John Lukacs examining "Junker's teeth" in the Roemer-Pelizaeus in Museum, Hildesheim, Germany, during the Paleopathology Association's European Meeting. Photo by Wilbert Bouts.

the second molar, which had broken roots, in place. In the most recent *Dental Anthropology Newsletter* (8[3]:2-8), Marshall Becker suggested that the roots were broken postmortem, and that the specimen may have served as a talisman or amulet, an interpretation that I regard as more likely.

The next issue's presidential address will focus on the current state of the association and directions for the future. The president strongly urges members to write (address in membership section), fax (503-346-0668), or e-mail (JRLUKACS@OREGON.UOREGON.EDU) their comments, concerns, and ideas for future development and enhancement of the association. Members are encouraged to send the editor brief topical articles, news, and views. Especially welcome are summaries of current work and events pertaining to dental anthropology in departments. This is our newsletter. It will grow and flourish as each of us takes an active role in submitting news, articles, current events, and letters to the editor. I am happy to serve as the association's president and look forward eagerly to communications from members.

Preliminary Program: Albert A. Dahlberg Memorial Symposium on Dental Morphology and Evolution

Sponsored by the Dental Anthropology Association. Organized by John R. Lukacs and G. Richard Scott
Symposium will take place in Oakland California during the AAPA meetings March 29-April 1, 1995.

G.R. Scott and Mrs. Thelma Dahlberg: Introduction.
T. Brown: A century of dental anthropology in south Australia.
S.W. Hillson: Crown morphology and the processes of dental enamel formation.
P. Smith, S. Spitz, and J. Becker: Crown pattern changes during enamel apposition.
L. Alvesalo and E. Tammisalo: Enamel and dentine thickness in 48,XXXX females' permanent teeth.
J.T. Mayhall, L. Alvesalo, and G. Townsend: Dental Anthropology of 47,XYY males: molar cusp area, volume, shape, and linear dimensions.
Y. Mizoguchi: Size and co-variation among deciduous teeth.
G. Townsend and V. Farmer: Dental asymmetry in the deciduous dentition of South Australian children.
E.F. Harris: Ontogenetic intraspecific pattern of tooth size associations in humans.
D.H. Morris: Systematic angular and linear measurement side bias in five samples of human dentitions.
A.M. Haeussler: Origin and relationships of people buried in large Ukrainian Mesolithic Era cemeteries: the evidence from dental morphology.
J.D. Irish: High frequency archaic dental traits in modern sub-Saharan African populations.
C.G. Turner II and D.E. Hawkey: Whose teeth are these: Carabelli's trait.
A. Cucina and M.Y. İşcan: Assessment of enamel hypoplasia in a high-status burial site.
P.L. Walker, L. Sugiyama, and R. Chacon: Variation in dental health of American Indian hortoculturalists.
J.R. Lukacs and Mrs. Thelma Dahlberg: Discussion, Comments, and Closing.

Mirror Imaging in Twins: Some Dental Examples

GRANT TOWNSEND, LINDSAY RICHARDS, TASMAN BROWN, AND SANDRA PINKERTON
Department of Dentistry, The University of Adelaide, Adelaide, South Australia 5005

Mirror imaging is a fascinating phenomenon that has been estimated to occur in around 25% of monozygous (MZ) twin pairs (Springer and Deutsch, 1981), although we are unaware of any detailed studies of its frequency in human populations. Other terms used to describe instances where one twin "mirrors" the other for one or more features include specularity, enantiomorphy, and asymmetry reversal. Numerous examples of mirror imaging have been described for different body features such as fingerprint patterns, direction and position of hair whorls, position of body organs (*situs inversus)*, and discordance for handedness.

