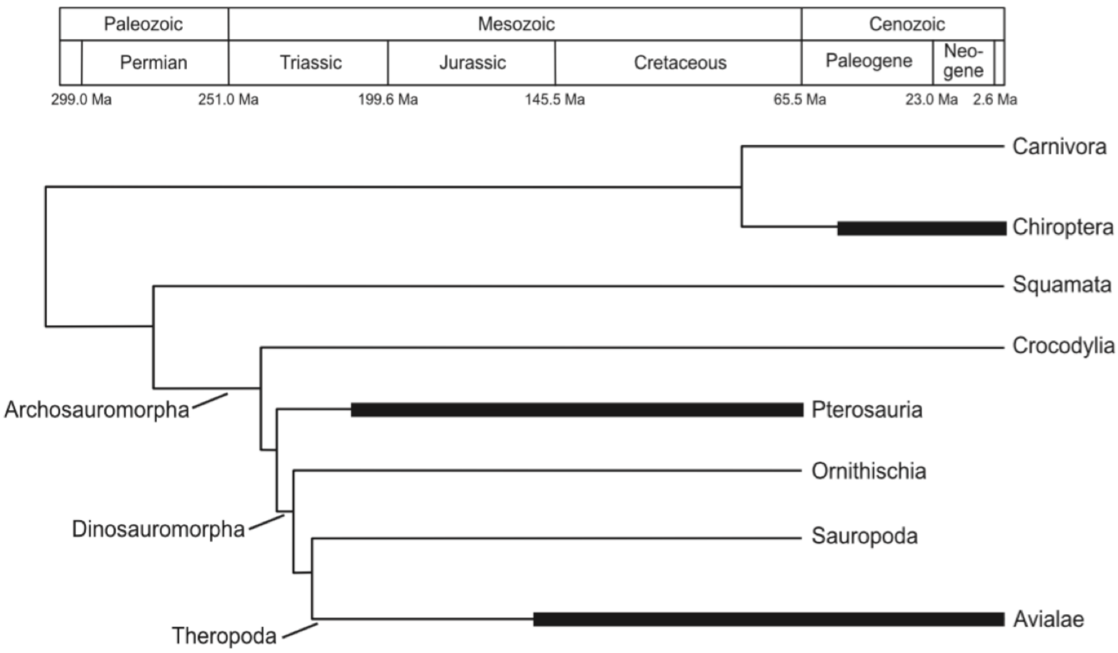
Figure 1.1

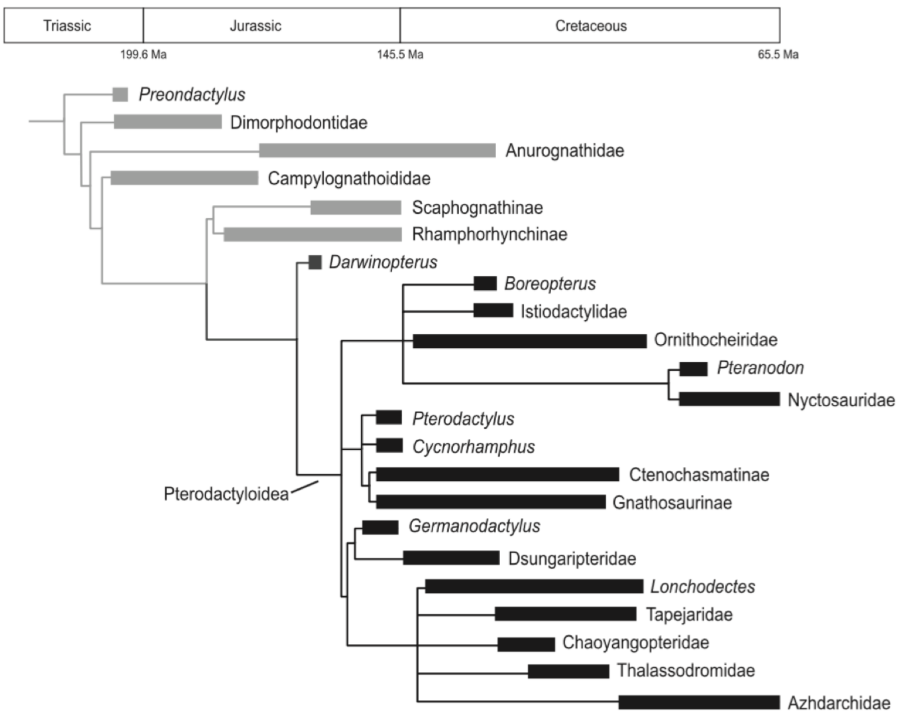
An Azhdarchid pterosaur flying high (from illustration by Mark Witton)

Figure 1.2



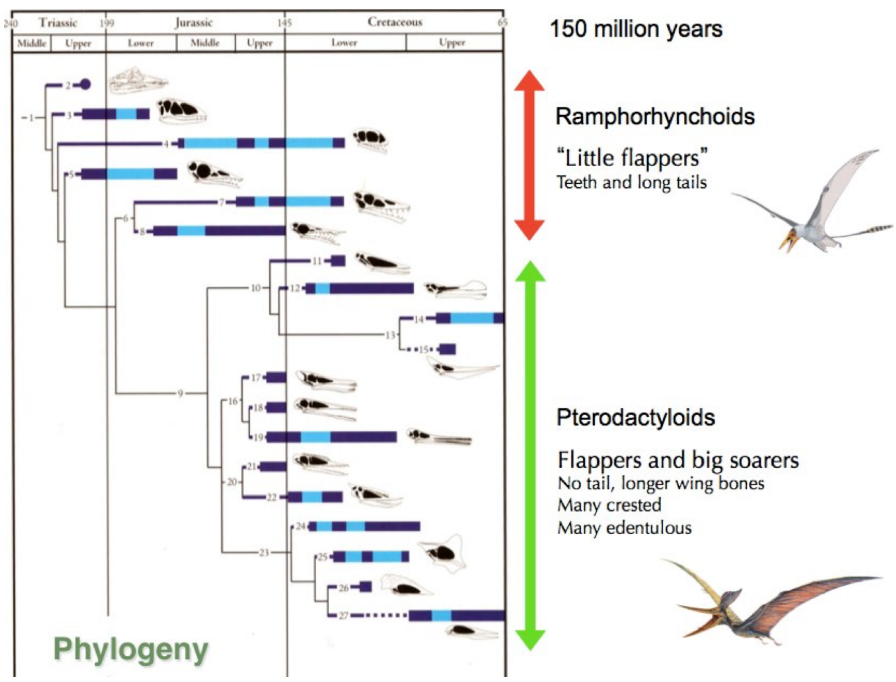
Hypothetical phylogenetic relationship between selected amniotes, illustrating the consensus position of the pterosauria. (After Middleton & English 2014).

