The 'bill to axilla' display, here described for the first time, appears to be closely related to the ecstatic and is probably also associated with pair-formation. Its resemblance to one of the attitudes of threat suggests that this display has in it a greater element of repulsion for the same sex and less attraction for the opposite sex than has the ecstatic. A possible relation to nervous strain of the ecstatic and 'bill to axilla' displays in some situations is suggested.

Bowing is believed to be both a posture and a display, and it is suggested that the display is associated with early pair-formation, and is possibly a form of appeasement ceremony.

Both sexes share the duties of nest-building. The Adélie's habit of stealing stones suggests that it serves a useful purpose in distributing stones throughout a colony from the outside towards the centre, thus reducing the necessity for long treks.

The breeding season starts when birds return to the rookeries in September and October and occupy nest-sites. They may have to travel 200 miles or more from their winter quarters, the last stage being over many miles (up to sixty) of rough sea ice. The occupation period is the period from arrival until the last egg has been laid. Evidence is given from marked birds that, once established, Adélies are, on the whole, very faithful to their old nest-sites from year to year, and keep the same mates. Nest-sites are often covered by a foot or more of snow, yet Adélies appear to come back to the same spot.

The normal clutch is two eggs, the interval between the first and second being 2–4 days. If eggs are removed as soon as laid, a third one is sometimes produced. Adélies are single-brooded. The average incubation period (from the day of laying until the chick is completely out) is thirty-five days with a range of thirty-three to thirty-eight days.

The care of the young is divided into three stages: the guard stage when one of the parents is at the nest to care for and feed the chicks while the other is away collecting food; the crèche stage, when the chick is left alone at an age of about 4 weeks and groups with others to form crèches of 100 or more chicks, and, later, the dispersal of the crèches. Evidence is given from a study of marked adults and chicks that parents feed their own chicks in the crèche, feeding others only in exceptional circumstances. There are no adult 'guardians' of the crèches. These two facts are contrary to previous accounts of penguins the chicks of which group together in crèches.

The Adélie's habit of 'keeping company' (that is, the partnership of two birds of opposite sex at a nest-site which may, or may not, lead to the establishment of a mated pair) is believed to have survival value in facilitating the formation of new pair-bonds should the original mate of an experienced breeder fail to return, or return very late.

Most Adélies moult away from the rookeries among the pack ice. The yearlings moult first. Little is known about the winter movements of the Adélie, but the birds appear to stay in the pack ice and visit land in winter only when gales break up the fast ice and bring the pack close to land.

REINFORCED PLASTICS

A CONFERENCE on reinforced plastics, organized by the British Plastics Federation, was held in Brighton during October 22–24. Twenty-four papers were presented, and a morning was devoted to short talks by representatives of industries which use plastic components.

For structural purposes, high polymers in bulk form are inadequate in strength and stiffness. After surface imperfections have been removed by acid polishing, bulk glass has great strength, of the order of 250,000 lb./in.^{2}, but it is structurally unsuitable, because of the ease with which the surface is damaged and because of the low average stress at which cracks are propagated from regions of damaged surface. By subdividing the glass into fine fibres, and bonding these together with a polymer, a useful two-phase structural material is obtained which is readily shaped during manufacture and which has high resistance to the propagation of cracks. The glass fibres are used in the form of rovings, chopped strand mat or woven fabrics. The polymers are usually polyesters or epoxides which have suitable mechanical properties at temperatures up to 150° C. Silicones are used where parts are required to operate at temperatures above 150° C., and they retain useful strength properties up to 250° C.

Typical strength data for polyester glass sheet materials at room temperature are given in Table 1.

Table 1

Reinforcement	Bidirectional glass fabric	Unidirectional glass fabric	Glass mat
Percentage glass by weight	60–65	62–67	30–45
Tensile strength (lb./in.^{2} $\times 10^{-3}$)	40–50	78–86	10–24
Young's modulus (lb./in.^{2} $\times 10^{-6}$)	1·0–2·8	4·0–5·0	1·0–2·0

Polyester and epoxide resins are first prepared as linear polymers, containing double bonds; at this stage they are viscous liquids. During preparation, water of condensation is removed. The linear polymers are then cross-linked using a monomer such as styrene or dicyandiamide. Cross-linking is achieved with the aid of a catalyst and may occur at room temperature or at an elevated temperature. Little condensation product is produced and little pressure is necessary.

There is at present little knowledge of the nature of the interface between glass and polymers. Glass is normally covered with a film of moisture in which soluble constituents of the glass dissolve. This film may prevent adhesion to the polymer or inhibit polymerization locally. Various finishes, of which vinyltrichlorsilane is an example, are available for application to glass; by reacting with the moisture film, these are thought to become chemically bonded to the silica in the glass, and to present an unsaturated hydrocarbon surface for adhesion to the polymer. The treatment of glass fibres with such finishes yields a more durable plastic under wet conditions, but there is not yet sufficient experience to enable a reliable assessment to be made of longterm durability. At the conference it was reported that a set of unstressed polyester–glass test pieces showed no deterioration in strength after exposure to English weather for two and a half years, and static-water tanks of the same material have now been in use for the same period with little apparent deterioration.

