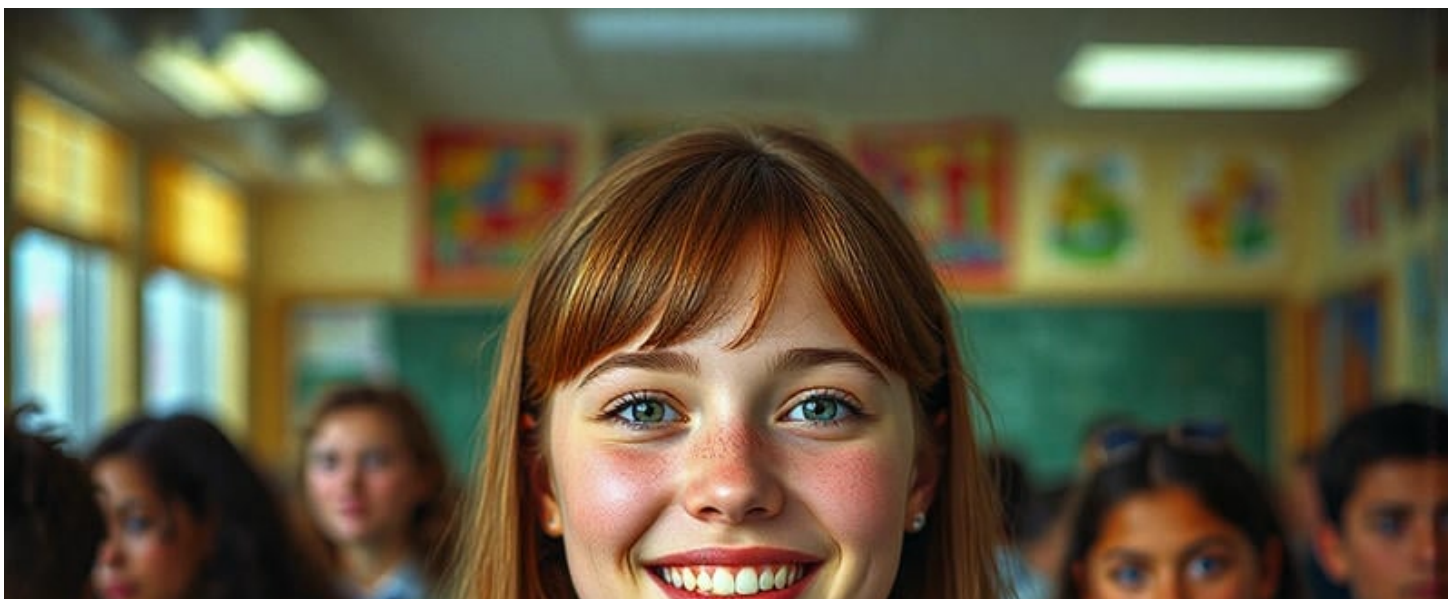


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Okay, so think about it: treatment plans, especially for kids, can be super confusing. Imagine a parent trying to wrap their head around some complex procedure, or a child feeling anxious because they just don't get what's happening. That's where digital models swoop in like tiny superheroes.

One of the biggest wins is enhanced visualization. Instead of relying on abstract explanations or diagrams, you can show parents and children a 3D, digital representation of the issue and the proposed solution. Suddenly, everything clicks. Orthodontists specialize in correcting dental irregularities in kids Orthodontics for young children mouth. They can rotate the model, zoom in on specific areas, see exactly what's going to be done, and even understand how things will look afterward.

For parents, this means less anxiety and a better grasp of the treatment's purpose and potential outcomes. They can participate more actively in the decision-making process, feeling empowered and informed. And for children, it's a game-changer. Visualizing the process makes it less scary, helps them understand what to expect, and can significantly reduce their fear and resistance. It's like giving them a sneak peek behind the curtain, demystifying the whole experience. Ultimately, enhanced visualization translates to better communication, increased trust, and a more positive treatment journey for everyone involved.

*** Common periodontal issues in children undergoing orthodontic treatment. —**

- * The interplay between orthodontic forces and periodontal tissues in young patients.
- * Common periodontal issues in children undergoing orthodontic treatment.
- * Preventive measures to maintain periodontal health during orthodontic treatment.
- * The role of oral hygiene instructions for children and parental involvement.
- * Early detection and management of periodontal problems during orthodontic care.
- * Collaboration between orthodontists and periodontists for optimal outcomes.

Okay, so one of the big wins with switching to digital models for planning treatments is that we get way more precise diagnoses and, in turn, way better treatment plans. Think about it: instead of relying on

physical impressions and plaster casts, which can be a bit clunky and prone to errors, we're talking about super accurate 3D representations of a patient's mouth. This means doctors can spot even the tiniest issues – things they might have missed before – and really understand the whole picture.

And because the diagnosis is more on point, the treatment plan is too. We can simulate different scenarios, tweak things, and really personalize the approach for each patient. This leads to fewer surprises during treatment, a more predictable outcome, and ultimately, happier patients. It's like having a super-detailed map before you start a journey; you're much more likely to get where you're going smoothly. So, yeah, better diagnosis and treatment planning leading to better outcomes? Absolutely a huge advantage of going digital.

*** Preventive measures to maintain periodontal health during orthodontic treatment.**

Okay, so think about it: traditional braces, traditional molds... it could be a bit of a guessing game, right? Especially explaining everything to a patient or their parents. Digital models? They're like having a crystal ball, but for teeth! Instead of just saying, "We're going to move this tooth like *this*," you can actually *show* them. You can spin the 3D model around, zoom in on problem areas, and even simulate how the teeth will shift over time. It's way easier for everyone to understand the treatment plan and visualize the end result. Plus, orthodontists can communicate with each other more effectively too, sharing these models and collaborating on complex cases. It just cuts through the confusion and makes sure everyone's on the same page, leading to a smoother, happier journey to a perfect smile.

*** The role of oral hygiene instructions for children and**

parental involvement.

Okay, so one of the really cool things about using digital models when planning things like braces and aligners is how much more precise we can be. Think about it: instead of relying on a physical mold that might have slight imperfections, or be a little bit off in one area, we're working with a super accurate 3D representation. This allows dentists and orthodontists to design custom appliances – the braces or aligners themselves – that fit *perfectly*. And when things fit perfectly, they're not only more comfortable for the patient, but they're also more effective at moving teeth into the right place. We can really fine-tune the design to address specific issues, leading to better, faster, and more predictable results. It's like having a tailor-made suit for your teeth, instead of something off the rack!

* Early detection and management of periodontal problems during orthodontic care.

Let's be honest, nobody enjoys having a tray of gooey stuff shoved into their mouth. Those traditional physical impressions, you know, the ones used to create models of your teeth? They're often uncomfortable, can trigger gag reflexes, and sometimes even require multiple attempts to get right. One of the coolest advantages of switching to digital models in treatment planning is that we can largely ditch that experience altogether. Instead of messy, uncomfortable physical impressions, we can use intraoral scanners. These scanners are like tiny, high-tech cameras that painlessly capture a detailed 3D image of your mouth. Think of it as a quick, non-invasive photoshoot for your teeth. The result? A more pleasant and efficient experience for you, and a more accurate starting point for your treatment plan. It's a win-win!

* Collaboration between orthodontists and periodontists for optimal outcomes.

Okay, so think about it: getting a kid excited about dental work? Near impossible, right? But digital models? They're actually kind of cool. One of the biggest advantages of using them in treatment planning, especially for younger patients, is that they allow for a visual simulation of how things are going to progress. Imagine showing a teenager, who's probably already self-conscious, a before-and-after picture that *they* can interact with. They can see their teeth gradually straightening, their bite improving, all on a screen. That's way more motivating than just hearing a dentist say, "Trust me, it'll get better."

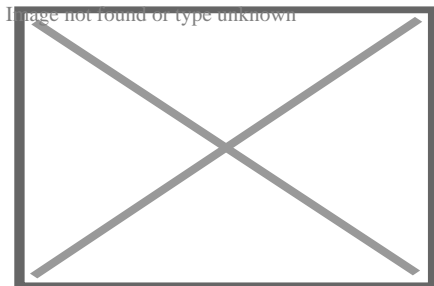
It's like a video game, really. Each appointment, each adjustment, feels like leveling up. They can see the progress, understand the steps involved, and feel more in control of the whole process. This visual feedback can significantly increase their cooperation and compliance, which, let's be honest, is half the battle with orthodontic treatment. It's not just about aesthetics either. Showing them how the treatment will improve their overall oral health, prevent future problems, that's something that can stick with them for life. It's about turning a potentially scary and uncomfortable experience into something engaging and empowering. And that's a pretty big win for everyone involved.

Okay, so, let's talk about patient data and digital models, yeah? One of the coolest things about ditching the old paper charts and going digital with planning is how much easier it makes storing and finding everything. Think about it: no more wrestling with overflowing filing cabinets or trying to decipher someone's chicken scratch notes from five years ago.

With digital models, all the patient's information – scans, treatment plans, progress reports, everything – is neatly organized and accessible with a few clicks. This isn't just about convenience, though. It's a game changer for long-term monitoring. Because you can easily access and compare data from different points in time, you can spot subtle changes or trends that might otherwise be missed. This leads to earlier detection of potential problems, more personalized treatment strategies, and ultimately, better outcomes for the patient. It's like having a super-organized, super-detailed health record right at your fingertips, allowing for a much more comprehensive and proactive approach to patient care.

