Norepinephrine (NE) Epinephrine (E) Receptors

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Norepinephrine, epinephrine, are in the class of **catecholamines** and they bind to adrenergic receptors.
Norepinephrine (noradrenalin)

- Released by the sympathetic postganglionic nerve endings
Epinephrine (adrenalin)

- A methyl derivative of norepinephrine. It is primarily an emergency hormone produced by the adrenal medulla.
Sympathetic Division

Both NE and E affect sympathetic nerves

- NE is neurotransmitter
- E is hormone
  - Increase heart rate and strength of contraction
  - Mobilize glucose from liver
  - Inhibit digestive activity
Synthesis of E and NE

- **TYROSINE**
  - tyrosine-3-monoxygenase
  - tyrosine hydroxylase
  - tetrahydrobiopterin

- **DOPA**
  - aromatic L-amino acid decarboxylase
  - pyridoxal phosphate

- **DOPAMINE**
  - dopamine β-hydroxylase
  - ascorbate

- **NOREPINEPHRINE**
  - phenylethanolamine-N-methyltransferase
  - S-adenosylmethionine

- **EPINEPHRINE**
Adrenergic Receptors

- Seven-pass transmembrane proteins that are coupled to G proteins
- There are multiple receptor types which are differentially expressed in different tissues and cells.
Two main families of adrenergic receptors

- Alpha (α)
- Beta (β)
Adrenergic Receptor Subtypes
Main Type of Adrenergic Receptors
Receptor Agonists Second Messenger G protein

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Agonists</th>
<th>Second Messenger</th>
<th>G protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>alpha₁ (α₁)</td>
<td>E&gt;NE</td>
<td>IP₃/Ca²⁺; DAG</td>
<td>G&lt;sub&gt;q&lt;/sub&gt;</td>
</tr>
<tr>
<td>alpha₂ (α₂)</td>
<td>NE&gt;E</td>
<td>↓ cyclic AMP</td>
<td>G&lt;sub&gt;i&lt;/sub&gt;</td>
</tr>
<tr>
<td>beta₁ (β₁)</td>
<td>E=NE</td>
<td>↑ cyclic AMP</td>
<td>G&lt;sub&gt;s&lt;/sub&gt;</td>
</tr>
<tr>
<td>beta₂ (β₂)</td>
<td>E&gt;&gt;NE</td>
<td>↑ cyclic AMP</td>
<td>G&lt;sub&gt;s&lt;/sub&gt;</td>
</tr>
<tr>
<td>Process</td>
<td>$\alpha_1$-receptor (IP$_3$, DAG)</td>
<td>$\alpha_2$-receptor ($\downarrow$ cAMP)</td>
<td>$\beta_1$-receptor ($\uparrow$ cAMP)</td>
</tr>
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<td>-------------------------</td>
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<tr>
<td>Carbohydrate metabolism</td>
<td>$\uparrow$ liver glycogenolysis</td>
<td>No effect</td>
<td>No effect</td>
</tr>
<tr>
<td>Fat metabolism</td>
<td>No effect</td>
<td>$\downarrow$ lipolysis</td>
<td>$\uparrow$ lipolysis</td>
</tr>
<tr>
<td>Hormone secretion</td>
<td>No effect</td>
<td>$\downarrow$ insulin secretion</td>
<td>No effect</td>
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Norepinephrine
References:

- http://www.neuro.wustl.edu/neuromuscular/lab/catechol.htm#ne
- http://arbl.cvmbs.colostate.edu/hbooks/pathphys/endocrine/adrenal/medhormones.html
- http://www.sosu.edu/faculty/mturnage/Fall%2003%20folders/