Figure 1.3



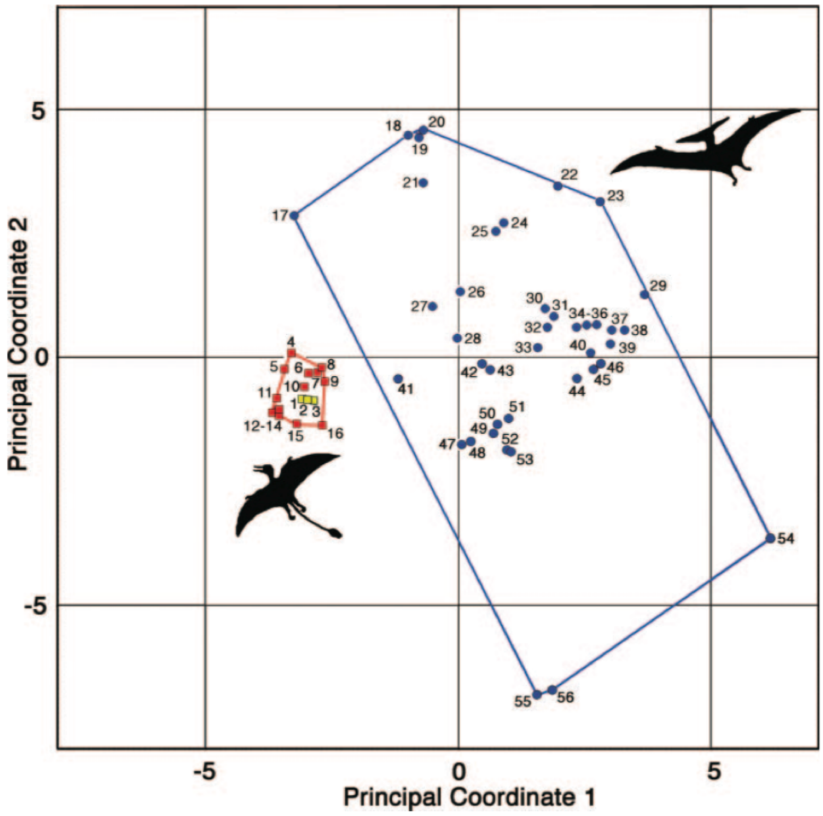
Simplified phylogenetic relationships of clades within the Pterosauria. (After Middleton & English 2014).

Figure 1.4



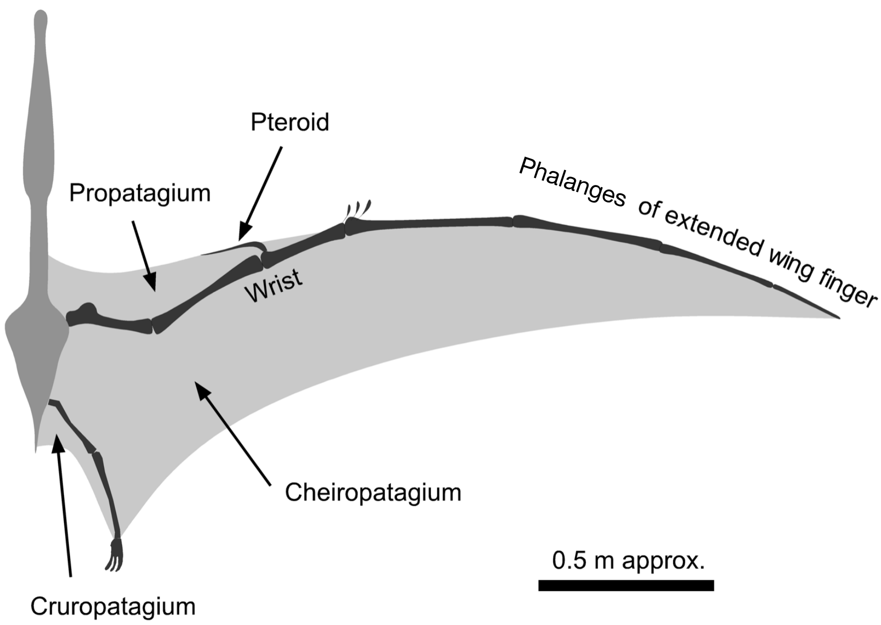
Another simplified phylogeny, adapted from Unwin (2005).

