Edward Williams and Laura Carrara-Cagni in conversation with Josh Meyer,
Managing Principal, Jacobs Laboratory Planning Group, USA

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This is the first in a series of conversations with experts for sectors we have been, and are still, involved in to bring together their and our expertise, summarising best practices and exploring future opportunities.

Following our interest and experience in healthcare and life science, we begin this series with Josh Mayer.

As managing principal of The Jacobs Laboratory Planning Group, Josh Meyer has exclusively programmed and designed laboratory and test facilities for over 38 years. Josh is a recognized leader in the programming and design of research and instructional laboratories and has an unparalleled understanding of the industry. He is a licensed architect in the State of New York. His expertise includes facilities analysis, facilities macro- and micro- development and vivarium design. Josh frequently lectures on the planning of laboratories and animal facilities and his accomplishments in laboratory design and master planning include more than 300 projects at the top research facilities and vivarium laboratories throughout the country.

Josh and Edward met in 2005 and worked together on the Frick Chemistry Laboratory, Department of Chemistry, Princeton University, USA, when Edward was a Director at Hopkins Architects: the project was completed in 2010.

Laura sits as a member of the Urban Land Institute Life Science and Healthcare product council both in the US and in Europe.

Laura and Edward met Josh Meyer late last year and asked him a few questions about best practices and the future of Life Science laboratories, all set out below:

EW/LCC How do you establish a new Life Science campus and what is your experience?

JM We have been involved in numerous life science campuses all over the world ranging including MIT, Harvard, Astra Zeneca Pharmaceuticals, Columbia University, Cornell University, Dana-Farber Cancer Institute, GlaxoSmithKline, Harvard Medical School, The Johns Hopkins School of Medicine, MD Anderson Cancer Center, Princeton University, Stanford University, Vanderbilt University, Vertex Pharmaceuticals, and Yale University, just to name a few. One question recurs which is what the minimum critical mass for a new life science campus is. This is an interesting question, for instance, Hong Kong University is 11M sqft. This is large, but for a new campus, you need at least 250,000 sqft gross. The number of storeys doesn't matter, except you want as many as possible to maximise land value, so the limit is set exclusively by codes. Memorial Sloane Kettering (MSK) campus in NYC is 21 storeys. We routinely build 8-10 storey lab blocks.

EW/LCC We understand that for life science developments location is critical, what are the priorities in this respect, in your opinion?

JM Connectivity is important. If campuses are not directly co-located, then this must be addressed. For example, San Francisco has regular shuttles, with live timetables visible from your desk.

The other priority is proximity to hospitals and medical schools. For example, Astra Zeneca took the decision to move all their disparate locations to concentrate them in one large campus in Cambridge, Massachusetts.

Then you need the infrastructure to attract the right personnel: a good and affordable school system, affordable housing, reasonable cost of living and preferably an attractive climate.

EW/LCC What is the future of the laboratory?

JM Laboratory Types: Considering the two lab types, experimental and computational, the future is going more and more towards a hybrid model of the two. You really want them close together, on the same floor plate, with 1/3 experimental, 1/3 computational and 1/3 hybrid.
Covid has changed how people are working and the challenge is how to get computational staff to come to the labs and how you get experimental and computational staff to interact. A possible solution for example is what they did at the John Hopkins Institute which has always been divided into two (or more) campuses; they have very large "always on" screens in strategic locations between each to communicate directly and to foster serendipitous interactions.

Technology: There is a strong drive to increase the use of technology platforms in core labs, for example, advanced imaging. It is now more and more critical how many CRYO EM's (cryo-electron microscopy) are to be provided, this is one of the most important tools in life science. The number of protein structures being determined using this method is growing at an explosive rate. (see https://www.nature.com/articles/d41586-020-00341-9) There should be a minimum of one per life science campus, the largest number we have seen so far is between 4 to 6. These machines do come with very extensive and tough-to-achieve vibration and shielding criteria.

For this reason, the most valuable spaces in any Life Science Campus are on the lower levels, ideally ground floors and possibly basements. This puts an interesting twist on space allocation as it means one wants to locate as many services plant out of these areas as possible. This lower location for these sorts of machines also offers the opportunity to allow visitors to come in and see researchers using these machines if the building is designed properly, something we managed at Princeton. People want to see the action and science on display.

EW/LCC What is a sustainable laboratory?

JM In the US all new Life Science construction is going to minimum LEED gold or even platinum standards. Most buildings run exclusively on electricity, with mostly photovoltaics for on-site power generation, but you do need a lot of it. Bunsen burners are rarely used nowadays, mostly replaced by equivalent electric versions, also because there is a wider variety of minerals used needing more adaptable equipment. Fume cupboards tend to be dealt with using filtered fume hoods if you know the materials to be used in the experiments, otherwise ultra-efficient fume hoods with automatic sash closers, like we used for the Frick Chemistry Building at Princeton University, USA.

EW/LCC Is there a minimum size for laboratories, a minimum width, height, and floor plate?

JM 25,000sft gross area is the minimum size to give a good critical mass on one floor, to have 10-12 researchers interact. It is worth noting that Stanford University used to limit departments or groups of researchers to this size as they felt it was the ideal unit size for good interaction.

The rule of thumb for ideal dimensions for a laboratory floorplate is 100x250ft, minimum 80ft (approximately 30x80m, minimum 25m).

In terms of height, it depends if the structure is concrete or steel. If you assume exposed services, of which the Frick is a good example, the optimal height would be approximately 9.5-10ft (2.9-3m) clear, 15ft (4.5m) floor-to-floor considering a 2-2.5ft (0.6-0.75m) structural zone.

EW/LCC Are there differences in the establishment of a laboratory cluster between geographical areas, USA, Europe and Asia?

JM The most critical aspect is access to staff recruiting, this depends mostly on:
• Climate
• Cost
• The quality of education in the country/location.

EW/LCC If you had to point to two or three examples of forward-looking laboratory projects what would they be?

JM I have four very good examples we have been working on in recent years:

• Harvard University Science and Engineering Complex

• Frick Chemistry Laboratory – Department of Chemistry, Princeton University designed by Hopkins Architects. That is how Edward and I met. Here, the NMR at basement level is visible to visitors and the central atrium connects labs and workspaces and welcomes visitors into the heart of the laboratory.

• Astra Zeneca in Cambridge, UK– this has a central courtyard that connects fabulously the labs and lets in natural light.

• Altman Research Institute, University of California in San Diego

Conclusion

As our global experience with Covid has attested, life science research is an important subject, as the sector worldwide—which covers biotechnology, pharmaceuticals, biomedical technologies, life systems technologies, nutraceuticals, environmental and biomedical devices—is the fastest growing real estate sector and critical to the maintenance and advancement of a good life for humanity.

We thank Josh Meyer for his time and invaluable input into this series, and we do hope you learnt as much as we did.

We would love to hear your thoughts in general or on any specific element, since access to such an expert in this field is a real treat.

The Frick Chemistry Laboratory Building, Princeton University,USA