Aroused: The History of Hormones and How They Control Just About Everything by Randi Hutter Epstein (W.W. Norton & Company, 2018).

Introduction

-defines hormones as not just internal secretions of the body, but thing that 'arouse' by exciting receptor on target cells, which flip switches to cause change

Chapter 1: The Fat Bride

-tells the story of Blanche Grey who was born in 1869 as a large baby and grew quite big by the time she was a teenager, when she ran off to Manhattan to join the freak show as a Fat Lady

-freak shows of the day attracted many physiologists, neuroscientists, and biochemists who aimed to prove that the people in them were the way they were because of a physical defect, not because of a moral failing or divine punishment

-a few days after her highly publicised wedding, which gave her the unique name The Fat Bride, Blanche became ill and died, setting off a trend of graverobbers trying to get part of her to sell to scientists

-while hormones are essentially just chins of amino acids or carbon atoms, they are vastly interesting because, unlike the nervous system where everything is connected, hormones operate wirelessly – a single hormone can be released in the brain and it will elicit a reaction in the testes or ovaries, with no direct connection made between them

-nine key glands that made hormones: the hypothalamus, pineal, and pituitary in the brain; the thyroid and neighbouring parathyroids in the throat; the islet of Langerhans in the pancreas; the adrenals that cap the kidneys; and the ovaries and testes

-every one of our cells have markers that direct hormone signals precisely where they need to go

-hormones rarely work alone, they can help each other and interfere with each other

-hormones control metabolism, behavior, sleep, lactation, stress, mood swings, sleep-wake cycles, the immune system, mating, fighting, fleeing, puberty, parenting, and sex

-hormones can work to get things back in balance but they can also cause everything to get out of control

-the study of hormones came along with the birth of physiology and chemistry in the mid-1800s, which was a time when there weren't a lot of ethical constraints on how doctors and scientists made their discoveries

-the earliest published experiment that pointed to the existence of hormones was in 1848 when a German doctor performed an experiment on 6 Roosters – two he removed their testes completely, two he left one testes, and the other two he transplanted the testes of each to other's stomach – found that those who had none gained weight, lost their brilliant comb and acted like hens, those with one had the single one swell and they acted like regular roosters and the transplanted ones did the same without creating any new connections in the body to help signally – leading the doctor to conclude that the testes had something in them that sent signals to the rest of the body

-Blanche's body never did get robbed but her highly publicised life and death is a great example of the curiosity that was driving discovery at the time

Chapter 2: Hormones… As We May Call Them

-it took a lot of experiments and quite a bit of push back against the establishment to convince the scientific world that there was something else in the body sending signals that did not run along the nervous system – it was thought that all control of the body ran along this system, and they could not comprehend how a mysterious chemical could deliver a message through the circulatory system
-in time, scientists came to understand that it wasn't one or the other but a complex push and pull among them
-much of the chapter is about the scientists William Bayliss and Ernest Starling who ran experiments on dogs out of University College and ran into heavy criticism from the anti-vivisection groups
-it was these two who first used the word "hormones" to define the chemical messengers there were finding, hormone coming from the Greek word hormao that means to excite or arouse

Chapter 3: Pickled Brains
-chapter on the work of Harvey Cushing, a neurosurgeon who kept meticulous notes as well as pieces of brain of his patients or the whole brains of people who passed in an effort to understand the pituitary gland
-Cushing discovered that the pituitary gland was actually two glands coming from the same stem, what we now call the anterior and posterior pituitary
-thanks to the work of Cushing (who has Cushing disease and Cushing disorder named after him) and those who followed after him, we know that the anterior pituitary discharges growth hormone and prolactin (most used in milk production), and it also secretes releasing hormones (hormones that prompt other glands to release hormones) such as gonadotropins (directs the testes and ovaries to release testosterone and estrogen), a hormone to have the thyroid ACTH, which then prompts the adrenal gland to release cortisol
-the posterior pituitary makes vasopressin, which maintains fluid balance, and oxytocin
-people who have tumors on the pituitary or other pituitary disorders can have abnormal growth patterns, be very lethargic, gain quite a bit of weight, have unusually hair growth, and other physical deformities
-in 1927, when Time magazine published a picture of a French women as an example of ugly in an ugly woman contest that was supposed to be mocking the beauty contests of the day, Cushing wrote and criticized Time because they were exploiting a woman who he believed to be suffering from a medical condition associated with the pituitary, pointing out that the 'freaks' of our society most likely had a medical condition

