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carrier pigeon

Definition from Wiktionary, the free dictionary

Contents

- 1 English
 - 1.1 Alternative forms
 - 1.2 Noun
 - 1.2.1 Usage notes
 - 1.2.2 Synonyms
 - 1.2.3 See also
 - 1.3 References

English

Alternative forms

carrier-pigeon

Noun

carrier pigeon (*plural* **carrier pigeons**)

1. A domestic pigeon which transports attached messages or very small parcels from the place where it is released to a familiar destination. [quotations ▼]

Usage notes

- The term ***carrier pigeon*** is often used, especially in newspaper and magazine articles, for a homing pigeon or racing pigeon that carries messages. Many pigeon fanciers (particularly homer men and homer women) consider this to be a misnomer because the term is outdated and originally referred to the ancestors of present-day Old English carriers. These "carrier pigeons" were formerly used to carry messages before the modern homing pigeon was developed in the 1800s (initially in Belgium and Britain), but is today strictly an exhibition pigeon or show pigeon that has mostly lost its strong homing instinct. The "carrier pigeon" was also one of the breeds used to develop the modern homing pigeon and therefore does have some "carrier blood" in it.^[1]

Synonyms

- homer
- homing pigeon

- racer
- racing pigeon

See also

- English Carrier
- King of the Doos

References

- ↑ The Carrier, or certainly the Horseman, was the first breed used in England for message-bearing purposes. The name, “Carrier Pigeon,” is still used today erroneously by many writers, especially in newspapers and periodicals, to describe the true Racing Homer. The Carrier today has been developed into a show bird alone, its homing propensities having long since ceased to be developed. — Wendell M. Levi, *The Pigeon*, 1941 (Renewed 1968), 1946, 1957, and 1963; p57.

- carrier pigeon (<http://www.onelook.com/?w=carrier+pigeon&ls=a>) at *OneLook Dictionary Search*

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Categories: English nouns | English countable nouns

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homing pigeon

Definition from Wiktionary, the free dictionary

Contents

- 1 English
 - 1.1 Noun
 - 1.1.1 Usage notes
 - 1.1.2 Synonyms
 - 1.1.3 Related terms
 - 1.1.4 Translations
 - 1.2 References

English

Noun

homing pigeon (*plural* **homing pigeons**)

1. A variety of domesticated rock pigeon (*Columba livia*) that has been selectively bred to be able to find its way home over extremely long distances. [quotations ▼]

Usage notes

- The term *carrier pigeon* is often used, especially in newspaper and magazine articles, for a homing pigeon or racing pigeon that carries messages. Many pigeon fanciers (particularly homer men and homer women) consider this to be a misnomer because the term is outdated and originally referred to the ancestors of present-day Old English carriers. These "carrier pigeons" were formerly used to carry messages before the modern homing pigeon was developed in the 1800s (initially in Belgium and Britain), but is today strictly an exhibition pigeon or show pigeon that has mostly lost its strong homing instinct. The "carrier pigeon" was also one of the breeds used to develop the modern homing pigeon and therefore does have some "carrier blood" in it.^[1]

Synonyms

- carrier pigeon, homer, messenger pigeon, racer, racing homer, racing pigeon

Related terms

Terms etymologically related to *homing pigeon*

[show ▼]

Translations

±domesticated rock pigeon with strong homing instinct

[show ▼]

References

- [^] The Carrier, or certainly the Horseman, was the first breed used in England for message-bearing purposes. The name, “Carrier Pigeon,” is still used today erroneously by many writers, especially in newspapers and periodicals, to describe the true Racing Homer. The Carrier today has been developed into a show bird alone, its homing propensities having long since ceased to be developed. — Wendell M. Levi, *The Pigeon*, 1941 (Renewed 1968), 1946, 1957, and 1963; p57.

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carrier-pigeon

Definition from Wiktionary, the free dictionary

English

Noun

carrier-pigeon (*plural* **carrier-pigeons**)

1. *Alternative form of* **carrier pigeon**.

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Carrier Pigeon

Wikibook

Contents

Articles

Carrier pigeon	1
Homing pigeon	3
Domestic pigeon	8
Rock dove	13

References

Article Sources and Contributors	23
Image Sources, Licenses and Contributors	24

Article Licenses

License	25
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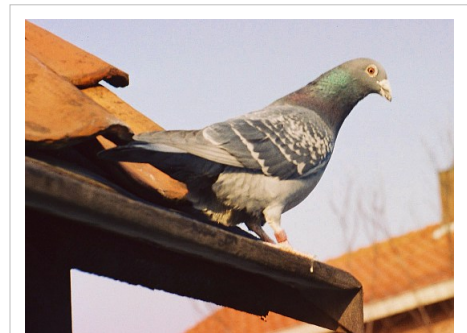
Carrier pigeon

This article is about carrier pigeons in general. For the specific show breed, see English Carrier. For the now-extinct breed, see Passenger Pigeon. For the aircraft, see Curtiss Carrier Pigeon.

A **carrier pigeon** or **messenger pigeon** is a homing pigeon (specifically a domesticated rock pigeon, *Columba livia*) that is used to carry messages. Using pigeons to carry messages is generally called "pigeon post". Most homing or racing type varieties are used to carry messages. There is no specific breed actually called "carrier pigeon". Carrier pigeons that are the basic Racing Homer were used to carry messages in World War I and World War II. Thirty-two pigeons were presented with the Dickin Medal.

History

The sport of flying homing pigeons was well-established as early as 3000 years ago. They were used to proclaim the winner of the Olympics. Messenger pigeons were used as early as 1150 in Baghdad^[1] and also later by Genghis Khan. By 1167 a regular service between Baghdad and Syria had been established by Sultan Nour-Eddin. In Damietta, by the mouth of the Nile, the Spanish traveller Pedro Tafur saw carrier pigeons for the first time, in 1436, though he imagined that the birds made round trips, out and back.^[2] The Republic of Genoa equipped their system of watch towers in the Mediterranean Sea with pigeon posts. Tipu Sultan used carrier pigeons. They returned to the Jamia Masjid mosque in Srirangapatna, which was his headquarters. The pigeon holes may be seen in the mosque's minarets to this day.

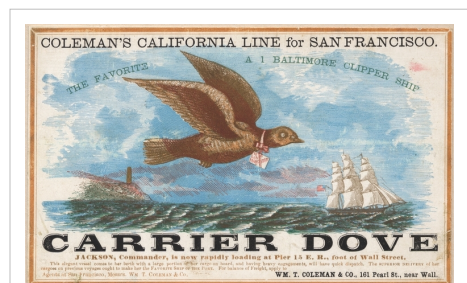


Carrier Pigeon

In 1818, a great pigeon race called the *Belgian Concourse* took place at Brussels. In 1860, Paul Reuter, who later founded Reuters press agency, used a fleet of over 45 pigeons to deliver news and stock prices between Brussels and Aachen, the terminals of early telegraph lines. The outcome of the Battle of Waterloo was also first delivered by a pigeon to England. During the Franco-Prussian War pigeons were used to carry mail between besieged Paris and the French unoccupied territory.

