Cockatiels:
Breeding Smart!

by
Linda S. Rubin
**About the Author ...**

*Linda S. Rubin* is an author, editor, speaker, and avian educator with an international byline and more than 30 years experience keeping and breeding cockatiels, budgerigars, and parrots. An avid enthusiast in the study of color mutations, she is widely recognized as a leading authority in the United States on cockatiel mutation genetics. She is the author of the books *Ultimate Parrot Guide,* and *Multiple Bird Households,* both of which have earned the distinction of receiving the ASPCA Seal of Approval. Her popular self-published volume, *Cockatiel Genetics Made Easy,* has sold to aviculturists, hobbyists, and zoos around the world for nearly two decades. Her self-published books have been turned into digital books, including: *Cockatiels: Breeding Smart, The Complete Guide to Cockatiel Color Mutations,* and *Cockatiels in Color.*

Linda writes as a Bird Breeder Expert for *BIRD TALK’S* website, *BIRDCHANNEL.COM* and is a USA columnist for *CAGE & AVIARY BIRDS* in the United Kingdom. With several hundred articles published since 1978, her writing background includes working for Seacoast Publishing as senior editor and feature writer for *Cockatiel & Parakeet World* magazine, and penning columns for *Cage & Aviary Birds (UK), Bird Times, Cage Bird Hobbyist,* UK *Birdkeeper,* ACBM, and the AFA *Watchbird.* Her features have appeared in many publications including BowTie, Inc.’s *magabook* (magazine-book) *Popular Birds: Cockatiels,* as well as *Bird Talk, Birds USA, Critters USA, Just Parrots, Australia’s Talking Birds,* trade publications, and in over a dozen international journals including the *Australian National Cockatiel Society, Native Cockatiel Society of Australia,* and the *Avicultural Society of Australia, Inc.* Linda is a recipient of the coveted WATCHBIRD Silver AVY Award for her writing in *AFA Watchbird* from the American Federation of Aviculture - the AVY's being considered the highest awards in US aviculture. Linda owns Aves Communications & Promotions offering her books and services that includes avicultural writing, editing, and avian consultations through her website, [www.CockatielsPlusParrots.com](http://www.CockatielsPlusParrots.com). She has presented on a range of topics to meetings around the USA since 1978, and at national and international conferences since 1982.

With more than thirty years dedication to national organizations, currently Linda is founding president of Cockatiel Foundation, Inc. - their webmaster, genetics consultant, and oversight for their journal publication; she also serves as the specialty organization vice president, public relations chair, and AVY awards chair for the American Federation of Aviculture, Inc. She is a certified avian specialist with the Pet Industry Joint Advisory Council, and a certified panel judge for the Cockatiel Foundation, and the Society of Parrot Breeders & Exhibitors, judging bird shows across the USA, Canada, and Puerto Rico since 1984. Linda is the facilitator of the original Cockatiel Genetics Workshops (TM) in the United States and a presenter at over a dozen national AFA conventions, the Canadian Parrot Symposium, and numerous conferences and private meetings - including Keynote Speaker at the First International Cockatiel Symposium hosted by the Australian National Cockatiel Society and the Native Cockatiel Society of Australia in Brisbane and Sydney, and as overseas speaker at the Avicultural Society of Australia in Melbourne, Australia. She enjoys sharing her knowledge and meeting other aviculturists through visits at conventions, meetings, and shows.
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*Dedication: To all the birds at Tangowood Aviary who taught me patience.*

1975-2010

Cover Photo: c. 2005 Linda S. Rubin, Heavy Pied/Whiteface hen

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The Cockatiel has long been a favorite pet, exhibition, and aviary bird, frequently reproducing when other Psittacine parrots will not. Generally, hardy in aviary life, cockatiels come in an every-growing number of both subtle and eye-catching color mutations, and handfed young can make ideal pets.

Generally sweet and docile, cockatiels should never be housed with larger, or more aggressive birds, since they seldom adequately defend themselves. Even smaller, more quarrelsome species such as budgies, some varieties of love birds, and certain finches, especially in mated pairs or flocks, should be maintained separately from cockatiels. These species, and other larger birds, could effectively monopolize feed and water dishes, preventing the less assertive cockatiel from obtaining adequate nutrition.