Figure 1.5



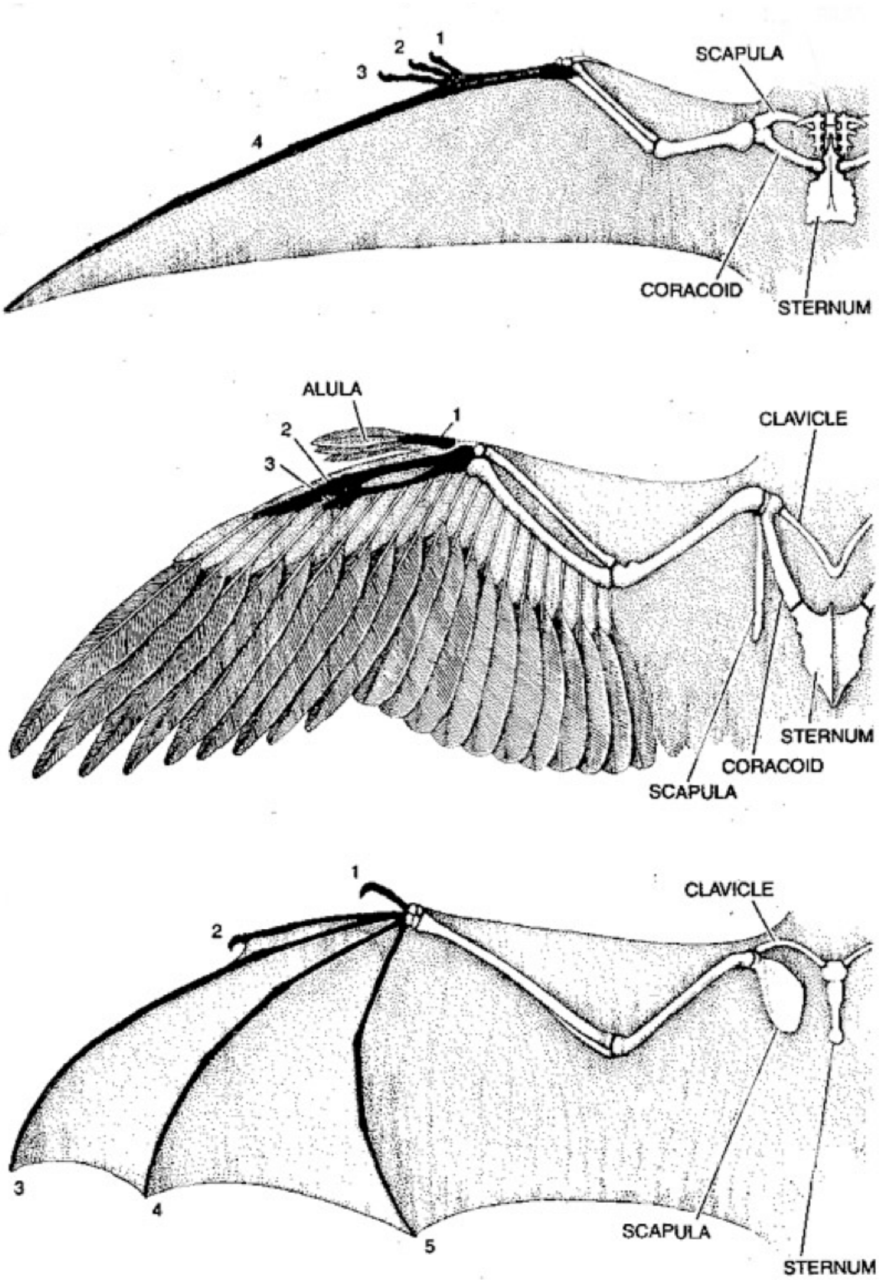
Indication of clear disparity between pterodactyloid and non-pterodactyloid pterosaurs. (From Prentice *et al.* 2011).

Figure 1.6



Schematic outline of the pterodactyloid pterosaur wing, showing the wing bones and regions of the wing membrane.

Figure 1.7



Pterosaur wing in comparison with wings of birds and bats. (From Wellnohfer 1991a).

Figure 1.8

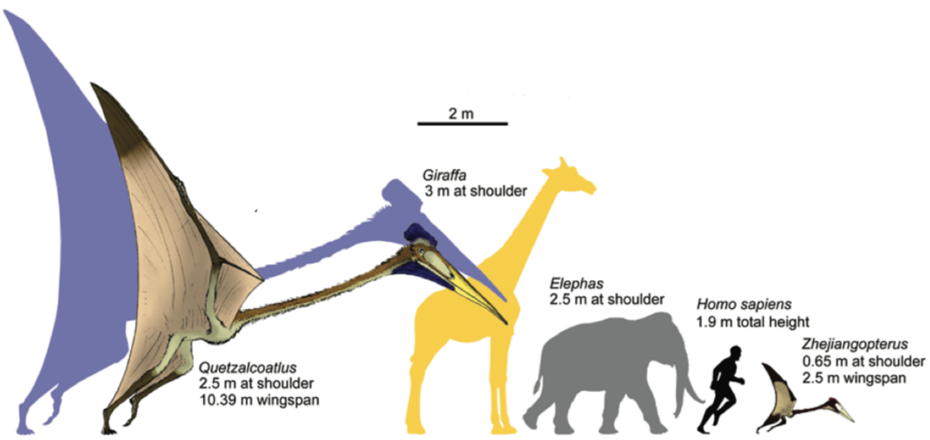
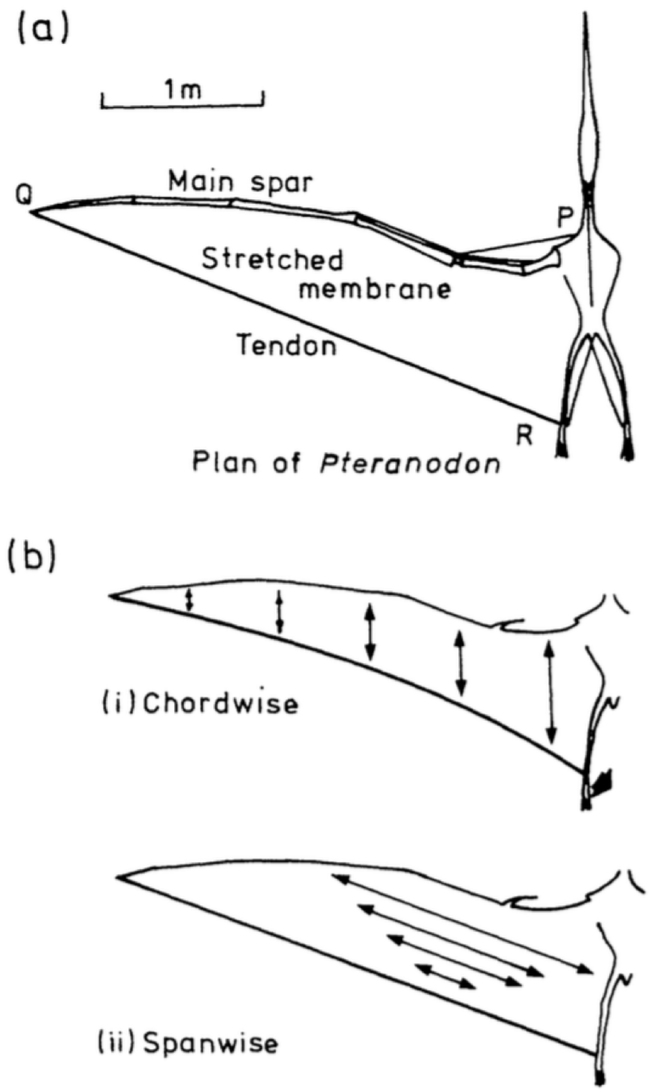


