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Genetics and dentistry

The avalanche of knowledge spurred by the Human Genome Project has led to enormous leaps in understanding of the human organism in both normal development and disease. As genetics and genomics revolutionize medicine, the practice of dentistry will be similarly affected. The study of the hereditary factors as they relate to the growth and development of the teeth and jaws (both normally and abnormally) and to oral and dental disease (eg, oral cancers, dental caries, and periodontal disease) suggest that there is a strong genetic correlation. It is also evident that there is a strong influence of systemic genetic disease on oral health care. Dentists should have overall knowledge of the genetic aspects of oral diseases and genetic tests for susceptibility to both common oral health concerns and orofacial structural anomalies. In regard to clinical practice, tomorrow's dentists will be expected to incorporate genetics in history-taking and differential diagnoses, carry out genetic testing, counsel patients, and (potentially) prescribe genomic treatment for oral and dental disease. Tomorrow's faculty will need a good grounding in genetics to pursue teaching and research careers.

Dental curricula should therefore be adapted accordingly. Genetics, including molecular biology, should be part of foundational studies to provide students with a sound basis upon which to build subsequent knowledge. The role of genetics in normal growth and development, as well as its role in pathological processes, must be incorporated into the curriculum. Genomics and proteomics may well have to be taught as their role in the detection and diagnosis of disease increases. Indeed, the existence of diagnostic kits using saliva to detect genetic polymorphisms and biomarkers underscores this point. Genetic principles should be incorporated into learning strategies.¹ Clinical application is essential for reinforcement. For example, family history, as well as pedigree construction and interpretation, should be part of routine clerking procedures. The ongoing acquisition and dissemination of knowledge is a duty of the dental practitioner. As technology advances, so

do the options for the dental professional to advance the oral health of the public.² Bioinformatics, the allied science that nowadays underpins the ability to access up-to-date genetic information, should also have a place in the curriculum.

The identification of a gene that causes gingival enlargement in hereditary gingival fibromatosis has made it possible to uncover a key clue of normal gingival development. Fibrous dysplasia, a bone disorder affecting the jaws, is now considered to be a genetic disorder expressing *GNAS1* gene mutations in osteoblastic lineage cells.³ Early prediction of malignancy in the fibroosseous lesions that have increased tendency for malignancy is now possible via the expression patterns of *c-fos* proto-oncogene. The dentin sialophosphoprotein (DSPP) gene that is responsible for the normal tooth development was isolated, and a multitude of mutations were identified that are responsible for different types of dentinogenesis imperfecta or dentinal dysplasias. *Runx2*, a master transcription factor of bone that plays role in all stages of bone development, is now thought to be intimately involved in the development of calcified tooth structures. It is possible that this gene has a pivotal role in the alveolar remodeling and stage setting for the normal eruption of teeth.⁴ A full understanding of the functionality of this gene might uncover the secrets of transmigratory patterns of teeth, as well as their ectopia.⁴

The field is relatively young, so the boundaries of knowledge are pushed outward on a near-daily basis. Dental faculty in general has little expert knowledge or experience of genetics and its application to the dental field. This may pose a problem in the delivery of knowledge of the latest advances and techniques. Most dental schools are associated with medical schools and should therefore have access to a source of genetic expertise. When this is not the case, distance learning may be an option. One-to-one collaborative links or subscriptions to international programs such as the IVIDENT project (www.ivalent.info) will allow the sharing of such expertise.

A recent report of the panel 3 of the Macy study⁵ strongly recommended a variety of methods by which the dental curriculum could be bolstered with the knowledge and dissemination of genetics as related to oral conditions. The report also stressed the need to integrate genetics into the core competencies of dental education so that the understanding of broad-based complex diseases are taught based on genetic studies and how they may be related to oral pathological processes.

As biomedical and clinical sciences associated with genetics are swiftly changing, dental professionals need to keep pace with the changing trends and knowledge in genetics. Dental education is not complete without the incorporation of this fundamental knowledge in our dental curricula.

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REFERENCES

1. Burke S, Martyn M, Thomas H, Farndon P. The development of core learning outcomes relevant to clinical practice: Identifying priority areas for genetics education for non-genetics specialist registrars. *Clin Med* 2009;9:49–52.
2. Collins F, Tabak L. A call for increased education in genetics for dental health professionals. *J Dent Educ* 2004;68:807–808.
3. Ippolito E, Bray EW, Corsi A, et al. Natural history and treatment of fibrous dysplasia of bone: A multicenter clinicopathologic study promoted by the European Pediatric Orthopaedic Society. *J Pediatr Orthop B* 2003;12:155–177.
4. Camilleri S, McDonald F. Runx2 and dental development. *Eur J Oral Sci* 2006;114:361–373.
5. Johnson L, Damsky C, Haden N, et al. Genetics and its implications for clinical dental practice and education. Report of panel 3 of the Macy Study. *J Dent Educ* 2008;72(2 suppl):86–94.