Should the cockatiel find itself forced further down the established pecking order by other species, and increasingly denied adequate food and water, such continuous abuse could lead to malnutrition, dehydration, and a lessening of resistance to disease. Additionally, the constant stress from fighting over territory within a pen or aviary could impose further stress-related disease, in addition to the more obvious risk of injury, and even death. Although the major factor in such situations is usually the height (and especially the length) of the flight, when providing enough space for cockatiels to escape bothersome individuals, even the most spacious of aviaries may not be adequate to deter known, or suspected aggressors, especially larger species.

Generally, most fanciers precede their larger collections with the acquisition of either a few pets, or pairs of cockatiels kept in cages. This may be sufficient for a period of time until the numbers begin to row, which is not difficult to achieve if one is captivated by the variety of color mutations, or should one begin to successfully raise a few clutches of young.

Standard cockatiel cages are quite suitable for one or two pet birds who are routinely allowed out of their cages for daily exercise to enhance their chances of living a full life span. It is of prime importance to secure cages equipped with cockatiel bar spacing to prevent a cockatiel from forcing its head between the vertical bars to become trapped, often with devastating consequences, ranging from injury to death. The slightly closer bar spacing on specially designed cockatiel cages prevents such tragedies. Additionally, an increased number of horizontal bars positioned along the vertical bars will allow a cockatiel to climb and effectively gain a secure foothold, again preventing fatal accidents.

The removal of the bottom grid positioned just above the tray will also eliminate worry over whether an inquisitive cockatiel may catch its head between the grid spacing as it retrieves items from the cage bottom, or even catch an open leg band on the grid, both of which have been known to happen.
In general, brass, chrome, or similar materials that allow for adequate disinfecting practices should be sought out. Some plastics might be difficult to sterilize in hot temperatures, while older, painted cages could contain toxic lead paint, which is extremely fatal when ingested. Utmost consideration should be given to cages with more length, and not just height - since cockatiels fly back and forth not up and down - and with enough space to allow each bird to comfortably stretch its wings and move around while confined.

However, once population starts to increase, larger caging will become necessary. There are now a number of excellent manufacturers who offer modern, easy to assemble enclosures, requiring simple maintenance and upkeep. Many cages and some aviaries can be ordered with casters and can be wheeled effortlessly to any location and may be dismantled and reassembled should the need arise. Such pens may be stackable, or come in double or triple supporting frames, for fanciers with ever-growing collections. Custom cut doors, or self-cut side openings for nest boxes may be easily accomplished with attention to blunting any jagged edges to the newly cut wire.

Another option is to build your own aviaries using clean, welded and washed wire, or other safe materials. It is not unusual for breeders who have been raising birds for many years to go through a metamorphosis when designing their aviaries. The author evolved through many changes beginning with large, eleven foot long, walk-in flights, composed of half inch by half inch welded wire mounted on wooden frames. Eventually, six foot long aviaries were installed, suspended off the floor by sturdy twelve gauge wire legs with custom cut doors created for ease in servicing flights. In recent years, walk-in flights custom ordered from a well-known manufacturer were installed. Such flights were chosen not only for their ease in maintenance and servicing, but for their ability to be completely disinfected since all materials were non-porous.

As the cockatiel is a swift, strong flyer, it must be given adequate room to exercise and maintain general good health and condition. Therefore, as much space as possible should be afforded to pairs, especially to promote a lengthy, reproductive life. Due to their flying ability, emphasis should be placed on both the length, and height, of flights. Although the depth of a flight need only be a minimum of three feet (of course, bigger is better), it is recommended to raise flights to at least six to eight feet high - in order to build strong chest muscle when birds fly upward and condition egg-laying muscles in females - to perhaps 10 to 20 feet in length (with safety netting) if space is available.

