Introduction

Skin cancer is one of the most common malignancies in human population and can be broadly categorized into melanoma and non-melanoma skin cancers (NMSCs). Sun exposure is a key risk factor for the development of skin cancers. In the United States, the incidence of melanoma has tripled since the 1970s, reported to be 18 cases per 100.000 populations at the beginning of the year 2000 **(Garbe and Leiter,2009).** The annual rate of incidence increase varies somewhat by the geographic region, but has been estimated to range from 3% to 7% per year for the Caucasian population **(Lens and Dawes, 2004).**

NMSCs, mostly squamous cell carcinomas (SCCs) and basal cell carcinomas (BCCs), generally occur in the elderly population over 50 years of age, and the incidence is increasing **(Christenson et al., 2005).** The associated mortality rate for NMSCs has remained steady in the United States since the 1970s and ranges from 0.8% to 1.0%. They are expected to account for more than 1 million cases of newly diagnosed cancers in the United States in 2008 **(Jemal et al., 2008).**

A wide array of therapeutic options are available for NMSCs, including surgery, radiation, cryotherapy, electrodessication/curettage, topical chemotherapy, and photodynamic therapy. Choosing the most appropriate and effective intervention depends on numerous factors including: the size and site of the lesion, whether it is a primary versus recurrent lesion, the histology of the tumor, patient comorbidities, and patient preferences. Surgical excision remains the most effective modality with the lowest rate of treatment failures **(Bath-Hextall et al., 2007).**

Complete surgical excision is also the treatment of choice for primary cutaneous melanoma and affords the patient the best prognosis **(Haigh et al., 2003).** In melanoma, accurate staging is crucial and is aided by sentinel lymph node biopsy in indicated cases **(Morton et al., 2006).**

After surgical excision, reconstruction can be accomplished by primary closure, local flaps, or secondary intention after complete excision. Most patients have a benign clinical course with excellent cosmetic and functional outcomes. Rare patients will present with facial skin cancers that involve large surface areas and treatment involves a large tissue resection making reconstruction of these defects problematic. The advent of free tissue transfer has allowed to reconstruct composite tissue defects with similar composite tissue. The variety of free tissues available for transfer ranges from thin flaps to osteocutaneous and large bulky myocutaneous flaps. With them, many of these large and composite tissue defects secondary to ablation can be successfully reconstructed**(Mark et al., 2003).**

Aim of the Work

The aim of this essay is to highlight different methods in the diagnosis and treatment of facial skin cancer and to handle various options for facial skin reconstruction after surgical excision in order to improve the quality of life of facial skin cancer patients.

Embryology of Face

The paired maxillary and mandibular prominences and the frontonasal prominence are the first prominences of the facial region. Later, medial and lateral nasal prominences form around the nasal placodes on the frontonasal prominence. All of these structures are important, since they determine,through fusion and specialized growth, the size and integrity of the mandible, upper lip, palate, and nose **(Sadler, 2003).**

Table (1): Structures Contributing to Formation of the Face **(from embryology of head and neck in Longman's medical embryology 9th edition, Sadler; (15): 363-400, 2003).**

Prominence	Structures Formed
Frontonasal[a]	Forehead, bridge of nose, medial and lateral nasal prominence
Maxillary	Cheeks, lateral portion of upper lip
Medial nasal	Philtrum of upper lip, crest and tip of nose
Lateral nasal	Alae of nose
Mandibular	Lower lip

[a] The frontonasal prominence is a single unpaired structure; the other prominences are paired.

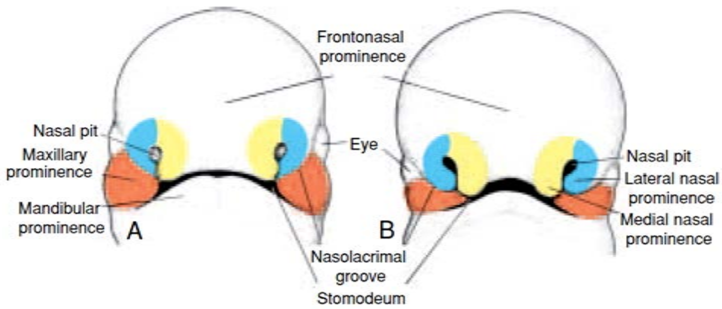

Figure (1): Frontal aspect of the face. A. 5-week embryo. B. 6-week embryo. The nasal prominences are gradually separated from the maxillary prominence by deep furrows. **(From embryology of head and neck in Longman's medical embryology 9th edition, Sadler; (15): 363-400, 2003).**

