Dermatologic Surgery
Motor Nerves

- **Temporal** branch of facial nerve; innervates frontalis and orbicularis muscles; damage causes EYEBROW PTOSIS

- **Marginal mandibular** branch of facial nerve; innervates orbicularis oris and lip depressors; damage causes LIP WEAKNESS and DRIBBLING WITH EATING/DRINKING

- **Zygomatic** and **buccal** branches overlap territories; damaging zygomatic causes WEAK EYE CLOSURE & ECTROPIION; damaging buccal (lip elevators) causes ORAL DRIBBLING

- **Cervical** branch runs deep, little harm if damaged

- **Accessory nerve (CN XI)**; located in posterior triangle of neck behind SCM at Erb’s point; innervates trapezius muscle; damage causes SHOULDERS DROOP & WINGED SCAPULA
Motor Nerves
Sensory Nerves

• Division of branches of the supratrochlear and supraorbital nerves (V₁) causes FOREHEAD NUMBNESS

• Three sensory nerves emerge from posterior triangle: transverse cervical (C2,3), division numbs ANTERIOR NECK; great auricular (C2,3), division numbs EAR; lesser occipital (C2,3), division numbs POST-AURICULAR AREA
**Anatomy Pearls**

**Sensory Nerves**

- **From ophthalmic division of trigeminal nerve (V₁):**
  - Supraorbital nerve
  - Supratrochlear nerve
  - Palpebral branch of lacrimal nerve
  - Intratrochlear nerve
  - External nasal branch of anterior ethmoidal nerve

- **From maxillary division of trigeminal nerve (V₂):**
  - Infraorbital nerve
  - Zygomaticofacial nerve
  - Zygomaticotemporal nerve

- **From mandibular division of trigeminal nerve (V₃):**
  - Mental nerve
  - Buccal nerve
  - Auriculotemporal nerve

- **Medial branches of dorsal rami of cervical spinal nerves:**
  - Greater occipital nerve (C₂)
  - 3rd occipital nerve (C₃)
  - From 4th, 5th, 6th and 7th nerves in succession below

- **Branches from cervical plexus:**
  - Lesser occipital nerve (C₂, 3)
  - Great auricular nerve (C₂, 3)
  - Transverse cervical nerve (C₂, 3)
  - Supraclavicular nerves (C₃, 4)

- **Ophthalmic nerve (V₁):**
  - Dorsal rami of cervical spinal nerves

- **Maxillary nerve (V₂):**

- **Mandibular nerve (V₃):**

- **Note:** Auricular branch of vagus nerve to external acoustic meatus and small area on postauricular surface of auricle

- **Branches from cervical plexus:**
### Sensory Nerve Blocks

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Territory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supraorbital (V₁)</td>
<td>Forehead</td>
</tr>
<tr>
<td>Supratrochlear (V₁)</td>
<td>Medial forehead</td>
</tr>
<tr>
<td>Infratrochlear (V₁)</td>
<td>Medial upper eyelid, nasal root</td>
</tr>
<tr>
<td>Infraorbital (V₂)</td>
<td>Lower eyelid, cheek, nasal sidewall, upper lip</td>
</tr>
<tr>
<td>Mental (V₃)</td>
<td>Lower lip, chin</td>
</tr>
</tbody>
</table>
Arteries and Veins

Arterial Supply:
- Internal carotid (ophthalmic)
- External carotid

Vulnerable Vessels:
- Superficial temporal artery
- Angular artery (nasolabial)
- Parietal emissary vein (subgaleal space)
- External jugular vein
- Parotid duct (over masseter)
Musculature

SMAS (Superficial musculoaponeurotic system):

- Fibrous sheath on head & neck between dermis and muscular fascia
- Continues on scalp as galea aponeurotica
- Most major vessels within or beneath SMAS

SCALP Layers:

- S = Skin
- C = Connective tissue
- A = Aponeurosis (galea)
- L = Loose areolar connective tissue
- P = Pericranium (periosteum)
Musculature

Anatomy Pearls
Musculature

- Epicranial aponeurosis (galea aponeurotica)
- Frontal belly (frontalis) of epicranius muscle
- Procerus muscle
- Corrugator supercili muscle
- Orbital part
  - Palpebral part
  - of orbicularis oculi muscle
- Levator labii superioris alaeque nasi muscle
- Transverse part
  - Alar part
  - of nasalis muscle
- Levator labii superioris muscle
- Auricularis anterior muscle
- Zygomaticus minor muscle
- Zygomaticus major muscle
- Levator anguli oris muscle
- Depressor septi nasi muscle
- Buccinator muscle
- Risorius muscle
- Orbicularis oris muscle
- Depressor anguli oris muscle
- Depressor labii inferioris muscle
- Mentalis muscle
- Platysma muscle
A: Nose, sebaceous portion (subdermal)
B: Forehead, eyelids, lips, limbs, dorsum of nose (fat/fascia)
C: Forehead vertical wounds (submuscular)
D: Cheek (high subcutis)
E: Beard, sideburns (subfollicular)
F: Scalp (subgaleal)
Local Anesthetics

