



Feathers make the
bird!

What feathers are

Although feathers start out alive as pinfeathers, when they are fully formed, like your hair, they are dead and cannot be repaired. When the shaft of a feather on your bird is still alive, it will have a purple-blue color and it will bleed profusely if it gets injured.

The central shaft of the feather is composed of a hollow base - called the quill or calamus and the remaining portion of the shaft called the rachis. The feathery sides or vane are composed of individual barbs, which are, themselves, covered with smaller barbules that keep them “zippered” together. The fluffy base portion is called the afterfeather.

Scientists who study feathers give different types of body feathers different names. The longest feathers of the wings are called primary feathers or flight feathers, the shorter wing feathers, secondary feathers. Together, they are called remiges. The base of these wing feathers is covered with shorter ones called coverts. Tail feathers are called retrices. The feathers that cover the bird’s body and give it its shape are called contour feathers. Under the contour feathers are the fluffy down feathers that provide insulation.

Do feathers fall out at the same time?

No or they couldn't fly. However, all birds loose their feathers symmetrically. This allows birds to continue to fly balanced while they are molting. By only loosing a few body feathers at a time, the bird also stays protected from the chill of rain and cold air.

What causes feathers to molt?

Some birds live in harsh climates or depend on food sources that are only available periodically. These birds have evolved to have their molts at exactly to the right season - when food is plentiful, their babies have flown away and the weather is mild. Parrots are less exacting because they come from areas where the temperature is tropical all year long and food is always available. But the basic mechanism of parrot feather molt remains the same. It has only been in the last few years that the process has begun to be understood.

“ Normal molt has nothing to do with temperature or new feathers pushing out old ones. It has everything to do with a natural hormonal rhythm that all birds maintain. ”

The rhythms of life that govern molt

It may surprise you that deep inside your parrot there is a clock. All birds have one. It is called their diurnal, circadian or photoperiodic clock and it keeps track of the hours of the day. It is also a calendar (circannual) clock, in that it keeps very accurate track of the month of the year. The clock is like a personal secretary. It informs the bird when it is the right time to breed, the best time to change feathers (molt), and, in some bird species other than parrots, the best time to fly south for the winter (no, birds don't fly South like Daffy because they are cold). The bird's circadian clock ticks from birth. But to remain accurate over time, its hands need to be fine-tuned from clues obtained from the environment around it. It receives these clues in the form of sunlight and the length of the days. The process of resetting the clock to the exact time is called entrainment.

What winds the clock?

The circadian clock responds best to certain wavelengths of light and also, to some extent, to the light's intensity. But most important, it seems, is the shape of the light-length curve during the year. Ordinary white sunlight or 'full spectrum light' contains all the colors of the rainbow. But within this rainbow of colors, the circadian clock responds best to red light (about 640nm). The annual cycle in birds begins with breeding. Lengthening spring days – sensed by the clock - trigger their annual reproductive and molt cycles. Once the process has started, the clock cannot be reset until a period of short, winter days, have passed. (photorefractoriness)

Where is this clock?

The circadian clock in birds resides in its pineal gland. This is a small organ that sits near the front of its brain. Within the pineal gland is a group of cells that chemically oscillate, that is they "tick" and keep pace like a musical metronome. . Even if these cells are removed from the bird and placed in a test tube, they continue to pulse. The pineal gland is "wired" to the eyes to "perceive" light and probably senses light in other ways as well. Humans also have a pineal gland. But our pineal glands work in a different manner - it is not as "independent " as the ones birds have. The way I have explained this is an oversimplification . Understanding molt is a bit like peeling an onion – remove one layer and you find another. It is a much more complex process involving lots of chemicals, many of them poorly understood. Humans and other mammals also have a circadian clock. But it has moved to another location in our brain.

How often do they molt?

That depends. Indoor parrots that receive artificial light have extended molt periods and they may have several per year. They may also retain certain feathers for over a year. That is because their clock is free-running and no longer precise.

Over the year, sunlight slightly bleaches feathers, the color of the new ones are more intense. This makes it easier to tell which feathers are the newest. Because breeding and molt are intimately connected through the same hormonal cycles, it is my suspicion that small parrot that breed more than once a year probably go through multiple molts as well.

Is there an order in which the feathers fall out?

Yes. When feathers are molted normally, an equal number are lost on both sides of the body. There are no bald patches and the new pin feathers appear quickly. In that way, the bird continues to have the ability to fly in balance, old feathers protect the new blood-filled pin feathers from damage and the bird can maintain its body temperature. This is most apparent with wing feathers and is the reason you need to examine de-flighted pets frequently to be sure the clipped feathers have not been replaced. Primary wing feathers are often the first to fall out during a molt. Usually, the inner ones fall first. Then the secondary flight feathers and tail feathers start being lost and replaced, followed by the contour feathers.