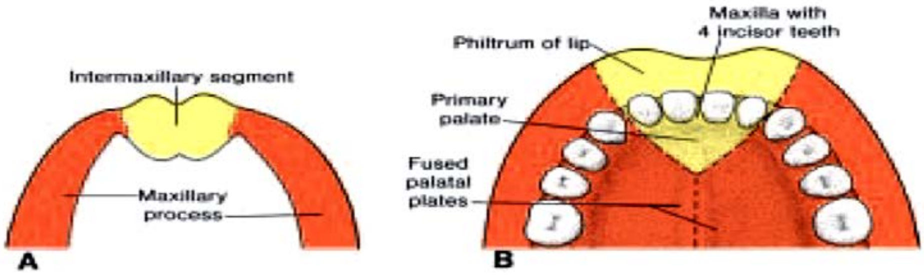

Figure (2):A. Intermaxillary segment and maxillary processes. **B.** The intermaxillary segment giving rise to the philtrum of the upper lip, the median part of the maxillary bone with its four incisor teeth, and the triangular primary palate.(From embryology of head and neck in Longman's medical embryology 9th edition, Sadler; (15): 363-400, 2003).

Formation of the upper lip occurs by fusion of the two maxillary prominences with the two medial nasal prominences. The intermaxillary segment is formed by merging of the two medial nasal prominences in the midline. This segment is composed of (*a*) the **philtrum,** (*b*) the **upper jaw component,** which carries the four incisor teeth, and (*c*) the **palatal component,** which forms the triangular primary palate. The nose is derived from (*a*) the **frontonasal prominence,** which forms the **bridge,** (*b*) the **medial nasal prominences,** which provide the **crest and tip,** and (*c*) the **lateral nasal prominences,** which form the **alae(Sadler, 2003).**

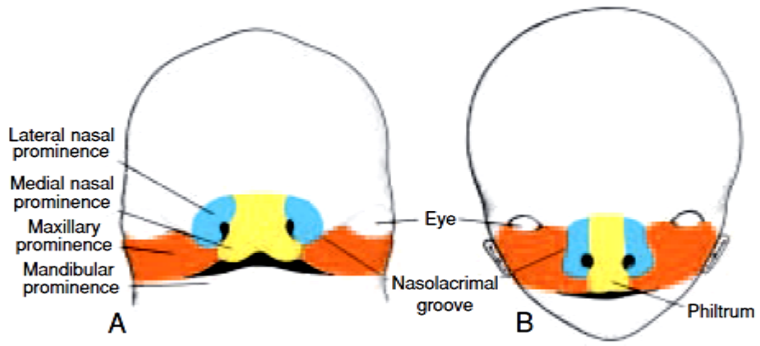

Figure (3):Frontal aspect of the face.A. 7-week embryo. Maxillary prominences have fused with the medial nasal prominences. **B.** 10-week embryo.(From embryology of head and neck in Longman's medical embryology 9th edition, Sadler; (15): 363-400, 2003).

Development of auricle

The auricle develops from six mesenchymal hillocks along the first and second pharyngeal arches. Defects in the auricle are often associated with other congenital malformations **(Sadler, 2003).**

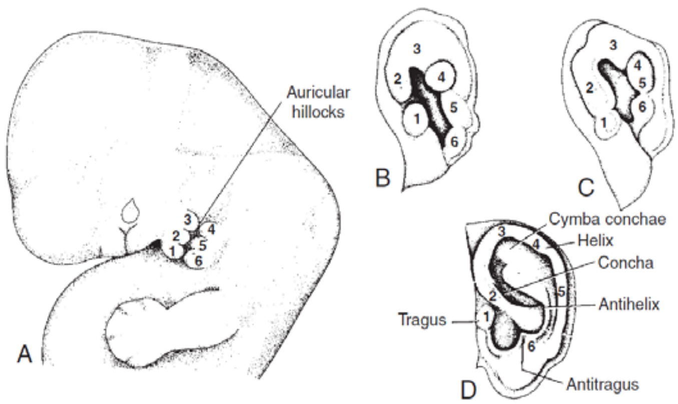

Figure (4):A. Lateral view of the head of an embryo showing the six auricular hillocks surrounding the dorsal end of the first pharyngeal cleft. **B** to **D**. Fusion and progressive development of the hillocks into the adult auricle (From embryology of head and neck in Longman’s medical embryology of ear 9th edition, Sadler TW; (16): 410-414, 2003).

