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HISTOLOGICAL STRUCTURE AND FUNCTIONAL SIGNIFICANCE OF ENDOCRINE GLANDS (IN CHILDREN)

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Annotatsiya

Ushbu maqolada bolalarda endokrin bezlarning gistologik tuzilishi, hujayra turlari va ularning funktsional ahamiyati batafsil tahlil qilinadi. Endokrin tizimning o‘sish va rivojlanish jarayonlarida, metabolizmni tartibga solishda, suyuqlik-elektrolit balansini saqlashda va immun javobda muhim roli ta’kidlangan. Maqolada qandli diabet, qalqonsimon bez kasalliklari va gormon yetishmovchiligi kabi patologik holatlarning rivojlanish mexanizmlari ham qisqacha yoritilgan.

Kalit so‘zlar

endokrin bezlar, gistologiya, gormonlar, bolalar, qalqonsimon bez, insulin, metabolizm

Abstract

This article provides a detailed analysis of the histological structure and functional significance of endocrine glands in children. The role of the endocrine system in growth and development, regulation of metabolism, maintenance of fluid-electrolyte balance, and immune response is highlighted. The article also briefly discusses the pathogenesis of disorders such as diabetes mellitus, thyroid diseases, and hormone deficiencies.

Keywords

endocrine glands, histology, hormones, children, thyroid gland, insulin, metabolism

Аннотация

В данной статье представлен подробный анализ гистологической структуры и функционального значения эндокринных желез у детей. Подчёркнута роль эндокринной системы в росте и развитии, регуляции обмена веществ, поддержании водно-электролитного баланса и иммунного ответа. Также кратко рассмотрен патогенез таких заболеваний, как сахарный диабет, заболевания щитовидной железы и гормональная недостаточность.

Ключевые слова

эндокринные железы, гистология, гормоны, дети, щитовидная железа, инсулин, метаболизм

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Introduction

The endocrine system is the central system that regulates growth, development, metabolism, fluid and electrolyte balance, and immune system function in the human body.he endocrine system is the central system that regulates growth, development, metabolism, fluid and electrolyte balance, and immune system function in the human body. In childhood, the role of this system is unique and is not limited to the production of hormoneshe endocrine system is the central system that regulates growth, development, metabolism, fluid and electrolyte balance, and immune system function in the human body. In childhood, the role of this system is unique and is not limited to the production of hormones, but participates in the maintenance of homeostasis through the maturation of organ systems, its continuous connection with the central and peripheral nervous system. The main glands of the endocrine system, controlled through the hypothalamus-pituitary Center, are the thyroid, parathyroid, pituitary, adrenal, pancreatic and genital glands. Each of them has a histologically specific structure, controlling physiological processes in children through different cell types and hormone production mechanisms.ach of them has a histologically specific structure, controlling physiological processes in children through different cell types and hormone production mechanisms. Endocrineach of them has a histologically specific structure, controlling physiological processes in children through different cell types and hormone production mechanisms. Endocrine gland activity varies with age, sex, and developmental stages, which are important for Childhood growth rate, mental development, and skeletal system maturation.

1. Thyroid gland (Glandula thyreoidea)

The thyroid gland consists of two lobes connected to each other by an isthmus.he thyroid gland consists of two lobes connected to each other by an isthmus. Each lobe is divided into follicles, and each folhe thyroid gland consists of two lobes connected to each other by an isthmus. Each lobe is divided into follicles, and each follicle is lined wihe thyroid gland consists of two lobes connected to each other by an isthmus. Each lobe is divided into follicles, and each follicle is lined with epithelial cells, inside which is the colloidal substance. The colloid is mainly composed of thyroglobulin, which acts as the main substrate for the synthesis of thyroxine (T4) and triiodothyronine (T3). The follicular epithelium is cubic or cylindrical, depending on the activity of the cells. Around the follicle are parapholicular C-cells, which produce calcitonin. Calcitonin reduces calcium levels in the blood, stimulating the accumulation of calcium in bone tissue. In childhood, this process is very important in bone development and mineralization.