Historically, pigeons carried messages only one way, to their home. They had to be transported manually before another flight. However, by placing their food at one location and their home at another location, pigeons have been trained to fly back and forth up to twice a day reliably, covering round-trip flights up to 160 km (100 mi). Their reliability has lent itself to occasional use on mail routes, such as the Great Barrier Pigeongram Service established between Auckland, New Zealand and Great Barrier Island in November 1897.^[3]

With training, pigeons can carry up to 75 g (2.5 oz) on their backs. The German apothecary Julius Neubronner used carrier pigeons to deliver urgent medication. In 1977 a similar carrier pigeon service was set up for the transport of laboratory specimens between two English hospitals. Every morning a basket with pigeons was taken from Plymouth General Hospital to Devonport Hospital. The birds then delivered unbreakable vials back to Plymouth as needed.^[4] The 30 carrier pigeons became unnecessary in 1983 because of the closure of one of the hospitals. In the 1980s a similar system existed between two French hospitals located in Granville and Avranches.



Carrier Dove, clipper ship

Homing pigeons were still employed in the 21st century by certain remote police departments in Odisha state in eastern India to provide emergency communication services following natural disasters. In March 2002, it was announced that India's Police Pigeon Service messenger system in Odisha was to be retired, due to the expanded use of the Internet. The Taliban banned the keeping and/or use of homing pigeons in Afghanistan.

Wartime use

Main article: War pigeon

Before the advent of radio, carrier pigeons were frequently used on the battlefield as a means for a mobile force to communicate with a stationary headquarters. In the 6th century BC, Cyrus, king of Persia, used carrier pigeons to communicate with various parts of his empire. During the 19th-century Franco-Prussian War, besieged Parisians used carrier pigeons to transmit messages outside the city; in response, the besieging German Army employed hawks to hunt the pigeons.

During the First and Second World Wars, carrier pigeons were used to transport messages back to their home coop behind the lines. When they landed, wires in the coop would sound a bell or buzzer and a soldier of the Signal Corps would know a message had arrived. He would go to the coop, remove the message from the canister, and send it to its destination by telegraph, field phone, or personal messenger.

A carrier pigeon's job was dangerous. Nearby enemy soldiers often tried to shoot down pigeons, knowing that released birds were carrying important messages. Some of these pigeons became quite famous among the infantrymen they worked for. One pigeon, named "The Mocker", flew 52 missions before he was wounded. Another, named "Cher Ami", was injured in the last week of World War I. Though she lost her foot and one eye, her message got through, saving a large group of surrounded American infantrymen.

References

- [1] First Birds' Inn: About the Sport of Racing Pigeons (<http://www.fbipigeons.com/THE SPORT.htm>)
- [2] "I saw there for the first time carrier pigeons, which take letters in their tail-feathers. They carry them from the place where they are bred to other places, and when the letters are detached they are set free and return to their homes. By this means the inhabitants have speedy news of all who come and go by sea or land." (Pedro Tafur, *Andanças e viagens* (<http://depts.washington.edu/silkroad/texts/tafur.html#ch8>)).
- [3] "Carrier pigeons still serve; Even in modern war they do messenger duty" (<http://select.nytimes.com/gst/abstract.html?res=FA0B12FF3D5E167B93C0A8178FD85F428385F9&scp=1&sq=Carrier+pigeons+still+serve&st=p>), *The New York Times*. April 12, 1936. p. SM26.
- [4] Pigeons flying for life (<http://news.google.com/newspapers?nid=1368&dat=19770723&id=Y9MVAAAIAIAJ&sjid=5xEEAAAIAIAJ&pg=3259,4076496>), *The Milwaukee Sentinel* – July 23, 1977

External links

- "The Passing of the Carrier Pigeon" ([http://books.google.com/books?id=p-IDAAAAMBAJ&lpg=PA195&dq=Popular Science 1930 plane "Popular Mechanics"&pg=PA194#v=onepage&q&f=true](http://books.google.com/books?id=p-IDAAAAMBAJ&lpg=PA195&dq=Popular Science 1930 plane)). *Popular Mechanics*: 194–197. February 1930.
- Reuters (3 November 2012). "WWII carrier pigeon remains found in UK chimney" (http://news.msn.com/us/video?videoid=514b03e9-e877-4c4b-b62e-5259d9930769&from=&src=v5:endslate:titleBar^link:&from=mpl_en-us_TMX_News_Player).

Homing pigeon

The **homing pigeon** is a variety of domestic pigeon (*Columba livia domestica*) derived from the rock pigeon, selectively bred to find its way home over extremely long distances. The wild rock pigeon has an innate homing ability, meaning that it will generally return to its nest and mate. This made it relatively easy to breed from the birds that repeatedly found their way home over long distances. Flights as long as 1,800 km (1,100 miles) have been recorded by birds in competitive pigeon racing. Their average flying speed over moderate distances is around 80 km/h (50 miles per hour) but speeds of up to 140 km/h (90 miles per hour) have been observed in top racers for short distances. Homing pigeons are called messenger or carrier pigeons when they are used to carry messages. They were used in many places in the world and in wars.



White Homing pigeon, sitting

Sexual dimorphism

Male and female pigeons (cocks and hens respectively), can be differentiated by physical characteristics of the head, beak, height, and breast, though visual identification of gender by physical characteristics alone can be inaccurate. Males usually stand taller, and have a larger beaks, crops, wattles, and eye ceres (fleshy growth around the eyes), as well as a round head and thicker nape. Females, on the other hand, tend to be shorter with smaller beaks, wattles, and ceres, as well as flatter heads and fuller breasts.

Male and female pigeons also show different behaviours. The "coo" of males is louder and more insistent, especially when courting. Display behaviour also differs between the sexes. Most notably, males often turn 360 degrees with an inflated crop and a loud "coo", to show interest in a female or to defend or discourage another pigeon from entering its territory (usually a nesting box), while females almost never turn full circle, but rather do a 270 degrees back-and-forth rotational motion.

Although the sexual dimorphism in homing pigeons is rather subtle most accomplished breeders of homing pigeons will easily distinguish the genders of this breed (this is not true for all breeds of domestic pigeon; for instance, archangels have males and females looking almost exactly alike).

Reproduction

During breeding season, usually during the warmer months, a male pigeon will court the female by puffing out his chest, bobbing his head and strutting in circles around her, all the while cooing his affections. If she accepts, she will allow him onto her back in order to copulate. After mating the male will build a nest out of gathered sticks in a suitable crevice, while the female watches and makes changes. Urban birds will gladly use a roof on a building. The female will usually lay two eggs which will hatch in 17 to 20 days. Both parents aid in rearing the nestlings. Fledglings usually leave the nest three to four weeks after hatching.

History

The sport of flying homing pigeons was well-established as early as 3000 years ago. They were used to proclaim the winner of the Olympics. Messenger pigeons were used as early as 1150 in Baghdad^[1] and also later by Genghis Khan. By 1167 a regular service between Baghdad and Syria had been established by Sultan Nour-Eddin. In Damietta, by the mouth of the Nile, the Spanish traveller Pedro Tafur saw carrier pigeons for the first time, in 1436, though he imagined that the birds made round trips, out and back.^[2] The Republic of Genoa equipped their system of watch towers in the Mediterranean Sea with pigeon posts. Tipu Sultan used carrier pigeons. They returned to the Jamia Masjid mosque in Srirangapatna, which was his headquarters. The pigeon holes may be seen in the mosque's minarets to this day.



