more than plentiful in a place like Boston.

Yet, Bob stands out.

My gut says it’s the internal motivations and personality traits that set him apart.

I’ll let him explain:

**Bob:** Yeah, well I think it goes back to something you asked before. I mean I think you know I would dream big. I'd follow your heart. I would never do something for the money. I would do it because you feel a passion and I’d dream big and recognize that you’ll probably run into a lot of obstacles if you do that.

But I wouldn't let those obstacles win. I'd keep pushing.

**Monologue:** Thank you to Bob Langer for taking the time to talk with us.

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Thanks!