Materials should be selected carefully, with good disinfecting tactics kept in mind. For example, the author’s original wood-framed wire aviaries were eventually torn out in favor of all wire and aluminum construction, because wood is a porous material and could potentially harbor harmful bacteria’s, etc. Additionally, white pine chips used over the years were abandoned in favor of thoroughly dried, uncolored newspaper (colored ink can be toxic), merely for ease of use and increased frequency in cleaning measures. Certainly, other materials such as cedar chips, plain white paper, or even corn cob bedding can be used to line aviaries however, the latter material must remain dry and free from moisture due to its tendency to harbor mold in the center of the bedding.

Popular wire size for aviary construction among many breeders typically varies from half-inch by half-inch wire, up to half-inch by two-inch wire. It is highly recommended that doors be constructed low enough, for example four feet high, to prevent any swift-flyers from darting out overhead whenever servicing a flight. Outside aviaries should
ideally have an added corridor with a safety door to trap any escapees who might otherwise slip off into the outside unimpeded.

It is recommended to install natural tree branches of varying diameter to all cages, pens and aviaries. The fluctuating sizes of the branches will afford some exercise to the feet, preventing sores and calluses however, such diameters should still be selected with the species natural grip in mind. The bark, when stripped by the birds, will provide added minerals to the diet, act as a stimulus to the breeding cycle while satisfying a natural urge to chew, and generally provide some satisfaction and amusement for resting birds. Popular varieties for cockatiels include Eucalyptus, willow, apple, maple, and birch. Cherry wood, in particular, should be avoided as it is known to be toxic to birds. All branches should be thoroughly cleaned and disinfected before installed, and selected from sites known to be free of pesticides.

Chapter Two
THE BREEDING COLONY

Indoor Versus Outdoor Breeding

The decision to erect indoor flights or build outside aviaries is dependent upon a number of factors, not least of all geography and zoning regulations. If one is fortunate enough to reside in a hospitable climate, the inclination is to erect outdoor aviaries, however, many cockatiel breeders have successfully produced superb individuals from well-run indoor studs. The aviculturist must weigh the pros and cons of indoor versus outdoor breeding, and decide on a system that is best for the conditions affecting the birds.

Advantages to outdoor aviaries include: easier maintenance and cleaning duties; exposure to fresh air, eliminating the need for air purifiers and cleaners to remove feather dust, dander, and harmful organisms abiding in indoor set-ups; improved feather condition from partial exposure to outdoor rain; some direct exposure to sunlight, allowing for the absorption of Vitamin D3; the possibility of building longer and more spacious flights and breeding pens, depending upon the space allotted.

Disadvantages to outdoor aviaries include: exposure to inclement weather, storms and natural disasters; vulnerability to predators possibly requiring construction of concrete floors to keep predators out; contact with disease from outdoor wild birds; exposure to parasites requiring regular worming treatments; increased risk of panic flights during flock alarm calls from perceived dangers (e.g., reacting to outdoor threats such as cats, raccoons, overhead planes, etc.); requiring safety netting to prevent accidents from swift flyers in overly long flights; the increased possibility of theft; and the increased danger of outdoor escape requiring the construction of safety corridors, if needed.

Advantages to indoor aviaries include: secure shelter from the elements; protection from both predators and outdoor wild birds carrying disease; protection from outdoor parasites; control over environmental conditions including temperature, humidity, and photo-light period, with the ability to extend the breeding season; plus possibly increased protection against theft and fewer escapes of aviary residents to the outdoors.
Disadvantages to indoor aviaries include: increased daily maintenance cleaning; the need for air purifiers, air cleaners, and possibly humidifiers; the need to provide vitamin supplementation containing vitamin D3 in correct ratio to vitamin A, calcium, and phosphorus for proper absorption (if not already provided in the feed); the need to regularly spray mist birds; the possibility of overcrowding in limited quarters with the increased risk of contagious illness being transmitted; plus aviary size is directly dependent upon available space.

Whatever you decide, the choice should be a compromise between the welfare of the birds and the ease of day-to-day maintenance you are able to expend. Otherwise, the work will become a burden and the aviculturist will eventually burn out or lose interest. To repeat a well-known adage, “Keep and breed only the number of birds that you can comfortably afford to house, care for, and feed in style.”