Surgical anatomy of the face

Anatomy of Scalp

The scalp consists of five layers that can be easily remembered by the mnemonic **SCALP**. The layers are **S**kin, **C**onnective tissue, epicranial**A**poneurosis (galea), **L**oose areolar connective tissue, and **P**ericranium (**P**eriosteum) **(Agur and Dalley, 2009).**

The layers of the forehead and scalp are similar, but the skin is thin with absence of hair follicles. The subcutaneous layer contains a rich vascular plexus. The epicranialaponeurosis (galea) is continuous with the superficial temporal fascia as well as the superficial musculo-aponeurotic system (SMAS) of the face **(Mankani and Mathes, 2006).**

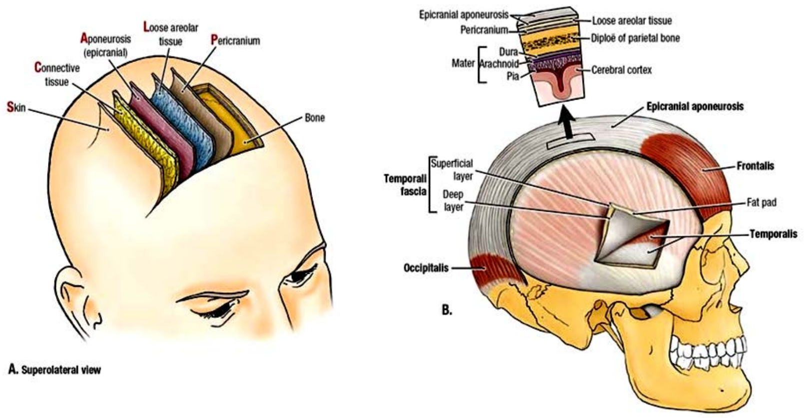

Figure (5):A. layers of scalp **B.** Occipitofrontalis and temporalmuscles and fascia(From Grant's atlas of anatomy 12th edition, anatomy of the head; relationships of the branches of the facial nerve and vessels to the parotid gland and duct; Agur and Dalley; 7(16): 635, 2009).

In the temporal-parietal region, there are four distinct fascial layers with anatomic significance. The most superficial layer is the **temporo-parietal** or **superficial temporal fascia** which is closely applied to the overlying skin and subcutaneous fascia and is difficult to dissect. Unless care is taken, it is easy to damage the overlying hair follicles, resulting in temporal alopecia **(Tellioglu et al., 2000).** Other layers include:

- **Sub-galeal fascia** which is easily dissected. The superficial temporal artery and the frontal branch of the facial nerve lie within this layer.

- **Superficial pad of fat** with numerous large perforating veins course through this layer, making dissection somewhat difficult.

- **Deep temporal fascia** overlying the temporalis muscle. Superiorly, it fuses with the pericranium. Inferiorly, at the level of the superior orbital margin, it splits into superficial and deep layers attached to the lateral and medial aspects of the zygomatic arch **(Stuzin et al., 1989).**

The loose areolar tissue layer is **the danger area of the scalp** because pus or blood spreads easily in it. Infection in this layer can pass into the cranial cavity through emissary veins, which pass through parietal foramina in the calvaria and reach intracranial structures such as the meninges. An infection cannot pass into the neck because the occipital belly of the occipitofrontalis attaches to the occipital bone and mastoid parts of the temporal bones. Neither can a scalp infection spread laterally beyond the zygomatic arches because the epicranialaponeurosis is continuous with the temporalis fascia that attaches to these arches. An infection or fluid (e.g. pus or blood) can enter the eyelids and the root of the nose because the frontal belly of the occipitofrontalis inserts into the skin and dense subcutaneous tissue and does not attach to the bone. Ecchymoses or purple patches develop as a result of extravasation of blood into the subcutaneous tissue and skin of the eyelids and surrounding regions **(Agur**and **Dalley, 2009).**