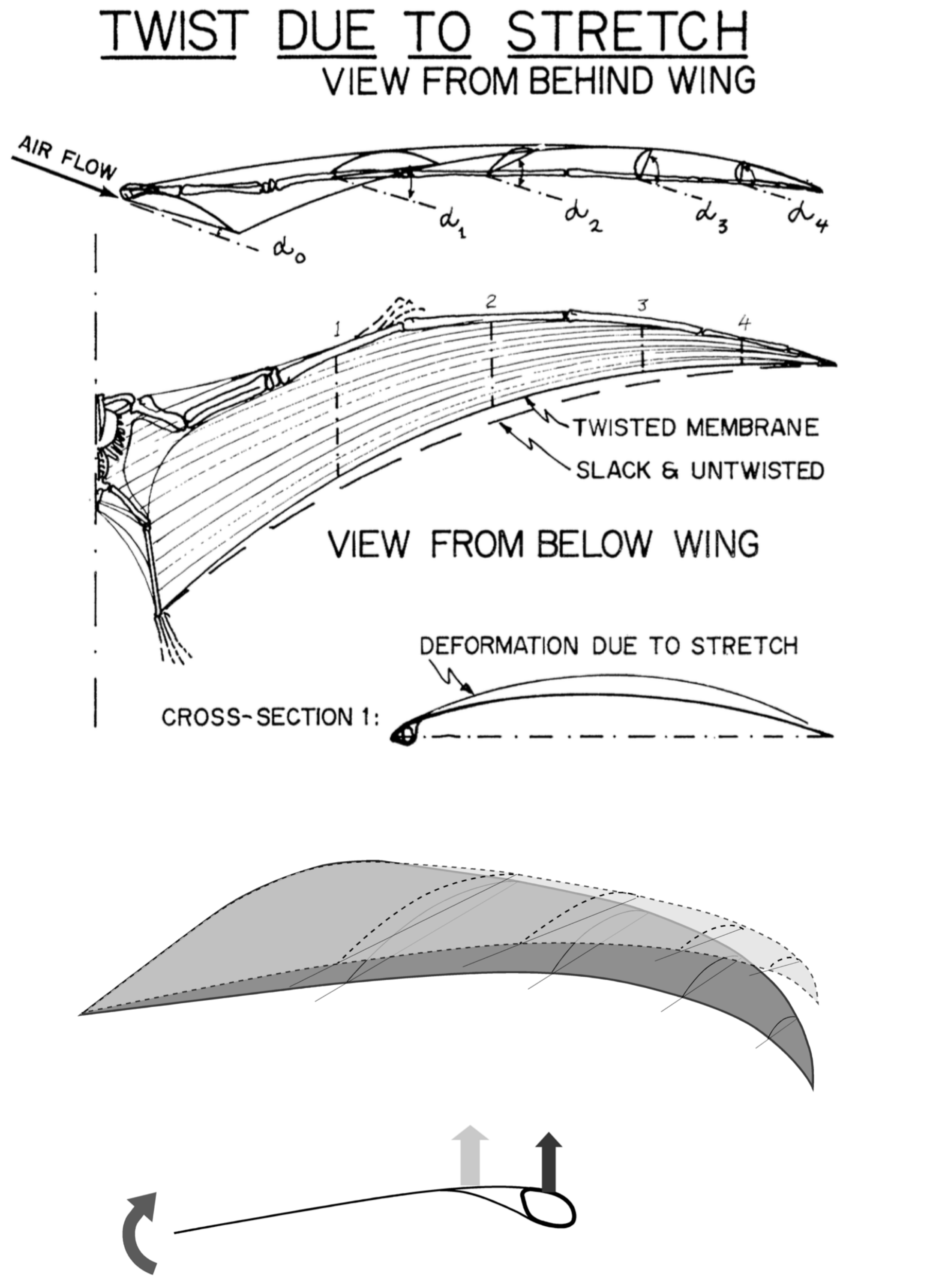
Illustration of the size of *Quetzalcoatlus* compared to extant mammals and one of the smallest azhdarchids, *Zhejianopterus* which has a 2.5m wingspan. (From Witton 2007).