Functional significance in children

Thyroid hormones accelerate metabolism in children, support the development of the nervous system, and promote physical growth and skeletal maturation.hyroid hormones accelerate metabolism in , support the development of the nervous system, and promote physical hyroid hormones accelerate metabolism in children, support the development of the nervous system, and promote physical growth and skeletal maturation. Thyroxine deficiency (hypothyroidism) in children leads to developmental delay, cretinism, and intellectual disability. At the same time, excessive hormone production (gigantism) causes metabolic disorders and increased cardiac activity.

2. Parathyroid glands (Glandulae parathyreoideae

The parathyroid glands are small, nodular, usually with 2-4 around each thyroid lobe.he parathyroid glands are small, nodular, usually with 2-4 around each thyroid lobe. The primary cells

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are paratghe parathyroid glands are small, nodular, usually with 2-4 around each thyroid lobe. The primary cells are paratgormone-producing cells that regulate the calcium and phosphorus balance in the blood. At the same time, there are oxyphil cells, which depend on metabolic activity, but do not play a significant role in hormone production.

Functional significance in children

Parathormone stimulates calcium resorption in bones, which helps with bone growth and mineralization in children.arathormone stimulates calcium resorption in bones, which helps with bone growth and mineralization in children. If there is parathormone deficiency, children experience muscle spasms, tetany conditions, and disorders in bone development. Therefore, the actParathormone stimulates calcium resorption in bones, which helps with bone growth and mineralization in children. If tarathormone stimulates calcium resorption in bones, which helps with bone growth and mineralization in children. If there is parathormone deficiency, children experience muscle spasms, tetany conditions, and disorders in bone development. Therefore, the activity of the parathyroid gland is very important for the healthy development of the skeletal system in childhood.

3. Pituitary gland (Hypophysis)

The pituitary gland consists of an anterior part, the adenohypophysis, and a posterior part, the neurohypophysis. The adenohypophysis is made up of different cells and produces different hormones:

* Somatotropin (GH) – controls the growth process.

• Adrenocorticotropic hormone (ACTH) – stimulates the adrenal gland cortex.Somatotropin (GH) – controls the growth process.

• Adrenocorticotropic hormone (ACTH) – stimulates the* Somatotropin (GH) – controls the growth process.

• Adrenocorticotropic hormone (ASomatotropin (GH) – controls the growth process.

• Adrenocorticotropic hormone (ACTH) – stimulates the adrenal gland cortex.

• Thyrotropic hormone (TSH) – controls thyroid function.

* Gonadotropins (FSH, LH) – control the gonads.

• Prolactin – stimulates the development of the mammary glands and milk production.

• The neurohypophysis is made up of neural fibers that store and release the hormones oxytocin and vasopressin into the circulation.

Functional significance in children

Pituitary hormones are central to growth and pubertal development in children. Somatotropin deficiency leads to nanism, overproduction leads to cases of gigantism and acromegaly.ituitary hormones are central to growth and pubertal development in children. Somatotropin deficiency leads to nanism, overproduction leads to cases of gigantism and actuitary hormones are central to growth and pubertal development in children. Somatotropin deficiency leads to nanism, overproduction

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leads to cases of giituitary hormones are central to growth and pubertal development in children. Somatotropin deficiency leads to nanism, overproduction leads to cases of gigantism and acromegaly. Gonadotropins control sexual maturation, while prolactin is involved in physiological processes associated with breastfeeding.

4. Adrenal glands (Glandulae suprarenales

• The adrenal glands are divided into sections of the cortex and medulla.

* Layers of Cortex:

• Zona glomerulosa-produces mineralocorticoids (aldosterone). Regulates water and salt balance.

• Zona fasciculata-produces glucocorticoids (cortisol). Controls metabolism and stress response.

• Zona reticularis - produces androgens Zona fasciculata-produces glucocorticoids (cortisol). Controls metabolism and stress response.

• Zona reticularis - produces androgens. Secondary sex is Zona fasciculata-produces glucocorticoids (cortisol). Controls metabolism and stress response.

• Zona reticularis - produces androgens. Secondary sex is involved in the development of signs.