We recently reported cases of mirror imaging in the dentitions and faces of South Australian twins enrolled in an on-going study of dentofacial variability at the Department of Dentistry, University of Adelaide (Townsend et al., 1992; Brown et al., 1992). Examples included mirror imaging for dental crown size, crown morphology

(e.g. Carabelli's trait), timing of tooth emergence, tooth rotations and crowding, tilting of teeth, agenesis of teeth, and dental arch shape. Several other authors have also reported interesting cases of mirror imaging in the dentition (e.g. Staley and Green, 1974; Schneider, 1985; West, 1985; Carton and Rees, 1987; Nik-Hussein and Salcedo, 1987; Beere et al., 1990).

The classical explanation for mirror imaging arose from early experiments where *situs inversus* was produced in twin newts by ligating the embryos. The twins were thought to have arisen from opposite halves of the original embryo, with the missing halves being replaced by uncommitted tissue (see Boklage, 1980). More recently, mirror imaging was suggested as possibly being associated with a delay in the timing of the twinning event. Monozygous twins can form at any time up to about ten days post-conception. Those with separate chorions are presumed to develop during the first five days, whereas those who share a chorion are thought to have formed sometime between six and nine days after conception. Approximately 30% of MZ twins are dichorionic, while about 60% are monochorionic. A small percentage of MZ twins have a single amnion and chorion, and these individuals are thought to have formed around nine to ten days after conception. Further delay in the twinning process is thought to lead to the rare occurrence of conjoined twins (Boklage, 1981).

If mirror imaging is associated with delayed cleavage of twins, one would expect a greater frequency of occurrence in monochorionic twins than in dichorionic twins. Unfortunately, evidence for this is limited (Hay and Howie, 1980), although our preliminary findings in South Australia twins indicate that this is a line of research worth pursuing (Townsend et al., 1992).