- Block Na\(^+\) influx into neurons, preventing depolarization
- Preferentially block unmyelinated C-fibers (pain, temp) compared to myelinated A-fibers (pressure, motor)
- All local anesthetics vasodilating except cocaine which vasoconstricts
- Classified into amides and esters
- Amides (e.g. lidocaine) metabolized by liver
- Esters (e.g. procaine) metabolized by plasma pseudocholinesterase. Patients deficient in this enzyme have increased toxicity to esters. Esters cross react w/ PABA.
- Multidose vials contain parabens preservative => allergic rxn
- Pearl: Bupivicaine (Marcaine) longest acting (3-10 hrs)
## Local Anesthetics

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Trade Name</th>
<th>Primary Use</th>
<th>Relative Potency</th>
<th>Onset</th>
<th>Duration* Plain</th>
<th>Maximum† Dose Plain</th>
<th>Maximum† Dose with Epinephrine</th>
</tr>
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<tbody>
<tr>
<td><strong>Amides</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bupivacaine</td>
<td>Marcaine</td>
<td>Infiltration</td>
<td>8</td>
<td>2–10 min</td>
<td>3–10 h</td>
<td>175 mg</td>
<td>250 mg</td>
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<tr>
<td>Dibucaine</td>
<td>Nupercaine</td>
<td>Topical</td>
<td></td>
<td>Rapid</td>
<td>Short</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etidocaine</td>
<td>Duranest</td>
<td>Infiltration</td>
<td>6</td>
<td>3–5 min</td>
<td>3–10 h</td>
<td>300 mg</td>
<td>400 mg</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>Xylocaine</td>
<td>Infiltration/Topical</td>
<td>2</td>
<td>Rapid</td>
<td>1–2 h</td>
<td>300 mg</td>
<td>500 mg (3850 mg dilute)</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>Carbocaine</td>
<td>Infiltration</td>
<td>2</td>
<td>3–20 min</td>
<td>2–3 h</td>
<td>300 mg</td>
<td>400 mg</td>
</tr>
<tr>
<td>Prilocaine</td>
<td>Citanest</td>
<td>Infiltration</td>
<td>2</td>
<td>Rapid</td>
<td>2–4 h</td>
<td>400 mg</td>
<td>600 mg</td>
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<tr>
<td>Prilocaine/Lidocaine</td>
<td>EMLA</td>
<td>Topical</td>
<td>30–120 min</td>
<td>Short</td>
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<tr>
<td><strong>Esters</strong></td>
<td></td>
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<tr>
<td>Benzocaine</td>
<td>Anbesol, etc.</td>
<td>Topical</td>
<td>1</td>
<td>Rapid</td>
<td>Short</td>
<td></td>
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<tr>
<td>Chloroprocaine</td>
<td>Nesacaine</td>
<td>Infiltration</td>
<td></td>
<td>Rapid</td>
<td>0.5–2 h</td>
<td>600 mg</td>
<td></td>
</tr>
<tr>
<td>Cocaine</td>
<td></td>
<td>Topical</td>
<td>1</td>
<td>2–10 min</td>
<td>1–3 h</td>
<td>200 mg</td>
<td></td>
</tr>
<tr>
<td>Procaine</td>
<td>Novocaine</td>
<td>Infiltration</td>
<td>1</td>
<td>Slow</td>
<td>1–1.5 h</td>
<td>500 mg</td>
<td>600 mg</td>
</tr>
<tr>
<td>Proparacaine</td>
<td>Ophthaine</td>
<td>Topical</td>
<td></td>
<td>Rapid</td>
<td>Short</td>
<td></td>
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</tr>
<tr>
<td>Tetracaine</td>
<td>Pontocaine</td>
<td>Infiltration</td>
<td>8</td>
<td>Slow</td>
<td>2–3 h</td>
<td>20 mg</td>
<td></td>
</tr>
<tr>
<td>Tetracaine</td>
<td>Cetacaine</td>
<td>Topical</td>
<td></td>
<td>Rapid</td>
<td>Short</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*In clinical practice, the duration of anesthesia appears to be less than stated above, especially for head and neck areas, and addition of epinephrine prolongs anesthesia by a factor of two.
†Maximum doses are for a 70-kg person.
**Local Anesthetics**

**Lidocaine**

- Lidocaine 1% with 1:10,000 epi is standard
- Lidocaine 1% = 1 g / 100 mL or 10 mg / mL
- **Max doses**: 5 mg/kg of 1% lido; 7 mg/kg of 1% lido with epi; 55 mg/kg for tumescent anesthesia (0.05-0.1% lido with 1:100,000 epi). Max dose for 70 kg patient using standard lido with epi = 490 mg = 49 mL

