Preface

It is believed that most cells in an organism carry the same genetic information. This is known as genetic equivalence. This leaves gene expression to represent all the differences in the cells of a multicellular organism. While previous large scale genetic screens defined genes necessary for embryogenesis, the genetic basis of post-embryonic development leading to the adult morphs is not well known. Natural selection during evolution specifically acts on variations in the adult form. Variation in adult morphology permits differentiation among species much more than the embryonic structures and distinguish even closely related fish. However, we know very little concerning the genes controlling the formation and variation of adult morphology. While it is essential to consider genetic factors when diagnosing the underlying cause for virtually all oral-facial anomalies and developmental variations, the importance of how genetic factors will affect the outcome of treatment is often not appreciated. Understanding the etiology of a malocclusion is important, e.g., if the patient is a thumb sucker, then that habit must stop. But in terms of etiology, the factors that influenced a malocclusion to develop may not be the same ones that will influence how the patient responds to treatment of that malocclusion. In addition, the patient's developmental stage during treatment is typically a later stage then when the basis of the malocclusion first formed. Although an environmental modification may alter the development of the phenotype at a particular moment, gross structural morphology, already present, may not change readily unless the environmental modification is sufficient to alter preexisting structure. As every orthodontist knows, the ability of the practitioner to affect a change is dependent both on the time of intervention (treatment) and the patient's stage of development. Knowing whether the cause of the problem is genetic has been cited as a factor in eventual outcome; that is, if the problem is genetic, then orthodontists may be limited in what they can do (or change), because

of an intrinsic "predestination." This is a misapplication of genetics to clinical practice since most malocclusions we treat appear to not be the result of a single dominant gene. There are inappropriate uses of heritability estimates in the literature as a proxy for evaluating whether a malocclusion or some anatomic morphology is "genetic." This however has no relevance to the question.

Regardless of the heritability estimate, there is not a yes or no answer. Heritability estimates only apply to the group that was studied and the environmental factors that they were exposed to up to that time. They do not necessarily apply to an individual at the time of the study, and are not predictive for an individual or the group in the future. How genetic factors will influence the response to environmental factors, including treatment, and the long-term stability of its outcome as determined by genetic linkage or association studies, should be the greatest concern for the clinician as they are the only way leading to a better understanding of the genetic background of the individual patient in terms of their malocclusion and response to treatment.(Hartsfield, 2008) It is of critical importance in clinical practice to understand how genetic factors and their interaction with environmental factors may affect facial growth. The aim of this chapter is to review what is known about the genetic factors that affect facial growth with an emphasis on human studies involving malocclusion.

In the preparation of this book, it has been the author's aim to keep in mind not only the requirements of students in this subject but as well the needs of student.

—Editor