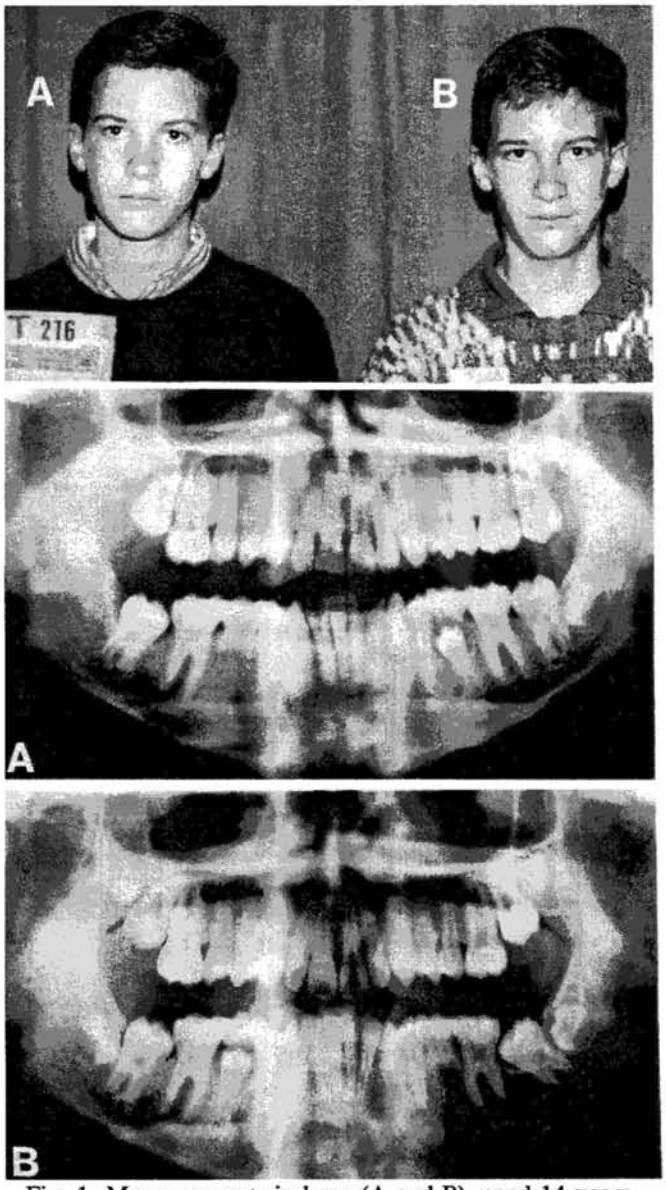

Fig. 1. Monozygous twin boys (A and B), aged 14 years, 9 months. Panoramic radiograph A (twin A) lacks a right mandibular second premolar (empty socket under right dm2, seen on the left in the photograph). Panoramic radiograph B (twin B) lacks a left mandibular second premolar (empty socket under left dm2, seen on the right in the photograph).

The two examples of mirror imaging presented in this article involve unilateral agenesis of permanent mandibular second premolars in MZ pairs. In both cases zygosities were confirmed by comparison of blood groups, as well as by various serum and enzyme polymorphisms. No information on chorion-type was available for either pair of twins. Birth weights were 3.4 and 3.6 kg for the males and 3.0 and 2.9 kg for the females.

Figure 1 shows MZ twin boys (A and B), aged 14 years, nine months, along with panoramic radiographs of their dentitions. The mandibular right second premolar is congenitally absent in twin A, whereas the mandibular left second premolar is missing in twin B.

Figure 2 depicts MZ twin girls aged 10 years, nine months, also with missing mandibular second premolars. In twin B the left tooth is missing, whereas in twin A the right tooth is absent.

Assessments of dental age based on the system described by Demirjian et al. (1973) indicated delays of 24 to 26 months in dental development in both sets of these twins. Furthermore, crown sizes of emerged