Stamp for early Pigeon-Gram service

In 1818, a great pigeon race called the *Belgian Concourse* took place at Brussels. In 1860, Paul Reuter, who later founded Reuters press agency, used a fleet of over 45 pigeons to deliver news and stock prices between Brussels and Aachen, the terminals of early telegraph lines. The outcome of the Battle of Waterloo was also first delivered by a pigeon to England. During the Franco-Prussian War pigeons were used to carry mail between besieged Paris and the French unoccupied territory. Possibly the first regular air mail service in the world was Mr. Howie's Pigeon-Post service from the Auckland New Zealand suburb of Newton to Great Barrier Island, starting in 1896. Certainly the world's first 'airmail' stamps were issued for the Great Barrier Pigeon-Gram Service from 1898 to 1908.^[3]

Homing pigeons were still employed in the 21st century by certain remote police departments in Odisha state in eastern India to provide emergency communication services following natural disasters. In March 2002, it was announced that India's Police Pigeon Service messenger system in Odisha was to be retired, due to the expanded use of the Internet. The Taliban banned the keeping and/or use of homing pigeons in Afghanistan.

Navigation

Main article: Animal navigation

Research has been performed with the intention of discovering how pigeons, after being transported, can find their way back from distant places they have never visited before. Most researchers believe that homing ability is based on a "map and compass" model, with the compass feature allowing birds to orient and the map feature allowing birds to determine their location relative to a goal site (home loft).^[4] While the compass mechanism appears to rely on the sun, the map mechanism has been highly debated.^[5] Some researchers believe that the map mechanism relies on the ability of birds to detect the Earth's magnetic field. It is true that birds can detect a magnetic field, to help them find their way home. Scientists have found that on top of pigeon's beak large number of particles of iron are found which remain aligned to north like man made compass, thus it acts as compass which helps pigeon in determining its home. A light-mediated mechanism that involves the eyes and is lateralized has been examined somewhat, but recent developments have implicated the trigeminal nerve in magnetoreception.^{[6][7]} Research by Floriano Papi (Italy, early 1970s) and more recent work, largely by Hans Wallraff, suggests that pigeons also orient themselves using the spatial distribution of atmospheric odors, known as olfactory navigation. Near their home lofts, in areas they have previously visited, pigeons probably are guided by visual landmarks.

Recent research by Jon Hagstrum of the US Geological Survey suggests that homing pigeons use low frequency infrasound to navigate.^[8] Sound waves as low 0.1 Hz have been observed to disrupt, or redirect pigeon navigation. The pigeon ear, being far too small to interpret such a long wave, directs pigeons to fly in a circle when first taking air, in order to mentally map such long infrasound waves.

Various experiments suggest that different breeds of homing pigeons rely on different cues to different extents. Charles Walcott at Cornell was able to demonstrate that while pigeons from one loft were confused by a magnetic anomaly in the Earth it had no effect on birds from another loft 1.6 km (1 mile) away. Other experiments have shown that altering the perceived time of day with artificial lighting or using air conditioning to eliminate odors in the pigeons' home roost affected the pigeons' ability to return home.

Some research also indicates that homing pigeons navigate by following roads and other man-made features, making 90 degree turns and following habitual routes, much the same way that humans navigate.

Roles

As carrier pigeons

Main article: Carrier pigeon

When used as carrier pigeons in pigeon post a message is written on thin light paper and rolled into a small tube attached to the bird's leg. Pigeons can only go back to one "mentally marked" point that they have identified as their home. So "pigeon mail" can only work when the sender is actually holding the receiver's pigeons. White homing pigeons are used in release dove ceremonies at weddings, funerals, and some sporting events.

In war

Main article: War pigeon

-  Media related to Pigeons in World War I at Wikimedia Commons

Birds were used extensively during World War I. One homing pigeon, Cher Ami, was awarded the French Croix de guerre for her heroic service in delivering 12 important messages, despite having been very badly injured.



A B-type bus from London converted into a Pigeon loft for use in Northern France and Belgium during the First World War



Crewman with homing pigeons carried in bombers as a means of communications in the event of a crash, ditching or radio failure.

During World War II, the Irish Paddy, the American G.I. Joe and the English Mary of Exeter all received the Dickin Medal. They were among 32 pigeons to receive this award, for their gallantry and bravery in saving human lives with their actions. Eighty-two homing pigeons were dropped into the Netherlands with the First Airborne Division Signals as part of Operation Market Garden in World War II. The pigeons' loft was located in London which would have required them to fly 390 km (240 miles) to deliver their messages.^[9] Also in World War II, hundreds of homing pigeons with the Confidential Pigeon Service were airdropped into northwest Europe to serve as intelligence vectors for local resistance agents. Birds played a vital part in the Invasion of Normandy as radios could not be used for fear of vital

information being intercepted by the enemy.

In computing

The humorous IP over Avian Carriers (RFC 1149) is an Internet protocol for the transmission of messages via homing pigeon. Originally intended as an April Fools' Day RFC entry, this protocol was implemented and used, once, to transmit a message in Bergen, Norway on April 28, 2001.^[10]

In September 2009, a South African IT company based in Durban pitted an 11-month-old bird armed with a data packed 4GB memory stick against the ADSL service from the country's biggest internet service provider, Telkom. The pigeon, Winston, took an hour and eight minutes to carry the data 80 km (50 miles). In all, the data transfer took two hours, six minutes, and fifty-seven seconds--the same amount of time it took to transfer 4% of the data over the ADSL.

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- [1] First Birds' Inn: About the Sport of Racing Pigeons (<http://www.fbipigeons.com/THE SPORT.htm>)
- [2] "I saw there for the first time carrier pigeons, which take letters in their tail-feathers. They carry them from the place where they are bred to other places, and when the letters are detached they are set free and return to their homes. By this means the inhabitants have speedy news of all who come and go by sea or land." (Pedro Tafur, *Andanças e viagens* (<http://depts.washington.edu/silkroad/texts/tafur.html#ch8>)).
- [3] The Great Barrier Island Pigeon-Gram Service (<http://www.tepapa.govt.nz/wings/pigeons3.htm>)
- [4] Bingman, V. P. (1998). Spatial representations and homing pigeon navigation. In S. Healy (Ed). *Spatial representation in animals*. (pp. 67-85). Oxford: Oxford University Press.
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- [6] Mora, C. V., Davison, M., Wild, J. M., and Walker, M. M. (2004). Magnetoreception and its trigeminal mediation in the homing pigeon. *Nature*, 432, 508-511.
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- [8] Knight, Kathryn (2013). Disappearing homing pigeon mystery solved. *The Company of Biologists*. Retrieved 2013-01-31
- [9] Cornelius Ryan - *A Bridge Too Far*
- [10] Bergen Linux User Group - The highly unofficial CPIP WG (<http://www.blug.linux.no/rfc1149/>)

Further reading

- *Chico, the Story of a Homing Pigeon in the Great War*, Lucy M Blanchard, Diggory Press, ISBN 978-1-84685-039-4
- *Wringer* by Jerry Spinelli
- *A Pigeon and a Boy*, by Meir Shalev (English translation by Evan Fallenberg), a historical novel about the use of pigeons by the Israel Defense Forces (and the Haganah before Israel was founded in 1948) in the defence of Israel when it was first founded, and in the defence of the Jewish community before Israeli independence
- Tegetmeier, William Bernhard (1871). *The homing or carrier pigeon*. London: George Routledge.
- "Nine Champions Create A Champion" (<http://www.hackemerlofts.com/articles.html>), Bob Kinney Silverado, *The Thoroughbred*, 15 May 1998


