

The beach pole house: A model to structure your research efforts and needs

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Abstract

As a group leader, it is a challenge to have a clear overview of your research and support projects, lab organization and how they harmonize in solving your research focus. The pole house model can assist in classifying all your efforts, revealing their relationships and identifying your needs.

The pole house at the beach has 3 layers and is anchored in the ground. The top rooms of the house represent the research projects addressing your research focus. In medicine, these typically include basic/functional, prevention, marker and therapy research. The second layer, the pole foundation, is the support layer and encompasses your work on technologies & protocols, models & biobanks, datasets and bioinformatics & statistics. The third layer, the infrastructure, plumbing and the connections to the ground, represents lab organization, management, outreach, education and more. The estate where your house is located represents your institute, while the beach symbolizes the beautiful view and environment that once in a while challenges you with pounding waves. Although research laboratories are typically single entities, they usually do share technologies, models and datasets with neighboring labs and therefore the pole foundation often supports multiple beach houses. The institute's estate is a large community of houses and the infrastructure of this metropolis and support for maintaining the different beach houses largely determines livability of the community.

Categorize the projects within your own lab

In a good size research group, various efforts are ongoing that will cover different aspects of your research activities. To summarize, classify, gain insight in these projects and identify whether they are in balance, it is easiest to separate them based on their main aspiration (Figure 1):

- (i) address a real life problem,
- (ii) supports that research, or
- (iii) provide the infrastructure.

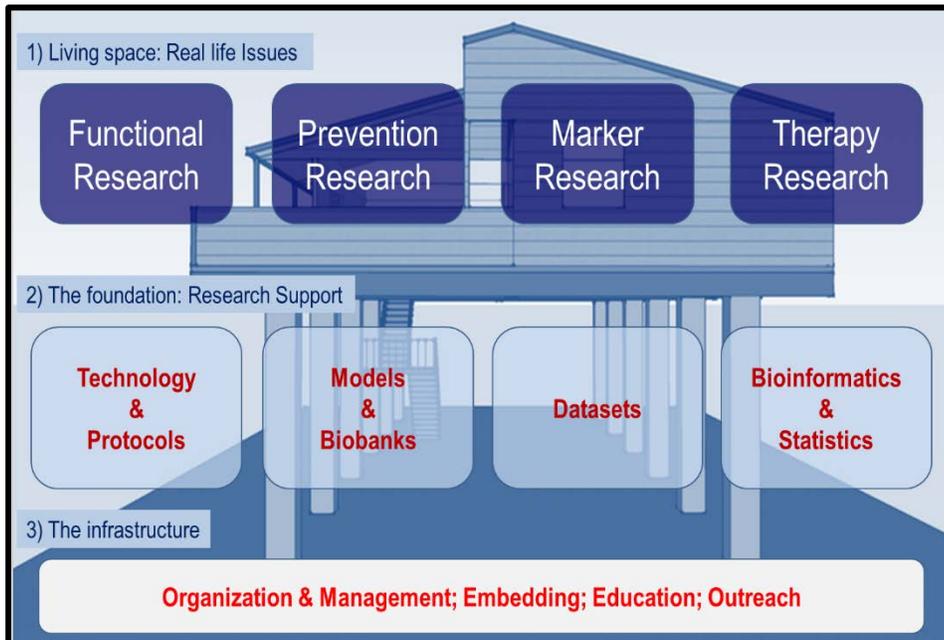


Figure 1: The beach house model. To structure and visualize the activities of a research group, three layers are defined: 1) the top rooms (living space) representing research on real life issues, 2) the pole foundation representing research on support projects and 3) the infrastructure of house mainly signifying organization, management and embedding of the group.

(i) Real life issues

Since my own work is in the field of prostate cancer, I will take the example of medicine. In this discipline, you cover most of the 'real life problem' research, when grouped in the following categories:

- A) Basic and functional research that aims at understanding the components and processes responsible for health and disease. This type of research is typically not aimed at directly helping patients but generates our basic knowledge of how nature works.
- B) Prevention research is focused on ways to remaining healthy. Avoiding illness is obviously the ultimate ambition, certainly for life threatening, chronic and disabling diseases.
- C) Marker research aims at determining risk, finding disease and predict therapy success. Different markers can be distinguished: risk, diagnostic, prognostic, predictive and monitoring markers. Particularly in cancer research, finding, validating and implementing the right cancer markers is a major portion of all research activities.
- D) Therapy research is of course focused on all aspects of disease treatments and well-being.

With these four categories, one covers most of the field of life sciences. Any other field of research, think of physics, earth sciences, economy, chemistry, mathematics, social sciences and many more, the top rooms of our beach house can specifically be redefined.

Although the beach house model aims at creating the bigger picture of your research group, the four categories of the living space can specifically assist in defining your research questions and aims of a certain medical research topic. Grouping your questions in 'functional', 'marker' or 'therapy'-related goals, will clarify the definition of independent aims for your grants to be written.