About child

"Children" and "Childhood" redirect here. For other uses, see [Child \(disambiguation\)](#), [Children \(disambiguation\)](#), and [Childhood \(disambiguation\)](#).

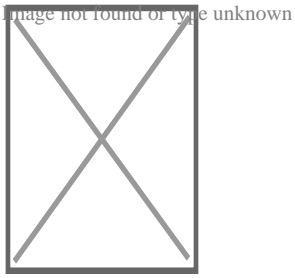


International children in traditional clothing at Liberty Weekend

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Part of a series on

**Human growth
and development**



Stages

- Gamete
- Zygote
- Embryo
- Fetus
- Infant
- Toddler
- Child
- Preadolescent
- Adolescent
- Emerging and early adulthood
- Young adult
- Middle adult
- Old adult
- Dying

Biological milestones

- Fertilization
- Pregnancy
- Childbirth
- Walking
- Language acquisition
- Puberty
- Menopause
- Ageing
- Death

Development and psychology

- Pre- and perinatal
- Infant and child
- Nature versus nurture
- Adolescent
- Youth
- Young adult
- Adult
- Maturity

Developmental stage theories

- Attachment
- Ecological
- Psychosocial
- Psychosexual development
- Moral
- Cognitive
- Cultural-historical
- Evolutionary

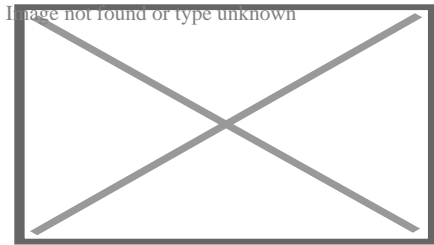
-  Psychology portal

A **child** (pl. **children**) is a human being between the stages of birth and puberty,^{[1][2]} or between the developmental period of infancy and puberty.^[3] The term may also refer to an unborn human being.^{[4][5]} In English-speaking countries, the legal definition of *child* generally refers to a minor, in this case as a person younger than the local age of majority (there are exceptions like, for example, the consume and purchase of alcoholic beverage even after said age of majority^[6]), regardless of their physical, mental and sexual development as biological adults.^{[1][7][8]} Children generally have fewer rights and responsibilities than adults. They are generally classed as unable to make serious decisions.

Child may also describe a relationship with a parent (such as sons and daughters of any age)^[9] or, metaphorically, an authority figure, or signify group membership in a clan, tribe, or religion; it can also signify being strongly affected by a specific time, place, or circumstance, as in "a child of nature" or "a child of the Sixties."^[10]

Biological, legal and social definitions

[edit]



Children playing ball games, Roman artwork, 2nd century AD

In the biological sciences, a child is usually defined as a person between birth and puberty,^{[1][2]} or between the developmental period of infancy and puberty.^[3] Legally, the term *child* may refer to anyone below the age of majority or some other age limit.

The United Nations Convention on the Rights of the Child defines *child* as, "A human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier."^[11] This is ratified by 192 of 194 member countries. The term *child* may also refer to someone below another legally defined age limit unconnected to the age of majority. In Singapore, for example, a *child* is legally defined as someone under the age of 14 under the "Children and Young Persons Act" whereas the age of majority is 21.^{[12][13]} In U.S. Immigration Law, a child refers to anyone who is under the age of 21.^[14]

Some English definitions of the word *child* include the fetus (sometimes termed *the unborn*).^[15] In many cultures, a child is considered an adult after undergoing a rite of passage, which may or may not correspond to the time of puberty.

Children generally have fewer rights than adults and are classed as unable to make serious decisions, and legally must always be under the care of a responsible adult or child custody, whether their parents divorce or not.

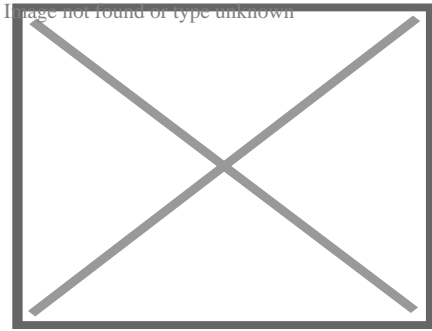
Developmental stages of childhood

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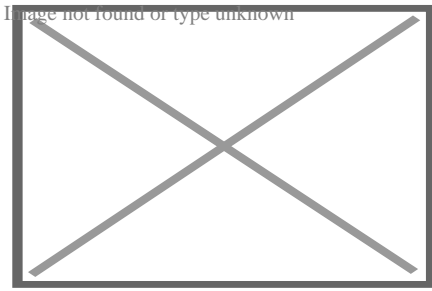
Further information: Child development stages and Child development

Early childhood

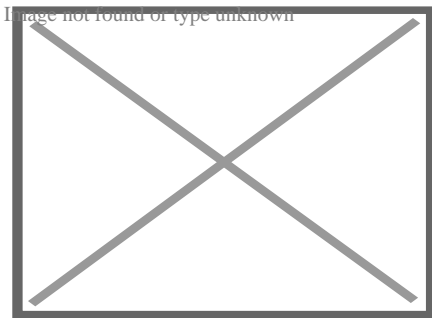
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Children playing the violin in a group recital, Ithaca, New York, 2011



Children in Madagascar, 2011



Child playing piano, 1984

Early childhood follows the infancy stage and begins with toddlerhood when the child begins speaking or taking steps independently.^{[16][17]} While toddlerhood ends around age 3 when the child becomes less dependent on parental assistance for basic needs, early childhood continues approximately until the age of 5 or 6. However, according to the National Association for the Education of Young Children, early childhood also includes infancy. At this stage children are learning through observing, experimenting and communicating with others. Adults supervise and support the development process of the child, which then will lead to the child's autonomy. Also during this stage, a strong emotional bond is created between the child and the care providers. The children also start preschool and kindergarten at this age: and hence their social lives.

Middle childhood

[edit]

Middle childhood begins at around age 7, and ends at around age 9 or 10.^[18] Together, early and middle childhood are called formative years. In this middle period, children develop socially and mentally. They are at a stage where they make new friends and gain new skills, which will enable them to become more independent and enhance their individuality. During middle childhood, children enter the school years, where they are presented with a different setting than they are used to. This new setting creates new challenges and faces for children.^[19] Upon the entrance of school, mental disorders that would normally not be noticed come to light. Many of these disorders include: autism, dyslexia, dyscalculia, and ADHD.^[20]

Special education, least restrictive environment, response to intervention and individualized education plans are all specialized plans to help children with disabilities.^[20]

Middle childhood is the time when children begin to understand responsibility and are beginning to be shaped by their peers and parents. Chores and more responsible decisions come at this time, as do social comparison and social play.^[20]

During social play, children learn from and teach each other, often through observation.^[21]

Late childhood

[edit]

Main article: Preadolescence

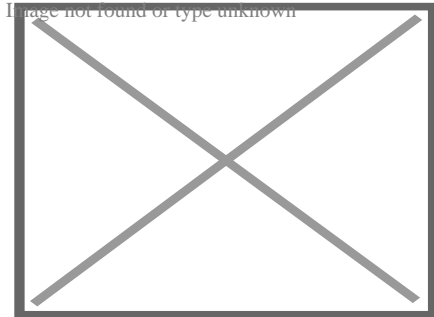
Preadolescence is a stage of human development following early childhood and preceding adolescence. Preadolescence is commonly defined as ages 9–12, ending with the major onset of puberty, with markers such as menarche, spermarche, and the peak of height velocity occurring. These changes usually occur between ages 11 and 14. It may also be defined as the 2-year period before the major onset of puberty.^[22] Preadolescence can bring its own challenges and anxieties. Preadolescent children have a different view of the world from younger children in many significant ways. Typically, theirs is a more realistic view of life than the intense, fantasy-oriented world of earliest childhood. Preadolescents have more mature, sensible, realistic thoughts and actions: 'the most "sensible" stage of development...the child is a much *less emotional being* now.'^[23] Preadolescents may well view human relationships differently (e.g. they may notice the flawed, human side of authority figures). Alongside that, they may begin to develop a sense of self-identity, and to have increased feelings of independence: 'may feel an individual, no longer "just one of the family."^[24]

Developmental stages post-childhood

[edit]

Adolescence

[edit]



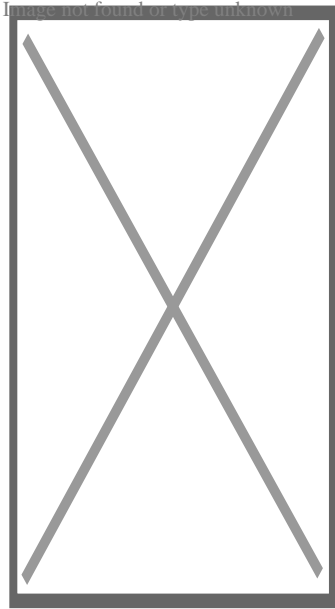
An adolescent girl, photographed by Paolo Monti

Adolescence is usually determined to be between the onset of puberty and legal adulthood: mostly corresponding to the teenage years (13–19). However, puberty usually begins before the teenage years (10—11 for girls and 11—12 for boys). Although biologically a child is a human being between the stages of birth and puberty,^[1]^[2] adolescents are legally considered children, as they tend to lack adult rights and are still required to attend compulsory schooling in many cultures, though this varies. The onset of adolescence brings about various physical, psychological and behavioral changes. The end of adolescence and the beginning of adulthood varies by country and by function, and even within a single nation-state or culture there may be different ages at which an individual is considered to be mature enough to be entrusted by society with certain tasks.