- **Lidocaine toxicity**:
  - Low blood levels: anxiety, tinnitus, tingling, numbness, nausea, vomiting, metallic taste, diplopia
  - Moderate: nystagmus, tremor
  - High: Convulsions, respiratory arrest
Epinephrine

• **Use**: added to anesthetic for vasoconstrictive properties (bloodless field, longer duration of analgesia)

• **Absolute contraindications**: hyperthyroid, pheochromocytoma

• **Relative contraindications**: HTN, severe CAD, narrow angle glaucoma, pregnancy, β-blockers, MAO inhibitors, TCAs

• **Epinephrine toxicity**:
  - **Low**: palpitations, anxiety, diaphoresis, HA, tremor, weakness
  - **High**: Cardiac arrhythmias, cerebral hemorrhage

• Avoid injection into digits or penis
**Local Anesthetics**

**Topical anesthetics**

- Good for children and lasers
- **EMLA** = Eutectic Mixture of Local Anesthetics = *lidocaine* + *prilocaine*; thick smear necessary
- Tetracaine (amethocaine) gel; thin smear OK, may cause urticaria
- LMX = Lidocaine 4%
Suture Materials

- Monofilament vs braided
- Absorbable vs non-absorbable
- Suture properties:
  - **Memory**: tendency to retain original shape
    Braided = low memory = better knot security
  - **Tissue reactivity**
    Monofilament & synthetic = lower reactivity
  - **Tensile strength**: Synthetic & nonabsorbable = strong
- Silk used for mucosal surfaces
- Maxon & PDS are absorbable sutures with high tensile strength
# Suture Materials

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>Memory</th>
<th>Tissue Reactivity</th>
<th>Tensile Strength Half-Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonabsorbable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>Twisted</td>
<td>Low</td>
<td>Very high</td>
<td></td>
</tr>
<tr>
<td>Nylon (Ethilon, Dermalon)</td>
<td>Monofilament</td>
<td>High</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Nylon (Nurolon, Surgilon)</td>
<td>Braided</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Polybutester (Novafil)</td>
<td>Monofilament</td>
<td>High</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Polyester, uncoated (Mersilene)</td>
<td>Braided</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Polyester, coated (Ethibond)</td>
<td>Braided</td>
<td>Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Polypropylene (Prolene, Surgilene)</td>
<td>Monofilament</td>
<td>Very high</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Silk</td>
<td>Braided/twisted</td>
<td>Very low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Stainless steel</td>
<td>Monofilament/twisted</td>
<td>Very high</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Absorbable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catgut, fast absorbing/mild chromic</td>
<td>Twisted</td>
<td>Very high</td>
<td>High</td>
<td>2 days</td>
</tr>
<tr>
<td>Catgut</td>
<td>Twisted</td>
<td>Very high</td>
<td>High</td>
<td>4 days</td>
</tr>
<tr>
<td>Catgut, chromic</td>
<td>Twisted</td>
<td>Very high</td>
<td>High</td>
<td>1 week</td>
</tr>
<tr>
<td>Polylactic acid (Vicryl)</td>
<td>Braided</td>
<td>Very low</td>
<td>Low</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Poliglycolic acid (Dexon)</td>
<td>Braided</td>
<td>Very low</td>
<td>Low</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Poliglecaprone 25 (Monocryl)</td>
<td>Monofilament</td>
<td>Low</td>
<td>Very low</td>
<td>1 week</td>
</tr>
<tr>
<td>Polyglyconate (Maxon)</td>
<td>Monofilament</td>
<td>Low</td>
<td>Very low</td>
<td>1 month</td>
</tr>
<tr>
<td>Polydoxanone (PDS)</td>
<td>Monofilament</td>
<td>High</td>
<td>Very low</td>
<td>1 month</td>
</tr>
</tbody>
</table>
Suture Needles

- **Anatomy:** Shank, body, point
- **Cutting:** cutting edge on inner curvature of needle facing towards wound edge
- **Reverse cutting** (preferred in skin surgery): cutting edge on outer curvature of needle facing away from wound edge, thus less risk of tearing through skin
<table>
<thead>
<tr>
<th>Suture Technique</th>
<th>Used For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical mattress</td>
<td>Wound eversion, high tension</td>
</tr>
<tr>
<td>Running subcuticular</td>
<td>No suture track marks</td>
</tr>
<tr>
<td>Running simple</td>
<td>Low tension closure</td>
</tr>
<tr>
<td>Figure of eight</td>
<td>Bleeding vessel</td>
</tr>
<tr>
<td>Tip stitch (Half buried horizontal mattress)</td>
<td>Avoid flap tip necrosis</td>
</tr>
<tr>
<td>Pulley stitch</td>
<td>High tension wounds</td>
</tr>
</tbody>
</table>
Good Areas

- Medial canthus
- Nasolabial fold
- Scalp
- Ear concha
- Pre- and post-auricular skin