Figure 1.9



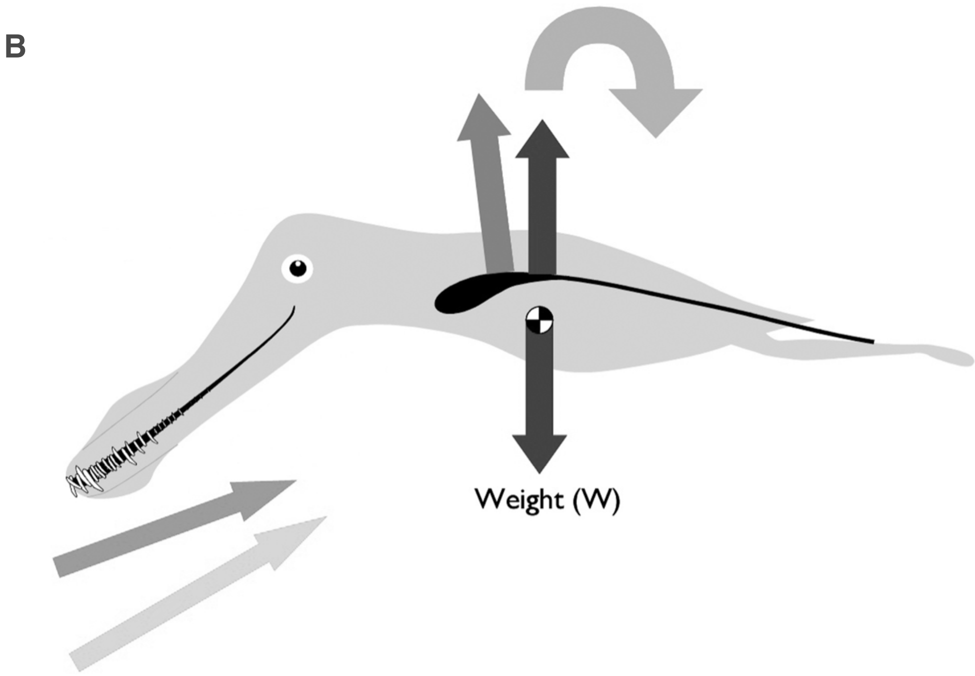
Wing shape and possible membrane tension directions. (redrawn by Sneyd *et al.* 1982 from Bramwell & Whitfield 1974). Note the anterior sweep (elevation in anatomical terminology) of the forelimb and the alternatives of spanwise (mediolateral) or chordwise (anteroposterior) membrane tension illustrated in (b).

Figure 1.10



Sketches showing the possible deflection of the wing under aerodynamic loading, inducing a spanwise twist which changes the local angle to the incident airflow. (Upper sketch from Stein 1975).

Figure 1.11



Change of relative positions of centre of pressure and centre of mass in a statically unstable airfoil. An angle of attack change (from A to B) due to a transient effect such as a gust of wind causes the centre of pressure to move forwards relative to the weight, thus creating a pitching moment that further destabilises the wing.

Figure 1.12

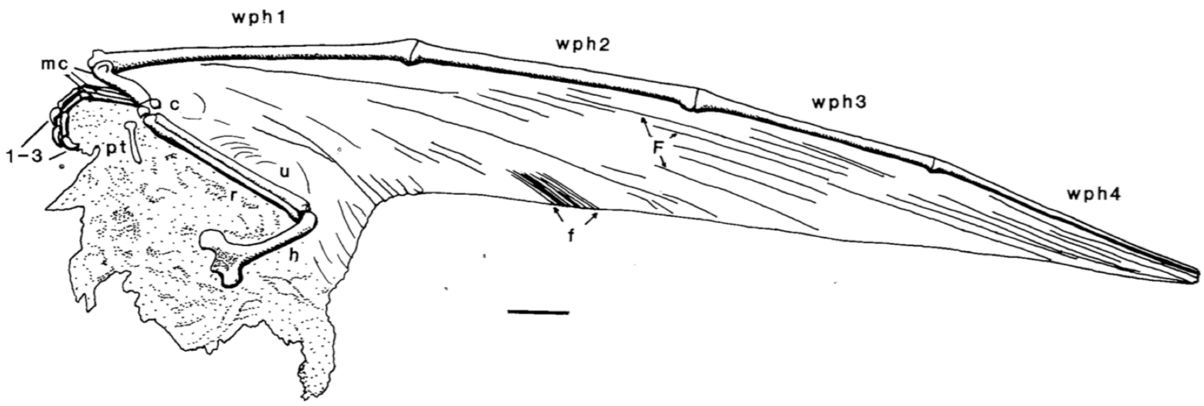
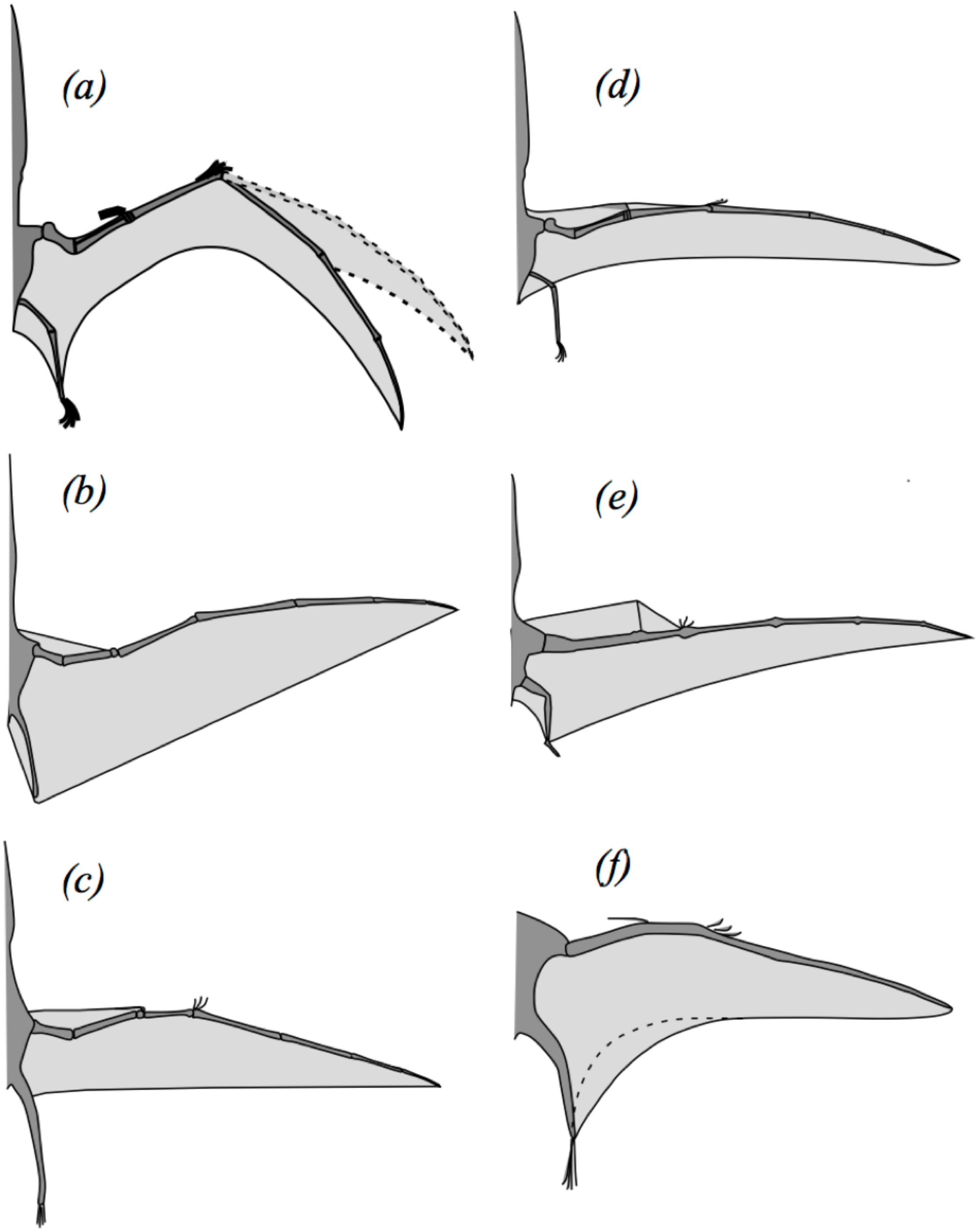


