



Establishing good laboratory practices in a basic science research group

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A good laboratory practice is an essential for academic integrity especially in natural sciences. We attempt to bring fundamental aspects of good scientific practices from both the laboratory, data analysis, reporting and writing in a research group and at a undergraduate level. Errors owing poor practices in basic sciences of protein three-dimensional structures [1] which are invaluable in drug-development or in biomedical sciences can be of immense patient damage [2,3].

Many universities lack formal courses on good scientific practices in their curricula. This in turn has tremendous burden on the research groups that later have to retrain the students on good laboratory practices that are essential for maintaining fundamental integrity to conduct proper science. We are on track (from summer semester 2020) to conduct a course work entitled 'Good Scientific Practices' at the undergraduate level at Goethe University Frankfurt at the Department of Organic Chemistry and Chemical Biology. This course work will have clear guidance on conducting experiments and general scientific work based on the recommendations issued primarily by the German Research Foundation [4,5].

The complete course is in the form of a obligatory lecture series with one hour seminars for 15 weeks in the fourth-semester (of a Bachelor study) followed by an written examination at the end of the semester. In every lecture, a theme is chosen, for example, 'data collection procedures', and an optimal way is practiced in detail (for 45 minutes). Later we plan to have a discussion with *junior research group leaders* from the campus with their experiences on the topic in their field. This would give the students first-hand knowledge on the academic way of doing work and serve as an example. It is also strictly necessary in experimental sciences to follow the regulations as dictated by state and federal laws, especially for safety, environmental and ethical reasons biologically relevant experiments. The course work will make aware of the individual and team responsibilities in scientific work.

In parallel, we have built a 'online' examination in the form of a questionnaire to be used by Bachelor, Master, PhD students or postdoctoral fellows at our laboratory. The participation of this online quiz takes about an hour or two. It is built into several modules and begins introduction to research integrity as a core module. Though it is primarily aimed at life-sciences, the modular setup allows for each research group to adapt it their needs. At the our research group every new member needs to complete this 'online' questionnaire that builds rules, awareness, and reporting which will go a long way in avoiding poor science work either by dishonesty or accident. We do note that there are 'commercial' providers that offer similar but very broad training. Unfortunately, they are prohibitively expensive and therefore not accessible to every research group. In addition our modular architecture (and open source) means, any research group can adapt this to serve their specific needs. A few groups in our campus want to base their questionnaire on our templates as a part of 'induction of new member'. We believe that introducing such a training at an early stage in the career would have immense benefits from proper experimentation, data collection,

documentation leading to improved reproducibility, originality, avoid poor ethical behaviour like that of overinterpretation, authorship, plagiarism and data manipulation. The system will also include an anonymous reporting system modelled on CIRS (Critical Incident and Error Reporting System) [6]. There are many universities and research institutes devoid of specific courses on 'good laboratory practices'. In such cases, this complete questionnaire could be treated as a 'GLP in a box' - (Good Laboratory Practices in a box) and could be offered in a 'plug-n-play' model everywhere.

Keywords: good laboratory practices.

References

- [1] Matthews, B. W. (2007). *Protein Science*. 16, 1013–1016
- [2] <https://dirnagl.com/2019/02/17/man-errs-as-long-as-he-strives/>
- [3] Yarborough, M., Bredenoord, A., D'Abramo, F., Joyce, N. C., Kimmelman, J., Ogbogu, U., Sena, E., Strech, D. & Dirnagl, U. (2018). *PLOS Biology*. 16, e2006343.
- [4] *Sicherung guter wissenschaftlicher Praxis*. Deutsche Forschungsgemeinschaft (DFG) (Ed.). Wiley-VCH (2013)
- [5] https://www.dfg.de/en/research_funding/principles_dfg_funding/good_scientific_practice/index.html
- [6] Dirnagl, U., Przesdzing, I., Kurreck, C. & Major, S. (2016). *PLOS Biology*. 14, e2000705