Do new feathers push out the old feathers?

It is not that simple. The key to new feather formation is the removal of the old feather. In some unclear way, the presence of a well-anchored feather prevents a new feather from forming. When that feather loosens or is plucked out, a new feather immediately begins to form. Prior to molting the blood vessels supporting feather growth dry up and feather attachment to the surrounding tissue becomes loosened. When you pluck out a parrot's feather, the process begins. But in a natural molt, at least in some bird species, the feather bud or follicle begins producing the new feather before the old one is completely shed. So, in a sense, the new feather does give the final push-out to the old one.

Will personality change while going through a molt?

If your parrot lives indoors in artificial light and molts only an occasional feather, its personality will not change. If your parrot has gone through a normal summer breeding cycle during which its sexual hormones surged, it will quiet down and become less aggressive during its subsequent molting period. Many parrots become less active and moody while molting. Your bird may not be as affectionate with you as it normally is. Parrots will scratch themselves more as the new contour and head feathers sprout.

Hormones and chemical factors involved

We know what hormones are in play when molt occurs. But we do not know the process by which they cause old feathers to fall and new feathers to replace them.

Cytokines (chemokines) are messenger proteins that carry signals locally between cells. These signaling molecules used extensively by birds in cellular communication. Unlike hormones – they concentrate locally and are active in a lower concentration. These signaling chemicals have been found to increase when molt begins – just like they do when hair is shed and regrown. Whether they function to dislodge the old feather or grow a new feather or if they are the actual cause of the molting process remains unknown. Similar factors are involved in the growth of hair.

Melatonin tells the bird when to molt. But it does not cause feathers to fall out or regrow. It is the primary hormone produced by the pineal gland. It is also called the timekeeper hormone because oscillations its production and secretion that are timed to the amount of light that is present are the body's central timekeeper. Its presence or absence controls the production of all other hormones involved in reproduction and molt as well as all differences between day and night time activities. Melatonin is secreted when it is dark. Daily melatonin production is longest in the winter when nights are long and shortest in summer when nights are short. But blood melatonin reaches its highest daily peaks in the spring and summer when days are lengthening and its lowest peaks in the fall and winter. Melatonin rhythm and amplitude govern the production of many hormones produced in the bird's pituitary gland. These include FSH, LH, and Prolactin, which are involved in nesting and reproduction, ACTH, which controls adrenal gland hormone production, TSH, which controls thyroid hormone production and GH which controls growth.

Hormones and chemical factors involved continued

LH (Luteinizing Hormone aka Interstitial Cell Stimulating Hormone or ICSH) In female birds, this hormone stimulates ovulation. In male birds, it stimulates testosterone production. In response to lowering levels of pineal-produced melatonin in the lengthening springtime days, blood levels of LH in birds increase and trigger their reproductive cycle. As their reproductive cycle ends the LH levels of birds decline. This decline occurs concurrently with their molt.

Prolactin (PRL) or Luteotropic hormone (LTH)d Prolactin is another hormone produced by the bird's pituitary gland under the control of the pineal gland. Some studies indicate that prolactin levels are highest in the period that birds begin their molt while others have reached the opposite conclusion. Progesterone is produced by the ovaries of birds as they go through their reproductive period. When I worked with penguins, one of my biggest problems was the failure of the birds to molt. Birds that did not molt also did not reproduce, so I suspected that their problem was due to the way the artificial light they received affected their circadian rhythms. I found that the only hormone that would cause these birds to go through a normal molt was a long-acting form of progesterone called Depo-Provera. This may have occurred because progesterone is known to affect the blood LH level of birds.

Thyroxin (thyroid hormone) I do not believe that thyroid hormone causes molt. Some veterinarians associate molt problems with thyroid problems. This is because birds that have had their thyroid glands removed have a number of problems – including the inability to molt normally.