Medulla

The Medulla is made up of neuroendocrine cells that produce adrenaline and norepinephrine. These hormones prepare the body for stress through the sympathetic nervous system, increase heart rate and control glucose levels.

Functional significance in children

Cortex hormones control fluid-salt balance, energy metabolism, and immune response in children. Medulla hormones, on the other hand, provide a stress response and cardiovascular function.ortex hormones control fluid-salt balance, energy metabolism, and immune response in children.ulla hormones, on the other hand, provide a stress response and cardiovascular function. Cortisol deficiency (Addison's disease) can cause serious physiological disorders in children.

1. Thyroid gland (Glandula thyreoidea)

In children, the thyroid gland is one of the most important endocrine organs in the growth and development of the body. Histologically it consists of two lobes and is divided into follicles.n children, the thyroid gland is one of the most important endocrine organs in the growth and dn children, the thyroid gland is one of the most important endocrine organs in the growth and development of the body. Histoln children, the thyroid gland is one of the most important endocrine organs in the growth and development of the body. Histologically it consists of two lobes and is divided into follicles. Each follicle is lined with cuboidal or low cylindrical epithelium and contains colloid inside. The colloid is mainly composed of thyroglobulin, where the hormones T4 (Thyroxine) and T3 (triiodothyronine) are synthesized. The shape of the epithelium changes depending on the activity of the follicular cells: during active production, the cells are cylindrical, and during low activity, they are cubic. Parafollicular C cells, located around the follicle, produce calcitonin, a hormone that stimulates calcium deposition in bone tissue and reduces blood calcium

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levels.follicular C cells, located around the follicle, produce calcitonin, a hormone that stimulates calcium deposition in bone tissue and reduces blood calcium levels. In children, rapid bone growth and mineralization, as well as the development of the nervous system, depend on the hormones T3 and T4.

From a medical point of view, thyroid deficiency in children leads to cases of hypothyroidism and cretinism. In this, the child's development slows down, mental and physical development slows down, metabolism decreases.rom a medical point of view, thyroid deficiency in children leads to cases of hypothyroidism and cretinism. In this, the child's development slows down, mental and physical development slows down, metabolism decreases. At the same time, excessive hormone production (gigantism), on the other hand, causes an increase in the activity of the heart and metabolism.

2. Parathyroid glands (Glandulae parathyreoideae

Parathyroid glands are small nodule-shaped organs located around the thyroid gland. Histologically, its main cells are paratgormone-producing cells, as well as metabolically active oxyphil cells.arathyroid glands are small nodule-shaped organs located around the thyroid gland. Histologically, its main cells are paratgormone-producing cells, as well as metabolically active oxyphil celall nodule-shaped organs located around the thyroid gland. Histologically, its main cells are paratgormone-producing cells, as well as metabolically active oxyphil cells. In children, paratgormone stimulates calcium resorption in bones, which is important for the rapid development of the skeletal system. Phosphorus metabolism is also regulated by parathormone. Parathormone deficiency leads to tetanic spasms, muscle damage, and impaired bone development. Therefore, parathyroid gland function is vital for the development of bones and the neuromuscular system in children.

3. Pituitary gland (Hypophysis)

The pituitary gland is one of the most important glands in children as a center for growth and pubertal development. It consists(Hypophysis)

The pituitary gland is one of the most important glands in children as a center Pituitary gland (Hypophysis)

The pituitary gland is one of the most important glands in children as a Pituitary gland (Hypophysis)

The pituitary gland is one of the most important glands in children as a center for growth and pubertal development. It consists of the adenohypophysis and neurohypophysis.

- Adenohypophysis hormones:
- Somatotropin (GH) – regulates growth in length, skeletal and muscle development.

• Adrenocorticotropic hormone (ACTH) – stimulates the adrenal gland cortex, controls cortisol production.

• Thyrotropic hormone (TSH) – controls thyroid function.

* Gonadotropins (FSH and LH) – affect the maturation and pubertal development of the gonads.

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• Prolactin-controls the development of the mammary glands and the process of breastfeeding.

Neurohypophysis hormones: oxytocin and vasopressin. Prolactin-controls the development of the mammary glands and the process of breastfeeding.

