Basics of Male Genital Anatomy and Physiology
Bird’s eye view of penile anatomy

• Surrounding organs and tissues
Penile structures
Internal Structure of the Penis

- Corpora cavernosa
- Glans penis
- Urethral opening
- Corona
- Urethra
- Corpus spongiosum
Corpora Cavernosa

- Pubic symphysis
- Cavernosal artery
- Tunica albuginea
- Crus
- Corpus cavernosum
- Corpus spongiosum
- Urethra
- Glans
Transverse section of normal penis

- Superficial dorsal vein
- Deep dorsal vein
- Dorsal artery and nerve
- Tunica albuginea
- Cavernous artery
- Corpora cavernosa
- Urethra
- Corpus spongiosum
- Urethra artery

© 2003 University of Florida
Vascular anatomy

- Arterial supply
- Venous drainage
- Micro-circulation
Figure 1.4 Venous drainage of the penis.
Venous drainage of the corpora

- Periprostatic plexus
- Cavernosal vein
- Internal pudendal vein
- Bulbar vein
- Deep dorsal vein
- Circumflex vein
- Subtunical venous plexus
- Retrocoronal venous plexus
Penile Venous Drainage

Cavernous Bodies: Flaccid and Erect State

Flaccid state:
- Cavernous muscle contracted
- Cavernous bodies empty

Erection:
- Increase of blood supply
- Cavernous bodies filled up with blood, erection occurs

Deep dorsal vein
Helicine arteries
Tunica albuginea
Deep penile artery
Veno-occlusive Mechanism
Veno-occlusive Mechanism
Normal penile erection mechanism is dependent on a delicate balance between corporal smooth muscle contraction and relaxation.
Penile Innervation and spinal cord involvement in erection

Parasympathetic pro-erectile origin: Limbic system Hypothalamus (PVN, MPA)

Activate Dopaminergic, oxytocinergic and melanocortin receptors

Spinal cord

Thoracolumbar erection center (T11-L2)

Sacral erection center (S2-S4)

Reflexogenic stimulation

Tactile stimulation of the genitals

Bowel or bladder stimuli

Visual
Auditory
Tactile
Olfactory
Gustatory
Memory
Imagination

Psychogenic stimulation

Vasodilation

Increased blood flow through penis

Erection

Flaccid penis

Erect penis

Nervi erigentes
The Autonomic Nerve Supply of the Pelvic and Genital Region

Source: Netter Atlas
Neural Anatomy

- Parasympathetic nerve supply (pelvic n.)
- Sympathetic nerve supply (hypogastric n)
- Somatic nerve supply (pudendal n)
Mechanism/Physiology of Erection (Nervous system)

1. Erotic stimuli
2. Neural initiation
3. Cellular activation
   - L-Arginine
   - NO
   - Guanylate cyclase
   - cGMP
   - Phosphodiesterase 5
4. Relaxation of cavernous smooth musculature
5. Erection
Physiology of Erection

Stimulatory Neurotransmitter
- Dopamine, NO, Oxytocin
- NE (partly), Serotonin (partly)
- alpha-MSH, Vasopressin, ACTH

Splanchnic nerve

Parasympathetic nerves

Endothelial cell

O$_2$ + L-Arginine $\rightarrow$ eNOS $\rightarrow$ NO + Citrulline

Nerve terminal

Smooth muscle cell

Splanchnic nerve

sCerebral sex center

Erotic stimuli
(visual, tactile, imaginary)
Erectile Mechanism
Figure 4.1 Phosphodiesterase type 5 inhibition prevents cGMP breakdown and thereby enhances the normal erectile response.

**NO**  Nitric oxide
**NANC** Nonadrenergic–noncholinergic neurones
**GTP** Guanosine triphosphate

Endothelial cells

- NANC
- NO
- Guanylate cyclase
- cGMP
- PDE 5
- GMP
- GTP
- RELAX
- Penile erection
Figure 1.6 Factors that influence balance between erection and flaccidity.