Chapter 4: Killer Hormones
-in the 1920s the popularity of hormones took off with the discovery of estrogen, progestogen, insulin, and much more, with people seeing children born with physical or mental deficiencies overcoming them, people with conditions such as diabetes and sex difficulties receiving treatment
-it was also beginning to be understood that hormones could also be behind emotions
-a popular author and doctor Louis Berman published many books at the time claiming that one's entire personality was controlled by which gland was most prominent in your hormonal level
-the 1920s also saw the fad of organotherapy – remedies made from grinding up organs and one pamphlet promised remedies for 116 supposedly hormone-based ailments

-the study of hormones also started to attract the attention of the eugenics movement, which picked up on some of the things being said about low intelligence, violence and other features being caused by hormone issues that could be hereditary
-in 1928 Berman underwent a three-year investigation of 250 juvenile delinquents and criminals at Sing-Sing prison, concluding that criminals have more than three times as many endocrine disturbances as law-abiding citizens, he had unique chemical disturbance make ups for each type of criminal
-chapter revolves around the 1924 murder trial of two 17-year-old boys in which expert testimony was given that the boy had endocrine disorders that caused them to be violent

Chapter 5: The Virile Vasectomy
-"Louis Berman, the psycho-endocrinology doctor, had big ideas: he wanted to use hormones to make the world a better place. A nation of chemically balanced bodies equaled a well-adjusted society, one free of crime, obesity, stupidity, and all the other traits that Berman linked to defective hormones. Utopia, brough to you by hormone specialists."
-another doctor, a physiologist from Vienna by the name of Eugen Steinach, pushed the idea that vasectomies boosted sex drive with the argument that it kept more of the male juices inside so they can continue to boost libido
-the 1920s was full of people peddling cures for hormonal disorders or boosts to those things that hormones controlled
-Steinach was a serious researcher who did a lot to advance our understanding of sex hormones and the influence they have on our lives, even if his vasectomy theory proved to be off the mark

Chapter 6: Soul Mates in Sex Hormones
-this chapter tells the story of Howard and Georgeanna Jones, a married couple who went through medical school together and did pioneering research in the field of sex hormones and in vitro feralization
-one of Georgeanna's tasks when she volunteered for a lab was to run pregnancy tests – which at that time (1930s) consisted of injecting the urine of a woman into a mouse and then waiting 100 days and then checking to see if the mouse's ovaries had red spots on them, which meant the woman was pregnant
-the scientist that Georgeanna was working under (Gey) developed the first machine to keep cells alive (and he was the one who gathered the cells of Henrietta Lacks's cervical cancer)
-early pregnancy tests assumed that the anterior pituitary gland was responsible for the pregnancy hormone since something similar if you injected some of that gland into mice but Georgianna discovered that it was actually a different reaction going on and she narrowed it down to something that the placenta was secreting and she was the one that isolated hCG

Chapter 7: Making Gender
-as well as being a test-tube baby pioneer, Howard Jones (husband of Georgianna) was also a leading figure in understanding how hormones impacted gender and the anomaly of gender-different persons
-Hermaphrodite comes from the Greek figure Hermaphroditus, which some accounts have as a teenage deity seduced by a nymph and when he rejected her advances she got the gods to wrap her body around his and fuse them together so they would always be one (other