History

[edit]

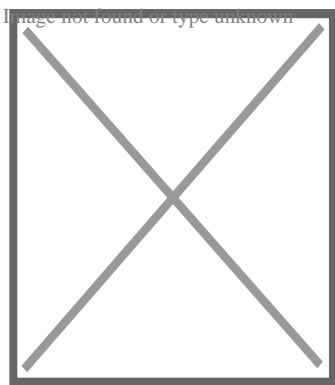
Main article: History of childhood



Playing Children, by Song dynasty Chinese artist Su Hanchen, c. 1150 AD.

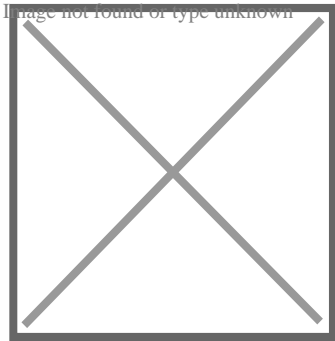
During the European Renaissance, artistic depictions of children increased dramatically, which did not have much effect on the social attitude toward children, however.[²⁵]

The French historian Philippe Ariès argued that during the 1600s, the concept of childhood began to emerge in Europe,[²⁶] however other historians like Nicholas Orme have challenged this view and argued that childhood has been seen as a separate stage since at least the medieval period.[²⁷] Adults saw children as separate beings, innocent and in need of protection and training by the adults around them. The English philosopher John Locke was particularly influential in defining this new attitude towards children, especially with regard to his theory of the *tabula rasa*, which considered the mind at birth to be a "blank slate". A corollary of this doctrine was that the mind of the child was born blank, and that it was the duty of the parents to imbue the child with correct notions. During the early period of capitalism, the rise of a large, commercial middle class, mainly in the Protestant countries of the Dutch Republic and England, brought about a new family ideology centred around the upbringing of children. Puritanism stressed the importance of individual salvation and concern for the spiritual welfare of children.[²⁸]



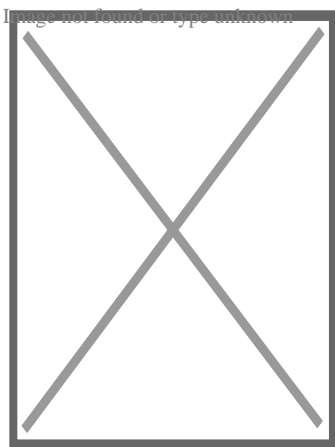
The Age of Innocence c. 1785/8. Reynolds emphasized the natural grace of children in his paintings.

The modern notion of childhood with its own autonomy and goals began to emerge during the 18th-century Enlightenment and the Romantic period that followed it.^[29]^[30] Jean Jacques Rousseau formulated the romantic attitude towards children in his famous 1762 novel *Emile: or, On Education*. Building on the ideas of John Locke and other 17th-century thinkers, Jean-Jaques Rousseau described childhood as a brief period of sanctuary before people encounter the perils and hardships of adulthood.^[29] Sir Joshua Reynolds' extensive children portraiture demonstrated the new enlightened attitudes toward young children. His 1788 painting *The Age of Innocence* emphasizes the innocence and natural grace of the posing child and soon became a public favourite.^[31]



Brazilian princesses Leopoldina (left) and Isabel (center) with an unidentified friend, c. 1860.

The idea of childhood as a locus of divinity, purity, and innocence is further expounded upon in William Wordsworth's "Ode: Intimations of Immortality from Recollections of Early Childhood", the imagery of which he "fashioned from a complex mix of pastoral aesthetics, pantheistic views of divinity, and an idea of spiritual purity based on an Edenic notion of pastoral innocence infused with Neoplatonic notions of reincarnation".^[30] This Romantic conception of childhood, historian Margaret Reeves suggests, has a longer history than generally recognized, with its roots traceable to similarly imaginative constructions of childhood circulating, for example, in the neo-platonic poetry of seventeenth-century metaphysical poet Henry Vaughan (e.g., "The Retreat", 1650; "Childe-hood", 1655). Such views contrasted with the stridently didactic, Calvinist views of infant depravity.^[32]



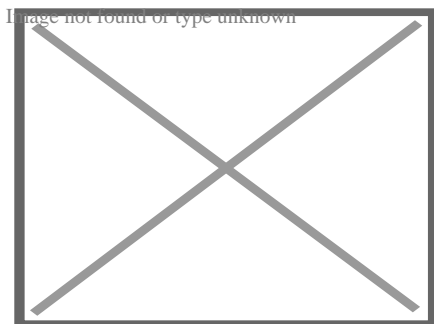
Armenian scouts in 1918

With the onset of industrialisation in England in 1760, the divergence between high-minded romantic ideals of childhood and the reality of the growing magnitude of child exploitation in the workplace, became increasingly apparent. By the late 18th century, British children were specially employed in factories and mines and as chimney sweeps,^[33] often working long hours in dangerous jobs for low pay.^[34] As the century wore on, the contradiction between the conditions on the ground for poor children and the middle-class notion of childhood as a time of simplicity and innocence led to the first campaigns for the imposition of legal protection for children.

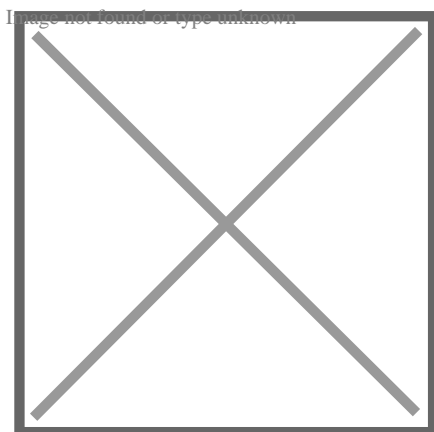
British reformers attacked child labor from the 1830s onward, bolstered by the horrific descriptions of London street life by Charles Dickens.^[35] The campaign eventually led to the Factory Acts, which mitigated the exploitation of children at the workplace^{[33][36]}

Modern concepts of childhood

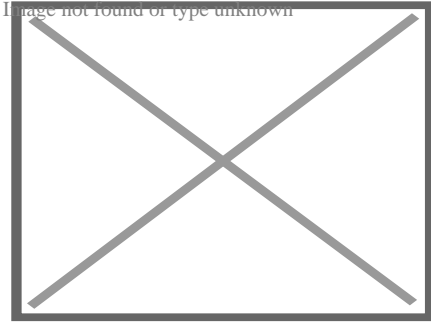
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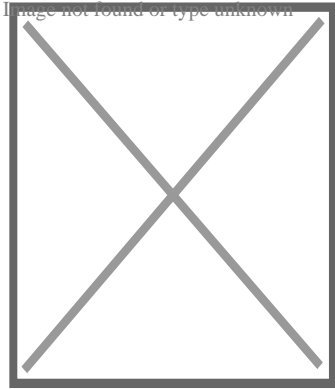
Children play in a fountain in a summer evening, Davis, California.



An old man and his granddaughter in Turkey.



Nepalese children playing with cats.



Harari girls in Ethiopia.

The modern attitude to children emerged by the late 19th century; the Victorian middle and upper classes emphasized the role of the family and the sanctity of the child – an attitude that has remained dominant in Western societies ever since.^[37] The genre of children's literature took off, with a proliferation of humorous, child-oriented books attuned to the child's imagination. Lewis Carroll's fantasy *Alice's Adventures in Wonderland*, published in 1865 in England, was a landmark in the genre; regarded as the first "English masterpiece written for children", its publication opened the "First Golden Age" of children's literature.

The latter half of the 19th century saw the introduction of compulsory state schooling of children across Europe, which decisively removed children from the workplace into schools.^{[38][39]}

The market economy of the 19th century enabled the concept of childhood as a time of fun, happiness, and imagination. Factory-made dolls and doll houses delighted the girls and organized sports and activities were played by the boys.^[40] The Boy Scouts was founded by Sir Robert Baden-Powell in 1908,^{[41][42]} which provided young boys with outdoor activities aiming at developing character, citizenship, and personal fitness qualities.^[43]

In the 20th century, Philippe Ariès, a French historian specializing in medieval history, suggested that childhood was not a natural phenomenon, but a creation of society in his 1960 book *Centuries of Childhood*. In 1961 he published a study of paintings, gravestones, furniture, and school records, finding that before the 17th century, children were represented as mini-adults.