External links

- An informative magazine article written in the 1880s (<http://www.pigeoncote.com/homing/homing.html>)
- Pigeon and Business and Communication (<http://pigeoncomm.site90.net/>)
- The three most important things that every pigeon fancier should know (<http://home.frognet.net/~marks444/info.html>)
- The great pigeon race disaster of 97 suggests an answer to an enduring mystery (<http://txtwriter.com/Onscience/Articles/pigeons.html>), George Johnson, "ON SCIENCE", *St. Louis Post Dispatch*
- The System of Military Dovecotes in Europe (<http://www.gutenberg.org/dirs/1/4/9/9/14990/14990-h/14990-h.htm#art10>) from an 1891 *Scientific American* article at Project Gutenberg
- RFC 1149 - A Standard for the Transmission of IP Datagrams on Avian Carriers

- Beginning pigeon site (<http://www.pigeon.org/beginnerscorner.htm>)
 - Resource for pigeon racers (<http://www.silvio-co.com/pigeons/>)
 - Round Trip War Birds (<http://books.google.com/books?id=nCcDAAAAMBAJ&pg=PA49>), *Popular Science*, November 1941, article on US Army Signal Corps use of homing pigeons with first high-speed photos showing how a pigeon flies
 - Barnhart & Son Lofts (<http://www.barnhartlofts.com>), long-time breeder, exhibitor, and judge of fancy and racing pigeons
 - Fragment 'Those waiting for the birds' (<http://www.youtube.com/watch?v=9Uh8QIfQ26Q>) (2008, Eve Duchemin), documentary about Belgian homing pigeons
-

Domestic pigeon

For the family, see Columbidae.

Domestic Rock Pigeon	
	
Red Sheffield domestic homing pigeon	
Conservation status	
Domesticated	
Scientific classification	
Kingdom:	Animalia
Phylum:	Chordata
Class:	Aves
Order:	Columbiformes
Family:	Columbidae
Genus:	<i>Columba</i>
Species:	<i>C. livia</i>
Subspecies:	<i>C. l. domestica</i>
Trinomial name	
<i>Columba livia domestica</i> Gmelin, 1789	
Synonyms	
<i>Columba domestica</i> <i>Columba livia rustica</i>	

The **domestic pigeon** (*Columba livia domestica*) is a pigeon that was derived from the rock pigeon. The rock pigeon is the world's oldest domesticated bird. Mesopotamian cuneiform tablets mention the domestication of pigeons more than 5,000 years ago, as do Egyptian hieroglyphics. Research suggests that domestication of pigeons was as early as ten thousand years ago. People who keep domestic pigeons are generally called pigeon fanciers. Domestic pigeons can often be distinguished from feral pigeons because they usually have a metal or plastic band around one (sometimes both) legs which shows, by a number on it, that they are registered to an owner.

Pigeons have made contributions of considerable importance to humanity, especially in times of war. In war the homing ability of pigeons has been put to use by making them messengers. So-called war pigeons have carried many vital messages and some have been decorated for their services. Medals such as the Croix de guerre, awarded to Cher Ami, and the Dickin Medal awarded to the pigeons G.I. Joe and Paddy, amongst 32 others, have been awarded to pigeons for their services in saving human lives. Despite this, many Americans and other city people consider

pigeons to be pests. Domestic pigeons are sometimes called "thoroughbreds of the air," while feral pigeons are sometimes called "rats with wings." A group of pigeons flying together is called a "kit".^[1]

Reproduction

Domestic pigeons reproduce in a similar way to the wild rock pigeon. Generally humans will select breeding partners. Crop milk produced by parent birds may occasionally be replaced with artificial substitutes. Baby pigeons are called *squeakers*. See Also:-Gallery

Homing pigeons

Main articles: Homing pigeon and Racing Homer

Trained domestic pigeons are able to return to the home loft if released at a location that they have never visited before and that may be up to 1000 km away. A special breed, called homing pigeons has been developed through selective breeding to carry messages and members of this variety of pigeon are still being used in the sport of pigeon racing and the white release dove ceremony at weddings and funerals.

The ability a pigeon has to return home from a strange location necessitates two sorts of information. The first, called "map sense" is their geographic location. The second, "compass sense" is the bearing they need to fly from their new location in order to reach their home. Both of these senses, however, respond to a number of different cues in different situations. The most popular conception of how pigeons are able to do this is that they are able to sense the Earth's magnetic field^[2] with tiny magnetic tissues in their head (magnetoception)Wikipedia:Citation needed. This is all the more surprising as they are not a migratory species, which is a fact used by some ornithologists to dispute this theoryWikipedia:Citation needed. Another theory is that pigeons have compass sense, which uses the position of the sun, along with an internal clock, to work out direction. However, studies have shown that if magnetic disruption or clock changes disrupt these senses, the pigeon can still manage to get home. The variability in the effects of manipulations to these sense of the pigeons indicates that there is more than one cue on which navigation is based and that map sense appears to rely on a comparison of available cues^[3]

Other potential cues used include:

- The use of a sun compass^[4]
- Nocturnal navigate by stars^[5]
- Visual landmark map^{[6][7]}
- Navigation by infrasound map^[8]
- Polarised light compass^[9]
- Olfactory stimuli^[10]

see: Olfactory navigation



Homing pigeon



Dovecote at Nymans Gardens, West Sussex, England

Other purposes of pigeon breeding

For food

Main article: Squab (food)

Pigeons are also bred for meat, generally called squab and harvested from young birds. Pigeons grow to a very large size in the nest before they are fledged and able to fly, and in this stage of their development (when they are called squabs) they are prized as food. For commercial meat production a breed of large white pigeon, named "King pigeon," has been developed by selective breeding. Breeds of pigeons developed for their meat are collectively known as utility pigeons.



Group of Pigeons

Exhibition breeds

Main article: Fancy pigeon

Pigeon fanciers developed many exotic forms of pigeon. These are generally classed as fancy pigeons. The Fanciers compete against each other at exhibitions or shows and the different forms or breeds are judged to a standard to decide who has the best bird. Among those breeds are the English carrier pigeons, a variety of pigeon with wattles and a unique, almost vertical, stance (pictures ^[11]). There are many ornamental breeds of pigeons, including the "Duchess" breed, which has as a prominent characteristic feet that are completely covered by a sort of fan of feathers. The fantail pigeons are also very ornamental with their fan-shaped tail feathers.

Flying/Sporting

Main article: Flying/Sporting Pigeons

Pigeons are also kept by enthusiasts for the enjoyment of flying/sporting competitions. Breeds such as tipplers are flown in endurance contests by their owners.

Experimentation

Domestic pigeons are also commonly used in laboratory experiments in biology, medicine and cognitive science.



Domestic pigeons in flight

Cognitive science

Pigeons have been trained to distinguish between cubist and impressionist paintings, for instance. In Project Sea Hunt, a US coast guard search and rescue project in the 1970s/1980s, pigeons were shown to be more effective than humans in spotting shipwreck victims at sea. Research in pigeons is widespread, encompassing shape and texture perception, exemplar and prototype memory, category-based and associative concepts, and many more unlisted here (see pigeon intelligence and discrimination abilities of pigeons).