(Avoid free margin)
Advancement

• Movement in straight line; keep length to width $\leq 3:1$

• Types: Single pedicle, double pedicle, island pedicle, periallar crescentic

Single Pedicle

Island Pedicle

Periallar crescentic
Rotation

- Types: Simple, O-T, O-Z

Simple

O-T

O-Z
Transposition

- Types: Rhombic, banner, bilobed, Z-plasty, nasolabial
Transposition

Z-plasty: breaks up scar lines
Other: Paramedian Forehead Flap

- Two stage transposition flap used for large nasal tip defects
- Vascular supply of pedicle supplied by supratrochlear artery
Grafts

- Types of Grafts:
  - **Split thickness**: Epidermis + variable dermis. Good for large defects, no repair needed at donor site.
  - **Full thickness**: Entire epidermis and dermis. Better cosmesis than STSG, but donor site requires repair.
  - **Composite**: Skin + cartilage, higher failure rate.

- Factors that affect survival:
  - Graft vascularity
  - Wound bed vascularity
  - Graft thickness (thinner does better)
  - Contact between graft and bed (drain hematoma)
Electrosurgery

- **Unipolar** (device tip to electrode on limb), **Bipolar** (between forceps tips), **Monoterminal** (current dissipates in tissue, risk of burns to operator)

- **Electrodessication and electrofulguration**: superficial destruction, *highly dampened* sine waveform current; dessication direct contact with tissue, fulguration arc across gap (*fulgur* = lightning)

- **Electrocoagulation and electrocautery**: deeper penetration, *moderately dampened* waveform; in electrocoagulation, resistance occurs at tissue, so electrode tip at ambient temperature; in electrocautery, resistance at tip which becomes hot and then coagulates by heat transfer

- **Electrosection**: cutting tissue, *undampened* sine waveform
Cryosurgery

<table>
<thead>
<tr>
<th></th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freon</td>
<td>-32 to +3.6°C</td>
</tr>
<tr>
<td>CO₂</td>
<td>-78.5 °C</td>
</tr>
<tr>
<td>NO</td>
<td>-89.5 °C</td>
</tr>
<tr>
<td>LN2</td>
<td>-196.5 °C</td>
</tr>
</tbody>
</table>

- Must reach –50 °C to destroy cancer cells; -25 °C to destroy benign cells
# Melanoma Staging

## Table 1. Staging Criteria for Melanoma

<table>
<thead>
<tr>
<th>Pathological and TNM Stage</th>
<th>Thickness of Lesion</th>
<th>Ulceration</th>
<th>No. of Involved Lymph Nodes</th>
<th>Nodal Involvement</th>
<th>Distant Metastasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>( \leq 1.0 ) mm</td>
<td>No</td>
<td>0</td>
<td>—</td>
<td>No</td>
</tr>
<tr>
<td>IB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1b</td>
<td>( \leq 1.0 ) mm</td>
<td>Yes or Clark level IV or V</td>
<td>0</td>
<td>—</td>
<td>No</td>
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<tr>
<td>T2a</td>
<td>1.01–2.0 mm</td>
<td>No</td>
<td>0</td>
<td>—</td>
<td>No</td>
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<tr>
<td>IIA</td>
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<td></td>
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<td></td>
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<tr>
<td>T2b</td>
<td>1.01–2.0 mm</td>
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<td>0</td>
<td>—</td>
<td>No</td>
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<tr>
<td>T3a</td>
<td>2.01–4.0 mm</td>
<td>No</td>
<td>0</td>
<td>—</td>
<td>No</td>
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<tr>
<td>IIB</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>T3b</td>
<td>2.01–4.0 mm</td>
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<td>—</td>
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<tr>
<td>T4a</td>
<td>( &gt;4.0 ) mm</td>
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<td>0</td>
<td>—</td>
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<tr>
<td>IIC</td>
<td>( &gt;4.0 ) mm</td>
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<td>0</td>
<td>—</td>
<td>No</td>
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<tr>
<td>IIa</td>
<td>N1a</td>
<td>Any</td>
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<td>Microscopic</td>
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<td>2 or 3</td>
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<td>2 or 3</td>
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<tr>
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<td>N1b</td>
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<td>M1c</td>
<td>Any</td>
<td>Any</td>
<td>Other visceral site</td>
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## Merkel Cell Staging

<table>
<thead>
<tr>
<th>Stage</th>
<th>Localized Disease</th>
<th>Lymph Node</th>
<th>Metastasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>Primary lesion &lt;= 2 cm</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>IB</td>
<td>Primary lesion &gt; 2 cm</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>II</td>
<td>Positive lymph node</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>III</td>
<td>Distant metastasis</td>
<td>+/-</td>
<td>+/-</td>
</tr>
</tbody>
</table>
Merkel Cell Treatment