In 1966, the American philosopher George Boas published the book *The Cult of Childhood*. Since then, historians have increasingly researched childhood in past times.^[44]

In 2006, Hugh Cunningham published the book *Invention of Childhood*, looking at British childhood from the year 1000, the Middle Ages, to what he refers to as the Post War Period of the 1950s, 1960s and 1970s.^[45]

Childhood evolves and changes as lifestyles change and adult expectations alter. In the modern era, many adults believe that children should not have any worries or work, as life should be happy and trouble-free. Childhood is seen as a mixture of simplicity, innocence, happiness, fun, imagination, and wonder. It is thought of as a time of playing, learning, socializing, exploring, and worrying in a world without much adult interference.^[29]^[30]

A "loss of innocence" is a common concept, and is often seen as an integral part of coming of age. It is usually thought of as an experience or period in a child's life that widens their awareness of evil, pain or the world around them. This theme is demonstrated in the novels *To Kill a Mockingbird* and *Lord of the Flies*. The fictional character Peter Pan was the embodiment of a childhood that never ends.^[46]^[47]

Healthy childhoods

[edit]

Role of parents

[edit]

Main article: Parenting

Children's health

[edit]

Further information: Childhood obesity, Childhood immunizations, and List of childhood diseases

Children's health includes the physical, mental and social well-being of children. Maintaining children's health implies offering them healthy foods, insuring they get enough sleep and exercise, and protecting their safety.^[48] Children in certain parts of the world often suffer from malnutrition, which is often associated with other conditions, such diarrhea, pneumonia and malaria.^[49]

Child protection

[edit]

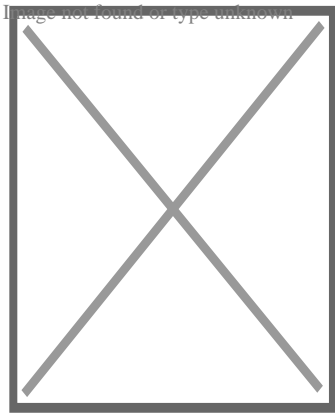
Further information: Child labor, Child labor laws, Risk aversion, Child abuse, and Protection of Children Act

Child protection, according to UNICEF, refers to "preventing and responding to violence, exploitation and abuse against children – including commercial sexual exploitation, trafficking, child labour and harmful traditional practices, such as female genital mutilation/cutting and child marriage".^[50] The Convention on the Rights of the Child protects the fundamental rights of children.

Play

[edit]

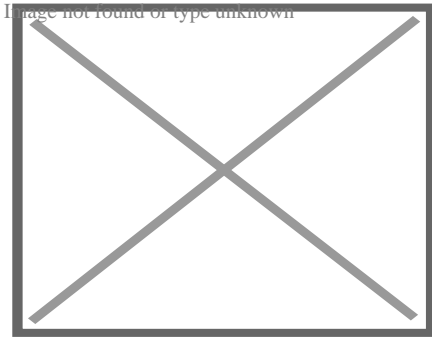
Further information: Play (activity), Playground, Imaginary friend, and Childhood secret club



Dancing at Mother of Peace AIDs orphanage, Zimbabwe

Play is essential to the cognitive, physical, social, and emotional well-being of children.^[51] It offers children opportunities for physical (running, jumping, climbing, etc.), intellectual (social skills, community norms, ethics and general knowledge) and emotional development (empathy, compassion, and friendships). Unstructured play encourages creativity and imagination. Playing and interacting with other children, as well as some adults, provides opportunities for friendships, social interactions, conflicts and resolutions. However, adults tend to (often mistakenly) assume that virtually all children's social activities can be understood as "play" and, furthermore, that children's play activities do not involve much skill or effort.^{[52][53][54][55]}

It is through play that children at a very early age engage and interact in the world around them. Play allows children to create and explore a world they can master, conquering their fears while practicing adult roles, sometimes in conjunction with other children or adult caregivers.^[51] Undirected play allows children to learn how to work in groups, to share, to negotiate, to resolve conflicts, and to learn self-advocacy skills. However, when play is controlled by adults, children acquiesce to adult rules and concerns and lose some of the benefits play offers them. This is especially true in developing creativity, leadership, and group skills.^[51]



Ralph Hedley, *The Tournament*, 1898. It depicts poorer boys playing outdoors in a rural part of the Northeast of England.

Play is considered to be very important to optimal child development that it has been recognized by the United Nations Commission on Human Rights as a right of every child.^[11] Children who are being raised in a hurried and pressured style may limit the protective benefits they would gain from child-driven play.^[51]

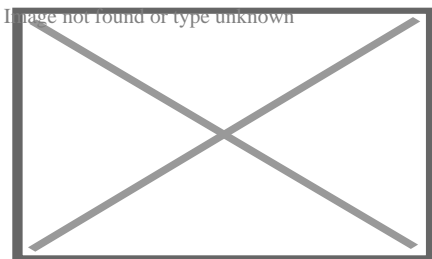
The initiation of play in a classroom setting allows teachers and students to interact through playfulness associated with a learning experience. Therefore, playfulness aids the interactions between adults and children in a learning environment. “Playful Structure” means to combine informal learning with formal learning to produce an effective learning experience for children at a young age.^[56]

Even though play is considered to be the most important to optimal child development, the environment affects their play and therefore their development. Poor children confront widespread environmental inequities as they experience less social support, and their parents are less responsive and more authoritarian. Children from low income families are less likely to have access to books and computers which would enhance their development.^[57]

Street culture

[edit]

Main articles: Children's street culture and Children's street games



Children in front of a movie theatre, Toronto, 1920s.

Children's street culture refers to the cumulative culture created by young children and is sometimes referred to as their *secret world*. It is most common in children between the ages of seven and twelve. It is strongest in urban working class industrial districts where children are traditionally free to play out in the streets for long periods without supervision. It is invented and largely sustained by children themselves with little adult interference.

Young children's street culture usually takes place on quiet backstreets and pavements, and along routes that venture out into local parks, playgrounds, scrub and wasteland, and to local shops. It often imposes imaginative status on certain sections of the urban realm (local buildings, kerbs, street objects, etc.). Children designate specific areas that serve as informal meeting and relaxation places (see: Sobel, 2001). An urban area that looks faceless or neglected to an adult may have deep 'spirit of place' meanings in to children. Since the advent of indoor distractions such as video games, and television, concerns have been expressed about the vitality – or even the survival – of children's street culture.

Geographies of childhood

[edit]

The geographies of childhood involves how (adult) society perceives the idea of childhood, the many ways adult attitudes and behaviors affect children's lives, including the environment which surrounds children and its implications.^[58]

The geographies of childhood is similar in some respects to children's geographies which examines the places and spaces in which children live.^[59]

Nature deficit disorder

[edit]

Main article: Nature deficit disorder

Nature Deficit Disorder, a term coined by Richard Louv in his 2005 book *Last Child in the Woods*, refers to the trend in the United States and Canada towards less time for outdoor play,^[60]^[61] resulting in a wide range of behavioral problems.^[62]

With increasing use of cellphones, computers, video games and television, children have more reasons to stay inside rather than outdoors exploring. “The average American child spends 44 hours a week with electronic media”.^[63] Research in 2007 has drawn a correlation between the declining number of National Park visits in the U.S. and increasing consumption of electronic media by children.^[64] The media has accelerated the trend for children's nature disconnection by deemphasizing views of nature, as in Disney films.^[65]

Age of responsibility

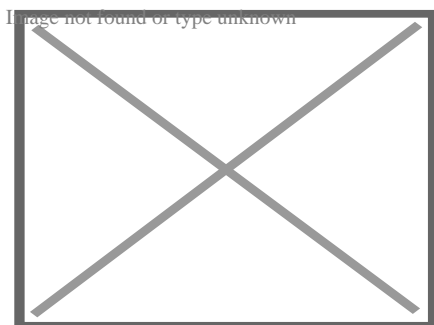
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Further information: Age of consent, Age of majority, Age of criminal responsibility, and Marriageable age

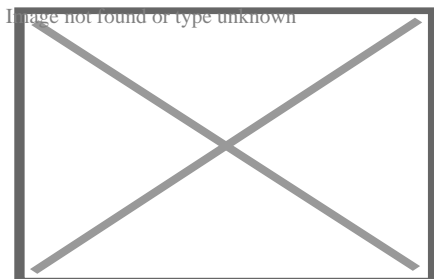
The age at which children are considered responsible for their society-bound actions (e. g. marriage, voting, etc.) has also changed over time,^[66] and this is reflected in the way they are treated in courts of law. In Roman times, children were regarded as not culpable for crimes, a position later adopted by the Church. In the 19th century, children younger than seven years old were believed incapable of crime. Children from the age of seven forward were considered responsible for their actions. Therefore, they could face criminal charges, be sent to adult prison, and be punished like adults by whipping, branding or hanging. However, courts at the time would consider the offender's age when deliberating sentencing.^[citation needed] Minimum employment age and marriage age also vary. The age limit of voluntary/involuntary military service is also disputed at the international level.^[67]

Education

[edit]



Children in an outdoor classroom in Bié, Angola



Children seated in a Finnish classroom at the school of Torvinen in Sodankylä, Finland, in the 1920s

Main article: Education

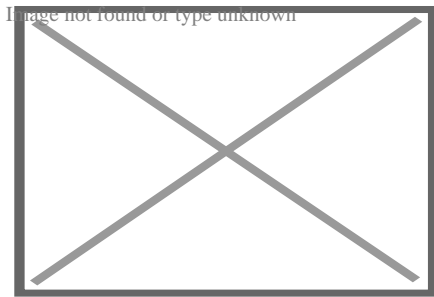
Education, in the general sense, refers to the act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and preparing intellectually for mature life.^[68] Formal education most often takes place through schooling. A right to education has been recognized by some governments. At the global level, Article 13 of the United Nations'

1966 International Covenant on Economic, Social and Cultural Rights (ICESCR) recognizes the right of everyone to an education.^[69] Education is compulsory in most places up to a certain age, but attendance at school may not be, with alternative options such as home-schooling or e-learning being recognized as valid forms of education in certain jurisdictions.

Children in some countries (especially in parts of Africa and Asia) are often kept out of school, or attend only for short periods. Data from UNICEF indicate that in 2011, 57 million children were out of school; and more than 20% of African children have never attended primary school or have left without completing primary education.^[70] According to a UN report, warfare is preventing 28 million children worldwide from receiving an education, due to the risk of sexual violence and attacks in schools.^[71] Other factors that keep children out of school include poverty, child labor, social attitudes, and long distances to school.^{[72][73]}

Attitudes toward children

[edit]



Group of breaker boys in Pittston, Pennsylvania, 1911. Child labor was widespread until the early 20th century. In the 21st century, child labor rates are highest in Africa.