Illegal predator killing by enthusiasts

In the US, some pigeon keepers illegally trap and kill hawks and falcons to protect their pigeons. In American pigeon-related organizations, enthusiasts openly shared their experiences of killing hawks and falcons, although this is frowned upon by the majority of fanciers. None of the major clubs condone this practice. It is estimated that almost 1000 birds of prey have been killed in Oregon and Washington, and that 1 to 2 thousand are killed in southern California annually. In June 2007, three Oregon men were indicted with misdemeanour violations of the Migratory Bird Treaty Act for killing birds of prey. Seven Californians and a Texan have also been charged in the case.

In the West Midlands region of the United Kingdom pigeon fanciers have been blamed for a trap campaign to kill peregrine falcons. Eight illegal spring-loaded traps were found close to peregrine nests and at least one of the protected birds died. The steel traps are thought to have been set as part of a “concerted campaign” to kill as many of the birds as possible in the West Midlands.

Pigeon related illness

Pigeon breeders sometimes suffer from an ailment known as *bird fancier's lung* or *pigeon lung*. A form of hypersensitivity pneumonitis, *pigeon lung* is caused by the inhalation of the avian proteins found in feathers and dung. It can sometimes be combated by wearing a filtered mask. Other pigeon related pathogens causing lung disease are Psittacosis, Histoplasmosis and cryptococcus neoformans.

Feral pigeons

Main article: Feral pigeon

Many domestic birds have escaped or been released over the years, and have given rise to the feral pigeon. These show a variety of plumages, although some look very like the pure rock pigeons. The scarcity of the pure wild species is partly due to interbreeding with feral birds.

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- [7] Kamil, A. C. & Cheng, K. (2001). Way-finding and landmarks: the multiple-bearing hypothesis. Journal of Experimental Biology, 204, 103–113.
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- [11] <http://wayback.archive.org/web/20071210183002/http://members.aol.com/duiven/highlight/carrier/carrier.htm>



Feral Rock Pigeons commonly show a very wide range of plumage variation


External links

- National Pigeon Association (USA) (<http://www.npauusa.com/>)
 - National Pigeon Association (Great Britain) (<http://www.nationalpigeonassociation.co.uk/>)
 - The Canadian Pigeon Fanciers Association (<http://www.pigeonfanciers.ca/>)
 - Australian National Pigeon Association (<http://spud1.50megs.com/>)
 - Nepal Pigeon Keeper's Association (<http://nepal.tiplers.com/>)
 - Wysinfo (http://www.wysinfo.com/Pigeons/Pigeons_overview.htm) A Web Documentary on Pigeons and Doves
-

Rock dove

"Rock pigeon" redirects here. For other uses, see Rock pigeon (disambiguation).

Rock dove



Adult *C. l. intermedia* in India

Conservation status

Extinct

Threatened

Least Concern

EX

EW

CR

EN

VU

NT

LC

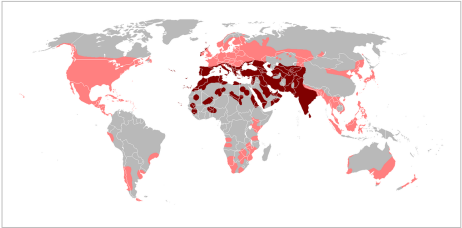
Least Concern (IUCN 3.1)

Scientific classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Aves
Order:	Columbiformes
Family:	Columbidae
Genus:	<i>Columba</i>
Species:	<i>C. livia</i>

Binomial name

Columba livia
Gmelin, 1789



approximate native range	introduced non-native populations
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The **rock dove**^[1] (*Columba livia*) or **rock pigeon** is a member of the bird family Columbidae (doves and pigeons). In common usage, this bird is often simply referred to as the "pigeon".

The species includes the domestic pigeon (including the fancy pigeon), and escaped domestic pigeons have given rise to feral populations around the world.

Wild rock doves are pale grey with two black bars on each wing, while domestic and feral pigeons are very variable in colour and pattern. There are few visible differences between males and females. The species is generally monogamous, with two squabs (young) per brood. Both parents care for the young for a time.

Habitats include various open and semi-open environments. Cliffs and rock ledges are used for roosting and breeding in the wild. Originally found wild in Europe, North Africa, and western Asia, feral pigeons have become established in cities around the world. The species is abundant, with an estimated population of 17 to 28 million feral and wild birds in Europe.

Taxonomy and naming

The rock dove was first described by Gmelin in 1789.^[2] The genus name *Columba* is the Latinized form of the Ancient Greek κόλυμβος (*kolumbos*), "a diver", from κολυμβάω (*kolumbao*), "dive, plunge headlong, swim". Aristophanes (Birds, 304) and others use the word κολυμβίς (*kolumbis*), "diver", for the name of the bird, because of its swimming motion in the air. The specific epithet is derived from the Latin *livor*, "bluish". Its closest relative in the *Columba* genus is the hill pigeon, followed by the other rock pigeons: the snow, speckled and white-collared pigeons.

The species is also known as the **rock pigeon** or **blue rock dove**, the former being the official name from 2004 to 2011, at which point the IOC changed their official listing to its original British name of rock dove (styled as *Rock Dove*). In common usage, this bird is still often simply referred to as the "pigeon". Baby pigeons are called *squabs*.

Subspecies

There are 12 subspecies recognised by Gibbs (2000); some of these may be derived from feral stock.

- *C. l. livia*, the nominate subspecies, occurs in western and southern Europe, northern Africa, and Asia to western Kazakhstan, the northern Caucasus, Georgia, Cyprus, Turkey, Iran, and Iraq.
- *C. l. atlantis* (Bannerman, 1931) of Madeira, the Azores and Cape Verde, is a very variable population with chequered upperparts obscuring the black wingbars, and is almost certainly derived from feral pigeons.
- *C. l. canariensis* (Bannerman, 1914) of the Canary Islands, is smaller and averages darker than the nominate subspecies.
- *C. l. gymnocyclus* (Gray, 1856) from Senegal and Guinea to Ghana, Benin and Nigeria is smaller and very much darker than nominate *C. l. livia*. It is almost blackish on the head, rump and underparts with a white back and the iridescence of the nape extending onto the head.
- *C. l. targia* (Geyr von Schweppenburg, 1916) breeds in the mountains of the Sahara east to Sudan. It is slightly smaller than the nominate form, with similar plumage, but the back is concolorous with the mantle instead of white.
- *C. l. dakhlae* (Richard Meinertzhagen, 1928) is confined to the two oases in central Egypt. It is smaller and much paler than the nominate subspecies.
- *C. l. schimperi* (Bonaparte, 1854) is found in the Nile Delta south to northern Sudan. It closely resembles *C. l. targia*, but has a distinctly paler mantle.
- *C. l. palaestinae* (Zedlitz, 1912) occurs from Syria to Sinai and Arabia. It is slightly larger than *C. l. schimperi* and has darker plumage.

- *C. l. gaddi* (Zarodney & Looudoni, 1906), breeds from Azerbaijan and Iran east to Uzbekistan is larger and paler than *C. l. palaestinae* with which it intergrades in the west. It also intergrades with the next subspecies to the east.
- *C. l. neglecta* (Hume, 1873), is found in the mountains of eastern Central Asia. It is similar to the nominate subspecies in size, but is darker with a stronger and more extensive iridescent sheen on the neck. It intergrades with the next race in the south.
- *C. l. intermedia* (Strickland, 1844) occurs in Sri Lanka and in India south of the Himalayan range of *C. l. neglecta*. It is similar to that subspecies, but darker with a less contrasting back.
- *C. l. nigricans* (Buturlin, 1908) in Mongolia and north China is variable and probably derived from feral stock.