When loaded to higher stresses, test pieces subjected to cycles of wetting and drying and to increase and decrease in temperature show deterioration in properties. Epoxides are generally superior to polyester under such conditions. Further research is necessary to produce a better understanding of the nature of the deterioration.

The behaviour of plastics reinforced with glass under cyclic loading is interesting. Glass alone withstands a cyclic loading for about the same time as it withstands a steady load equal to the maximum occurring during the cyclic loading. This delayed fracture under steady load is known to be caused by attack of the atmosphere. With plastics reinforced with glass, once the adhesion between glass and polymer has failed, atmospheric attack can take place, especially if the polymer has crazed; but deterioration under cyclic loading may also be associated with damage to the glass surface when it slides in the polymer matrix or rubs against another fibre and with local non-uniformity of the distribution of load among the fibres.

Plastics reinforced with glass fail under cyclic loading in a shorter time than would produce failure under static loading of the same intensity. They therefore display a definite fatigue effect as well as delayed fracture. The relatively high resistance to propagation of cracks is shown by cyclic loading tests on notched test-pieces. For a given notch and nominal stress cycle, the number of cycles to failure may be higher for the plastic than for aluminium alloy.

In plastics reinforced with fibre, each fibre contributes to strength and stiffness only in the direction of its length, and it has been calculated that a two-dimensional isotropic mat of fibres should have strength and stiffness equal to one-third of that of the longitudinal strength of an array of parallel fibres. In principle, glass flakes, if of equal breaking stress, should form a sheet material three times as strong and stiff as a material reinforced with fibre. Preliminary experiments with glass flake material reported at the conference showed considerable increase in stiffness, but the expected increase in strength was not achieved, probably because of damage at the edges of the flakes.

Originally developed for aircraft radomes, plastics reinforced with glass are finding increasing application in a wide variety of components. These include boats (including ship's lifeboats), car bodies, bus and railway wagon-tops, translucent building panels, ventilation ducting, tanks for the chemical industry, partitions for aircraft and ships, and jigs and press tools. Their development has been a co-operative effort of physicists, chemists and engineers. Their further development will depend on the invention of stiffer glass, of resins more stable chemically and on research into the mechanism of deterioration and fracture.

C. GURNEY

WHEAT GENETICS

DURING the ninth International Congress of Genetics, held at Bellagio in 1953, a small group of participants resolved to organize in the future special meetings at which the objects, results and techniques of current research in wheat cytogenetics could be discussed, and at which workers in the field could be brought into personal contact. As a result, the first International Wheat Genetics Symposium was held during August 10–15 at the University of Manitoba, Winnipeg, Canada. Some 150 participants from twenty-nine countries assembled to join in the formal sessions and in informal discussions, and to see something of the famous wheat-growing region of Manitoba.

The formal meetings were held under the general chairmanship of Dr. H. Kihara (Japan), who, in his opening remarks, recollected that it was exactly forty years since the correct chromosome numbers of the polyploid series in wheat were determined by Sakamura and by Sax. The intervening years had seen intensive research in the sub-tribe Triticinae, and this work had contributed to making the cytogenetic composition of common wheat, *Triticum vulgare*, better understood than that of any other polyploid species. Among the themes of the symposium were some of those which have been most prominent over the years in wheat cytogenetics, notably the investigation of the inheritance and the utilization of disease resistance, the study of the genetic make-up of wheat using aneuploids and the study of interspecific crosses.

In distilling the essence of many years of research into the application of backcrossing to plant breeding, and particularly to breeding for disease resistance, Dr. F. N. Briggs (United States) emphasized that these methods could only be applied when suitable recurrent parents were available and where improvement was required over only a limited sector of the total range of genetic variation. Combination of backcrossing with any other method, although sometimes necessary, meant departing from the security of a tested genotype.

Backcrossing is being used by Dr. N. E. Borlaug (Mexico) to produce multi-line varieties of wheat designed to combat stem rust, the biggest single disease hazard to world wheat production. Numbers of different rust resistant parents are backcrossed into a common, generally useful, but rust susceptible, recurrent-parent variety. When the recurrent variety has been reconstituted in each backcross line to such an extent that there is little difference between them, except the source of their disease resistance, seed of the lines can be mixed in various proportions to form multi-line varieties. Since the multi-line variety includes several genetically distinct types of disease resistance, it is likely that during a rust attack some of its component lines will be resistant to the prevalent races of the pathogen. The risk of catastrophic crop failures will therefore be minimized, both on account of the yield returned by the resistant lines and because the lower proportion of susceptibles will limit the build-up of the epidemic. The actual