**Controlled versus Colony Breeding**

If one is interested in producing a quantity of young during the breeding season and not concerned with superior quality, or specific color mutations, colony breeding is a method of producing an abundance of offspring. Experienced cockatiels usually make good parents and have been known to take care of their own, and sometimes other pairs’ young. Eager parents, both cocks and hens, have been seen diving into their nest box, or even their neighbors’ to satisfy the hungry cries of chicks who have been left temporarily unattended. Such actions are probably more a condition of biology and increased hormone levels, although good parenting skills are also a condition that is affected by learned behavior (e.g., trial and error).

To plan a successful colony, it is best to expose birds to prospective mates prior to the breeding season in order to enhance the formation of pair bonds, or else additional time must be allowed for birds to pair off at the start of the season. Any extra birds that remain unmated should be removed in order to maintain harmony within the colony. By allowing pairs to form bonds prior to the breeding season, such birds will easily pair up again upon being reintroduced, requiring less time before they go to nest and the eventual production of eggs.

Although many pairs do form bonds with a single mate, it is not unusual for a chance indiscretion to occur. Therefore, when using the colony system, the pedigree of offspring cannot be absolutely guaranteed, even if the breeder is convinced of a pair’s faithfulness.

It is especially important to give the pairs a lot of space and avoid overcrowding in a colony flight. Ample room will prevent such behaviors as squabbling over nests and established territory or perch space. The flight also must be large enough to accommodate any young produced that will share the accommodations once fledged.

A number of additional nest boxes should be provided beyond the number of cockatiel pairs housed to offer birds some choice and to keep fighting over boxes to a minimum. If boxes are attached inside the flight, pairs are able to mate while standing on top of them, which provides a flat surface aiding the female to keep her balance while the male is standing on her back to begin the process. However, all perches should be securely fastened, should the pairs prefer to utilize them for mating, otherwise infertile eggs may result. If nest boxes are hung on the outside of the flight, it offers the
advantage of easy nest inspection without any intrusion into the aviary or disruption to the colony.

Nest boxes should be removed after two rounds of young are produced, or approximately ten to twelve chicks per pair. If nest boxes are allowed to remain, they will encourage continuous breeding and egg production, ultimately draining and overtaxing the energies and reproductive life span of the pairs. Additionally, young chicks generally too immature to breed, will be stimulated to reproduce much earlier than they should and attempt to go to nest before they are developmentally ready to be responsible parents.

On the other hand, controlled, individual cage breeding, housing one pair per pen, is highly recommended when one is intent upon producing the best quality of birds possible; when attempting to produce particular color mutations; or when attempting to breed for exhibition. Controlled breeding is an absolute necessity when guaranteeing the pedigree and parentage of offspring produced.

Further advantages to individual cage breeding include increased control over the breeding cycle and the ability to document vital information and data on specific individuals or pairs. Accurate record-keeping, the banding of young from known parentage, and other helpful information may be reliably collected. The major drawback to individual cage breeding however, is the increased maintenance time necessary for servicing additional aviaries or pens in use, plus the space necessary in which to house individual sets-ups and expectant nursery pens.

While smaller collections using the controlled breeding practice may permanently house established pairs together, the majority of breeders with any number of birds usually resort to flocking their cockatiels in a minimum of two separate resting flights, plus at least one holding or nursery flight for young, unflighted birds.

In the USA, adult cockatiels are usually housed separately with one flight for cocks and another flight for hens. The general consensus is that cockatiels exhibit strong pair bonds that will only strengthen when birds live in the resting flight with their bonded counterpart. Therefore, in order to encourage an individual to be more receptive to a new partner, established pairs are split up during the resting season by housing the sexes separately, then eventually repairing to new partners, should that be a goal.