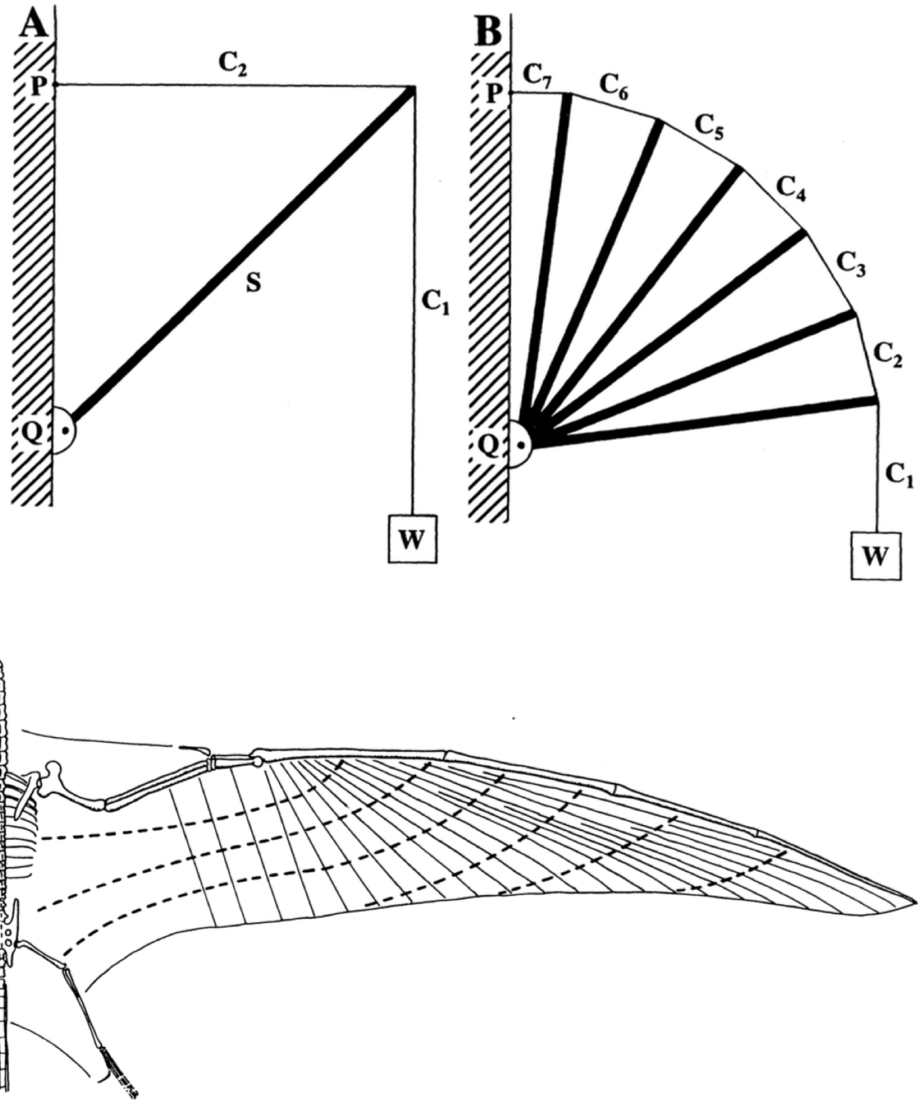
Illustration of the Zittel wing (from Padian & Rayner 1993), showing direction of folds preserved in the wing membrane. Padian & Rayner (1993) argued that the aktinofibrils more or less followed the directions of the folds in the membrane.