(ii) Research support

In order to perform research on real life issues, we always need a level of support that by itself is a research layer. In our model, it is represented by the pole foundation, an essential part of the house. With respect to my research on cancer, I defined 4 pillars:

- A) Technology & Protocols. For our functional, marker or therapy research, we need to have access to most appropriate and optimal technologies, protocols and procedures. Research in this field is typically focused on development and improvement of technologies and is one of the major driving forces of progress in medicine, but also other fields of research. This pillar is absolutely essential and needs to be up-to-date. You might not perform any research in this area, but you must have access to robust protocols and the latest technologies to be able to perform competitive research.
- B) Models & Biobanks. To perform basic, translational and applied research, you need to have the right model systems and cohorts of samples. For cancer research we often use cell lines and mouse models for gene manipulations and drug testing. For validation of novel markers, access to patient samples (tissue or body fluids) is pivotal. In medicine, research in this area is often focused on the development of new *in vitro* and genetically modified model systems.
- C) Databases: All the data you generated in previous experiments should be stored and available for linking to new experiments and data from other resources. These days, omics technologies generate high content and high throughput data that provides a wealth of information. In combination with imaging and clinical patient databases, a powerful resource can be created. Accessibility to published datasets has become key in research progress.
- D) Bioinformatics & Statistics. Having access to the right databases is great, but data processing and data mining have evolved by themselves to an important field of research.

What if your research is on a technology, database development, bioinformatics or models? Sometimes, research groups are fully focused on technology research and provide the tools for research of other groups on real life issues. Nothing wrong with that, in fact, these groups drive scientific progress. Think of all the technology development behind genomics and proteomics, the

human genome project database, CRISPR/Cas9 knockout technologies and many more. The research support layer is represented by the most important part of any house, the foundation.

(iii) The infrastructure

The beach house infrastructure is often considered as the least important and least productive part of the building. As a group leader trained in science, you want to spend your time on the support layer and the real life issues. Unfortunately, the 'management' part of your research group typically is the most time-consuming. Tough luck, creating and maintaining the infrastructure includes an extremely broad set of tasks that someone has to oversee and perform. As a group leader you regularly have to look at your beach house and ask the following questions:

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| - Are all living spaces (top rooms) in order? | Lab and topic organization |
| - Are all pole foundations present and strong enough? | Research support, collaborations |
| - Is the house sturdy anchored in the ground? | Embedding in institute |
| - What is my estate/neighborhood like? | Level of your institute and collaborators, support from the institute (human resources, financial dept., Technology & Transfer Office, etc.) |
| - Can people find me and are others interested in my home? | Publications, outreach, education |
| - Are all residents happy and performing optimally? | Human capital, work environment, lab meetings, secretary/lab support, data governance, Electronic Lab Notebooks, social activities, etc. |
| - Where is maintenance needed? | Grant writing, collaborations |
| - And much more | The other 40 hours a week you wondered where they went |

Epilogue

I have used the beach house model in the past year to categorize my projects and grants and to determine the weaknesses and strengths within my group. In presentations I noticed that the model can be expanded in many directions. I have been in discussions on the sewer system, pounding waves and quicksand and some presented much nicer houses than in figure 1. As another example, I tried to convey the point that the new developments in the support layer drive cancer research (figure 2). These fun discussions (thanks to all involved) were useful and showed the many ways in which

specific issues can be represented. The model also has its limitations and I struggle to visualize timelines and the importance of disease stages in my research. Also the many different aspects of the infrastructure (such as lab- and project-management) are not yet well defined and categorized. For now, I leave these issues up to your creativity.

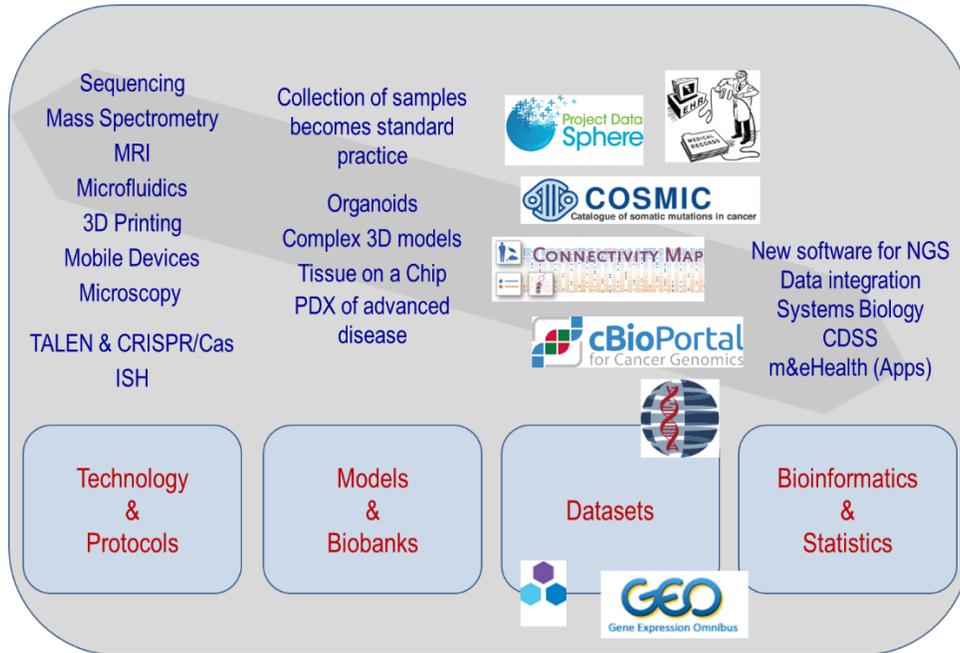


Figure 2: Previous and future key developments within the support layer that will change functional, marker and therapy research in the field of cancer.