Of course, when such proven producing pairs are reunited, they quickly go to nest. However, should a new mate be selected (e.g., to produce a specific mutation, create a new line, or improve show qualities), it is easier to foster a new bond if the original mate is not accessible. Yet, in some instances, some pairs do form strong pair bonds and may refuse to accept any other partner while the original mate is within sight, or earshot, of its presence, or call.

Generally speaking, most cockatiels will pair with a new partner and produce eggs within two to three weeks of introduction, with the provision of an acceptable nesting site, increased food supply, and other necessary environmental stimuli (i.e., increased temperature, proper humidity, extended photo-light period and soft foods).

In recent years, the author has chosen to house the cockatiel genders together (as do many European breeders), and found few exceptions to pairs accepting new mates. Such exceptions were found in older, more established pairs, or pairs that have produced young together and formed exceptionally strong pair bonds (as evidenced by mutual preening, perching together, or sitting nearby, even in large flights).
**Dietary Requirements**

Every breeder has their own particular favorite method of feeding and fortunately, the nutritional studies and research conducted by feed manufacturers and universities have been of great benefit to cockatiels. Aviculturists should research the literature, then choose a diet that works best for them. The following is the most recent diet used by the author, with modifications made from time-to-time over the past 30-plus years.

**Feed:** A high grade, well-cleaned, cockatiel mix should be available at all times. The author originally mixed her own blend, however, fortified brands were obtained once they became available. Some commonly found mixes the author uses includes primarily canary seed and white proso millet, with smaller amounts of sunflower, safflower, oat groats, red millet, wheat, toasted corn flakes, buckwheat, flax seed, corn gluten meal, ground corn, ground wheat, soybean meal, ground rice, algae meal, alfalfa meal, Brewers dried yeast, wheat germ meal, including a long list of vitamins, minerals, electrolytes, and dried bacillus fermentation product (the latter of which is thought to provide beneficial bacteria for digestion in the gut, while strengthening the immune system).

About twice a week, a highly nutritional treat is provided consisting of dried seeds, vegetables, and fruits. These seed-shaped “berries” are available from a variety of manufacturers and vary in ingredients and flavors.

**Pellets or Extruded Diets:** An excellent optimum daily diet for birds, pellets can supplement the cockatiel diet and it is helpful to familiarize cockatiels to both seeds and pellets for optimum nutrition. Although other Psittacine parrot species may be entirely converted to pelleted or extruded diets, it is **crucial to understand that cockatiels must not be fed pellets as a sole diet, but rather, in addition to seeds.** Although neither seeds nor pellets are found in the wilds of Australia as the cockatiel’s native diet, seeds more closely approximate the natural diet and are well-received. Some studies have found cockatiels to suffer from kidney or liver damage when kept on a pellet or extruded diet alone. However, when fed together, most cockatiels have benefited with the combination of feeding both pellets and seeds, compared to just seeds alone.

The author has taken the “shot-gun approach” by feeding two or three brands (and flavors) of pellets at a time, along with seed since the early to mid-1980’s, and has had some near record-breaking longevity records in cockatiels, including a sizable number of males of various mutations living into their mid-to-late 20’s, with the record at Tangowood Aviary of a 31 year-old Normal Grey male cockatiel named “Dixie.”

**Supplemental Mash:** Commercial conditioning mashed can be made available to breeding pairs if desired, in addition to the regular diet and soft food mixes. Many mashed are available for breeding birds (as are many pelleted products), and the author has used them through the earlier years for extra nutrition to rejuvenate resting birds, boost the nutritional needs of breeding and molting birds, and provide extra additives for young, sick, or aging birds who, being further down the established pecking order, may benefit by the added nutritional support.
**Vitamins, Minerals, and Electrolytes:** Originally, we had to supplement the diet. However, studies have shown vitamins rapidly dissipate when added to water, and since pellets and fortified seed mixes are routinely available with carefully calculated formulas, the need to supply vitamins separately is satisfied elsewhere. However, if one chooses not to feed fortified products, vitamins should be added to the diet because seeds are notoriously deficient.

During the breeding season, a daily offering of soft food (discussed in the upcoming chapter), is lightly salted with a powdered avian multivitamin-mineral supplement containing vitamin D3, and is also offered to any sick bird, or periodically to resting birds so they are trained to eat the mix should they one day breed or become ill.