Neurohypophysis hormones: oxytocin and vasopressin. Oxytocin is important in the process of muscle contraction and breastfeeding, while vasopressin is important in controlling the fluid-electrolyte balance.

Pituitary activity in children is closely related to growth rate, skeletal system development, and reproductive system maturation.ituitary activity in children is closely related to growth rate, skeletal system development, and reproductive system maturation. Somatotropin deficiency is manifested by nanism, overproduction gituitary activity in children is closely related to growth rate, skeletal system development, and reproductive system matPituitary activity in childly related to growth rate, skeletal system development, and reproductive system maturation. Somatotropin deficiency is manifested by nanism, overproduction gigantism, or acromegaly. The timely production of gonadotropins up to pubertate determines the sexual development of the child.

4. Adrenal glands (Glandulae suprarenales

The adrenal glands are divided into the cortex and the medulla.

* Layers of Cortex:

* Zona produces glomerulosa-aldosterone, which regulates the balance of sodium and potassium.

• Zona fasciculata-produces glucocorticoids (cortisol), controls metabolism and responds to stress. -produces glucocorticoids (cortisol), controls metabolism and responds to stress.

• Zona reticularis-produces androgens, is involved in pubertal development and the formation of sexua Zona fasciculata-produces glucocorticoids (cortisol), controls metabolism and responds to stress.

• Zona reticularis-produces androgens, is involved in pubertal development and the formation of sexual signs.

The Medulla is composed of neuroendocrine cells and produces adrenaline and norepinephrine. These hormones enhance the sympathetic response, accelerate heart function, and control blood glucose levels.

In children, the adrenal glands regulate fluid-salt balance, stress adaptation, energy metabolism, and immune response. Cortisol deficiency causes Addison's disease in children, while overproduction causes Cushing's syndromen children, the adrenal glands regulate fluid-salt balance, stress adaptation, energy metabolism, and immune responIn children, the adrenal glands regulate -salt balance, stress adaptation, energy metabolism, and immune response. Cortisol deficiency causes Addison's disease in children, while overproduction causes Cushing's syndrome.

5. Pancreas (pancreas

The Endocrine part of the pancreas is the Langerhans Islands. They include several cell types:

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* Alpha cells - produce glucagon.

* Beta cells - produce insulin.

* Delta cells-produce somatostatin.

In children, insulin regulates glucose metabolism, while glucagon increases glucose levels. Insulin deficiency leads to type 1 diabetes mellitus, which slows down growth and energy processes.n children, insulin regulates glucose metabolism, while glucagon increases glucose levels. Insulin deficiency leads to type 1 diabetes mellitus, which slows down growth and energy processes. Somatostatin, on the other hand, inhibits the secretion of other hormones and ensures the balance of the endocrine system.

6. Sex glands (Ovarium and Testis)

In children, the gonads are important for sexual development and reproductive system maturation. Ovary: consists of an epithelial lining and follicles, and produces estrogen and progesteronen children, the gonads are important for sexual development and reproductive system maturation. Ovary: consists of an epithelial lining and follicles, an children, the gonads are important for sexual development and reproductive sym maturation. Ovary: consists of an epithelial lining and follicles, and produces estrogen and progesterone. These hormones control pubertal development, secondary sexual characteristics, and growth. Testis: The tubules produce testosterone through Leydig cells. Testosterone plays an important role in the sexual development, muscle growth, and development of secondary sexual characteristics in children. In children, when hormone secretion of the gonads is premature or delayed, there is a violation of pubertal development, hormone dysbalance and a delay in psychological growth.