Description

The adult of the nominate subspecies of the rock dove is 29 to 37 cm (11 to 15 in) long with a 62 to 72 cm (24 to 28 in) wingspan. Weight for wild or feral rock doves ranges from 238–380 g (8.4–13.4 oz), though overfed domestic and semi-domestic individuals can exceed normal weights. It has a dark bluish-gray head, neck, and chest with glossy yellowish, greenish, and reddish-purple iridescence along its neck and wing feathers. The iris is orange, red or golden with a paler inner ring, and the bare skin round the eye is bluish-grey. The bill is grey-black with a conspicuous off-white cere, and the feet are purplish-red. Among standard measurements, the wing chord is typically around 22.3 cm (8.8 in), the tail is 9.5 to 11 cm (3.7 to 4.3 in), the bill is around 1.8 cm (0.71 in) and the tarsus is 2.6 to 3.5 cm (1.0 to 1.4 in).

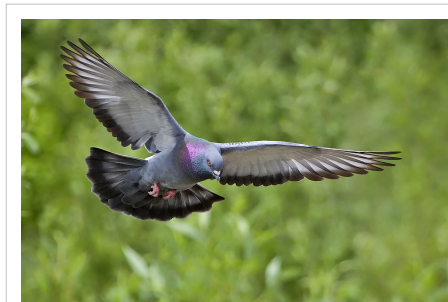


A distinctive operculum is located on top of the beak

The adult female is almost identical to the male, but the iridescence on the neck is less intense and more restricted to the rear and sides, while that on the breast is often very obscure.

The white lower back of the pure rock dove is its best identification character; the two black bars on its pale grey wings are also distinctive. The tail has a black band on the end and the outer web of the tail feathers are margined with white. It is strong and quick on the wing, dashing out from sea caves, flying low over the water, its lighter grey rump showing well from above.

Young birds show little lustre and are duller. Eye colour of the pigeon is generally orange but a few pigeons may have white-grey eyes. The eyelids are orange in colour and are encapsulated in a grey-white eye ring. The feet are red to pink.



In flight

When circling overhead, the white underwing of the bird becomes conspicuous. In its flight, behaviour, and voice, which is more of a dovecot *coo* than the phrase of the wood pigeon, it is a typical pigeon. Although it is a relatively strong flier, it also glides frequently, holding its wings in a very pronounced V shape as it does. Though fields are visited for grain and green food, it is often not plentiful enough as to be viewed as pest.

Pigeons feed on the ground in flocks or individually. They roost together in buildings or on walls or statues. When drinking, most birds take small sips and tilt their heads backwards to swallow the water.

Pigeons are able to dip their bills into the water and drink continuously without having to tilt their heads back. When disturbed, a pigeon in a group will take off with a noisy clapping sound.



Group of doves

Pigeons, especially homing or carrier breeds, are well known for their ability to find their way home from long distances. Despite these demonstrated abilities, wild rock doves are sedentary and rarely leave their local areas.

Distribution and habitat



Feral rock doves in semi-natural habitat perched on sea cliffs

The rock dove has a restricted natural resident range in western and southern Europe, North Africa, and into South Asia. The rock dove is often found in pairs in the breeding season but is usually gregarious. The species (including ferals) has a large range, with an estimated global extent of occurrence of 10,000,000 km² (3,900,000 sq mi). It has a large global population, including an estimated 17–28 million individuals in Europe. Fossil evidence suggests the rock dove originated in southern Asia and skeletal remains unearthed in Israel confirm their existence there for at least three hundred thousand years. However, this species has such a long history with humans that it is impossible to tell exactly where the species' original range was. Its habitat is natural cliffs, usually on coasts. Its domesticated form, the

feral pigeon, has been widely introduced elsewhere, and is common, especially in cities, over much of the world. A rock pigeon's lifespan is anywhere from 3–5 years in the wild to 15 years in captivity, though longer-lived specimens have been reported. The main causes of mortality in the wild are predators and persecution by humans. Wikipedia:Citation needed The species was first introduced to North America in 1606 at Port Royal, Nova Scotia.

Reproduction

The rock dove breeds at any time of the year, but peak times are spring and summer. Nesting sites are along coastal cliff faces, as well as the artificial cliff faces created by apartment buildings with accessible ledges or roof spaces.



The nest is a flimsy platform of straw and sticks, laid on a ledge, under cover, often on the window ledges of buildings. Two white eggs are laid; incubation is shared by both parents lasting from seventeen to nineteen days. The newly hatched squab (nestling) has pale yellow down and a flesh-coloured bill with a dark band. For the first few days, the baby squab is tended and fed (through regurgitation) exclusively on "crop milk" (also called "pigeon milk" or "pigeon's milk"). The pigeon milk is produced in the crops of *both* parents in all species of pigeons and doves. The fledging period is about 30 days.

Predators

With only its flying abilities protecting it from predation, rock pigeons are a favorite almost around the world for a wide range of raptorial birds. In fact, with feral pigeons existing in most every city in the world, they may form the majority of prey for several raptor species who live in urban areas. Peregrine falcons and Eurasian sparrowhawks are natural predators of pigeons that are quite adept at catching and feeding upon this species. Up to 80% of the diet of peregrine falcons in several cities that have breeding falcons is composed of feral pigeons. Some common predators

of feral pigeons in North America are opossums, raccoons, red-tailed hawks, great horned owls, eastern screech owls and *Accipiters*. The birds that predate pigeons in North America can range in size from American kestrels to golden eagles and can even include gulls, crows, and ravens. On the ground the adults, their young and their eggs are at risk from feral and domestic cats. Doves and pigeons are considered to be game birds as many species have been hunted and used for food in many of the countries in which they are native.

Parasites

	
<i>Tinaminyssus melloi</i> , a nasal mite.	Pigeon louse fly (<i>P. canariensis</i>), a blood-sucking ectoparasite.

Pigeons may harbour a diverse parasite fauna. They often host the intestinal helminths *Capillaria columbae* and *Ascaridia columbae*. Their ectoparasites include the Ischnoceran lice *Columbicola columbae*, *Campanulotes bidentatus compar*, the Amblyceran lice *Bonomiella columbae*, *Hohorstiella lata*, *Colpocephalum turbinatum*, the mites *Tinaminyssus melloi*, *Dermanyssus gallinae*, *Dermoglyphus columbae*, *Falculifer rostratus*, and *Diplaegidia columbae*. The hippoboscid fly *Pseudolynchia canariensis* is a typical blood-sucking ectoparasite of pigeons, found only in tropical and sub-tropical regions.

Human health

Pigeons have been falsely associated with the spread of human diseases. Wikipedia:Verifiability Contact with pigeon droppings poses a minor risk of contracting histoplasmosis, cryptococcosis, and psittacosis, and exposure to both droppings and feathers can produce bird fancier's lung. Pigeons are not a major concern in the spread of West Nile virus; though they can contract it, they do not appear to be able to transmit it. Pigeons are, however, at potential risk for carrying and spreading avian influenza. One study has shown that adult pigeons are not clinically susceptible to the most dangerous strain of avian influenza, the H5N1, and that they did not transmit the virus to chickens. Other studies have presented evidence of clinical signs and neurological lesions resulting from infection, but found that the pigeons did not transmit the disease to chickens reared in direct contact with them. Pigeons were found to be "resistant or minimally susceptible" to other strains of avian influenza, such as the H7N7.