Cuttlebone, or mineral block - a vital source of calcium for both resting and egg-laying birds and not merely a toy - is always available. Some aviculturists supply oyster shell, which is an added soluble supply of calcium in addition to cuttlebone. Washed, baked, chicken egg shells - baked at 350 degrees for 45 minutes - can add valuable calcium to the diet. Wash the shells first to remove all traces of Salmonella bacteria.

**Water:** Water is essential to metabolize many elements in the body, and vitally necessary to maintain continued good health. Do not add liquid vitamins to water; studies have shown bacteria to double in the water in a few hours and multiply exponentially after that hours later. If you must use liquid (or powdered) vitamins at any time, try adding it to a favorite soft food mix.

Provide clean, fresh drinking water DAILY in thoroughly scrubbed, disinfected drinking vessels. Keep another set of drinkers on hand to use when it is time to clean and disinfect the current drinkers.

Dishwashing detergent and water is a good cleanser to scrub out drinkers when changed daily until it is time to replace them with a new set that are already more adequately disinfected. There are many bird-appropriate disinfectants available through distributors and retailers, or you can choose to do the “birdie dishes” in the dishwasher.

DO NOT use the same scrub utensil for cleaning out water cups from different cages; the author uses separate paper towels to disinfect and clean them individually in order to keep possible contagion and potential transmission of illness restricted. Vessels should always be changed and replaced if contaminated by droppings, dirt, or foreign substances. **The standard “ounce of prevention,” can really save that expensive “pound of cure” at the avian veterinarian,** especially if the flock comes down sick due to poor husbandry practices or preventative transmission of disease.

**Fresh Produce:** A variety of vegetables should be offered two to three times a week at minimum, and daily to breeding, weaning, and young birds. Dark green, leafy vegetables supply necessary carotene (converted by the liver into vitamin A). Vegetables high in carotene and vitamin A include: dandelion, collard greens, carrot tops, and kale, ranking highest. Other vegetables containing a variety of vitamins and minerals include broccoli, mustard greens, fresh peas, string beans, chicory, parsley and watercress. As a rule, calcium is found in the leaves, while phosphorus is found in the stems or stalks. Lettuce, containing little nutrition, is next to useless, so always make an effort to choose a darker green, leafy vegetable to supply better nutrients.
Yellow/orange/red vegetables loaded with carotene (a precursor to vitamin A) include: raw carrots, raw pepper, and cooked vegetables such as yams, squash, sweet potato, and pumpkin. Most green vegetables, corn (niblets or on the cob), carrots, and peppers, should be served raw whenever possible, because cooking destroys much of the nutrition. In a pinch, however, frozen, mixed vegetables such as corn, peas, carrots, and beans, can be served cooked, or used in the corn/rice/bean diet as discussed in the next chapter.

Fresh fruit, such as apple, orange, cut grapes, bananas, mango, and a number of other fruits will be accepted if the birds are trained to eat them. Seasonal favorites such as cranberries and pomegranate can be a source of amusement in addition to added nutrition when the birds discover how to pick up, play with, and eat them. Cockatiels, unlike the rest of the parrot family, do not rely heavily on fruit, preferring instead fresh greens and other vegetables as an adjunct to their feed. Yet, fruit can become a small and healthful addition to the diet if cockatiels are patiently and consistently trained to accept them.

Table Foods: Breeders with smaller collections or just a few birds may be able to provide some occasional table foods. The rule of thumb is to think of your bird as a “health food nut,” and avoid any foods that contain fat, sugar, chocolate, alcohol, and caffeine, all of which can be either harmful or toxic to birds.

Simple carbohydrates such as fruits and vegetables as outlined above, or complex carbohydrates such as pastas, noodles, macaroni, brown rice, and spaghetti, etc. are good offerings - just set aside the portions before adding sauces or spices. Other healthy additions include whole grain foods including: oatmeal, cereals, toast, pancakes; proteins such as cheese, scrambled or 20-minute hard-boiled eggs (to remove Salmonella bacteria), or occasional small pieces of chicken, or well cooked meat (my first cockatiel enjoyed stealing the tuna fish out of my sandwich at lunch), and other tidbits - provided they are healthy - may all be used as supplements when fed in moderation.

