factor limiting resolution, decreases dramatically at high voltages, it increases again with specimen thickness, and performance is as yet no better than 10 Å. For higher resolutions, electronic instabilities also become limiting.

Efforts by R. K. Hart and co-workers in the United States to design and produce a 1 Å resolution 700 kV microscope incorporating superconducting lenses and an ultra-high vacuum system were criticized by V. E. Cosslett as a waste of money at a stage when conventional problems are still being resolved. As well as in metallurgy the microscope is being applied to the structure of ceramics, cements and polymers and also to problems of magnetic domains, although work described at the conference showed that the scanning electron microscope may often be more suitable. There are prospects, too, for biological material where, for example, thick sections or whole organelles could be visualized in three dimensions by using the stereo-technique or more extensive tilting procedures.

Of considerable interest were recent developments in Germany by G. Möllenstadt *et al.* and F. Thon aimed at enhancing resolution in the normal 100 kV microscope. By the use of a zone plate, originally suggested by W. Hoppe in 1961, placed in the back focal plane of the objective lens, the resolution and the phase contrast effect in the image may be improved. Despite the complex problems of manufacturing and calculating the required characteristics for such plates, the resolution limit valid for a circular aperture has already been surpassed and future prospects are very encouraging.

SPORTING PHYSIOLOGY

Rugby Football as a Science

from a Correspondent

THE first conference ever to discuss the use of scientific methods in rugby football to assess fitness, limits of endurance, techniques and interaction with society was held at the University of Salford from September 13–15. The conference organizer, Mr D. Masterson, director of physical education at Salford, pointed out that scientific studies in sport have developed rapidly since 1960, but that Britain lags behind other European and North American countries in the application of scientific method. One exception to this was the general acceptance of coaching at all levels in rugby football in Wales.

Among the participants at the conference were doctors, surgeons, physiotherapists and physicists as well as players and coaches. Contributions covered a wide range of interests and included lectures on physiological, sociological, psychological and medical topics. There was also a session on modern coaching and training techniques.

At the conference, J. D. Brooke and H. Thomason, of the University of Salford, introduced the human biological concepts of linear and stress physical work states during exercise to exhaustion. They presented data referring to normal and strained physiological responses observed in several experiments. Other techniques of assessing the fitness of rugby players were described by E. Gwyn Evans of the University College of Wales, while A. Willey of Firbeck Hospital, Nottingham, demonstrated his modified controlled interval method of cardiovascular training.

The importance of personality characteristics was emphasized by Professor J. Loy of the University of California, who claimed that coaches experimenting with innovations in techniques and tactics are more successful at producing winning teams than those who keep to established methods. The personality assessment of players, as measured by Cattell's sixteen-factor inventory, was described by K. Hardman, who has used the technique on a number of national teams.

Aquaplaning at Wembley.

In another contribution, Dr P. Wooler and D. Masterson described certain aerodynamic aspects of kicking. They described this as theoretical effects of forces and showed film loops which have been used in analyses of the punt and screw kicks. The sociology of rugby football included a lecture by J. Huins on the problems the game is encountering in Wales, and E. Saunders of the Carnegie College of Physical Education spoke of the role of games in society with particular reference to rugby.

The conference closed with three papers on the medical aspects of rugby. Dr Evans Robson of Loughborough College of Education described the administrative difficulties involved in the provision of medical facilities for a large seven-a-side tournament which might involve 1,000 players over a number of days. Dr S. T. Lunt from Hull Kingston Rovers Rugby League Football Club spoke about typical injuries and their treatment and emphasized the danger of allowing injured players to carry on. He stressed, in particular, the possibility that concussed players may later be injured more seriously, and praised the substitution rule in Rugby League, which has reduced the practice of sending injured players back into the game.