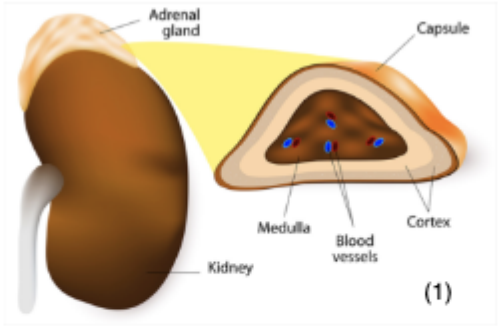
THE ADRENAL GLAND

FUNDAMENTAL FUNCTIONS

› Involved in the manufacture and secretion of *hormones* (1)
› Regulate blood pressure, the immune system, response to stress and the sleep/wake cycle



(1)

OUTER ADRENAL CORTEX

› Secretes two corticosteroid hormones: *cortisol* and *aldosterone* (2)

	CORTISOL	ALDOSTERONE
REGULATION	› Body's use of fats and carbs › Suppression of inflammation › Sleep/wake cycles	› Blood pressure and pH (through electrolyte regulation in blood and urine)
PRODUCTION	› Hypothalamus (CRH) → pituitary gland (ACTH) → hormone release to promote cortisol secretion	› Signals from kidneys

(2)

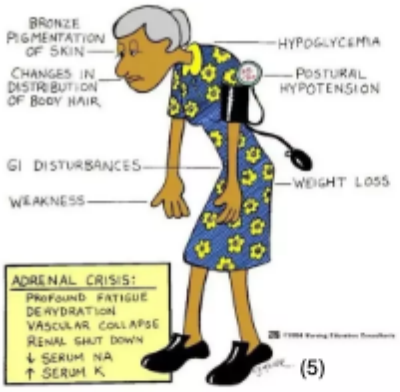
INNER ADRENAL MEDULLA

› Secretes *adrenaline* and *noradrenaline*
› Adrenaline, produced by suprarenal glands, is involved in response to *external stress*
› Adrenal glands trigger hypothalamus to promote production and secretion of adrenaline into bloodstream (2)

	ADRENALINE	NORADRENALINE
EFFECT ON BODY	› Increase heart rate › Increase blood sugar levels › Airway's smooth muscles relax (promotes O_2 intake)	› Vasoconstriction, which leads to high blood pressure

(2)

ADDISON'S DISEASE



(5)

› Occurs when adrenal glands fail to produce sufficient cortisol or aldosterone (3)
› Symptoms often overlooked due to similarities in symptoms of other diseases as well as slow appearance (4)
› Common symptoms include weight loss, weakness, abdominal pain, darker skin (knees, toes and lips) (4)
› Most common diagnosis is through blood test (6)

CAUSES (4)
› Damage to adrenal glands (eg due to autoimmune diseases)
› Infections or viruses (such as tuberculosis, HIV, AIDS)
› Difficulties in the production of hormones due to genetics
› Cancer cells in adrenal glands
› Bleeding in adrenal glands

ADRENAL CRISIS (7)
› A life-threatening condition that occurs in patients who do not take regular medication, as well as those who have yet to be diagnosed
› Triggered by highly stressful situations as adrenal glands fail to produce stress-managing hormones
› Symptoms may include extreme weakness, mental confusion, extremely low blood pressure, dizziness...
› Those experiencing Adrenal crisis must immediately be injected with corticosteroid in order to raise cortisol levels in blood (4)

TREATMENTS

› Prior to 1930s, 80% of Addison's Disease patients died `within two years (8, 10)

EXISTING TREATMENT
› *Glucocorticoids* replace the missing aldosterone and cortisol (8)
› *Short-acting* glucocorticoids roughly mimic normal rhythm of cortisol release
› *Long-acting* glucocorticoids have smoother physiological effects, avoiding marked changes in dose

`	SHORT-ACTING	LONG ACTING
PROS	› Dose can be adjusted	› More easily administered in those with non-compliant schedule
CONS	› True rhythm cannot be replicated › Symptoms of fatigue, nausea and headaches	› Correct dose is hard to determine

ALTERNATIVE TREATMENT
› Transplantations of cortical adrenal tissue appeared in literature as early as 1951
› Successful in experimental animals, yet to be achieved in humans (11)

IMPLICATIONS (12)
› Those suffering from adrenal insufficiency receive much higher levels of glucocorticoids than otherwise produced
› May give rise to adverse effects on one's bones
› Data gathered from UK, NZ and NO measuring bone mineral density in femoral neck and lumbar spine
› Results show that bone mineral density was significantly lower in neck and spine of those with Addison's disease
› Significantly lower in males compared to females
› Similar trends found in hip and spine

REFERENCES

1. Adrenal Glands 101 [Internet]. Hopkinsmedicine.org. 2018 [cited 28 October 2018]. Available from: https://www.hopkinsmedicine.org/healthlibrary/conditions/endocrinology/adrenal_glands_85,p00399
2. Robert M. Sargis MD P. An Overview of the Adrenal Glands [Internet]. EndocrineWeb. 2018 [cited 28 October 2018]. Available from: https://www.endocrineweb.com/endocrinology/overview-adrenal-glands
3. Addison's Disease [Internet]. 2018 [cited 6 November 2018]. Available from: https://www.healthline.com/health/addisons-disease
4. Information H, Diseases E, Disease A, Disease A, Center T, Health N. Adrenal Insufficiency & Addison's Disease | NIDDK [Internet]. National Institute of Diabetes and Digestive and Kidney Diseases. 2018 [cited 4 November 2018]. Available from: https://www.niddk.nih.gov/health-information/endocrine-diseases/adrenal-insufficiency-addisons-disease#preparehttps://academic.oup.com/jcem/article/102/2/379/2972062?searchresult=1
5. What is Addison's Disease in Layman's Terms? [Internet]. Quora.com. 2018 [cited 6 November 2018]. Available from: https://www.quora.com/What-is-Addisons-Disease-in-laymans-terms
6. Bornstein S, Allolio B, Arlt W, Barthel A, Don-Wauchope A, Hammer G et al. Diagnosis and Treatment of Primary Adrenal Insufficiency: An Endocrine Society Clinical Practice Guideline. The Journal of Clinical Endocrinology & Metabolism. 2016;101(2):364-389.
7. Addisonian Crisis (Acute Adrenal Crisis) [Internet]. Healthline.com/ 2018 [cited 6 November 2018]. Available from: https://www.healthline.com/health/acute-adrenal-crisis
8. THORN G. TREATMENT OF ADDISON'S DISEASE. The Journal of Clinical Endocrinology & Metabolism. 1941;1(1):76-81
9. Addison's disease [Internet]. nhs.uk. 2018 [cited 29 October 2018]. Available from: https://www.nhs.uk/conditions/addisons-disease/
10. Dunlop D. Eight-six Cases of Adison's Disease. BMJ [Internet]. 1963 [cited 29 October 2018];2(5362):887-892. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1873052/
11. F. PATNIO J, E. FENN J. A Successful Transplant of Embryonic Adrenal Tissue in a Patient with Addison's Disease. THE YALE JOURNAL OF BIOLOGY AND MEDICINE. 1993;66(1):3-10.
12. Løvås K, Gjesdal C, Christensen M, Wolff A, Almås B, Svartberg J et al. Glucocorticoid replacement therapy and pharmacogenetics in Addison's disease: effects on bone. European Journal of Endocrinology. 2009;160(6):993-1002.