Domestication

Main article: Domestic pigeon

Rock doves have been domesticated for several thousand years, giving rise to the domestic pigeon (*Columba livia domestica*). As well as food and pets, domesticated pigeons are used as homing pigeons. They were in the past also used as carrier pigeons, and so-called war pigeons have played significant roles during wartime, with many pigeons having received bravery awards and medals for their services in saving hundreds of human lives: including, notably, the British pigeon Cher Ami who received the Croix de Guerre for her heroic actions during World War I, and the Irish Paddy and the American G.I. Joe, who both received the Dickin Medal, amongst 32 pigeons to receive this medallion, for their gallant and brave actions during World War II. There are numerous breeds of fancy pigeons of all sizes, colours and types.



Feral pigeon

Main article: Feral pigeon

Many domestic birds have escaped or been released over the years, and have given rise to the feral pigeon. These show a variety of plumages, although some have the blue barred pattern as does the pure rock dove. Feral pigeons are found in large numbers in cities and towns all over the world. The scarcity of the pure wild species is partly due to interbreeding with feral birds.

Stages of life cycle



Egg, measured in centimetres



Nest with two eggs



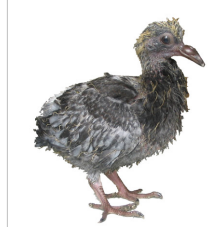
Nestlings, one day



Nestling, five days



Nestlings, about ten days



Young bird, 22 days



Feral pigeons in foreplay

Osmoregulation

Challenges

Water is taken in by the *Columba livia* directly by drinking water or indirectly from the food they ingest. They drink water through a process called double-suction mechanism. The daily diet of the Pigeon places many physiologically challenges it must overcome through osmoregulation. Protein intake for example causes an excess of amine groups when it is broken down for energy. To regulate this excess and secrete these unwanted toxins the *Columba livia* must remove the amine groups as uric acid. Nitrogen excretion through uric acid can be considered an advantage because it doesn't require a lot of water and isn't very soluble, but producing it takes more energy because of its complex molecular composition.

The danger of desiccation is a major threat to animals living on land. Water is lost in urine and feces, but evaporation is the principal route of water loss. Water lost must be replaced by drinking and water in food. Dehydration or salt-loading decreases the filtration rate primarily by the shut down of the nephrons, which is controlled by an antidiuretic hormone, arginine vasotocin. Pigeons adjust their drinking rates and food intake in parallel and when adequate water is unavailable for excretion, food intake is limited to maintain water balance. As *Columbia livia* inhabit arid environments, research attributes this to their strong flying capabilities to reach the available water sources, not because of exceptional potential for water conservation. *Columbia livia* kidneys, like mammalian kidneys, are capable of producing urine hyperosmotic to the plasma utilizing the processes of filtration, reabsorption and secretion, which will be discussed later and explained through the Starling-Landis Hypothesis. The medullary cones function as countercurrent units that achieve the production of hyperosmotic urine. Hyperosmotic urine can be

understood in light of the law of diffusion and osmolarity.

Organ of osmoregulation

Unlike a number other bird species which have the salt gland as the primary osmoregulatory organ, *Columba livia* does not use their salt gland even though it exists. *Columba livia* uses the function of their kidneys to maintain homeostatic balance of ions such as sodium and potassium while preserving water quantity in the body. Filtration of the blood, reabsorption of ions and water, and secretion of uric acid are all components of the kidney's process. The kidneys of *Columba livia* are located in its pelvic region. *Columba livia* has two kidneys that are coupled, each having three partially separate lobes; the posterior lobe is the largest in size. Like mammalian kidneys, the avian kidney contains a medullary region and a cortical region. Peripherally located around the cortical region, the collecting ducts gather into cone-like ducts, medullary cones, which converge into the ureters. There are two types of nephrons in the kidney; nephrons that are located in the cortex and do not contain the loop of Henle are called loopless nephrons, the other type are called looped or mammalian nephrons. Looped nephrons contain the loop of Henle that continue down into the medulla then enter the distal tubule drain towards the ureter. Mammals generally have a more vascularized glomeruli than the nephrons in birds. The nephrons of avian species can not produce urine that is hyperosmotic to the blood, but, the loop of Henle utilizes countercurrent multiplication which allows it to become hyperosmotic in the collecting duct. This alternation of permeability between different sections of the ascending and descending loop allows for the elevation of the urine osmotic pressure 2.5 times above the blood osmotic pressure.

Specialize cell types involved in osmoregulation

The integumentary system functions in osmoregulation by acting as a barrier between the extracellular compartment and the environment to regulate water gain and loss, as well as solute flux. The permeability of the integument to water and solutes varies from animal to animal. The excretory system is responsible for regulating water and solute levels in the body fluids. Pigeons can produce hyperosmotic urine but their renal system is different from other animals. They do not produce concentrated urine to reduce water loss but produce a whitish part called urate. It is considered as uric acid solid crystals and it is less toxic than urea.^[3] The wastes move from the blood of the peritubular capillaries passes through the tubule cells and into the collecting ducts and transported as urate (uric acid). Urate is then transported to the cloaca and from there to the large intestine where uric acid particle and water and solutes in the urine can be reabsorbed and balanced. Thus this allows them to save their body water instead of excreting large volume of dilute urea. Cells of the proximal tubule have numerous microvilli and mitochondria which provide surface area and energy to the proximal tubule cells.^[4]

The blood pH is regulated by the A and B types of cells located in distal tubule and collecting duct. The A type cells are acid secreting cells that have a proton ATPase in the apical membrane and a $\text{Cl}^-/\text{HCO}_3^-$ exchange system in the basolateral membrane whereas, the B type cells are base secreting cells, which secrete bicarbonate into the lumen of the tubule in exchange for chloride ions. The regulation of pH in blood determines whether bicarbonate is reabsorbed or secreted.

Transport mechanisms of osmoregulation

The filtrate contains lots of important substances. In the proximal tubules of the *Columbia livia* kidney, substances that are needed, such as vitamins and glucose are reabsorbed into the blood. Their kidney has a variety of ion channels involved in salt and water transport. Water is reabsorbed through aquaporins which are present in the lumen of proximal tubule, basolateral membrane, and blood vessel near proximal tubule. Water flows from the epithelial cells into the blood via osmosis. Since osmosis occurs, the osmolarity of the filtrate remains isotonic. Sodium/Potassium/ATPase transporter is located in the basolateral membrane of the epithelial cell, which is opposite of the lumen of proximal tubule, and actively pumps sodium out of the cell into the blood.

Special adaptations

Eggshell's gas exchange and water loss

Gas exchange across eggshells results in water loss from the egg. However, the egg must retain enough water to hydrate the embryo. This results in the knowledge that changing temperatures and humidity can affect the eggshell's architecture. Behavioral adaptations in *Columba livia* and other birds, such as the incubation of their eggs, can help with the effects of these changing environments. It was found that eggshell architecture undergoes selection decoupled from behavioral effects, and that humidity may be a driving selective pressure. Low humidity requires enough water to keep the embryo from desiccation, and high humidity needs enough water loss to facilitate the initiation of pulmonary respiration. The water loss from the eggshell is directly linked to the growth rate of the species. The ability of the embryo to tolerate extreme water loss is due to the parental behavior in species colonizing in different environments. Studies have been done showing that wild habitats of *Columba livia* and other birds have a higher rate tolerance of various humidity levels, but *Columba livia* do prefer areas where the humidity closely matched their native breeding conditions. The pore areas of the shells allow water to diffuse in and out of the shell, preventing the possible harming of the embryo due to the high rates of water retention. If an eggshell is thinner, it can cause a decrease in pore length, and an increase in conductance and pore area. A thinner eggshell can also cause a decrease in mechanical restriction of the embryo.

