Abstract
The development of personal care formulations will necessarily include the consideration of the required product rheology and the correct rheology modifier to provide these effects. Whilst the efficacy of the finished product will depend on the choice and level of active ingredients and excipients, the aesthetics and even the penetration of these actives into the stratum corneum will be affected by the product rheology.

Rheology modifiers are often referred to as thickeners and, whilst increasing the apparent viscosity will confer a feeling of “quality” to the formulation, this is only one aspect of rheological control. The product itself can be Newtonian or pseudoplastic, thixotropic, be a ringing gel or a stringy flowable liquid. This will then affect the way that the product appears in the bottle, how easy it is to pour or scoop from the packaging, how easy it is to rub into the skin or along the hair shaft, and how easy it is to rinse and remove the product after use. It will also be essential to choose the correct rheological characteristics to ensure the stability of the finished formulation.

Polymeric Rheology Modifiers
Polymeric rheology modifiers can be added to formulations to control the rheology and the required effect can be achieved with low concentrations of the polymer. The resulting solution will have a rheology somewhere between the viscous behaviour of water and the elastic behaviour of rubber. The typical flow curve for a polymeric rheology modifier will be as shown in Figure 1.

Introduction
The development of personal care formulations will necessarily include the consideration of the required product rheology and the correct rheology modifier to provide these effects. Whilst the efficacy of the finished product will depend on the choice and level of active ingredients and excipients, the aesthetics and even the penetration of these actives into the stratum corneum will be affected by the product rheology.

Rheology Modifiers
Rheology can be defined as “the science or study of how things flow”, and it is a requirement of personal care products that they flow in the right way. A skin cream should appear highly viscous in the jar but should be capable of being picked up and rubbed into the skin. Nail polish should be sufficiently viscous to suspend the high volume of suspended pigment, not drip from the brush but thin sufficiently on the nails to provide an even coverage without any obvious brush strokes.

Rheology modifiers are often referred to as thickeners, and whilst increasing the apparent viscosity will confer a feeling of “quality” to the formulation, this is only one aspect of rheological control. The product itself can be Newtonian or pseudoplastic, thixotropic, be a ringing gel or a stringy flowable liquid. This will then affect the way that the product appears in the bottle, how easy it is to pour or scoop from the packaging, how easy it is to rub into the skin or along the hair shaft, and how easy it is to rinse and remove the product after use. It will also be essential to choose the correct rheological characteristics to ensure the stability of the finished formulation.

To achieve such varied effects, a number of different types of rheology modifier are available to the formulator. These include natural gums such as guar and starch, modified naturals such as cellulose derivatives, synthetics such as acrylic polymers and inorganic such as clays. Table 1 shows some examples of these different classifications.