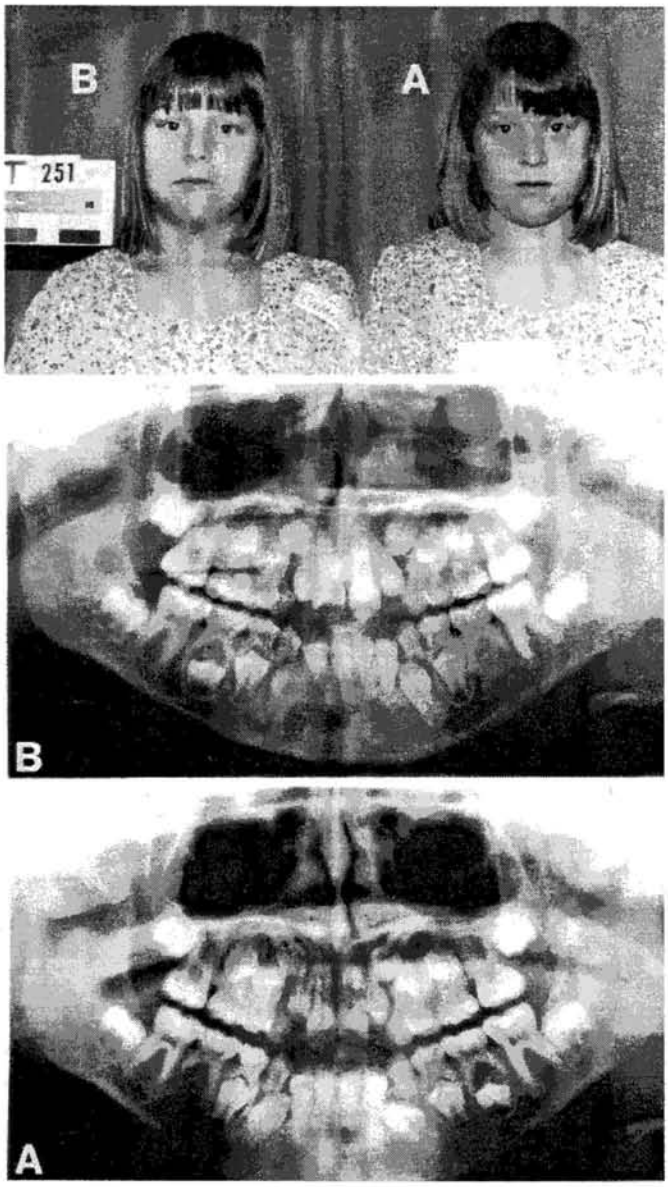

Fig. 2. Monozygous twin girls (B and A), aged 10 years, 9 months. Panoramic radiograph B (twin B) lacks a left mandibular second premolar (empty socket under left dm2, seen on the right in the photograph). Panoramic radiograph A (twin A) lacks a right mandibular second premolar (empty socket under right dm2, seen on the left in the photograph).

permanent teeth are generally smaller than normal, particularly in buccolingual dimensions of mandibular incisors where sex-specific Z-scores ranged from -0.6 to -2.3. Neither of the twin pairs showed any other obvious mirror imaged features, apart from their missing teeth

These two cases raise interesting questions, not only about the biological basis of mirror imaging, but also about the genetics of missing teeth. The genetic basis of hypodontia is accepted, but the exact mode of inheritance remains unclear. Both monogenic and multifactorial etiologies have been proposed (Graber, 1978). That agenesis tends to be more common in certain teeth, e.g., permanent upper lateral incisors, second premolars, and third molars — the distal, later-forming teeth in each class, is also known. Furthermore, agenesis, delayed calcification, and reduced size of the remaining teeth are associated with one another (see review by Garn, 1977).

Brook (1984) has proposed a multifactorial threshold model, including polygenic and environmental influences, that links tooth size and number. This model postulates an underlying continually variable distribution or liability related to tooth size, with superimposed thresholds determining missing teeth or supernumeraries. He postulates that the genetic component of the multifactorial system is distributed throughout the genome.

An inherited liability to agenesis, therefore, may not target specific teeth, but rather affect the whole dentition. However, later forming teeth, that form over long periods, may be more likely to be influenced by developmental disturbances, and, therefore, fail to develop. Under this general polygenic model, discordance between twins for sidedness of agenesis could purely be a chance event, occurring in those MZ twins whose similar genetic constitution places them below a developmental threshold. Indeed, many, or perhaps most, isolated examples of mirror imaging in twins likely result from the chance effect of minor developmental disturbances of bilateral structures, rather than being due to some basic alteration in determination of body symmetry associated with the twinning process.

As we have suggested previously (Townsend et al., 1992), more studies of twin pairs who display mirror imaging for several features, as well as their families, are needed to unravel the biological basis for mirror-imaging. If any DAA members can help us, we would be very interested to hear from you.

LITERATURE CITED

Beere D, Hargreaves JA, Sperber GH, and Cleaton-Jones P (1990) Mirror image supplemental primary incisor teeth in twins: case report and review. Pediat. Dent. *12*:390-392.

Boklage CE (1980) The sinistral blastocyst: an embryologic perspective on the development of brain-function asymmetries. In J Heron (ed.): Neuropsychology of Left Handedness. New York: Academic Press, pp. 115-137.

