BMSN1601– Anatomy – Part III (L18-L20)

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| Introduction to The Endocrine System |

*# Gland: any specialized group of cells, makes and secretes a hormone*

◉ Hormones regulate the following body functions:

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| Mood | Sleep Cycle | Growth and Development |
| Metabolism and Energy Balance | Body Defense | Reproductive Process |

◉ Location of Major Endocrine Glands

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| Common Major Endocrine Glands | Pituitary gland |
| Pineal gland |
| Thyroid gland |
| Parathyroid gland |
| Hypothalamus |
| Thymus |
| Pancreas |
| Adrenal glands |
| Female Only: Major Endocrine Gland | Ovary |
| During Pregnancy Only: Major Endocrine Gland | Placenta |
| Male Only: Major Endocrine Gland | Testicle |

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| Secretion of Hormone – Mode of Action |

◉ Endocrine Glands has 3 Mode of Action to secret the hormone

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| Endocrine Signaling | Paracrine Signaling | Autocrine Signaling |
| ◉ Act on distant cells | ◉ Act on cells next to secreting cell | ◉ Act on cell that secreted them |
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| Exocrine Gland versus Endocrine Gland |

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| Endocrine | Exocrine |
| Do not have ducts (Ductless) | Do have ducts |
| Secret Hormone | Secret Sweat, Enzymes, Mucus, Sebum (皮脂) |
| Finally Carry to the ICF | Finally Carry to the outside of the body or into a body cavity |

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| Classification of Hormone – Structural Difference |

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| Amino acid derivatives (Amines) | Peptide and Proteins Hormone | Steroid (類固醇) |

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| Introduction to Amine Hormone (Amino acid derivatives) |

◉ Amine Hormones are **derivatives of the amino acid tyrosine**.

◉ Half-Life: minutes to few days

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| Amine Hormone | Thyroid Hormone | From **Thyroid Gland** |
| Epinephrine | From **Adrenal Medulla** |
| Norepinephrine |
| Dopamine | From **Hypothalamus** |

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| Introduction to Peptide Hormone |

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◉ There is a signal peptide in the polypeptide to tell the cell whether the Hormones:

▨ Should be encapsulated in cell

▨ directly release to the blood vessel

◉ The cell may secrete **multiple peptide hormones**—*derived from the same prohormone*—each of which differs in its

effects on target cells.

◉ Release the contents of the secretory vesicles by **exocytosis**

◉ Relative Half Life in Blood: minutes

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| Introduction to Steroid Hormone |

◉ Steroid Hormone are **derived from cholesterol (e.g.: cortisol)** and primarily produced by the:

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| Adrenal Cortex | Gonads (Testes / Ovaries) | Placenta (During pregnancy) |

◉ Vitamin D can be converted into active steroid hormone @ Liver / Kidney

◉ Steroid hormones **diffuse across the plasma membrane** into the circulation

▨ Reversibly **bound to carrier proteins such as albumin** in plasma

◉ **Synthesized in sER on demand** because of **longer half-life**

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| Summary of Amine Hormone, Peptide Hormone, Steroid Hormone |

◉ Do notice that: catecholamines and thyroid hormone are Amine Hormone

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|  | Major Form in Plasma | Location of Receptors | Rate |
| Peptides and catecholamines | Free | Plasma Membrane | Fast (minutes) |
| Steroids and thyroid hormone | Protein-bound | Intracellular | Slow (hours to day) |

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| Introduction to Some Important Hormone – Part I |

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| Introduction to Some Important Hormone – Part II |

表格

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| Introduction to Mechanism of Hormone Action |

◉ A hormone **can only trigger A SINGLE REACTION** in **SEPECIFIC CELLS**

*Hormone Receptors can also be triggered by the hormones which have high structural similarity hormone.*

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| Water-Soluble Hormone  (Peptides & Catecholamines Hormone) | Lipid-Soluble Hormone  (Steroid & Thyroid Hormone) |
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| ◉ Attach to the Membrane Protein and trigger series  Responses through Signal transduction.  ◉ Responses including:  ▨ Cytoplasmic Responses  ▨ Nuclear Responses | ◉ The Receptors are inside the Nucleus  ◉ Responses including:  ▨ Nuclear Responses [Controlling Gene Expression] |

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| 💦 | Supplementary Note:  ◉ Cytoplasmic Responses: Transport specific/some substance from intracellular vesicle release to the extracellular  fluid.  ◉ Nuclear Responses: Induce Gene Expression or Silencing Gene Expression. |

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| Hormone Interaction At Whole Body Level – Redundant Effect |

◉ **Safe-guard mechanism for very important metabolism**

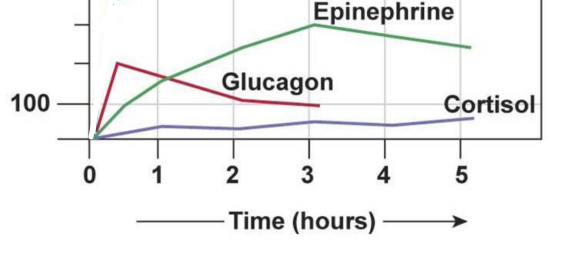
◉ **Produce synergistic outcome:**

combine action of redundant hormones to produce effects greater than the sum of their individual effects

◉ Definition: *Different hormones produce same effect*

◉ Case Study: Epinephrine, glucagon, and cortisol can all act on liver to increase blood glucose level. Although the result is

the same, the **mechanisms and time constant are different**.



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| Epinephrine (Adrenaline) | Glucagon | Cortisol |
| Amino Acid Derivative Hormone | Peptide Hormone | Steroid |
| ◉ Via Sympathetic Nerve System  🡪 Take times for Sympathetic Nerve  System to work. | ◉ Faster as 2 Responses are induced  (Cytoplasmic & Nuclear Response) | ◉ Only 1 Response is induced  (Controlling Gene Expression - Slow) |

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| Hormone Interaction At Whole Body Level – Reinforcement effects |

◉ Definition:

**Acts in different tissues to induce different responses which reinforce each other from perspective of body.**

◉ Case Study: Effect of Cortisol in Our Body

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| Pancreas | Adipose Tissue | Skeletal Muscle |
| Decrease Insulin Secretion | Increase break down of lipid | Increase break down of protein |
| * Maintain Blood Glucose Level | * Converting fatty acid into glucose in Liver | * Converting amino acid into glucose in Liver |
| **Blood Glucose Level is Increased** | | |