- Biopsy of Primary Lesion Shows MCC
  - Nodes Not Palpable
    - Sentinel Lymph Node Biopsy (SLNB) & Wide Local Excision
      - SLNB Negative
        - Radiotherapy to Primary Site ± Draining Lymph Node Basin
        - Consider Adjuvant Chemotherapy if Primary Lesion > 2 cm
      - SLNB Positive
        - CT Scan of Chest, Abdomen & Pelvis
  - Nodes Palpable
    - Biopsy of Palpable Nodes Show MCC
      - CT Scan Negative
        - Wide Local Excision
      - CT Scan Positive
        - Further Evaluation and Palliative Surgery, Radiotherapy &/or Chemotherapy
    - Biopsy of Palpable Nodes Does Not Show MCC
      - Wide Local Excision

www.merkelcell.org
Electromagnetic Spectrum
## Important Wavelengths

<table>
<thead>
<tr>
<th>Spectrum</th>
<th>Wavelength (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultraviolet</td>
<td>1-400</td>
</tr>
<tr>
<td>UVC</td>
<td>200-280</td>
</tr>
<tr>
<td>UVB</td>
<td>280-320</td>
</tr>
<tr>
<td>nb-UVB</td>
<td>310-312</td>
</tr>
<tr>
<td>UVA2</td>
<td>320-340</td>
</tr>
<tr>
<td>UVA1</td>
<td>340-400</td>
</tr>
<tr>
<td>Visible</td>
<td>400-700</td>
</tr>
<tr>
<td>Infrared</td>
<td>700-10,000</td>
</tr>
</tbody>
</table>
Theory of Lasers

- **How it works:** Energy source excites atoms of lasing medium, atoms decay from metastable state back to ground state, emitting coherent photons

- **Terminology:** energy (joules), power (watts), fluence (joule/cm$^2$), irradiance (watts/cm$^2$)

- **Longer wavelengths** penetrate deeper in skin

- **Laser modes:** continuous, pulsed, Q-switched

- **Selective photothermolysis:** pulse duration < thermal relaxation time

- **Chromophores:** melanin, oxyhemoglobin, water
## Lasers in Dermatology

<table>
<thead>
<tr>
<th>Laser</th>
<th>$\lambda$ (nm)</th>
<th>Target / Use</th>
<th>Tattoo</th>
<th>Risks</th>
<th>Spectrum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excimer</td>
<td>193, 308, 355</td>
<td>Psoriasis, vitiligo, LASIK</td>
<td></td>
<td>Cataract formation</td>
<td>UV</td>
</tr>
<tr>
<td>Argon</td>
<td>488, 514</td>
<td>Vascular, photodynamic</td>
<td></td>
<td></td>
<td>Visible</td>
</tr>
<tr>
<td>Pulsed Dye Green</td>
<td>510</td>
<td>Melanin</td>
<td>Red</td>
<td></td>
<td>Visible</td>
</tr>
<tr>
<td>Copper Vapor / Bromide</td>
<td>512, 578</td>
<td>Vascular, melanin</td>
<td></td>
<td></td>
<td>Visible</td>
</tr>
<tr>
<td>Krypton</td>
<td>520, 568</td>
<td>520 (melanin); 568 (vascular)</td>
<td></td>
<td></td>
<td>Visible</td>
</tr>
<tr>
<td>KTP</td>
<td>532</td>
<td>Vascular, melanin</td>
<td></td>
<td>Retinal injury (low)</td>
<td>Visible</td>
</tr>
<tr>
<td>Freq doub Nd:YAG, LP</td>
<td>532</td>
<td>Telangetasias, melanin</td>
<td></td>
<td>Retinal injury (high)</td>
<td>Visible</td>
</tr>
<tr>
<td>Freq doub Nd:YAG, QS</td>
<td>532</td>
<td>Melanin</td>
<td>Red</td>
<td>Retinal injury (high)</td>
<td>Visible</td>
</tr>
<tr>
<td>Pulsed Dye Yellow</td>
<td>577-600</td>
<td>Vascular (PWS), warts, keloids</td>
<td></td>
<td>Retinal injury (low)</td>
<td>Visible</td>
</tr>
<tr>
<td>Ruby, LP</td>
<td>694</td>
<td>Hair removal</td>
<td></td>
<td>Retinal injury (high)</td>
<td>Visible</td>
</tr>
<tr>
<td>Ruby, QS</td>
<td>694</td>
<td>Lentigines, Nevus Ota</td>
<td>Black, blue, green</td>
<td>Retinal injury (high)</td>
<td>Visible</td>
</tr>
<tr>
<td>Alexandrite, LP</td>
<td>755</td>
<td>Hair removal, leg veins</td>
<td></td>
<td>Retinal injury (high)</td>
<td>Infrared</td>
</tr>
<tr>
<td>Alexandrite, QS</td>
<td>755</td>
<td>Lentigines, Nevus Ota</td>
<td>Black, blue, green</td>
<td>Retinal injury (high)</td>
<td>Infrared</td>
</tr>
<tr>
<td>Diode</td>
<td>800-1000</td>
<td>Hair removal, vascular lesions</td>
<td></td>
<td>Retinal injury (high)</td>
<td>Infrared</td>
</tr>
<tr>
<td>Nd:YAG, LP</td>
<td>1064</td>
<td>Hair removal, vascular lesions</td>
<td></td>
<td>Retinal injury (high)</td>
<td>Infrared</td>
</tr>
<tr>
<td>Nd:YAG, QS</td>
<td>1064</td>
<td>Lentigines, Nevus Ota</td>
<td>Black</td>
<td>Retinal injury (high)</td>
<td>Infrared</td>
</tr>
<tr>
<td>Erb:YAG</td>
<td>2940</td>
<td>Ablate warts, keratoses, skin resurface</td>
<td></td>
<td>Corneal injury, burns</td>
<td>Infrared</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>10,600</td>
<td>Ablate warts, keratoses, skin resurface</td>
<td></td>
<td>Corneal injury, burns</td>
<td>Infrared</td>
</tr>
<tr>
<td>Xenon Flashlamp (IPL)</td>
<td>500-1200</td>
<td>Vascular and pigmented</td>
<td></td>
<td>Retinal injury (low)</td>
<td>Visible/IR</td>
</tr>
</tbody>
</table>
Laser Pearls