Social attitudes toward children differ around the world in various cultures and change over time. A 1988 study on European attitudes toward the centrality of children found that Italy was more child-centric and the Netherlands less child-centric, with other countries, such as Austria, Great Britain, Ireland and West Germany falling in between.^[74]

Child marriage

[edit]

In 2013, child marriage rates of female children under the age of 18 reached 75% in Niger, 68% in Central African Republic and Chad, 66% in Bangladesh, and 47% in India.^[75] According to a 2019 UNICEF report on child marriage, 37% of females were married before the age of 18 in sub-Saharan Africa, followed by South Asia at 30%. Lower levels were found in Latin America and Caribbean (25%), the Middle East and North Africa (18%), and Eastern Europe and Central Asia (11%), while rates in Western Europe and North America were minimal.^[76] Child marriage

is more prevalent with girls, but also involves boys. A 2018 study in the journal *Vulnerable Children and Youth Studies* found that, worldwide, 4.5% of males are married before age 18, with the Central African Republic having the highest average rate at 27.9%.^[77]

Fertility and number of children per woman

[edit]

Before contraception became widely available in the 20th century, women had little choice other than abstinence or having often many children. In fact, current population growth concerns have only become possible with drastically reduced child mortality and sustained fertility. In 2017 the global total fertility rate was estimated to be 2.37 children per woman,^[78] adding about 80 million people to the world population per year. In order to measure the total number of children, scientists often prefer the completed cohort fertility at age 50 years (CCF50).^[78] Although the number of children is also influenced by cultural norms, religion, peer pressure and other social factors, the CCF50 appears to be most heavily dependent on the educational level of women, ranging from 5–8 children in women without education to less than 2 in women with 12 or more years of education.^[78]

Issues

[edit]

Emergencies and conflicts

[edit]

See also: Declaration on the Protection of Women and Children in Emergency and Armed Conflict, Children in the Israeli–Palestinian conflict, Save the Children, Inter-Agency Network for Education in Emergencies, Military use of children, Trafficking of children, International child abduction, and Refugee children

Emergencies and conflicts pose detrimental risks to the health, safety, and well-being of children. There are many different kinds of conflicts and emergencies, e.g. wars and natural disasters. As of 2010 approximately 13 million children are displaced by armed conflicts and violence around the world.^[79] Where violent conflicts are the norm, the lives of young children are significantly disrupted and their families have great difficulty in offering the sensitive and consistent care that young children need for their healthy development.^[79] Studies on the effect of emergencies and conflict on the physical and mental health of children between birth and 8 years old show that where the disaster is natural, the rate of PTSD occurs in anywhere from 3 to 87 percent of affected children.^[80] However, rates of PTSD for children living in chronic conflict conditions varies from 15 to 50 percent.^[81]^[82]

Child protection

[edit]

This section is an excerpt from Child protection.[edit]

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Childcare

At home

- Parents
- Extended family
- Au pair
- Babysitter
- Governess
- Nanny

Outside the home

- Daycare
- Pre-school playgroup

Educational settings

- Early childhood education
- Homeschooling
- Pre-kindergarten
- Preschool
- Kindergarten
- Primary school

Institutions and standards

- Child protection
- *In loco parentis*
- Minor

Related

- Child abuse
- Child marriage
- Child Online Protection
- Family law
- Men in early childhood education
- Orphanage
- Parenting

Child protection (also called child welfare) is the safeguarding of children from violence, exploitation, abuse, abandonment, and neglect.^{[83][84][85][86]} It involves identifying signs of potential harm. This includes responding to allegations or suspicions of abuse, providing support and services to protect children, and holding those who have harmed them accountable.^[87]

The primary goal of child protection is to ensure that all children are safe and free from harm or danger.^{[86][88]} Child protection also works to prevent future harm by creating policies and systems that identify and respond to risks before they lead to harm.^[89]

In order to achieve these goals, research suggests that child protection services should be provided in a holistic way.^{[90][91][92]} This means taking into account the social, economic, cultural, psychological, and environmental factors that can contribute to the risk of harm for individual children and their families. Collaboration across sectors and disciplines to create a comprehensive system of support and safety for children is required.^{[93][94]}

It is the responsibility of individuals, organizations, and governments to ensure that children are protected from harm and their rights are respected.^[95] This includes providing a safe environment for children to grow and develop, protecting them from physical, emotional and sexual abuse, and ensuring they have access to education, healthcare, and resources to fulfill their basic needs.^[96]

Child protection systems are a set of services, usually government-run, designed to protect children and young people who are underage and to encourage family stability. UNICEF defines^[97] a 'child protection system' as:

"The set of laws, policies, regulations and services needed across all social sectors – especially social welfare, education, health, security and justice – to support prevention and response to protection-related risks. These systems are part of social protection, and extend beyond it. At the level of prevention, their aim includes supporting and strengthening families to reduce social exclusion, and to lower the risk of separation, violence and exploitation. Responsibilities are often spread across government agencies, with services delivered by local authorities, non-State providers, and community groups, making coordination between sectors and levels,

including routine referral systems etc., a necessary component of effective child protection systems."

—*United Nations Economic and Social Council (2008), UNICEF Child Protection Strategy, E/ICEF/2008/5/Rev.1, par. 12–13.*

Under Article 19 of the UN Convention on the Rights of the Child, a 'child protection system' provides for the protection of children in and out of the home. One of the ways this can be enabled is through the provision of quality education, the fourth of the United Nations Sustainable Development Goals, in addition to other child protection systems. Some literature argues that child protection begins at conception; even how the conception took place can affect the child's development.^[98]

Child abuse and child labor

[edit]

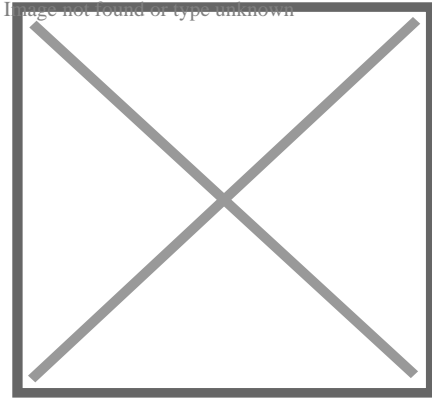
Protection of children from abuse is considered an important contemporary goal. This includes protecting children from exploitation such as child labor, child trafficking and child selling, child sexual abuse, including child prostitution and child pornography, military use of children, and child laundering in illegal adoptions. There exist several international instruments for these purposes, such as:

- Worst Forms of Child Labour Convention
- Minimum Age Convention, 1973
- Optional Protocol on the Sale of Children, Child Prostitution and Child Pornography
- Council of Europe Convention on the Protection of Children against Sexual Exploitation and Sexual Abuse
- Optional Protocol on the Involvement of Children in Armed Conflict
- Hague Adoption Convention

Climate change

[edit]

This section is an excerpt from Climate change and children.[edit]



A child at a climate demonstration in Juneau, Alaska

Children are more vulnerable to the effects of climate change than adults. The World Health Organization estimated that 88% of the existing global burden of disease caused by climate change affects children under five years of age.^[99] A *Lancet* review on health and climate change lists children as the worst-affected category by climate change.^[100] Children under 14 are 44 percent more likely to die from environmental factors,^[101] and those in urban areas are disproportionately impacted by lower air quality and overcrowding.^[102]

Children are physically more vulnerable to climate change in all its forms.^[103] Climate change affects the physical health of children and their well-being. Prevailing inequalities, between and within countries, determine how climate change impacts children.^[104] Children often have no voice in terms of global responses to climate change.^[103]

People living in low-income countries experience a higher burden of disease and are less capable of coping with climate change-related threats.^[105] Nearly every child in the world is at risk from climate change and pollution, while almost half are at extreme risk.^[106]

Health

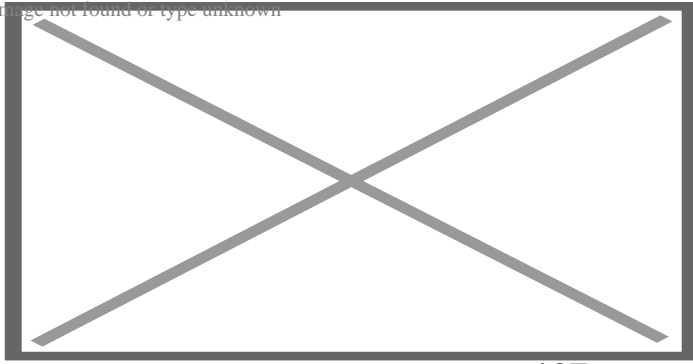
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Child mortality

[edit]

Main articles: Child mortality and Infant mortality

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World infant mortality rates in 2012.^[107]

During the early 17th century in England, about two-thirds of all children died before the age of four.^[108] During the Industrial Revolution, the life expectancy of children increased dramatically.^[109] This has continued in England, and in the 21st century child mortality rates have fallen across the world. About 12.6 million under-five infants died worldwide in 1990, which declined to 6.6 million in 2012. The infant mortality rate dropped from 90 deaths per 1,000 live births in 1990, to 48 in 2012. The highest average infant mortality rates are in sub-Saharan Africa, at 98 deaths per 1,000 live births – over double the world's average.^[107]

See also

[edit]

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- Outline of childhood
- Child slavery
- Childlessness
- Depression in childhood and adolescence
- One-child policy
- Religion and children
- Youth rights
- Archaeology of childhood