The scalp has a rich vascular plexus supplied by branches of both the internal and external carotid arteries. The extensive interconnections between each of the angiosomes allow re-plantation of the entire scalp based on a single donor vessel **(Wells, 2006).**

Anatomy of Eye and Eyelid

The eyes lie at the junction of the upper and middle third of the face. The distance between the eyes is roughly equivalent to the width of one eye (actually slightly wider) or the root of the nose (actually slightly narrower). The curves of the upper and lower eyelids are different, the margin of the upper lid lies along the circumference of a smaller circle (2/3 of the radius of the lower lid). The highest point of the upper eyelid lies one third of the way from the medial canthus, while the lowest point of the lower lid lies one third of the way from the lateral canthus – at the medial and lateral corneal limbi approximately **(Chiu and Burd, 2005).**

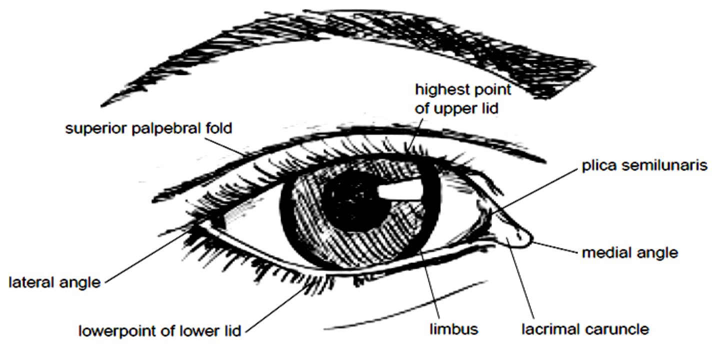

Figure (6):Configuration of the eye (From; Key topics in plastic and reconstructive surgery; facial anatomy, Chiu andBurd; (19): 65-68; 2005).

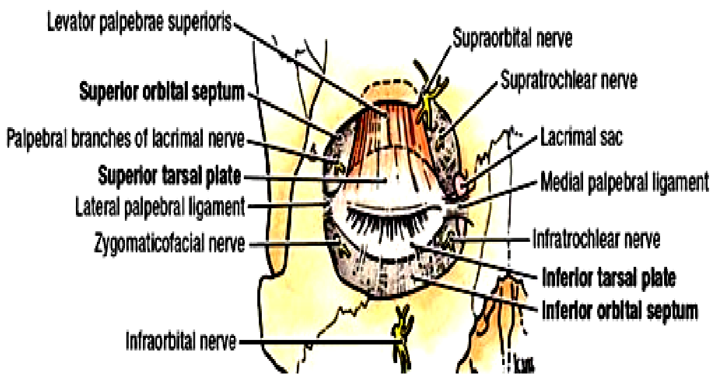

Figure (7):Orbital septum and eyelid (From Grant's atlas of anatomy 12th edition, anatomy of the head; cutaneous branches of trigemenal nerve, muscle of facial expression, and eyeled; Agur and Dalley; 7(15): 631-634, 2009).

The eyelid is a three-layered structure, consisting of thin **skin** on the outside, **mucosal lining** on the inside, and structural elements bridging the space between. The mucosal lining is the **palpebral conjunctiva** which forms the posterior wall of the lids, folding back upon it to form the anterior covering of the globe, the **bulbar conjunctiva.** The apexes of the folds are known as the **superior** and **inferior fornices (Spinelli, 2004).**

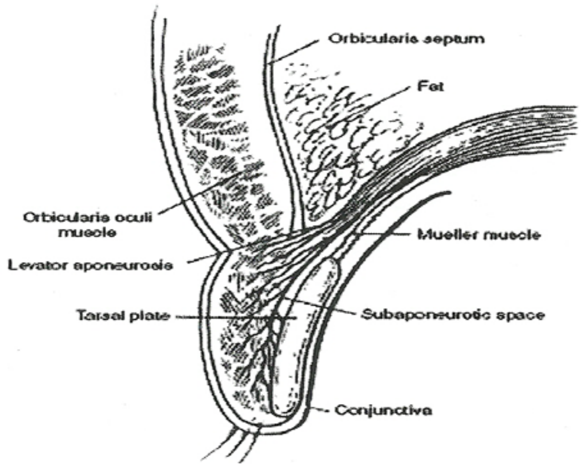

Figure (8): Upper eyelid in cross section. (From Newman MI and Spinelli MH: Reconstruction of the eyelids, correction of ptosis, and canthoplasty in: Grabb and Smith's Plastic Surgery 6th ed. (eds.). Thorne, Beasley, Aston et al. Lippincott Williams and Wilkins, 39: 397-416, 2007).