- PDL 585 for removal of Port Wine Stains
- CO$_2$ laser for actinic cheilitis
- Scarring from continuous wavelength lasers = Argon, Krypton, Carbon Dioxide
- Excimer laser only UV spectrum laser; causes cataracts
- Corneal injury and burns from Erb:YAG and CO$_2$
- Q-switched lasers best for tattoo removal (short pulse duration good for small compartment size)
- Mechanism of laser tattoo removal: tattoo pigment in lysosomes vaporized, cell destroyed, extracellular phagocytosis and lymphatic clearance of pigment
<table>
<thead>
<tr>
<th>Tattoo color</th>
<th>Compound</th>
<th>Laser to treat</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Mercuric oxide, sulfide</td>
<td>PDL 510, QS FD Nd:YAG</td>
<td>Allergic rxn</td>
</tr>
<tr>
<td>Green</td>
<td>Chromium salts</td>
<td>QS Ruby, QS Alexandrite</td>
<td>Allergic rxn</td>
</tr>
<tr>
<td>Yellow</td>
<td>Cadmium sulfide</td>
<td></td>
<td>Phototoxic rxn</td>
</tr>
<tr>
<td>Black</td>
<td>Carbon</td>
<td>QS Nd:YAG</td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td>Iron oxide</td>
<td></td>
<td>Beware: Reduced form instantaneous darkening</td>
</tr>
<tr>
<td>Dark Blue</td>
<td>Cobalt</td>
<td>QS Ruby, QS Alexandrite</td>
<td>Allergic rxn</td>
</tr>
<tr>
<td>Light Blue</td>
<td>Manganese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>Titanium oxide</td>
<td></td>
<td>Beware: Reduced form instantaneous darkening</td>
</tr>
</tbody>
</table>
Cosmetic Fillers

Categories:

1. **Autologous**: Lipotransfer
   - No risk of rejection; harvesting procedure, fat may be frozen 12-18 months, fat graft survival: 0-80%

2. **Xenograft**: Bovine collagen, hyaluronic acid
   - *Zyderm I, Zyderm II, Zyplast*

3. **Allograft**: Human tissue culture
   - *Cosmoderm, Cosmoplast, Dermalogen, Cymetra, Fascian*

4. **Synthetic substances**
   - Polytetrafluoroethylene
Cosmetic Fillers

Bovine Collagen

- Zyderm I (35 mg/dl), Zyderm II (65 mg/dl), Zyplast
- 98% Type I and 2% Type III collagen, in saline and lido
- Zyderm lasts 3 months, used for superficial wrinkles
- Zyplast crosslinked with glutaraldehyde, lasts longer, less immunogenic, used for deeper creases
- 3% patients hypersensitive, so perform “Double Skin Testing” using Zyderm I. Test at 0 and 2 weeks w/ small subcutaneous injection.
- Rare complications: granuloma, sterile abscess
Hyaluronic Acid

- Natural occurring polymer polysaccharide of glucuronic acid and N-acetyl glucosamine
- Chemical composition same between species
- Lasts 6 months
- Hylaform (Hylan B gel): derived from rooster combs
- Restylane, Perlane: fermentation product of Streptococcus
Human Collagen

• No skin testing necessary

• Cosmoderm (superficial dermis), Cosmoplast (deep); derived from cell culture of human foreskin fibrocytes

• Others: Cymetra, Isolagen, Autologen, Fascian
Botulinum Toxin

- Polypeptide derived from *Clostridium botulinum*
- Seven serotypes (A-G), BTX-A used in dermatology
- Applications: Facial lines, brow ptosis, hyperhidrosis
- Mechanism: inhibits release of acetylcholine from pre-synaptic terminal at NMJ; heavy chain of BTX binds presynaptic receptors allowing endocytosis of light chain, causing degradation of docking and fusion machinery
- Adverse effects: does not cross blood-brain barrier, ptosis, ectropion, diplopia
- Drug interactions: potentiated by aminoglycosides, blocked by antimalarials
Dermabrasion