- PGE<sub>1</sub> Prostaglandin E<sub>1</sub>
- VIP Vasoactive intestinal polypeptide
- NO Nitric oxide
- NA Noradrenaline
Functional (Psychogenic) ED

Stress/distress, performance anxiety

Increased sympathetic tone (Adrenalin↑)

ED
Other Endothelial factors

• Angiotensin- regulation of the cavernous smooth muscle tone (contraction)
• Endothelin (contraction)
• Prostanoids (PGE1- Relaxation), PGE2- Contraction)
• Bradykinin (Relaxation)
Penile Dimensions

Glans penis

Corpus Cavernosum (shaft)

Testis (in scrotum)

Foreskin

Scrotum

Glans
Penile Dimensions

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Mean or range age, years</th>
<th>Population</th>
<th>Flaccid*</th>
<th>stretched length</th>
<th>circumference</th>
<th>suprapubic fat depth</th>
<th>Erect*</th>
<th>circumference</th>
</tr>
</thead>
<tbody>
<tr>
<td>[54]</td>
<td>2770</td>
<td>20–59</td>
<td>–</td>
<td>9.7</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>15.5</td>
<td>–</td>
</tr>
<tr>
<td>[19]</td>
<td>156</td>
<td>–</td>
<td>Mostly Caucasian</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>16</td>
<td>13.5 (base)</td>
</tr>
<tr>
<td>[14]</td>
<td>80</td>
<td>54</td>
<td>White 67.5%, Black 20%, Asian 12.5%</td>
<td>8.85</td>
<td>12.5</td>
<td>9.7 (mid shaft)</td>
<td>2.85</td>
<td>12.89</td>
<td>12.3 (mid shaft)</td>
</tr>
<tr>
<td>[20]</td>
<td>184</td>
<td>–</td>
<td>Heterosexual 60%</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>15.71</td>
<td>13.2 (base)</td>
</tr>
<tr>
<td>[16]</td>
<td>813</td>
<td>30.8</td>
<td>All homosexual</td>
<td>10.4</td>
<td>–</td>
<td>9.8 (max)</td>
<td>–</td>
<td>16.4</td>
<td>12.6 (max)</td>
</tr>
<tr>
<td></td>
<td>3417</td>
<td>30.5</td>
<td>All heterosexual</td>
<td>9.8</td>
<td>–</td>
<td>9.4 (max)</td>
<td>–</td>
<td>15.6</td>
<td>12.2 (max)</td>
</tr>
<tr>
<td>[15]</td>
<td>111</td>
<td>18–19</td>
<td>Potent German men</td>
<td>8.6</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>14.48</td>
<td>–</td>
</tr>
<tr>
<td>[18]</td>
<td>3300</td>
<td>17–19</td>
<td>German men with ED</td>
<td>9.22</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>14.18</td>
<td>–</td>
</tr>
<tr>
<td>[21]</td>
<td>200</td>
<td>20–22</td>
<td>Italian men</td>
<td>9</td>
<td>12.5</td>
<td>10 (mid shaft)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>[22]</td>
<td>104</td>
<td>54</td>
<td>Turkish men</td>
<td>6.8</td>
<td>8.98</td>
<td>–</td>
<td>–</td>
<td>12.7</td>
<td>–</td>
</tr>
<tr>
<td>[17]</td>
<td>124</td>
<td>59</td>
<td>British men</td>
<td>–</td>
<td>13 (median)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After RP</td>
<td>8</td>
<td>12.5</td>
<td>10 (mid shaft)</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Korean men</td>
<td>6.9</td>
<td>9.6</td>
<td>8.5 (mid shaft)</td>
<td>1.1</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Stretched and Erect Length

Erect length (cms) vs Stretched length (cms) graph with an R-squared value of 0.793.

Wessells et al, 1996
Stretched Penile Length (n=80)

Wessells et al, 1996
Penile Size

• The studies show reasonable consistency
  – Stretched length is approximately 2-3 cms shorter than the erect length, but correlates well with it
• True micropenis is under 7cms length
• Little data on (presumed) racial differences
• Homosexual men appear to have larger penises than heterosexual men
• Pelvis surgery appears to result in reduced penile length
• ED appears to result in reduced penile length
Penile Dimensions

The mean flaccid penis length - 9.8 ±1.84 cm (3.89 inches). (12-13cm stretched)

The mean flaccid circumference - 9.4 cm (3.75 inches)

The mean erect penis length - 13-15.6±1.9cm (5.13 in.)

The mean erect circumference - 11.39 cm. (4.48 in.)

Randy Klein. PENILE AUGMENTATION SURGERY Electronic Journal of Human Sexuality, Volume 2,1999

Somatic motoneurons of the bulbo and ischio cavernous muscles are T dependent.