Ever since the time of van der Waals in 1870, the energies and facilities of this laboratory have been turned toward the study of gases and their liquefaction and solidification, because, in this way, much can be learned of the structure and properties of matter.

We may understand the general problem of such investigations by consideration of such a typical substance as water. If we lower the temperature of water to 0°C. it freezes or becomes ice. Again, if we raise the temperature of water in an open vessel to 100°C. the water passes into steam or vapour. Both ice and steam are water, chemically speaking, but their physical properties are very different from those of ordinary liquid water. We find similar phenomena with other substances. Lead is solid at ordinary temperatures, but if the temperature be raised to 327°C., the lead melts and becomes liquid; if we heat it to about 1500°, it boils and becomes vapour. Even iron may be melted and vapourized. The temperature of the sun is so high that its atmosphere contains iron in the form of vapour. On the other hand, if we take air, which, at ordinary temperature is a gas, and cool it sufficiently, it becomes a liquid and if cooled still more it becomes a solid, resembling ice. In general, then, the condition in which we find any substance depends on the temperature. If we raise the temperature sufficiently, all substances may be vapourized, and, we believe, if we lower it sufficiently, that all substances may be solidified. Only one substance, helium, has resisted all efforts to liquefy it. Here is one of the unities of Nature, a great law of corresponding states.

Obviously, two lines of attack are open to investigate these states of matter and the transitions from one to another. We may raise the temperature and liquefy solids and vapourize liquids, or, we may lower the temperature and liquefy gases and solidify liquids. There are several good reasons why the latter method has been chosen at Leiden. To begin with, manipulation of bodies at high temperature is attended by great experimental difficulties. Apparatus becomes very difficult to build and handle and the control of the temperature becomes very difficult. Again, there is a better chance of discovering fundamental truths at low temperatures than at high,