- Removal of epidermis and papillary dermis with a motorized wire brush or diamond fraise
- **Uses**: acne scars, traumatic scars, photodamage, wrinkles, AKs, SKs, rhinophyma, syringomas, small cysts, tattoos
- **Contraindications**: isotretinoin within past year, surgery within past year involving extensive undermining, keloid diathesis, active HSV or bacterial infection
- **Post-op**: reepithelialization 5-7 days, persistent erythema 4-8 weeks, sun protection necessary
- **Microdermabrasion**: Aluminum oxide or sodium chloride microcrystals used to remove epidermis
Uses: shallow rhytids, photodamage, acne scarring, AKs, SKs, freckles, lentigines, melasma

Ideal patient light skin; avoid neck (scarring); acyclovir prophylaxis if history of HSV

Superficial: Granular layer / papillary dermis
  - TCA 10-25%, resorcinol, Jessner’s, salicylic acid, alpha-hydroxy acids, dry ice, tretinoin

Medium: Papillary dermis / upper reticular dermis
  - Phenol 88% or combination peels of 35% TCA + (CO2, Jessner’s, glycolic acid). Phenol associated w/ CARDIAC ARRHYTHMIAS

Deep: Mid-reticular dermis
  - Baker’s phenol-croton oil.
Hair Removal

• Temporary Methods:
  • Plucking/Waxing/Epilation: safe, lasts 6-8 weeks, irritation
  • Chemical depilation: thioglycolates disrupt disulfide bonds, lasts 2 weeks, irritation & sulfurous odor; useful for PFB
  • Eflornithine (Vaniqa) cream: inhibits ornithine decarboxylase, FDA approved for facial hair in women

• Permanent Methods:
  • Electrolysis: needle inserted into hair follicle and DC or AC current applied to destroy matrix, best results 15-25% regrowth after 6 months, painful, caution pacemakers and hx of HSV
  • Laser: selective photothermolysis of melanin in matrix, ideal patient light skin & dark hair, risks: PIPA / pain / scarring
Practice Questions
<table>
<thead>
<tr>
<th>Laser Type</th>
<th>Wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nd:YAG</td>
<td>A. 585 nm</td>
</tr>
<tr>
<td>PDL Yellow</td>
<td>B. 755 nm</td>
</tr>
<tr>
<td>Alexandrite</td>
<td>C. 1064 nm</td>
</tr>
<tr>
<td>CO2</td>
<td>D. 2940 nm</td>
</tr>
<tr>
<td>Erb:YAG</td>
<td>E. 10,600 nm</td>
</tr>
<tr>
<td>Laser</td>
<td>Wavelength</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>1) Nd:YAG</td>
<td>C. 1064 nm</td>
</tr>
<tr>
<td>2) PDL Yellow</td>
<td>A. 585 nm</td>
</tr>
<tr>
<td>3) Alexandrite</td>
<td>B. 755 nm</td>
</tr>
<tr>
<td>4) CO2</td>
<td>E. 10,600 nm</td>
</tr>
<tr>
<td>5) Erb:YAG</td>
<td>D. 2940 nm</td>
</tr>
</tbody>
</table>
Which two branches of the facial nerve are most susceptible to damage during skin surgery?
Which two branches of the facial nerve are most susceptible to damage during skin surgery?

1. Temporal (unilateral eyebrow ptosis)

2. Marginal Mandibular (oral incontinence)
What is the maximum volume of 1% lidocaine without epinephrine that can be given to a 60 kg adult?
What is the maximum volume of 1% lidocaine without epinephrine that can be given to a 60 kg adult?

$60 \text{ kg} \times 5 \text{ mg/kg} = 300 \text{ mg} = 30 \text{ mL}$
Which suture material is most appropriate for use on mucosal surfaces?
Which suture material is most appropriate for use on mucosal surfaces?

Silk.
Which type of suture needle has a greater risk of tearing through the skin, cutting or reverse cutting?
Which type of suture needle has a greater risk of tearing through a skin wound edge, cutting or reverse cutting?

Cutting.
Which of the following sites is best for second intention healing?

A. Forehead
B. Nasal tip
C. Medial canthus
D. Chin
E. Lower eyelid
Which of the following sites is best for second intention healing?

A. Forehead
B. Nasal tip
C. Medial canthus
D. Chin
E. Lower eyelid
Match the flap with its type:

1) O-Z
2) Island pedicle
3) Bilobed
4) Z-plasty
5) Periallar crescentic

A. Advancement
B. Rotation
C. Transposition
D. Inversion
E. Transalignment
Match the flap with its type:

1) O-Z  ➡️  B. Rotation
2) Island pedicle  ➡️  A. Advancement
3) Bilobed  ➡️  C. Transposition
4) Z-plasty  ➡️  C. Transposition
5) Periallar crescentic  ➡️  A. Advancement
Electrocoagulation utilizes which type of current?