Sources

[edit]

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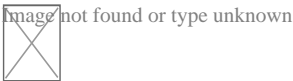
Further reading

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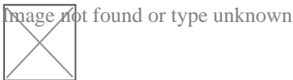
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Family

- History
- Household
- Nuclear family
- Extended family
- Conjugal family
- Immediate family
- Matrifocal family

First-degree relatives

- Parent
 - mother
 - father
- Child
 - son
 - daughter
- Sibling
 - brother
 - sister

Second-degree relatives

- Grandparent
- Grandchild
- Uncle/Aunt
- Niece and nephew

Third-degree relatives

- Great-grandparent
- Great-grandchild
- Great-uncle/Great-aunt
- Cousin

Family-in-law

- Spouse
 - wife
 - husband
- Parent-in-law
- Sibling-in-law
- Child-in-law
 - daughter-in-law
 - son-in-law

Stepfamily

- Stepparent
 - stepfather
 - stepmother
- Stepchild
- Stepsibling

Kinship terminology

- Kinship
- Australian Aboriginal kinship
- Adoption
- Affinity
- Consanguinity
- Disownment
- Divorce
- Estrangement
- Family of choice
- Fictive kinship
- Marriage
- Nurture kinship
- Chinese kinship
- Hawaiian kinship
- Sudanese kinship
- Eskimo kinship
- Iroquois kinship
- Crow kinship
- Omaha kinship

Genealogy and lineage

- Bilateral descent
- Common ancestor
- Family name
- Heirloom
- Heredity
- Inheritance
- Lineal descendant
- collateral descent
- Matrilineality
- Patrilineality
- Progenitor
- Clan
- Royal descent

Family trees

- Pedigree chart
- Genogram
- Ahnentafel
 - Genealogical numbering systems
 - Seize quartiers
 - Quarters of nobility

Relationships

- Agape (parental love)
- Eros (marital love)
- Philia (brotherly love)
- Storge (familial love)
- Filial piety
- Polyfidelity

Holidays

- Mother's Day
 - U.S.
- Father's Day
- Father–Daughter Day
- Siblings Day
- National Grandparents Day
- Parents' Day
- Children's Day
 - Japan
- Family Day
 - Canada
- American Family Day
- International Day of Families
- National Family Week
 - UK
- National Adoption Day

Related

- Single parent
- Wedding anniversary
- Godparent
- Birth order
- Only child
- Middle child syndrome
- Sociology of the family
- Museum of Motherhood
- Astronaut family
- Dysfunctional family
- Domestic violence
- Incest
- Sibling abuse
- Sibling estrangement
- Sibling rivalry

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Development of the human body

Before birth

- Development
- Zygote
- Embryo
- Fetus
- Gestational age

Birth and after

- Birth
- Child development
 - Stages
 - Early
 - Puberty
- Adult development
- Ageing
- Senescence
- Death

Phases

- Early years
 - Infant
 - Toddler
 - Early childhood
 - Childhood
 - Child
- Youth
 - Preadolescence
 - Adolescence
 - Emerging adulthood
- Adulthood
 - Young adult
 - Middle adult
 - Elder adult
- Dying

Social and legal

- Minor
- Age of majority

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National

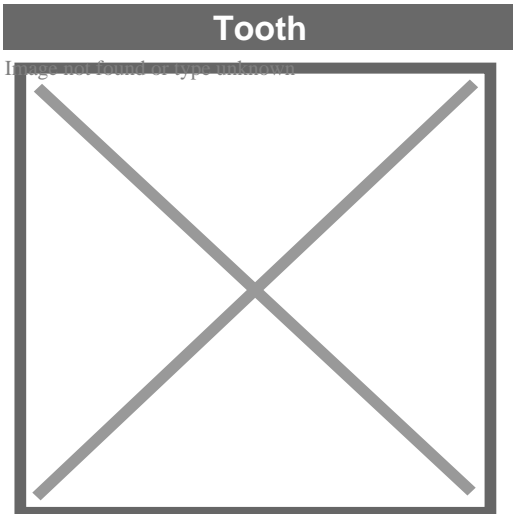
- Germany
- United States
- France
- BnF data
- Czech Republic
- Spain
- Latvia
- Sweden
- Israel

Other

- NARA
- Encyclopedia of Modern Ukraine

About tooth

This article is about teeth in general. For specifically human teeth, see Human tooth. For other uses, see Tooth (disambiguation).



A chimpanzee displaying his teeth

Details

Identifiers

Latin	<i>dens</i>
MeSH	D014070

A **tooth** (pl.: **teeth**) is a hard, calcified structure found in the jaws (or mouths) of many vertebrates and used to break down food. Some animals, particularly carnivores and omnivores, also use teeth to help with capturing or wounding prey, tearing food, for defensive purposes, to intimidate other animals often including their own, or to carry prey or their young. The roots of teeth are covered by gums. Teeth are not made of bone, but rather of multiple tissues of varying density and hardness that originate from the outermost embryonic germ layer, the ectoderm.

The general structure of teeth is similar across the vertebrates, although there is considerable variation in their form and position. The teeth of mammals have deep roots, and this pattern is also found in some fish, and in crocodylians. In most teleost fish, however, the teeth are attached to the outer surface of the bone, while in lizards they are attached to the inner surface of the jaw by one side. In cartilaginous fish, such as sharks, the teeth are attached by tough ligaments to the hoops of cartilage that form the jaw.^[1]

Monophyodonts are animals that develop only one set of teeth, while diphyodonts grow an early set of deciduous teeth and a later set of permanent or "adult" teeth. Polyphyodonts grow many sets of teeth. For example, sharks, grow a new set of teeth every two weeks to replace worn teeth. Most extant mammals including humans are diphyodonts, but there are exceptions including elephants, kangaroos, and manatees, all of which are polyphyodonts.

Rodent incisors grow and wear away continually through gnawing, which helps maintain relatively constant length. The industry of the beaver is due in part to this qualification. Some rodents, such as voles and guinea pigs (but not mice), as well as lagomorpha (rabbits, hares and pikas), have continuously growing molars in addition to incisors.^[2]^[3] Also, tusks (in tusked mammals) grow almost throughout life.^[4]

Teeth are not always attached to the jaw, as they are in mammals. In many reptiles and fish, teeth are attached to the palate or to the floor of the mouth, forming additional rows inside those on the jaws proper. Some teleosts even have teeth in the pharynx. While not true teeth in the usual sense, the dermal denticles of sharks are almost identical in structure and are likely to have the same evolutionary origin. Indeed, teeth appear to have first evolved in sharks, and are not found in the more primitive jawless fish – while lampreys do have tooth-like structures on the tongue, these are in fact, composed of keratin, not of dentine or enamel, and bear no relationship to true teeth.^[1] Though "modern" teeth-like structures with dentine and enamel have been found in late conodonts, they are now supposed to have evolved independently of later vertebrates' teeth.^[5]^[6]

Living amphibians typically have small teeth, or none at all, since they commonly feed only on soft foods. In reptiles, teeth are generally simple and conical in shape, although there is some variation between species, most notably the venom-injecting fangs of snakes. The pattern of incisors, canines, premolars and molars is found only in mammals, and to varying extents, in

their evolutionary ancestors. The numbers of these types of teeth vary greatly between species; zoologists use a standardised dental formula to describe the precise pattern in any given group.^[1]

Etymology

[edit]

The word *tooth* comes from Proto-Germanic **tanþs*, derived from the Proto-Indo-European **h₂nt-*, which was composed of the root **h₂nt-* 'to eat' plus the active participle suffix **-nt-*, therefore literally meaning 'that which eats'.^[7]

The irregular plural form *teeth* is the result of Germanic umlaut whereby vowels immediately preceding a high vocalic in the following syllable were raised. As the nominative plural ending of the Proto-Germanic consonant stems (to which **tanþs* belonged) was **-iz*, the root vowel in the plural form **tanþiz* (changed by this point to **t^{iu}ntiz*)

via unrelated phonological processes) was raised to /œ/ and later unrounded to /e/

resulting in the

alternation attested from Old English. Cf. also Old English

'book/books' and

'mouse/mice', from Proto-Germanic **m^{iu}ntiz*

and **m^{iu}ntiz*

respectively.

Cognate with Latin

, Greek

(*odous*), and Sanskrit *dát*.

Origin

[edit]

Teeth are assumed to have evolved either from ectoderm denticles (scales, much like those on the skin of sharks) that folded and integrated into the mouth (called the "outside–in" theory), or from endoderm pharyngeal teeth (primarily formed in the pharynx of jawless vertebrates) (the "inside–out" theory). In addition, there is another theory stating that neural crest gene regulatory network, and neural crest-derived ectomesenchyme are the key to generate teeth (with any epithelium, either ectoderm or endoderm).[⁴][⁸]

The genes governing tooth development in mammals are homologous to those involved in the development of fish scales.[⁹] Study of a tooth plate of a fossil of the extinct fish *Romundina stellina* showed that the teeth and scales were made of the same tissues, also found in mammal teeth, lending support to the theory that teeth evolved as a modification of scales.[¹⁰]

Mammals

[edit]

Main article: Mammal tooth

Teeth are among the most distinctive (and long-lasting) features of mammal species. Paleontologists use teeth to identify fossil species and determine their relationships. The shape of the animal's teeth are related to its diet. For example, plant matter is hard to digest, so herbivores have many molars for chewing and grinding. Carnivores, on the other hand, have canine teeth to kill prey and to tear meat.