The elements of the lid, between the skin and conjunctiva, are considered to form a bi-lamellar structure. The anterior lamella primarily consists of **skin** and **muscle**, while the posterior lamella is made of **tarsal plates** and **conjunctiva**. The **orbicularis oculi** muscle makes up the support layer of the anterior lamella and consists of three separate divisions based on the underlying anatomic structure: **pretarsal**,**preseptal**, and **orbital**. The **pretarsal orbicularis** is divided into superficial and deep as well as the **preseptal**part, they are responsible for the involuntary blink and tear drainage respectively. The **orbital orbicularis** has the widest distribution over the upper and lower orbital region and performs protective forced eyelid closure **(Codner, 2000).**

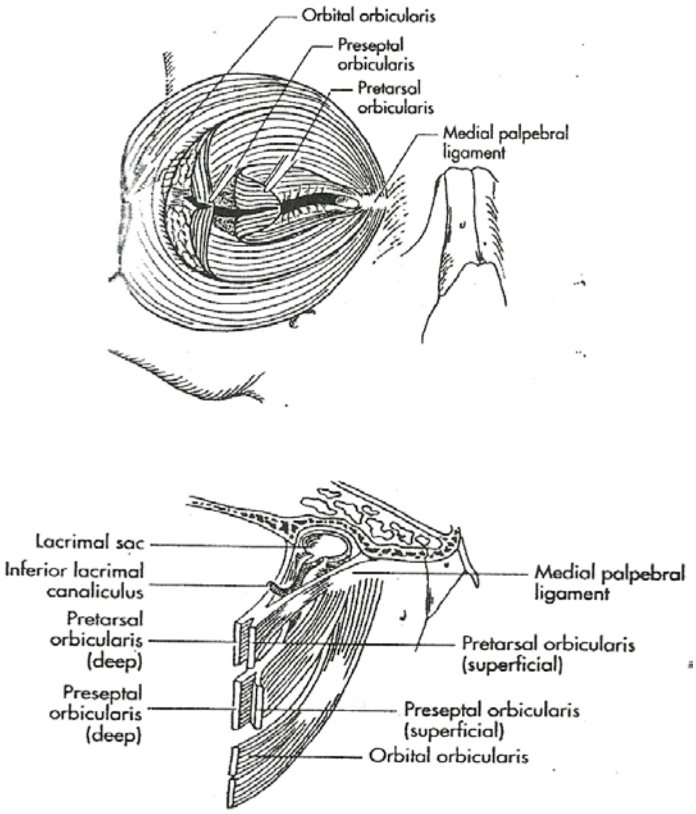

Figure (9): Divisions of the Oribularis Oculi muscle. (From Codner: Reconstruction of the eyelids and orbit in: Plastic Surgery Indications Operations and Outcome (eds). Achauer, Eriksson Guyuron et al.: Philadelphia, Mosby, 87: 1425-1464, 2000).

Anatomy of ear

The ear skin is thin and closely adherent to the underlying cartilage on the anterior aspect until helical rim is reached. From superior to inferior aspect along the rim, the amount of subcutaneous tissue (and consequently the excess skin) in relation to cartilage increases, culminating in an earlobe composed totally of skin and subcutaneous tissue. On the posterior aspect of the ear, the skin is thicker. More subcutaneous tissue is present and blood vessels are abundant. The skin is much less adherent to the cartilage. The configuration of the external ear is complicated and merits careful study **(Jackson, 2007).**