accounts say that Hermaphroditus possesses the brawn of his father Hermes and the beauty of his mother Aphrodite, making the perfect human)
-the term Hermaphrodite was used all the way up until the 1990s to describe anyone born or displaying non-binary gender, now it is referred to as intersex
-in the early 1900s, scientists discovered that there is a hormone that causes a fetus to develop either male or female genitals, or something close to one of the other, or some mix of the two (generally referred to as the anti-Mullerian hormone that pushes a fetus to be male, since the Mullerian ducts are what one develops into female organs)
-even after the hormone pushes development one way or the other, someone with XY or XX chromosomes can still have conditions in which they do not respond to hormones in the typical way and display intersex characteristics
-talks about the work of John Money and the Johns Hopkins team that pioneered gender research, and how this non-medical professional (he had a PhD in social relations from Harvard) stripped back the understanding of gender as being just about gonads and chromosomes and had people looking at variations in genitalia, hormone levels, gender a person was raised to be and the gender role they take on in life
-while the Johns Hopkins group expanded the view of gender, they pushed the notion that gender normality was the ideal, so it was best to young baby to have gender expression as clearly male or female even if it meant multiple surgeries and hormone treatment for the rest of the person's life (even going so far as to "correct" micro penises by making that baby a girl or completely removing clitorises that were too long)
-throughout tells the story of Brian/Bonnie/Bo who was a true intersexed baby and had their gender changed from boy to girl when they were a toddler and had to undergo a lifetime of treatments to deal with the fact that they had both male and female sex organs

Chapter 8: Growing Up
-about the discovery of growth hormone in the pituitary and the fact and only human growth hormone could work on humans, used to treat problems that can be caused by a deficit of HGH, as well as "treating" dwarfism and general non-ideal height
-tells the story of Jeffery Balaban's mother who was pushed to look at HGH treatment and then told that she had to get her own pituitaries to have the treatment happen, so she spearheaded a letter writing campaign in the 1960s that ended up making them the third largest collectors of pituitaries in the country, exceeded only by the National Institutes of Health and the Veterans' Administration

Chapter 9: Measuring the Immeasurable
-about Rosalyn Yalow who figured out that hormones caused an immune response and it did so by knocking hormones off of antibodies, thereby brilliantly figuring out that you can inject a known amount of hormones attached to antibodies into a person and then measure the amount of hormone that gets knocked off its antibody to get an accurate reading on the particular hormone level that person has
-this is a technique called radioimmunassay, or RIA for short, and it is the basis for all hormone level testing today
-also the scientist behind the test done at birth for vitamin K, which is an indicator of a hormone deficiency that, if caught before the first 6 months, can be easily corrected and end a significant problem with brain development

Chapter 10: Growing Pains
-about the discovery of contaminated HGH when young people started dying from a brain disease that was usually only seen in the elderly
-led to some dial back on the popularity of hormones and the creation of synthetic HGH
-a lot of the chapter shows the push back from the scientific community who had gotten on the hormone rocket ride and were hesitant to admit to any draw backs

Chapter 11: Hotheads: The Mysteries of Menopause
-about the ups and downs in popularity of using estrogen or a combination of estrogen and progestogen to treat the symptoms of menopause
-it has been found that hot flashes don't come from low levels of estrogen but rather from when estrogen levels quickly plummet, which also sees an increase of adrenaline at the same time (unknown if the drop causes this or if the other way around or if they happen at the same time due to another factor), which causes the hot flash
-the only other animal known to have hot flashes is the killer whale
-some small brain studies have shown that the hypothalamus in post-menopausal women is three times larger than in younger women (most likely in response to the body's request for more estrogen, which the hypothalamus sends out and grows itself to increase estrogen receptors, but the ovaries' lack of ability to produce it)
-one theory is that swollen cells in the hypothalamus are probably messing up older women's internal climate control system, but this is far from certain
-even without understanding what was going on, hormone replacement therapy (HRT) went ahead and became very popular for treating menopausal symptoms
-both the birth control pill and HRT represent the first time that masses of people were taking drugs to treat or prevent no real illness – they were taking them to navigate two crucial times in their lives, to prevent unwanted pregnancy and to prevent unwanted menopausal symptoms
-conclusive studies showed that taking estrogen could cause uterine cancer, but that taking estrogen with progestogen did not have the same effect
-multiple studies have been done to try to prove the health benefits or side effects of HRT but have had non-conclusive and sometimes contradictory results
-many people taut the benefits of compound hormones, but they fall outside of the FDA standards, so they are easier to produce and market as safe when they really haven't been proven as such

