

Swann

MEMORANDUM REGARDING THE BUILDING OF A LABORATORY

1. I think it is very important to make ample provision for the "means of doing things", for technical operations, in fact. One should have a good shop and a separate workshop, a glassblowing room, and a room for general utility operations usually carried out by the glassblower, such as sputtering, baking out metals, filling Geiger counters, etc.
2. The instrument maker in the workshop should be adaptable to the learning of all kinds of operations. If he cannot spin metal, he should learn how to spin metal, and so forth. In a laboratory, the instrument maker must be everything between a watch maker and a plumber.
3. One should have plenty of space in a machine shop because he will always need more than he thinks he will need, and the head machinist should have a little room to himself.

There should be a separate blacksmith's shop adjoining the main shop.

I believe the essential tools for a machine shop are:

- Large lathe (16")
- Small precision lathes
- General Utility lathe which can be adapted for metal spinning
- Large and small drill presses
- Milling machine
- Shaper
- Machine hacksaw

There should, of course, be high pressure air for blow-pipes.

The shop should have a north light.

As luxuries, but very desirable ones, I would add a surface grinder, a machine for making lock joints, and a set of rollers; and if possible, an additional set of small pressure rollers for rolling small strips are useful. There should be a powerful electric welder, and an electroplating ~~machine~~ out fit is very convenient for finishing instruments.

- 3A. The question of having members of the research staff working in the large shop always presents a problem. To forbid them so to work is inefficient. If they are allowed to work there to their heart's content, the chief instrument maker will eventually have apoplexy. The solution is this: If a researcher has a problem in which it is experient for him to work in the main shop, having gone over the work to be done in detail, that work becomes assigned to the head of the shop, and the researcher in the shop then works under his immediate direction in the capacity of an apprentice for the time being. In



other words, he does not make his own decisions as to what to do, what tools to use, and how to use them. He acts, as aforesaid, in the capacity of an apprentice. This always works, and the head of the shop is happy, because he never minds having another apprentice.

4. There should be a wood shop equipped with a circular saw and a band saw, a mechanical knife, and a joiner.
5. The question of liquid air presents a problem. I am of opinion that if liquid air can be bought, it should be bought, if the supply is accessible and of reasonable price and if the use of liquid air is continuous and large. If the problem is one where one requires a few liters now and again, I think it is well to install a machine which will provide 2 or 3 liters per hour. If one installs a machine which provides 6 liters an hour and does not have somebody to run it continually and look after it continually, it will usually be in the condition in which it is out of order because something is broken down.
6. I think that a Fellows' or Students' shop is very desirable, and it should contain an ordinary size lathe and drill press, a grinding wheel and the usual assortment of hand tools, etc. It is very desirable to make and enforce a rule by which nobody ever takes a tool out of the shop. Our own instructions are to the effect that if the building is burning down and a screw-driver from the Fellows' shop would save it, let it burn.

On the other hand, one must have tools which he can take about to various parts of the laboratory and which are not so commonly used as to warrant everybody having a set. For this reason, we have cabinets in the halls, fitted with such tools. There are a number of badges with the name of each person on them. If a man takes a tool, he simply removes one of his badges from one hook and hangs it on the one from which he has taken the tool.

For a graduate students' laboratory, I have always insisted that all the graduate students, including the women, learn something about the use of tools and glassblowing. I used to give six demonstrations in glassblowing myself. It is better to do this than to have it done by the professional glassblower, because the professional glassblower works on principles which are absolutely essential for speedy work, but which take a long time to acquire. The amateur method of glassblowing can be equally effective and can be learned very readily, but if a man adopted it as a profession he would starve. The course ended by the student constructing a fairly elaborate McLeod gauge.

I also used to have about six demonstrations given in machine shop work, the whole thing designed to illustrate the simpler operations, and the end point was the construction of a rather well made and sturdy electrometer key, in whose parts there were illustrated the various operations concerned, such as turning down a cylinder,



boring a hole, spinning a piece of metal, soldering, tapping a thread, etc.

7. Personally, I am in favor of square-shaped research rooms, except in the case of large long ones. I do not like narrow, rectangular affairs, with windows just at one end.
8. In putting up slate slabs around the walls, it is well to have them free from the walls at the two ends, so that one can get at the ends and operate from them.
9. Personally, I like wooden floors, although it is practically impossible to have them in the modern laboratory construction. Concrete is very tiring on the feet, and this counts in the long run.
10. I think one should not economize on the sizes of wires which feed the laboratory from the batteries and allied circuits. Moreover, I am in favor of having all wiring for experimental purposes in open and exposed view as far as laws will permit.
11. All of the workshop appliances and the like, including the storage battery room, motor generator room, etc., should be on the ground floor, and there should be easy access from the outside to a large elevator.
12. Solid piers are now somewhat out of date. However, one or two in suitable positions can have their advantages.
13. In olden days a constant temperature room for a concave grating was considered an essential. Its use is now problematical.
14. If you can secure air-conditioning, that is a tremendous advantage, not only for comfort, but for electrical experiments.
15. I am in favor of high ceilings and a plentiful supply of electrical outlets, including a pair of high potential outlets in each room.
16. An attic with plenty of storage space is desirable.