

CHAPTER 1

Introduction

Few books have been written to date focusing on curly hair and hair types. Most of the books that do exist on this topic have been written either by consumers or professional hairstylists. In this book, I present the perspective of a hair chemist who has spent most of his life researching the structure, physics, and chemistry of curly hair; formulating new products to care for curly hair; and manufacturing these new products. Herein, the term curly hair will encompass wavy, curly, and coily hair types. Curly hair is unique in terms of its geometric shape and has unique properties when compared to its counterpart, straight hair. Therefore, combing, cleansing, conditioning, and styling curly hair requires detailed knowledge and special techniques that are quite different from those required for the care of straight hair.

In order to have a discussion about curly hair we have to understand how hair is categorized. Historically hair has been categorized by race, mainly Caucasian (straight to wavy), Asian (straight), and African (curly to coily). Given human migratory patterns over the past few centuries the ethnicity model is outdated and we are moving towards classifying hair more objectively. For example, recently, hair typing systems such as Andre Walker's have emerged that classify hair into four categories: Type 1 as

straight hair, Type 2 as wavy hair, Type 3 as curly hair, and Type 4 as coily hair (see Chapter 3 for more details on Andre Walker's hair typing system). Throughout this text we will refer to hair interchangeably using the terms outlined in **Table 1.1**.

Table 1.1 *Hair fiber shape descriptors*

Hair Type	Shape Description	Ethnicity
Type 1	Straight	Caucasian, Mongolian, Asian, Japanese
Type 2	Wavy	Hispanic, Caucasian
Type 3	Curly, S-shaped	African-American, African-descent, Brazilian
Type 4	Curly-to-coily, Coily, Spiraled, Z-shaped	African-American, African-descent, Brazilian

In this book, I discuss the logic of hair typing with respect to hair shape, as well as combing, cleansing, conditioning, styling, maintenance, and the role of the scalp in hair growth. As both consumers and hairstylists are deeply involved in the art of curly hair involving all of the above-mentioned areas, it is my hope that they will benefit from the inner secrets of a formulating hair chemist, and gain an expanded understanding of curly hair and how to care for it on a daily or weekly basis. Every day, new products for curly hair are introduced, and it is important for consumers to know the parameters of evaluating these products.

In Chapter 2, the structure of hair is discussed in simple terms. The structure of the cuticles, the cell membrane complex (CMC) and its various types, and cortical cell types such as para- and ortho- cells are discussed with respect to hair type. The structural differences between Types 1, 2, 3, and 4 hair are described based on cortical-cell differences and the number of cuticle layers. The inner structure of the cortex is methodically examined, based on macrofibrils, microfibrils/intermediate filaments, the matrix, protofibrils, protofilaments, and dimers. Lastly, the role of the medulla is explained. At the end of the chapter, the terms used

in discussing the structure of hair are defined.

In Chapter 3, hair types and the various properties associated with them are discussed. For example, with the stepwise change from Type 1 (straight) to Type 4 (coily) hair, a dramatic increase occurs in waviness, porosity, ellipticity, frizziness, shrinkage, twists in the hair strand, and scalp dryness. Similarly, in going from Type 1 to Type 4 hair, a negative association can be observed, namely, a declining trend in scalp moisture, strength or elasticity, shine, smoothness, layers of cuticles, 18-MEA, and hair growth.

Chapter 4 deals with the scalp and hair growth, followed by hair loss and its remedies. A comparison of the scalp's moisture content and its transepidermal water loss properties (TEWL) is presented, and the differences between Caucasian and African-descent hair are pointed out. The parts of a hair follicle and differences in follicle shape between Caucasian and African-descent hair are explained. The hair growth cycle is discussed, and the anagen, catagen, telogen, and exogen phases are detailed, along with differences in the hair growth rate among Caucasian and African-descent populations. The causes of hair loss such as androgenetic alopecia, traction alopecia, chemically induced alopecia, dandruff-caused alopecia, menopause, and dietary deficiencies are discussed. Lastly, hair loss remedies based on medical science such as minoxidil, finasteride, and dutasteride are presented and their side effects are described. Alternative remedies such as saw palmetto extract and phytosterols are introduced, and natural ingredients such as biotin; copper; green tea; aloe vera gel; iron; zinc; niacin; fatty acids; selenium; Vitamins D, E, and A; folic acid; and amino acids are described. Dandruff remedies and surgical transplants are briefly touched upon. The definition of terms used in the chapter is provided to help readers.

In Chapter 5, the cleansing of the hair and scalp is discussed in great detail. Cleansing plays a critically important role in ensuring a healthy head of hair. The purpose of cleansing the hair and scalp is explained with reference to the differences between Caucasian and African-descent consumers. A number of relevant aspects are examined in this context such as moisture content and TEWL; the impact of detergents on hair and scalp integrity, notably with respect to moisture content and TEWL; and

mitigation of the deleterious effects of detergents such as sodium lauryl sulfate. Various types of detergents are described, including anionic, cationic, amphoteric, and natural detergents. Explained are the physics of hair and scalp cleansing and the effects of detergents on the pH of the hair and scalp, the moisture content and TEWL of the hair and scalp, as well as the integrity of hair surface lipids and the cuticles. Mitigation of hair and scalp damage is then reviewed. In addition, a six-step product development process is described for hair chemists, hairstylists, consumers, and new entrepreneurs, highlighting the extensive efforts involved in the development of new products. Types of shampoos and co-wash cleansers are also discussed in detail.

In Chapter 6 the various ways to condition the hair and scalp and remedies for treating a damaged hair and scalp are outlined. First, the causes of hair damage are explored ranging from chlorine damage in swimmers' hair to damage from chemical treatments such as lightening, relaxing, and coloring. To mitigate damage, remedies must be based upon the proper selection of quaternary conditioning agents, according to the hair type and its needs, such as cationic silicone polymers, polyquaternium compounds, additives such as moisturizing agents, hair strengthening agents, hair pH balancers, and scalp rebuilders. The factors involved in the penetration of these conditioners into the hair and scalp such as length of application time, heat, and pH, along with the types of conditioners used are discussed in detail so that consumers can apply them in their everyday hair and scalp care practices in order to alleviate potential damages.

Chapter 7 provides a discussion of hairstyling and maintenance products, which are essential to the final appearance and assembly of curly hair. Styling products are based on leave-in conditioners and special waters containing essential oils, ceramides, and vitamins for the hair and scalp. These special waters are a new innovation in the field. Other hair styling products are twist and defining creams, curling jellies, curling creams, curling smoothies, and foam setting-lotions. Daily maintenance products for style preservation are moisturizing hair lotions, butter creams, natural oils (especially those rich in phytosterols), edge defining pomades, oil sheen sprays, and scalp serums. Scalp serums are particularly important for stimulating the scalp and discouraging the presence of fungi and bacteria