Figure 1.13



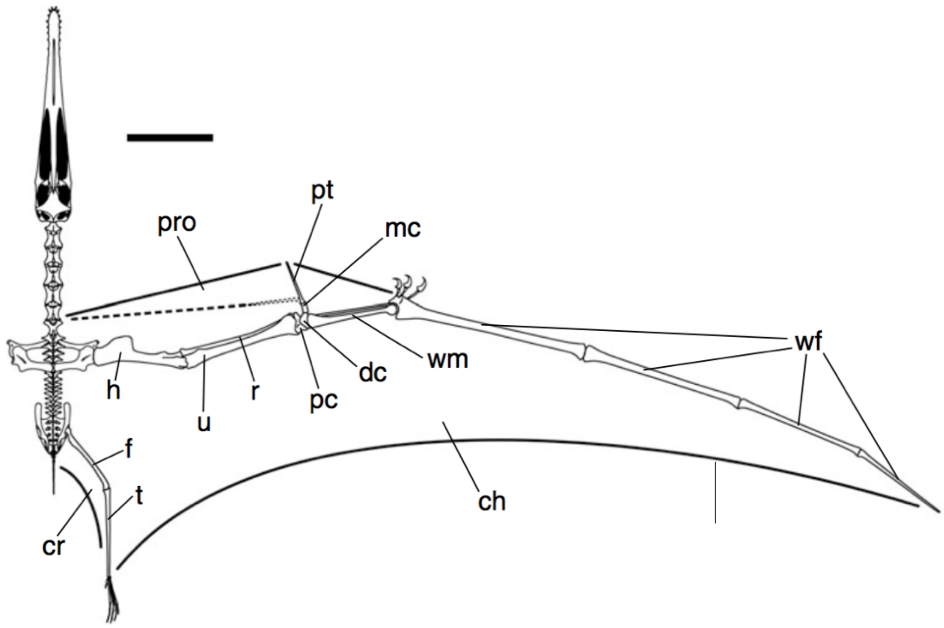
Variety of wing reconstructions in the literature. (a) Eaton 1910, (b) Bramwell & Whitfield 1974, (c) Wellnhofer 1985, (d) Bennett 2001, (e) Wilkinson 2008, (f) Elgin *et al.* 2010. The ankle attachment for the membrane is now the prevailing view show first by Eaton in 1910 and most recently by Elgin *et al.* 2010.

Figure 1.14



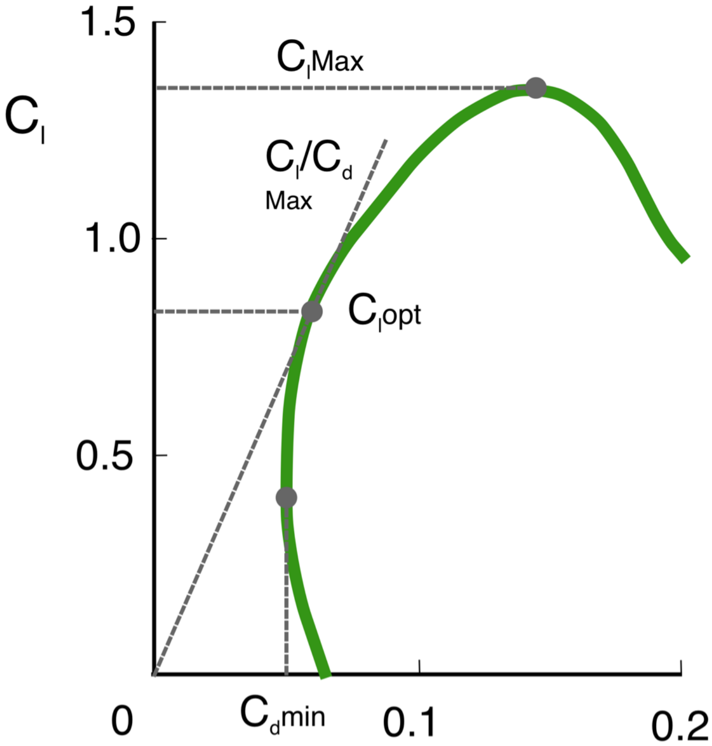
Cable and strut explanation of the structural role of the aktinofibrils. Basic mechanics dictates that the strut S in figure A must be subject to a compressive force, which in B is simply distributed across more struts (from Bennett 2000). As a consequence of this proposed mechanism, Bennett (2000) argued that the tension in the membrane was directed more or less normal to the direction of the aktinofibrils, as shown by the dashed lines in the illustration of the complete wing.