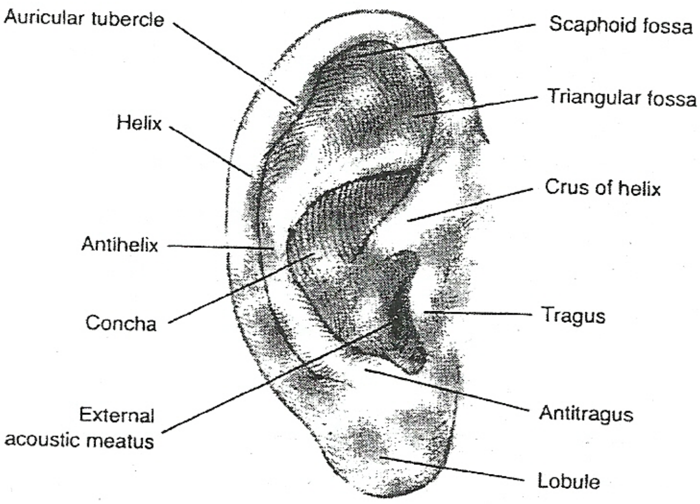

Figure (10): Configuration of the auricle. (From Jackson: Ear reconstruction in: Local flaps in head and neck reconstruction 2nd ed. Quality Medical Publishing Inc. St. Louis 6: 313-364, 2007).

The axis of the ear is on average 20° which is roughly the incline of the dorsum of the nose – although the ear is usually more vertical. The superior attachment of the external ear lies just above the upper eyelid. The ear protrudes from the skull by about 20° **(Chiu andBurd, 2005).**

The rich vascular supply of the ear comes from the **superficial temporal** and **posterior auricular** vessels, which can nourish a nearly avulsed ear even on narrow tissue pedicles **(Brent, 2006).**

The sensory supply is chiefly derived from the inferiorly coursing **great auricular nerve**. Upper portions of the ear are supplied by **lesser occipital** and **auriculo-temporal** nerves, whereas the conchal region is supplied by a branch of the **vagus nerve (Brent, 2006).**

Anatomy of Nose

There are up to nine cosmetic subunits of the nose, (Fig. 11). If a defect is more than half the size of a subunit, cosmetic results may be better by replacing the entire subunit, although not everyone follows this advice as it involves sacrificing 'good' skin. Sebaceous glands on the tip and alar region, consequently skin grafts in this region may look more obvious. The underlying cartilages are very important in maintaining the shape of the nose **(Chiu and Burd, 2005).**

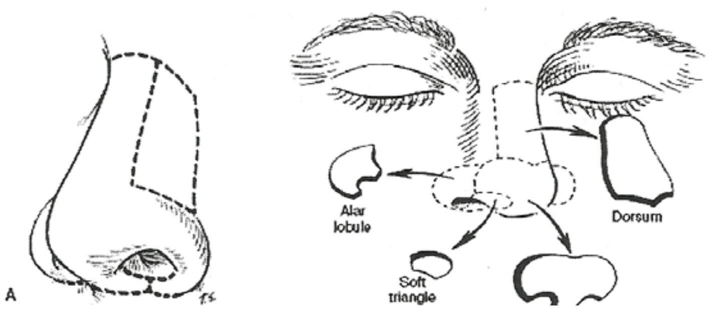

Figure (11): Aesthetic subunits of the nose.
A: Lateral wall subunit. B: The nasal lobule and its aesthetic subunits. (From *Menick FJ:* Nasal reconstruction in: Grabb and Smith's Plastic Surgery 6th ed. (eds.) Thorne CH, Beasley RW, Aston SJ, et al. Lippincott Williams and Wilkins, 38:389-396, 2007.)

The skin of the nose varies in texture and thickness over the nasal surface. The upper two thirds of the nose is covered by thin, smooth, and mobile skin, whereas most of the lower third is thick and pitted, except along the alar rim and columella (Fig. 12). These thick and thin skin zones do not correspond to subunit contour or outline, and are distinct from regional units **(Menick, 2000).**

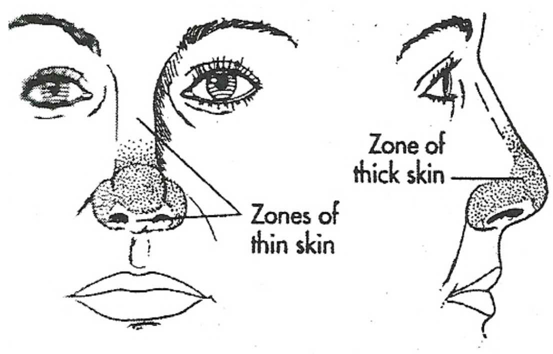

Figure (12): Zones of skin thickness (From Burget and Menick: Aesthetic reconstruction of the nose, Mosby, St. Louis, 1994).