A. Undampened waveform
B. Moderately dampened waveform
C. Highly dampened waveform
D. Accelerated waveform
E. Decelerated waveform
Electrocoagulation utilizes which type of current?

A. Undampened waveform

B. Moderately dampened waveform

C. Highly dampened waveform

D. Accelerated waveform

E. Decelerated waveform
What is the standard surgical margin for a melanoma in situ?

A. 4 mm
B. 5 mm
C. 10 mm
D. 1 cm
E. 2 cm
What is the standard surgical margin for a melanoma in situ?

A. 4 mm
B. 5 mm
C. 10 mm
D. 1 cm
E. 2 cm
Match the spectrum with the wavelength:

1) UVA2  
   - A. 200-280 nm

2) UVC  
   - B. 280-320 nm

3) UVB  
   - C. 320-340 nm

4) Infrared  
   - D. 400-700 nm

5) Visible  
   - E. 700-10^5 nm
Match the spectrum with the wavelength:

1) UVA2  ➔  C. 320-340 nm
2) UVC  ➔  A. 200-280 nm
3) UVB  ➔  B. 280-320 nm
4) Infrared  ➔  E. 700-10^5 nm
5) Visible  ➔  D. 400-700 nm
Which of the following lasers emits in the UV range?

A. CO2
B. Nd:YAG
C. KTP
D. Excimer
E. Alexandrite
Which of the following lasers emits in the UV range?

A. CO2
B. Nd:YAG
C. KTP
D. Excimer
E. Alexandrite
Zyderm II is composed of which type(s) of bovine collagen?

A. Collagen I
B. Collagen II
C. Collagen III
D. Collagen I + II
E. Collagen I + III
Zyderm II is composed of which type(s) of bovine collagen?

A. Collagen I
B. Collagen II
C. Collagen III
D. Collagen I + II
E. Collagen I + III
Which of the following lasers is most likely to cause scarring?

A. KTP
B. Diode
C. Argon
D. Erb:YAG
E. PDL
Which of the following lasers is most likely to cause scarring?

A. KTP
B. Diode
C. Argon
D. Erb:YAG
E. PDL
Which of the following color tattoos is associated with immediate adverse darkening with laser treatment?

A. Yellow
B. Blue
C. Green
D. White
E. Blue
Which of the following color tattoos is associated with immediate adverse darkening with laser treatment?

A. Yellow
B. Blue
C. Green
D. White
E. Blue
Which of the following is a contraindication to dermabrasion?

A. Isotretinoin within past year
B. Recent surgery with undermining in area of treatment
C. Keloid diathesis
D. Active HSV infection
E. All of the above
Which of the following is a contraindication to dermabrasion?

A. Isotretinoin within past year
B. Recent surgery with undermining in area of treatment
C. Keloid diathesis
D. Active HSV infection
E. All of the above
EMLA (Eutectic Mixture of Local Anesthetics) consists of which of the following?

A. Lidocaine + Procaine
B. Lidocaine + Marcaine
C. Lidocaine + Prilocaine
D. Lidocaine + Tetracaine
E. Procaine + Prilocaine
EMLA (Eutectic Mixture of Local Anesthetics) consists of which of the following?

A. Lidocaine + Procaine
B. Lidocaine + Marcaine
C. Lidocaine + Prilocaine
D. Lidocaine + Tetracaine
E. Procaine + Prilocaine
Which vessel may be damaged during subgaleal dissection of the scalp?
Which vessel may be damaged during subgaleal dissection of the scalp?

Parietal emissary vein.
Which tattoo pigment is most commonly associated with a phototoxic reaction?
Which tattoo pigment is most commonly associated with a phototoxic reaction?

Cadmium sulfide (yellow).
Which of the following lasers is most likely to damage the cornea?

A. Q-switched Nd:YAG
B. Frequency-doubled QS Nd:YAG
C. Argon
D. Erb:YAG
E. Pulse Dye Green
Which of the following lasers is most likely to damage the cornea?

A. Q-switched Nd:YAG
B. Frequency-doubled QS Nd:YAG
C. Argon
D. Erb:YAG
E. Pulse Dye Green
Damage to which nerve causes shoulder droop? Where does this nerve emerge?
Damage to which nerve causes shoulder drop? Where does this nerve emerge?

Spinal accessory nerve (CN XI). It emerges from the posterior triangle of the neck at Erb’s point.
Which of the following regional blocks is used to produce anesthesia of the upper lip?

A. Supratrochlear
B. Infratrochlear
C. Infraorbital
D. Mental
E. Buccal
Which of the following regional blocks is used to produce anesthesia of the upper lip?

A. Supratrochlear
B. Infratrochlear
C. Infraorbital
D. Mental
E. Buccal