Boklage CE (1981) On the timing of monozygotic twinning events. In L Gedda, P Parisi, and WE Nance (eds.): Twin Biology and Multiple Pregnancy. New York: Alan R Liss, pp. 155-165.
Brook AH (1984) A unifying aetiological explanation for anomalies of human tooth number and size. Archs. Oral Biol. *29*:263-278.
Brown T, Townsend GC, Richards LC, Travan GR, and Pinkerton SK (1992) Facial symmetry and mirror imaging in South Australian twins. In T Brown and S Molnar (eds.): Craniofacial Variation in Pacific Populations. Adelaide: Department of Dentistry, Anthropology and Genetics Laboratory, pp. 79-98.
Carton A, and Rees RT (1987) Mirror image dental anomalies in identical twins. Br. Dent. J. *162*:193-194.
Demirjian A, Goldstein H, and Tanner JM (1973) A new system of dental stage assessment. Hum. Biol. *45*:211-227.
Garn SM (1977) Genetics of dental development. In JA McNamara (ed.): The Biology of Occlusal Development. Craniofacial Growth Series, Ann Arbor: The University of Michigan, pp. 61-88.
Graber LW (1978) Congenital absence of teeth: a review with emphasis on inheritance patterns. J. Am. Dent. Assoc. *96*:266-275.
Hay DA, and Howie PM (1980) Handedness and differences in birth weight of twins. Perceptual and Motor Skills *51*:666.
Nik-Hussein NN, and Salcedo AH (1987) Double teeth with hypodontia in identical twins. J. Dent. Child. *54*:179-181.
Schneider PE (1985) Mirror-image twins with geminated incisors. Report of a case. Quintessence Int. *6*:429-431.
Springer SP, and Deutsch G (1981) Left Brain, Right Brain. San Francisco: W.H. Freeman and Company.
Staley RN, and Green LJ (1974) Types of tooth cusp occurrence asymmetry in human monozygotic and dizygotic twins. Am. J. Phys. Anthropol. *40*:187-196.
Townsend GC, Richards LC, and Brown T (1992) Mirror imaging in dentitions of twins — what is the biological basis? In T Brown and S Molnar (eds.): Craniofacial Variation in Pacific Populations. Adelaide: Department of Dentistry, Anthropology and Genetics Laboratory, pp. 67-78.
West VC (1985) Mirror image twins. Aust. Orthod. J. *9*:243.

SPURIOUS "EXAMPLES" OF ANCIENT DENTAL IMPLANTS or APPLIANCES
Part Two of a Series

MARSHALL JOSEPH BECKER
Department of Anthropology, West Chester University, West Chester, PA 19383, U.S.A.

ABSTRACT In addition to the various copies of ancient dental appliances, enormous numbers of reports deal with fanciful and unverifiable examples. These spurious dental bridges (or fake ancient crowns, inlays, or fillings) have been traced to their sources. While most of these spurious examples, such as the "stone" implant from Turkey (Atilla, 1993), discussed below, are found in the secondary literature, a few are accepted by scholars who were well versed in ancient dentistry (Guerini, 1909:68,n 1). In most cases, these spurious examples are the result of wishful thinking combined with poor referencing of earlier secondary sources, ignorance of the technology involved in the construction of dental appliances, and a lack of scholarly communication.

SPURIOUS DENTAL IMPLANTS

The classical literature is filled with references to ancient gold dental appliances in the Circum-Mediterranean region (Clawson, 1933; Becker, 1992; Ms. A), with the first documentation of discovery of an Etruscan gold dental appliance dating to the end of the 18th century (Böttiger, 1797). The archaeological verification of these publications appears to have spawned numerous reports which cannot be confirmed. Spurious accounts of ancient dental appliances were so common that Van Marter (1885, 1886) spent considerable time attempting to trace supposed Egyptian examples, which generally turned out to be amulets (Bonner 1950). Mummery (1870) had already discounted claims of early Egyptian examples, but the poor scholarship and the gullibility of authors over the decades has filled the literature with fanciful accounts. Weinberger's (1948:77-81) excellent review dismissed most of these tales, but he later generated still more mythical examples (Waarsenburg 1991:243, notes 13, 20). A review of commonly noted examples of spurious dental appliances and implants appears below.

The "Dental Bridge" in the Skull of Pliny A skull with a non-matching mandible, together with "Pliny's sword," is now on display in the Museo Storico dell'Arte Sanitaria of the Accademia di Storia dell'Arte Sanitaria in Rome. Although, the provenance is imprecise (Waarsenburg, 1991), the skull and a mandible have been "identified" as belonging to Pliny the Elder, who died in the eruption of Vesuvius in 79 AD (Cannizzaro 1901; Micheloni 1976: 311).