Thermoregulation

Temperature changes

The *Columbia Livia* is habituated within many vast environments with varying degrees of temperatures. Like all vertebrates, *Columbia Livia* perspires heat through evaporation of water when temperatures are high in the environment.^[5] It's preferred niche temperature ranges between +39 - +42 degrees Celsius.

Peripheral thermoreceptors of the *Columbia Liva* regulate its body's response to the cold. During low temperatures, which put the *Columbia Liva*'s body under stress it accommodates extreme temperatures by increasing its internal temperatures within the core and spinal cord. Along with this increase, there is also a decrease in temperature within the legs, neck and back skin.^[6]

Physiological challenges placed on organism

Columba Livia stabilize their internal body temperature independent of alteration in ambient temperature. They are also able to withstand extreme climate conditions, such as ambient temperature range of +42 to -40°C. The temperature regulation of *Columba Livia* is generally based on the principle of endotherms. Being endothermic they use metabolic heat to raise body temperature. *Columba Livia* are also homeotherms, meaning that they are thermoregulators and maintain a relatively constant body temperature. The heat exchange between animals and their surroundings occurs due to conduction, convection, radiation and evaporation. Fourier's Law of Heat Conduction describes the loss of heat experienced by animals through conduction. At low ambient temperatures the endothermic animals are able to reduce their heat loss by lowering the skin temperature and by increasing their peripheral insulation, which is discussed later.

Behavioral adaptations

Columba Livia does a few things to regulate its body temperature. Normally it will drink water after they have eaten, but when stressed by heat they can drink whenever needed to lower its body temperature. Another way it can regulate its heat is through Ptilomotor responses. Ptilomotor responses allow for better insulation of the body, because smooth muscle contractions make the feathers stand up straighter, which traps more air next to the skin. *Columba Livia* exhibits T_a (ambient temperature) selecting behavior. It will seek out its desired thermal neutral zone

temperatures, in order to expend less energy heating and cooling its body.

Physiological changes to blood flow

Areas poorly or not insulated by feathers such as the beak, head, and feet have vasomotor responses. To reduce heat loss while in cold atmospheric temperatures, endothermic animals will lower the skin temperature by restricting the amount of blood that reaches it, called vasoconstriction. The sympathetic nervous system stimulates the constriction of the vascular beds at low temperatures. Vasodilation does the opposite; to increase the heat lost by convection after high muscular activity or from heat stress, *Columba Livia* increases its blood flow to the surface of its body. Cutaneous tissue of the beak, feet, and bends in the wings are dilated. To regulate brain temperature it uses the vascular vessels(plexus) in the eyes, in combination with vasomotion. Evaporation is usually controlled by sweat glands, however, birds use their breathing pattern to control heat dissipation. The frequency in breathing depends on body temperature, T^b ; to increase respiratory evaporation the bird's breathing rate would increase. The most important thermoregulatory mechanism is called shivering thermogenesis. The skeletal muscles are used to generate heat through contractions when the surrounding air, T_a , is below its thermal neutral zone. As the temperature drops, the shivering increases to generate more heat. Non-shivering thermogenesis is used by *Columba Livia*, when exposed to cold to generate heat; an increase in Na^+/K^+ -ATPase activity drives this mechanism in the liver.

Special adaptations

A study was done by Michael E. Rashotte, et al. (1998) comparing the vigilance states and body temperature is different within in fed and fasted pigeons (*Columba Livia*). Fasting induces nocturnal hypothermia in pigeons. There are different sleep patterns associated with heat production in pigeons, slow wave sleep (SWS) and paradoxical sleep (PS). An increase of SWS and PS was compared to the fasting-induced nocturnal hypothermia by comparing body temperature (T_b) and vigilance states when pigeons were fed and fasted. It was found that the T_b was decreasing near the beginning of the dark phase and that the time spent in SWS and PS was elevated in the fasting pigeons due to the increase of frequency and duration. When body temperature was low in the middle of the dark phase, it showed that SWS was elevated but it did not affect the PS stage. When the body temperature was high during the last hours of dark, SWS remained elevated in fasting-induced and that PS was relatively high. Rashotte, et al. (1998) suggests that more evidence is needed to confirm these results but he suggests that pigeons may be best viewed as an animal that has a shallow hypometabolic state that fall within (or very close to) their euthermic range. It is also seen that a pigeon's vigilance stage can be compared similarly to mammals in hibernation.

Specialize organs or anatomy involved in thermoregulation

The purpose of thermoregulation is to maintain body temperature by producing heat through physiological and metabolic reactions. Heat gain should equal to rates of heat loss. If the body temperature is unbalanced, the animal becomes either warmer or colder. Heat production in birds is associated to shivering. The large flight muscles-pectoralis as well as the leg muscles generate heat by shivering.^[7]

Columba Livia have strong wings with flexible feathers which provide enough insulation to keep their body warm and dry. The fat layers and feathers reduce the flow of heat between an animal and its environment and lower the energy cost of keeping warm. In some birds the heat loss from the legs and feet is limited in cold weather because of a countercurrent mechanism that saves heat and in hot weather it can serve as heat radiators which increase blood flow.

Thermoregulation in birds requires cooling as well as warming. At low temperature birds can tuck head and neck under their wings to reduce heat loss. The heat is lost by the pigeons as an insensible heat by evaporation of water from the respiratory system and skin when temperature gradient is less and relative humidity is low. At the relatively high temperature birds increase their respiration rate to increase their cooling by evaporation. The panting is important in birds which involves gular flutter. The pouch richly supplied with blood vessels in the floor of the

mouth; the rapid movement of the upper throat tissues - fluttering the pouch increases evaporation. Pigeons can use evaporative cooling to keep body temperature close to 40°C in air temperatures as high as 60°C, as long as they have sufficient water.^[8]

Also from previous studies experiment shows that a bird is capable of evaporating enough water from the cloaca for thermoregulation and results suggests that some birds' cloacal evaporation can be controlled and could serve as an important maneuver for thermoregulation at high ambient temperatures.

Regulation of metabolism

Columba Livia as homeothermic animals, are able to regulate heat production and external heat loss in autonomic ways, by a feedback control system. Negative feedback is the most important principle for regulation; a decrease of ambient temperature evoked by cold activates some thermoregulatory effector mechanisms, which reduce the heat loss and increase the internal heat production. The metabolic rate of resting *Columba Livia* at neutral ambient temperature, is reduced by a level of 5-10% during drowsiness, sleep and darkness. An increase follows every kind of muscle activity, such as flying, which increases metabolic rate by 10-12 times. Heat production throughout the day contributes to a high level of body temperature.

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External links

- Ageing and sexing (PDF; 3.4 MB) by Javier Blasco-Zumeta & Gerd-Michael Heinze (http://www.ibercajalav.net/img/259_RockDoveClivia.pdf)
- Rock Dove videos, photos, and sounds (<http://ibc.lynxeds.com/species/rock-dove-columba-livia>) at the Internet Bird Collection
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