Mammals, in general, are diphyodont, meaning that they develop two sets of teeth. In humans, the first set (the "baby", "milk", "primary" or "deciduous" set) normally starts to appear at about six months of age, although some babies are born with one or more visible teeth, known as neonatal teeth. Normal tooth eruption at about six months is known as teething and can be painful. Kangaroos, elephants, and manatees are unusual among mammals because they are polyphyodonts.

Aardvark

[edit]

In aardvarks, teeth lack enamel and have many pulp tubules, hence the name of the order Tubulidentata.[¹¹]

Canines

[edit]

In dogs, the teeth are less likely than humans to form dental cavities because of the very high pH of dog saliva, which prevents enamel from demineralizing.^[12] Sometimes called cuspids, these teeth are shaped like points (cusps) and are used for tearing and grasping food.^[13]

Cetaceans

[edit]

Main article: Baleen

Like human teeth, whale teeth have polyp-like protrusions located on the root surface of the tooth. These polyps are made of cementum in both species, but in human teeth, the protrusions are located on the outside of the root, while in whales the nodule is located on the inside of the pulp chamber. While the roots of human teeth are made of cementum on the outer surface, whales have cementum on the entire surface of the tooth with a very small layer of enamel at the tip. This small enamel layer is only seen in older whales where the cementum has been worn away to show the underlying enamel.^[14]

The toothed whale is a parvorder of the cetaceans characterized by having teeth. The teeth differ considerably among the species. They may be numerous, with some dolphins bearing over 100 teeth in their jaws. On the other hand, the narwhals have a giant unicorn-like tusk, which is a tooth containing millions of sensory pathways and used for sensing during feeding, navigation, and mating. It is the most neurologically complex tooth known. Beaked whales are almost toothless, with only bizarre teeth found in males. These teeth may be used for feeding but also for demonstrating aggression and showmanship.

Primates

[edit]

Main articles: Human tooth and Dental anatomy

In humans (and most other primates), there are usually 20 primary (also "baby" or "milk") teeth, and later up to 32 permanent teeth. Four of these 32 may be third molars or wisdom teeth, although these are not present in all adults, and may be removed surgically later in life.^[15]

Among primary teeth, 10 of them are usually found in the maxilla (i.e. upper jaw) and the other 10 in the mandible (i.e. lower jaw). Among permanent teeth, 16 are found in the maxilla and the other 16 in the mandible. Most of the teeth have uniquely distinguishing features.

Horse

[edit]

Main article: Horse teeth

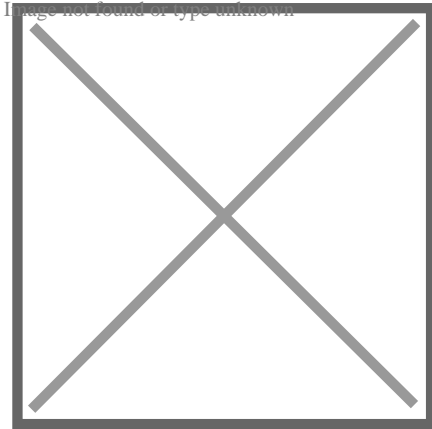
An adult horse has between 36 and 44 teeth. The enamel and dentin layers of horse teeth are intertwined.^[16] All horses have 12 premolars, 12 molars, and 12 incisors.^[17] Generally, all male equines also have four canine teeth (called tushes) between the molars and incisors. However, few female horses (less than 28%) have canines, and those that do usually have only one or two, which many times are only partially erupted.^[18] A few horses have one to four wolf teeth, which are vestigial premolars, with most of those having only one or two. They are equally common in male and female horses and much more likely to be on the upper jaw. If present these can cause problems as they can interfere with the horse's bit contact. Therefore, wolf teeth are commonly removed.^[17]

Horse teeth can be used to estimate the animal's age. Between birth and five years, age can be closely estimated by observing the eruption pattern on milk teeth and then permanent teeth. By age five, all permanent teeth have usually erupted. The horse is then said to have a "full" mouth. After the age of five, age can only be conjectured by studying the wear patterns on the incisors, shape, the angle at which the incisors meet, and other factors. The wear of teeth may also be affected by diet, natural abnormalities, and cribbing. Two horses of the same age may have different wear patterns.

A horse's incisors, premolars, and molars, once fully developed, continue to erupt as the grinding surface is worn down through chewing. A young adult horse will have teeth, which are 110–130 mm (4.5–5 inches) long, with the majority of the crown remaining below the gumline in the dental socket. The rest of the tooth will slowly emerge from the jaw, erupting about 3 mm (1? 8 in) each year, as the horse ages. When the animal reaches old age, the crowns of the teeth are very short and the teeth are often lost altogether. Very old horses, if lacking molars, may need to have their fodder ground up and soaked in water to create a soft mush for them to eat in order to obtain adequate nutrition.

Proboscideans

[edit]



Section through the ivory tusk of a mammoth

Main article: Elephant ivory

Elephants' tusks are specialized incisors for digging food up and fighting. Some elephant teeth are similar to those in manatees, and elephants are believed to have undergone an aquatic phase in their evolution.

At birth, elephants have a total of 28 molar plate-like grinding teeth not including the tusks. These are organized into four sets of seven successively larger teeth which the elephant will slowly wear through during its lifetime of chewing rough plant material. Only four teeth are used for chewing at a given time, and as each tooth wears out, another tooth moves forward to take its place in a process similar to a conveyor belt. The last and largest of these teeth usually becomes exposed when the animal is around 40 years of age, and will often last for an additional 20 years. When the last of these teeth has fallen out, regardless of the elephant's age, the animal will no longer be able to chew food and will die of starvation.^{[19][20]}

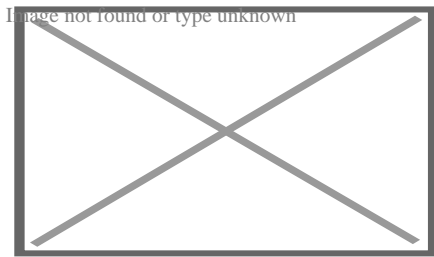
Rabbit

[edit]

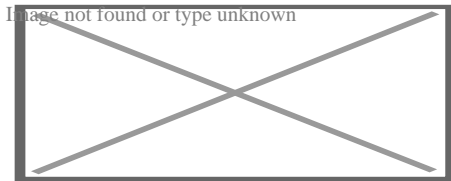
Rabbits and other lagomorphs usually shed their deciduous teeth before (or very shortly after) their birth, and are usually born with their permanent teeth.^[21] The teeth of rabbits complement their diet, which consists of a wide range of vegetation. Since many of the foods are abrasive enough to cause attrition, rabbit teeth grow continuously throughout life.^[22] Rabbits have a total of six incisors, three upper premolars, three upper molars, two lower premolars, and two lower molars on each side. There are no canines. Dental formula is $\frac{2.0.3.3}{1.0.2.3} = 28$. Three to four millimeters of the tooth is worn away by incisors every week, whereas the cheek teeth require a month to wear away the same amount.^[23]

The incisors and cheek teeth of rabbits are called aradicular hypsodont teeth. This is sometimes referred to as an elodont dentition. These teeth grow or erupt continuously. The growth or

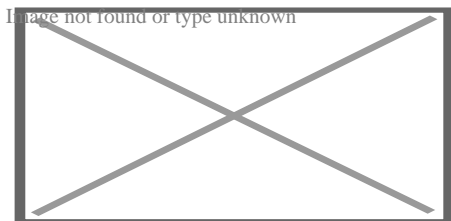
eruption is held in balance by dental abrasion from chewing a diet high in fiber.



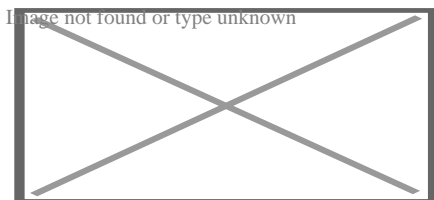
Buccal view of top incisor from *Rattus rattus*. Top incisor outlined in yellow. Molars circled in blue.



Buccal view of the lower incisor from the right dentary of a *Rattus rattus*



Lingual view of the lower incisor from the right dentary of a *Rattus rattus*



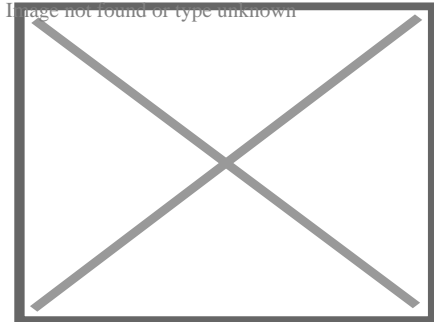
Midsagittal view of top incisor from *Rattus rattus*. Top incisor outlined in yellow. Molars circled in blue.

Rodents

[edit]

Rodents have upper and lower hypselodont incisors that can continuously grow enamel throughout its life without having properly formed roots.^[24] These teeth are also known as aradicular teeth, and unlike humans whose ameloblasts die after tooth development, rodents continually produce enamel, they must wear down their teeth by gnawing on various materials.^[25] Enamel and dentin are produced by the enamel organ, and growth is dependent on the presence of stem cells, cellular amplification, and cellular maturation structures in the

odontogenic region.^[26] Rodent incisors are used for cutting wood, biting through the skin of fruit, or for defense. This allows for the rate of wear and tooth growth to be at equilibrium.^[24] The microstructure of rodent incisor enamel has shown to be useful in studying the phylogeny and systematics of rodents because of its independent evolution from the other dental traits. The enamel on rodent incisors are composed of two layers: the inner portio interna (PI) with Hunter-Schreger bands (HSB) and an outer portio externa (PE) with radial enamel (RE).^[27] It usually involves the differential regulation of the epithelial stem cell niche in the tooth of two rodent species, such as guinea pigs.^{[28][29]}



Lingual view of top incisor from *Rattus rattus*. Top incisor outlined in yellow. Molars circled in blue.