Summary: Cockatiels must be exposed to a variety of foods in order to develop good eating habits. This is solely the responsibility of the owner or breeder, and should be done at an early age. However, even older birds can be trained to eat new foods with your patience and dedicated persistence. The truth is, the task lies with you and your willingness not to give up until your pairs are routinely eating these foods. And, if these foods aren't available on a daily basis (e.g., fresh greens) they can't be eaten, so the moral is to present fresh food every day and expect to waste it as part of the training process until pairs are eating such foods routinely.

BREEDING STATS AT A GLANCE

Breeding Age: An absolute minimum of 12 months. However, many breeders prefer to set up pairs between 18 and 24 months to allow for full maturity.
Onset of Egg-laying: Most pairs will produce eggs within ten to fourteen days after being placed in a breeding pen with an acceptable mate, next box, and conditioning diet. If the pair do not produce in a few weeks, try re-matching them to different mates or check their condition, and breeding environment, including photo-light period and humidity, nest boxes, perches, feed, etc.

Incubation: Eggs hatch between 18 and 21 days, depending upon when the hen first begins to sit the clutch. Virgin hens, in particular, may not sit until the second or third egg is laid. In this case, allow the eggs several extra days to hatch. DO NOT PREMATURELY OPEN THE EGGS!

Banding: Closed, coded, seamless leg bands serve as permanent identification and are available through national organizations. Depending upon bloodlines, chicks may be banded between ten days and two weeks of age or around the time the eye slits are opening. Very large chicks may need to be banded earlier. Pet quality (small size) birds may even be banded a few days later (check the chicks each morning to be certain the band remains on the leg and is comfortable).

Fledging: Chicks leave the nest between four and five weeks of age. They are fully feathered except for a short tail and are still dependent upon their parents for food. They will learn from their parents to pick at food and return to the next box at night to sleep until fully weaned.

Weaning: Chicks are fully weaned anywhere from seven to ten weeks (eight is average weaning age) when raised by the parents - or eight to ten weeks or later, when handfed. Chicks that continue to beg for food and do not have a full crop at night when hand-feeding, should continue to be fed. Studies conducted at University of California at Davis have demonstrated that chicks will wean when they are developmentally ready to do so and not before. Beginning at four weeks of age, providing a water dish to chicks that are being handfed helps promote the weaning process. Stop feeding only when you see chicks eating and their crops continue to be full at night for several evenings in a row, showing that they are independent and capable of eating on their own.

Chapter Three
THE BREEDING SEASON

Breeding Condition

Breeding birds require five prerequisites: 1) optimum nutrition, 2) increased photo-light (i.e., daylight) period, 3) proper humidity levels, 4) an acceptable mate, and 5) an adequate nesting site. Increased or normal room temperature (e.g., 68 to 72 degrees) will mimic the breeding season, although many breeders have been successful with lower temperature provided it remains constant without fluctuation. Increased humidity via open water drinking bowls, or spray baths, signal the onset of the rainy season that wild pairs rely upon to provide the “milky stage” seeds with which they feed their young.
Optimum nutrition is key to the growing chick and must be provided before the egg receives its outer calcium shell, meaning well before the egg is actually laid. This can easily be accomplished by providing a soft food supplement, in addition to the regular diet, fortified by a light salting of an avian multivitamin-mineral supplement containing vitamin D3, made especially for birds. The author uses a salt shaker filled with the powdered avian vitamin-mineral supplement to daily “salt” the soft food mix before it is presented to each pair.

Breeders have utilized a number of soft food supplements such as cooked, mashed, hard-boiled egg, combined with carrot, whole wheat bread, and commercial mashes - to the popular parrot corn/rice/bean (legume) diet. The author's favorite is the corn/rice/bean supplement to the regular diet utilizing such legumes as fresh frozen or canned lima beans, black-eyed peas, chick, navy, pinto, and kidney beans, or the 15-bean mix found in the market which may be slow cooked. Beans such as lima must be well-cooked to remove any toxins remaining in improperly cooked, or raw beans.