Different characteristics of the pituitary gland and its cell

In children, pituitary cell activity is age-related, and neonate and childhood somatotropic cells (somatotrophs) are significantly active.n children, pituitary cell activity is age-related, and neonate and childhood somatotropic cells (somatotrophs) are significantly active. They stimulate the growth of skeletal and muscle tissue through the production of GH (gn children, pituitary cell activity is age-related, and neonate and childhood somatotropic cells (somatotrophs) are significantly active. They stimulate the growth of skeletal and muscle tissue through the production of GH (growth hormone). Histologically, somatotrophic cells have large amounts of granules that prepare the hormone for distribution in the blood. In the adenohypophysis, the density and proportion of corticotrophic, thyrotrophic and gonadotrophic cells adapt to the rate of growth in childhood. The neurohypophysis, on the other hand, contains pituicytes and neurosecretory fibers. These fibers store oxytocin and vasopressin in the last joints. In children, vasopressin secretion, which is responsible for controlling the water-electrolyte balance, only increases significantly during fluid deficiency or excessive stress.hese fibers store oxytocin and vasopressin in the last joints. In children, vasopressin secretion, which is responsible for controlling the water-electrolyte balance, only increases significantly during fluid deficiency or excessive stress. Therefore, during the period of neonate and baby, the water-salt balance changes rapidly.

Adrenal glands-morphological features

In children, the ratio of the cortex to the medulla of the adrenal gland is different than in adults: the cortex is relatively larger, and the medulla is smaller.n children, the ratio of the cortex to the

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medulla of the adrenal gland is different than in adults: the cortex is relatively larger, and the medulla is smaller. Zoiratio of the cortex to the medulla of the adrenal gland is different than in adults: the cortex is relatively larger, and the medulla is smaller. Zona glomerulosa cells have a high level of mitotic activity for mineralocorticoid production, making the sodium and potassium balance rapidly flexible in children. Zona fasciculata and reticularis, on the other hand, have high activity in glucocorticoid and androgen production, serving to accelerate stress and energy metabolism.

The medulla's neuroendocrine cells (chromaffin cells) produce adrenergic and noradrenergic hormones.he medulla's neuroendocrine cells (chromaffin cells) produce adrenergic and noradrenergic hormones. In children, these cells, together with the medulla's neuroendocrine cells (chromaffin cells) produce adrenergic and noradrenergic hormones. In children, these cells, together with the sympathetic nervous system, have a morphologically dense and rich granule system for rapid response. At the same time, the adrenal medulla has a higher number of beta-adrenergic receptors than adults, which allows for rapid changes in heart rate and blood pressure in children.

New information of the pancreas

The histological structure of the Langerhans islands varies depending on the stage of development in childhood. During the Neonatal period, the number of beta cells is relatively low, which leads to subtle control of glucose regulation in the baby.he histological structure of the Langerhans islands varies depending on the stage of development in childhood. During the Neonatal period, the number of beta cells is relatively low, which leads to subtle control of glucose regulation in the baby. Beta cells of the pancreas store large amounts of insulin granule, while alpha cells are prepared to release glucagon quickly.

In children, somatostatin, produced by delta cells, not only inhibits the secretion of glucagon and insulin, but also regulates pancreatic growth through autocrine and paracrine signaling.n children, somatostatin, produced by delta cells, not only inhibits the secretion of glucagon and insulin, but also regulates pancreatic growth through autocrine and paracrine signaling. Thus, the Intraorganizmal signaling system of the Langerhans Islands provides metabolic adaptation in childhood.

New histological features of the thyroid and parathyroid glands

In children, the amount of mitochondria and endoplasmic reticulum in thyroid follicular cells is greater than in adults, which accelerates hormone synthesis. the amount of mitochondria and endoplasmic reticulum in thyroid follicular cells ren, the amount of mitochondria and endoplasmic reticulum in thyroid follicular cells is greater than in adults, which accelerates hormone synthesis. Follicular epithelial cells actively absorb thyroglobulin from the colloid to produce T3 and T4. At the same time, parafollicular C cells have a large number of secretory vacuoles to accelerate the secretion of calcitonin, which plays an important role in bone development.

The primary paratgormone-producing cells of the parathyroid gland (chief cells) have higher density in children than in adults, rapidly regulating bone mineralization and calcium-phosphorus balance.he primary paratgormone-producing cells of the parathyroid gland (chief cells) have higher density in children than in adults, rapidly regulating bone mineralization and calcium-phosphorus balance. Also, oxyphilic cells are rich in mitochondria, which increases metabolic activity.

