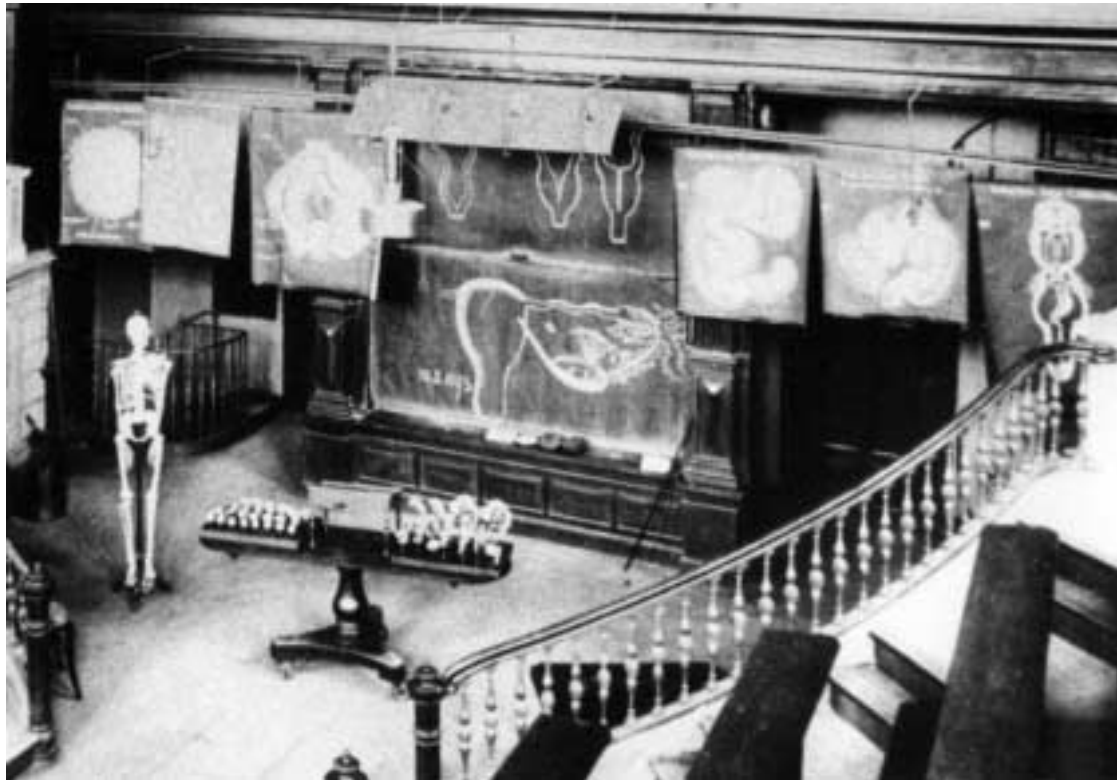


traditional skeleton – visual aids that in one form or another were used in every university: chalk drawings, charts, and on the table in front of the blackboard two trays of Ziegler models. (Glass photographs of microscopical objects could also be projected on to a wall.)

With so many other teaching aids available, why buy expensive models? Natural preparations had an aura of authenticity, but also three major drawbacks: some objects were very scarce; most embryos had to be viewed under a microscope or at least a magnifying glass, an obstacle to group instruction; and even expert preparation did not display the structures of interest as clearly as a purpose-built device. These disadvantages were alleviated to some extent by schematic drawings and charts, which made embryonic bodies available at a convenient size and in pre-interpreted forms – but with the deeply felt loss of the third dimension. Anatomists accepted Ziegler’s claim that for difficult objects it was far better to offer the student developmental stages “in corporeal and, we might even say, graspable form”.<sup>107</sup> Models worked against the tendency to try to imagine development in the plane of a page.<sup>108</sup>

How three-dimensional an engagement did Adolf Ziegler’s creations invite? We can think in terms of how much depth was used and of how wide a viewing angle was implied.<sup>109</sup> At one extreme are the models of the development of human external genitalia (**series 14**), deep reliefs finished only on one side. At the

**Fig. 16.** Visual aids for embryology, arranged for a lecture in the Freiburg gynaecological clinic on 18 February 1893. The Ziegler models on the table are, on the left, apparently Berthold Hatschek’s amphioxus (**plate 13; series 22**), and on the right, two series of human embryonic anatomies (**plates 17–18; series 1 and 3**). Photograph (detail) from Universitätsarchiv Freiburg.



other are the heart and skull models (**plates 3b and 15**), which show “complicated cubic relations” in the round.<sup>110</sup> Inbetween, many models were designed to be seen from one principal perspective (e. g. **plates 4, 10 and 11**).

It may seem obvious that using depth, avoiding the imposition of a single point of view, and even bringing hands into play as well as eyes, would set struggling student imaginations free. But how free were the students, and to do what? Only the nearest and keenest-eyed will have been able to appreciate the models as a lecturer held them up, but some waxes were handed round and students gathered afterwards for demonstrations.<sup>111</sup> Manchester students heard about amphioxus early in the course, then studied the Hatschek-Ziegler models,<sup>112</sup> apparently before turning to their own books and microscope slides (**fig. 17**). Even in the classrooms, encounters were probably more visual than tactile; glass covers were sometimes added to keep off fingers and dust. However unrestricted the interaction, though, some students – especially the many who were there, not for love of embryology, but to gain a professional qualification – will have experienced as a mixed blessing the freedom to learn more effectively the discipline’s standard forms.

The models’ three-dimensionality worked together with scale, texture and colour to convert delicate and shimmering but tiny and elusive forms into solid and opaque but huge and memorable shapes. Magnification brought together

**Fig. 17.** Learning to see microscopically. Class in a zoological laboratory at Owens College, Manchester, around 1900, with (remounted and labelled) Hatschek-Ziegler amphioxus models on the table (**plate 13; series 22**). Detail of photograph from John Rylands University Library, Manchester.