The teeth have enamel on the outside and exposed dentin on the inside, so they self-sharpen during gnawing. On the other hand, continually growing molars are found in some rodent species, such as the sibling vole and the guinea pig.^{[28][29]} There is variation in the dentition of the rodents, but generally, rodents lack canines and premolars, and have a space between their incisors and molars, called the diastema region.

Manatee

[edit]

Manatees are polyphyodont with mandibular molars developing separately from the jaw and are encased in a bony shell separated by soft tissue.^{[30][31]}

Walrus

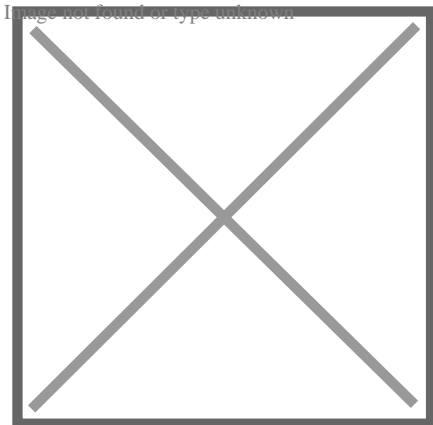
[edit]

Main article: Walrus ivory

Walrus tusks are canine teeth that grow continuously throughout life.^[32]

Fish

[edit]



Teeth of a great white shark

See also: Pharyngeal teeth and Shark tooth

Fish, such as sharks, may go through many teeth in their lifetime. The replacement of multiple teeth is known as polyphyodontia.

A class of prehistoric shark are called cladodonts for their strange forked teeth.

Unlike the continuous shedding of functional teeth seen in modern sharks,^[33]^[34] the majority of stem chondrichthyan lineages retained all tooth generations developed throughout the life of the animal.^[35] This replacement mechanism is exemplified by the tooth whorl-based dentitions of acanthodians,^[36] which include the oldest known toothed vertebrate, *Qianodus duplicis*^[37].

Amphibians

[edit]

All amphibians have pedicellate teeth, which are modified to be flexible due to connective tissue and uncalcified dentine that separates the crown from the base of the tooth.^[38]

Most amphibians exhibit teeth that have a slight attachment to the jaw or acrodont teeth. Acrodont teeth exhibit limited connection to the dentary and have little enervation.^[39] This is ideal for organisms who mostly use their teeth for grasping, but not for crushing and allows for rapid regeneration of teeth at a low energy cost. Teeth are usually lost in the course of feeding if the prey is struggling. Additionally, amphibians that undergo a metamorphosis develop bicuspid shaped teeth.^[40]

Reptiles

[edit]

The teeth of reptiles are replaced constantly throughout their lives. Crocodylian juveniles replace teeth with larger ones at a rate as high as one new tooth per socket every month. Once mature, tooth replacement rates can slow to two years and even longer. Overall, crocodylians may use 3,000 teeth from birth to death. New teeth are created within old teeth.^[41]

Birds

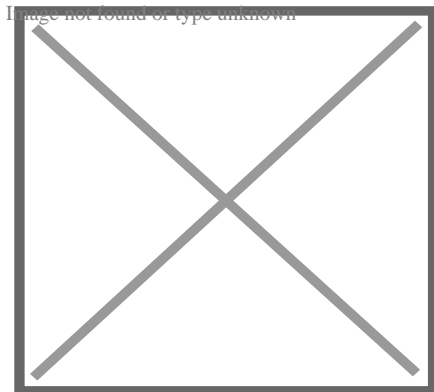
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Main article: Ichthyornis

A skull of Ichthyornis discovered in 2014 suggests that the beak of birds may have evolved from teeth to allow chicks to escape their shells earlier, and thus avoid predators and also to penetrate protective covers such as hard earth to access underlying food.^[42]^[43]

Invertebrates

[edit]

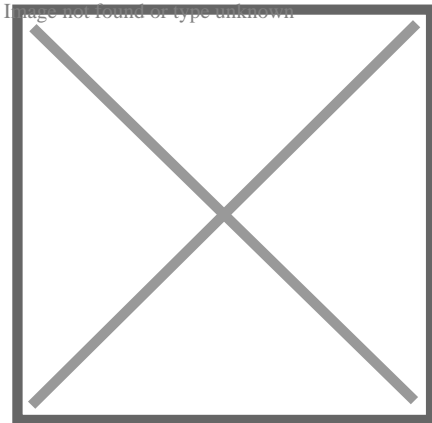


The European medicinal leech has three jaws with numerous sharp teeth which function like little saws for incising a host.

True teeth are unique to vertebrates,^[44] although many invertebrates have analogous structures often referred to as teeth. The organisms with the simplest genome bearing such tooth-like structures are perhaps the parasitic worms of the family Ancylostomatidae.^[45] For example, the hookworm *Necator americanus* has two dorsal and two ventral cutting plates or teeth around the anterior margin of the buccal capsule. It also has a pair of subdorsal and a pair of subventral teeth located close to the rear.^[46]

Historically, the European medicinal leech, another invertebrate parasite, has been used in medicine to remove blood from patients.^[47] They have three jaws (tripartite) that resemble saws in both appearance and function, and on them are about 100 sharp teeth used to incise the host. The incision leaves a mark that is an inverted Y inside of a circle. After piercing the skin and injecting anticoagulants (hirudin) and anaesthetics, they suck out blood, consuming up to ten times their body weight in a single meal.^[48]

In some species of Bryozoa, the first part of the stomach forms a muscular gizzard lined with chitinous teeth that crush armoured prey such as diatoms. Wave-like peristaltic contractions then move the food through the stomach for digestion.[⁴⁹]



The limpet rasps algae from rocks using teeth with the strongest known tensile strength of any biological material.

Molluscs have a structure called a radula, which bears a ribbon of chitinous teeth. However, these teeth are histologically and developmentally different from vertebrate teeth and are unlikely to be homologous. For example, vertebrate teeth develop from a neural crest mesenchyme-derived dental papilla, and the neural crest is specific to vertebrates, as are tissues such as enamel.[⁴⁴]

The radula is used by molluscs for feeding and is sometimes compared rather inaccurately to a tongue. It is a minutely toothed, chitinous ribbon, typically used for scraping or cutting food before the food enters the oesophagus. The radula is unique to molluscs, and is found in every class of mollusc apart from bivalves.

Within the gastropods, the radula is used in feeding by both herbivorous and carnivorous snails and slugs. The arrangement of teeth (also known as denticles) on the radula ribbon varies considerably from one group to another as shown in the diagram on the left.

Predatory marine snails such as the Naticidae use the radula plus an acidic secretion to bore through the shell of other molluscs. Other predatory marine snails, such as the Conidae, use a specialized radula tooth as a poisoned harpoon. Predatory pulmonate land slugs, such as the ghost slug, use elongated razor-sharp teeth on the radula to seize and devour earthworms. Predatory cephalopods, such as squid, use the radula for cutting prey.

In most of the more ancient lineages of gastropods, the radula is used to graze by scraping diatoms and other microscopic algae off rock surfaces and other substrates. Limpets scrape algae from rocks using radula equipped with exceptionally hard rasping teeth.[⁵⁰] These teeth have the strongest known tensile strength of any biological material, outperforming spider silk.[⁵⁰] The mineral protein of the limpet teeth can withstand a tensile stress of 4.9 GPa, compared to 4 GPa of spider silk and 0.5 GPa of human teeth.[⁵¹]

Fossilization and taphonomy

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Because teeth are very resistant, often preserved when bones are not,^[52] and reflect the diet of the host organism, they are very valuable to archaeologists and palaeontologists.^[53] Early fish such as the thelodonts had scales composed of dentine and an enamel-like compound, suggesting that the origin of teeth was from scales which were retained in the mouth. Fish as early as the late Cambrian had dentine in their exoskeletons, which may have functioned in defense or for sensing their environments.^[54] Dentine can be as hard as the rest of teeth and is composed of collagen fibres, reinforced with hydroxyapatite.^[54]

Though teeth are very resistant, they also can be brittle and highly susceptible to cracking.^[55] However, cracking of the tooth can be used as a diagnostic tool for predicting bite force. Additionally, enamel fractures can also give valuable insight into the diet and behaviour of archaeological and fossil samples.

Decalcification removes the enamel from teeth and leaves only the organic interior intact, which comprises dentine and cementine.^[56] Enamel is quickly decalcified in acids,^[57] perhaps by dissolution by plant acids or via diagenetic solutions, or in the stomachs of vertebrate predators.^[56] Enamel can be lost by abrasion or spalling,^[56] and is lost before dentine or bone are destroyed by the fossilisation process.^[57] In such a case, the 'skeleton' of the teeth would consist of the dentine, with a hollow pulp cavity.^[56] The organic part of dentine, conversely, is destroyed by alkalis.^[57]

See also

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-  [Medicine portal](#) limited content known
- Animal tooth development
- Dragon's teeth (mythology)

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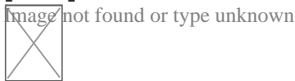
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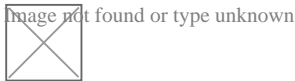
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