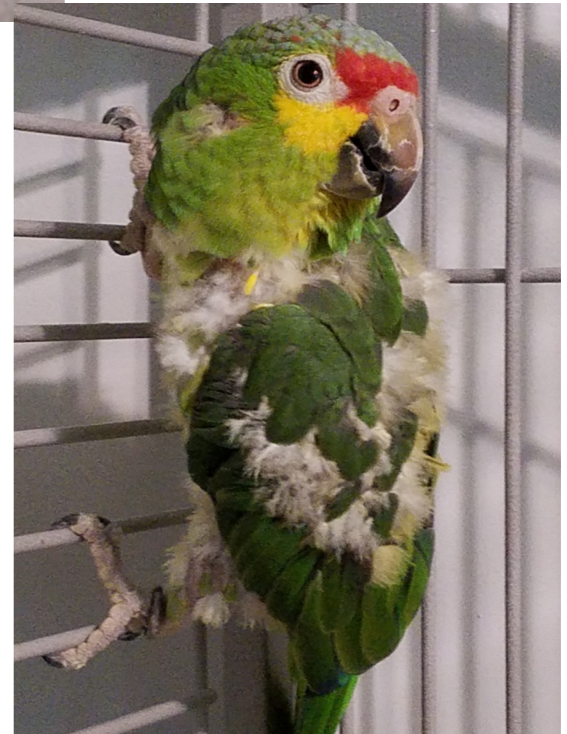
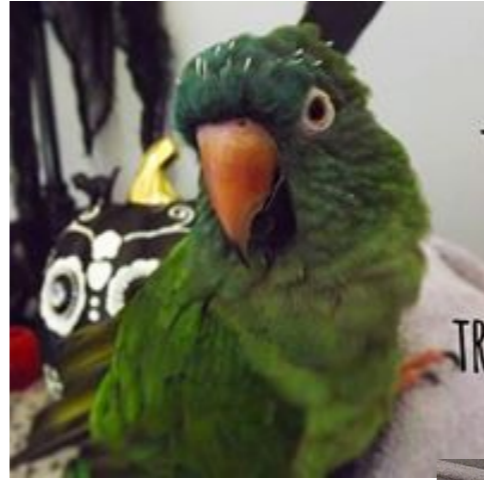
Could it be over preening?

Feathers are complex structures that require constant care called preening. Preening removes dirt spreads the bird's body oils and realigns the feather's structure. It is also a social activity between birds and their mates and owners. Most parrots have an oil or preen gland (uropygial gland) situated at the base of their tail which is the source of most of their feather oil. Without this oil, the feathers will absorb rainwater and the bird will be unable to fly or maintain its normal body temperature. Some bird species- those that are less likely to bathe or immerse themselves in water - produce feather dust instead of oil glands. They have powder down feathers that shed a very fine, white, waxy powder composed of keratin that is spread through the feathers when the bird preens itself. This "dust" fulfills the same function of the oil glands, as it forms a waterproof barrier for contour feathers. Those species that produce the greatest amount of feather powder are Cockatiels, Cockatoos and African Greys.



An owl's oil gland - also known as uropygial gland or preen gland
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More on these topics in a future presentation



Feather Health

The biggest cause of poor feathering is malnutrition due to the bird consuming an unbalanced diet. Even if you are feeding a balanced diet, parrots often pick through it, eating only the things that catch their fancy. Other chronic diseases of parrots also lead to abnormal feathers. These include a number of bacterial, viral, fungal and parasitic problems. If there is a problem internally, it will continue to present itself on or in the feathers. Molting will not change that.

Feathers should be treated with utmost care by you even if the birds do not. Your hands carry everything from oils to bacteria so keep that in mind when coming home from grocery shopping, work, working outside, or going to the bird shows or bird club. This will interfere with the antibacterial and anti-mycotic properties of their feathers. Wash your hands as you would for a new born. Newspaper liners for cages shouldn't be used due to the vegetable dye being used and transferring to your bird's feathers. Misting and/or baths are very important to encouraging healthy preening and cleaning. Try to ensure your bird gets at least 15 minutes of sun a day even if it has to be through UV lighting. More on feather health later.

More on these topics in a future presentation

How can you help them through a molt?

Sometimes molts are easy and sometimes they are rough on the birds. The molts can last from one to three months. We have seen even longer than three months. They look like baby ragamuffins. They feel like baby ragamuffins too. So here are a few things you can do to help them through it.

1. Mist with aloe water to help with itching a couple of times a day. Make your own or order George's spray on Amazon.
2. Pour them some aloe water in their bowl for them to drink in the morning. Replace it later with filtered water.
3. It is also helpful to install an HVAC (AC/Heating filter) with a MERV 11 rating or better (for normal households, they recommend 8 or 9).
4. Give them extra calories during this time. Nutriberries or millet can do the job.
5. Share a cup of Chamomile tea with them in the evening (try to use organic whole chamomile flowers).
6. Move in a humidifier and keep it about 55% humidity. This is an important opportunity for birds that people often forget to do especially during winter months.
7. Easy on the petting. Ask them if they want some help with the preening around the head area. Wash your hands before you do.
8. Keep it calm and relaxing around your bird. High energy music, lots of guests, taking them on play dates can invite unwanted behavior you would rather not have to work on later.
9. Make sure they get their sleep! They need rest and even naps.
10. They need to be warm. You may enjoy your house at 68 but most birds temps are much higher than that. Bump up the air conditioning or put a warming panel in front of a perch so they can have that option.
11. Flax seeds as it is packed with plant protein, fiber, B vitamins, minerals, and is an amazing source of omega 3 fatty acids, but it also contains mostly healthy polyunsaturated fats and is lower in saturated fats than most nuts.





THANK YOU

Ron Hines DVM PhD for making your paper
available for educational purposes.