Figure 1.15



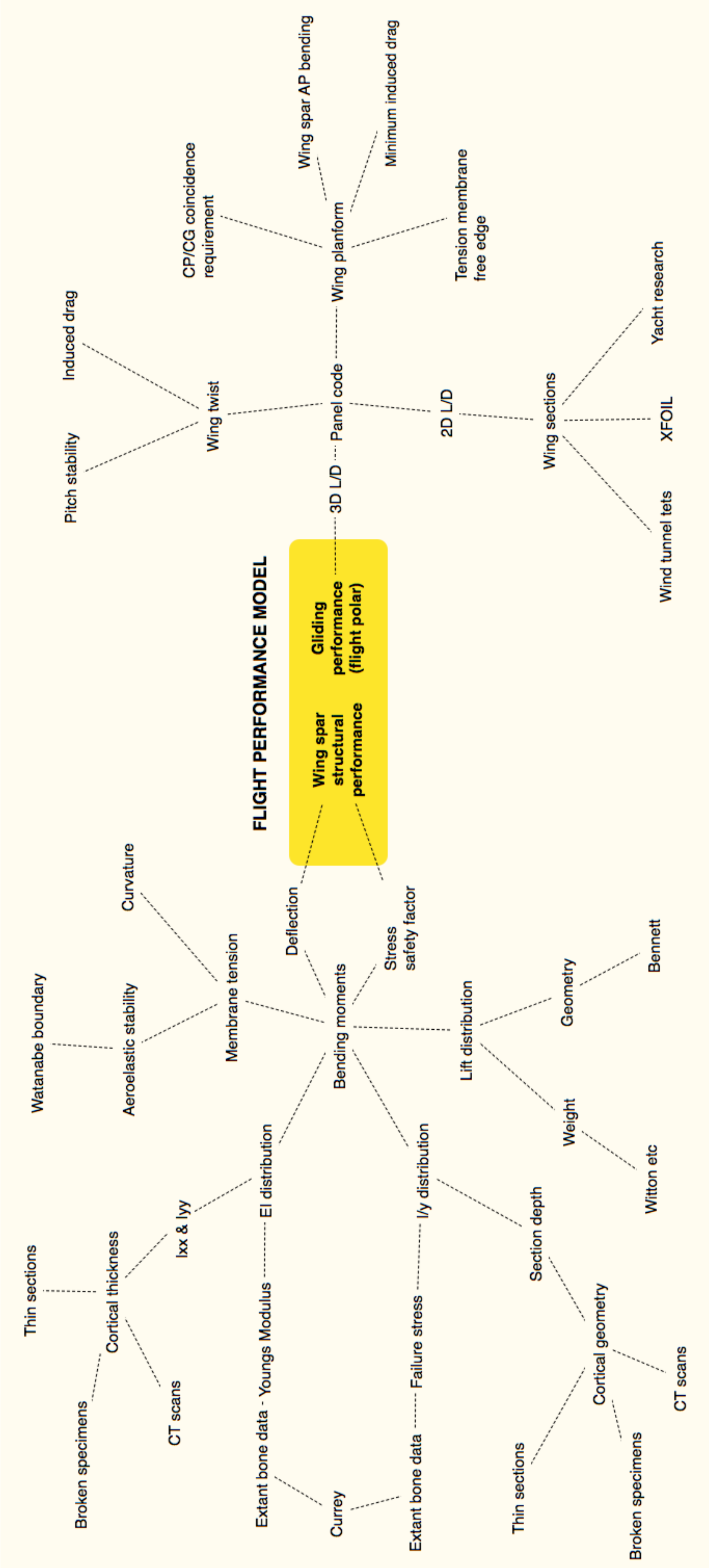
Alternative pteroid orientations. The solid outline shows the wide propatagium that would result from the anterior orientation of the pteroid whereas the dashed outline shows the shape of the propatagium when the pteroid is directed medially. (From Wilkinson 2008). pt=pteroid bone.

Figure 1.16



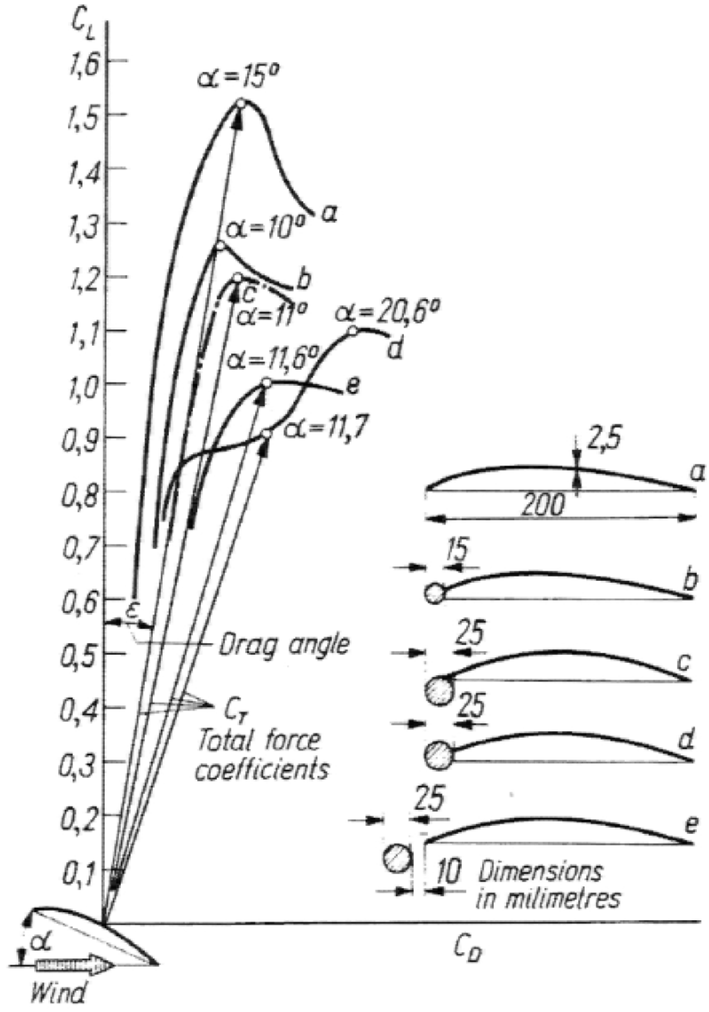
Schematic polar plot of 2D aerodynamic data. This form of presentation allows key parameters to be readily observed: C_{lmax}, the maximum lift coefficient and an indication of low speed flight capability, C_{dmin}, the minimum drag, C_l/C_{dmax}, the best lift to drag ration (a measure of aerodynamic efficiency) and C_{lopt}, the lift coefficient at which the best lift:drag ratio is achieved.

Figure 1.17



Spider diagram of the variables considered in the development of the flight performance model.

Figure 1.18



Effect of a leading edge spar (mast) on the performance of a cambered plate airfoil. It is apparent that both mast diameter and position relative to the leading edge of the airfoil are important. Even a small diameter mast (b) reduces the maximum lift by 15% and a location on the high pressure side (ventral in the case of a pterosaur wing) is superior (compare (c) and (d).) From Marchaj 1988.