Sex glands

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In children, the gonads produce low levels of hormones at an early stage of development, but there is a minipubertal phase in the neonate and infant period, with estrogen and testosterone levels rising briefly.n children, the gonads produce low levels of hormones at an early stage of development, but there is a minipubertal phase in the neonate and infant period, with estrogen and testosterone levels rising briefly. This phase is histologically associated with the activation of follicular and Leydig cells.

Ovarian follicles are in the form of primordial and primary follicles in children, which are prepared for further pubertal development. Leydig cells produce testosterone in children, but secretion continues at low levels until pubertate.varian follicles are in the form of primordial and primary follicles in children, which are prepared for further pubertal development. Leydig cells produce testosteronOvarian follicles are in the form of primordial and primary follicles in children, which are prepared for further pubertal development. Leydig cells produce testosterone in children, but secretion continues at low levels until pubertate. At the same time, in children, the stromal and vascular composition of the gonads is highly developed, providing adaptation to hormone transport and follicular growth.

Neuroendocrine and autocrine-paracrine properties of endocrine glands

New studies show that endocrine glands in children are not limited to the distribution of hormones through the blood. They control activity by signaling autocrine (host) and paracrine (host).tudies show that endocrine glands in children are not limited to the distribution of hormones through the New studies show that endocrine glands in children are not limited to the distribution of hormones through the blood. They control activity by signaling autocrine (host) and paracrine (host). For example:

- Pancreatic beta cells cross-regulate insulin.
- Parathyroid cells cross-regulate calcium levels.
- Adrenal cortex cells control cortisol production using local mediators.

These mechanisms allow children to regulate hormones at a high rate and in a manner appropriate to the growth process.

Conclusion

In children, the endocrine system and its glands play a central role in ensuring growth, development, metabolism and homeostasis.sion

In children, the endocrine system and its glands play a central role in ensuring growth, development, metabolism and homeostasis. From a histological point of view, each endocrinusion

In children, the endocrine system and its glands play a central role in ensuring growth, development, metabolism and homeostasis. From a histological point of view, eaildren, the endocrine system and its glands play a central role in ensuring growth, development, metabolism and homeostasis. From a histological point of view, each endocrine gland has a unique cellular composition, with their structure and function adapted to the age, sex, and developmental stages of the child. The thyroid gland produces the hormones T3 and T4 through the follicular epithelium and

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colloid, which are vital for the development of the brain, skeleton, and muscular system. Parafollicular C cells produce calcitonin, which regulates calcium metabolism.

Chief and oxyphil cells of the parathyroid glands control the calcium and phosphorus balance in the blood, important for skeletal development and muscle activity.hief and oxyphil cells of the parathyroid glands control the calcium and phosphorus balance in the blood, important for skeletal development and muscle activity. The adenohypophysis and neurohypophysis sections of the pituitary gland control growth rate, pubertal development and reproductive system maturation in children through the production of somatotropic, gonadotropic, corticotropic and other hormones.

The adrenal glands produce mineralocorticoids, glucocorticoids, androgens, adrenaline, and noradrenaline through the cortex and medulla.he adrenal glands produce mineralocorticoids, glucocorticoids, , adrenaline, and noradrenaline through thds produce mineralocorticoids, glucocorticoids, androgens, adrenaline, and noradrenaline through the cortex and medulla. he adrenal glands produce mineralocorticoids, glucocorticoids, androgens, adrenaline, and noradrenaline through the cortex and medulla. These hormones regulate fluid-salt balance, metabolism, stress responses, and cardiovascular function in children. The Langerhans islets of the pancreas produce insulin, glucagon, and somatostatin, which regulate glucose metabolism and energy balance. The gonads (ovaries and testes) produce hormones necessary for pubertal development, the formation of secondary sexual characteristics, and the maturation of the reproductive system. During childhood, the endocrine glands function with autocrine and paracrine mechanisms, ensuring their rapid and flexible response.

In general, the histological structure of the endocrine glands in children and their hormone secretion activity are of incomparable importance in growth, development, and maintaining the internal balance of the body.n general, the histological structure of the endocrine glands in children and their hormone secretion activity are of incomparable importance in growth, development, and maintaining the internal balance of the n general the histological structure of the endocrine glands in children and their hormone secretion activity are of incomparable.

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