Chapter 12: Testosterone Endopreneurs
-about the discovery of testosterone and the marketing of it as providing men energy and virility
-this went even a step further because it was something that wasn't even a malady like menopausal symptoms, it was just fighting against basic life
-most of the time testosterone has to be injected but there is a gel version, which has the serious problem of being able to be picked up by children and women who the men come in contact with
-the prescribing of testosterone has been heavily marketed and popularized even though there is no evidence that it does what it says it is doing and some indication that it can cause significant harm (again, non-conclusive and sometimes contradictory studies results)

Chapter 13: Oxytocin: That Lovin' Feeling
-about another heavily marketed hormone that had very little evidence supporting the claims they were making and several studies showing that it could possibly have significant side effects (besides knowing that oxytocin can induce labour and lactation as well as being responsible for mother-baby bonding, it is also said that it relaxes people and makes them more loving and trusting)
-from letter sent to Harvey Cushing about 100 years ago (still relevant today): "It is pathetic if not disgusting to witness this **endocrine orgy** now rampant in our profession, much of it the result of abysmal chaotic nonsensical ignorance, more of it alas the result of commercial greed." Adding on: "Endocrinology is fast becoming a mockery and a disreputable business and it is high time that some honest fearless words were uttered." (Written by Dr. Hans Lisser, head of the University of California San Francisco's ductless gland clinic)

Chapter 14: Transitioning
-discusses the introduction of testosterone and estrogen in the transgender transitioning process, mainly taking off in the 1950s and 60s
-says that taking testosterone builds muscles, sprouts hair growth, boosts libido and can alter body odor, while taking estrogen decreases the production of testosterone (some transgender men take anti-androgens to further diminish their testosterone level)
-the experience of transgender individuals on hormones are giving some insights into what impact these hormones might have on personality and mood (although difficult to gauge given all the cultural and personal influences that can impact this too)
-testosterone has been linked to increasing the blood cell count, which can lead to increased risk of stroke and heart attack, and estrogen can lead to higher levels of depression

Chapter 15: Insatiable: The Hypothalamus and Obesity
-one the discovery that both the urge to eat and our feeling of being full or satiated come from hormones
-in a many-times repeated experiments, two rats were joined together, sharing the same circulatory system (with the thought that joined blood would produce same results at a hormone level) and one rat had their hypothalamus removed causing them to have insatiable hunger and overeat but then the conjoined rat would refuse to eat every time
-the conclusion of this study was that consuming calories fires up a chemical reaction that shuts down appetite, so the eating rat set off a "I feel full" hormone which circulated in their bloodstream
-in 1994 scientists discovered the hormone causing this and named it leptin, low levels of it cause hunger and high levels cause fullness (the hormone was found in fat cells), insatiable eating comes from a deficit in the leptin receptor in the hypothalamus
-the body always sensing a lack or lowered level of leptin also causes it to shut down high-energy functions that aren't essential to survival, which means people who suffer from this also have difficulties with puberty, fertility and immunity
-there's also lots of current research going on concerning the chemicals coming from the digestive tract and the impact they can have on metabolism, hunger and obesity
-weight loss surgery is also thought to work because of the way that it alters hunger hormones although it is unknown exactly how
-"Research into obesity is more than merely a study of weight gain. It is on the forefront of endocrinology because it connects cells to behavior in ways that the twentieth-century

pioneers of hormone science longed to do, but never could. ‘We humans carry with us the deep-seated wish to have control,’ said Friedman, the discoverer of the leptin gene. “For obesity, there is an illusion of control because you can lose weight if you stop eating, but that ignores the fact that there is a basic drive that will push you to eat in the same way there is a basic drive that pushes you to drink fluids or have sex or do lots of other things. I don’t think on the whole that humans have come to grips entirely with how powerful our basic drives are, how difficult it is to use conscious means to control them.’ How our hormones, that is, control just about everything.”

Epilogue

-we began with studying the glands inside of us and other animals for clues to possibly existing hormones and now have come to understand that “each of us is one small pond within a vast ocean of hormone-changing chemicals

-Cushing’s summary of his career that launched so much of endocrinology: “We find ourselves embarked on a fog-bound and poorly charted sea of endocrinology. It’s easy to lose our bearing for we have, most of us, little knowledge of the seafaring and only a vague idea of our destinations.”