An easy shortcut is to purchase frozen whole kernel cut corn (or small frozen mixed vegetables), instant whole grain brown rice, and fresh-frozen or canned beans found in most supermarkets. Microwave the fresh frozen beans (e.g., lima) thoroughly, add warmed soft corn, and cook enough brown rice (white rice lacks the food value found in whole grain brown rice), to coat the corn and beans. Leftover rice may be stored in the refrigerator up to 5 days, and the bean mix can be frozen in portions and re-warmed. Portions of the corn/rice/bean mix should be increased as chicks grow. It is an excellent soft food - and a complete protein - useful for conditioning birds, rearing chicks, and for sick birds too infirm to crack hard seed or pellets. The author feeds it periodically to the resting flock so all birds enjoy and are familiar with the soft food mix before it's required.

Soft foods such as whole wheat bread is also an excellent supplement. Although many authors in earlier years report dipping the bread in milk, avian research studies have found that cockatiels lack the enzyme lactase, and are unable to break down the milk sugar lactose, which results in diarrhea. Calcium can be supplied in other forms and it is therefore recommended to feed fresh whole-wheat bread without the milk.

Egg food can be another excellent soft food, but care must be taken to replace the mix several times a day, because bacteria counts in egg build up in a matter of hours. All traces of egg must be removed from the cage bottom to prevent a bird finding and ingesting it later. The author, like many aviculturists today, has found the corn/rice/bean supplement to be one of the most nutritious and easiest to follow.

Environmental Conditions

To stimulate breeding, an extended photo-light period (i.e., the number of daylight hours) is required. Breeders who raise birds indoors have an advantage of being able to control the environment, and hence the breeding season, through the provision of artificial light. As non-seasonal breeders, cockatiels can be bred any time of the year as long as conditions such as the number of necessary daylight hours are met.

The photo-light period may be aided by installing an automatic light timer and dimmer to indoor aviaries to provide a few extra hours of added light for parents to finish feeding hungry babies. Lights during the breeding season in the author’s aviary are not extended beyond 10:00 PM at night.
Proper humidity levels are important to hatching eggs. If humidity is too low, chicks stick to the egg membrane and cannot rotate inside the egg to pip their way out. Conversely, too much humidity can drown a chick inside the egg. Cockatiel hens generally control humidity levels by sitting in an open water bowl, or bath, and returning dripping wet to the nest to sit the eggs, prior to their hatching. When necessary, either spray misting, or the provision of a humidifier may be helpful.

Always wash and disinfect all dishes and equipment on a routine basis to prevent contamination and disease. Routine hand-washing is essential, especially before attending another aviary, and can significantly cut down on spreading germs and disease. The author uses an anti-bacterial soap between servicing aviaries and before and after handling birds, babies, or any aviary equipment. A stronger surgical iodine scrub is used before and after handling birds that are ill or under quarantine (including their feed or equipment). Such birds should always be serviced last.

**Pair Bonding**

Cockatiels should never be set up to breed unless they are in breeding condition. Breeding birds are healthy, filled with energy and vitality, and usually engage in behaviors such as chewing or burrowing under paper at the floor of the cage, seeking out nesting sites, or actively courting a mate. Hens will emit a soft repetitive warble while crouching low on the perch. Cocks will engage in ritual behaviors e.g., mutual preening, strutting, tapping, possible courtship feeding, and attempts to mount the hen.

While most cockatiels will accept whichever mate you provide, on rare occasion a bird might utterly reject the one you choose.Behaviors range from passive resistance to outright hostility. In such a case, it is best to re-pair such birds, or allow them to rest until they return to breeding condition. Previously bonded birds may require more time.

**Breeding Pens and Nest Boxes**

Cockatiels are known to reproduce quite well in pens measuring as little as four foot in length, by two and a half feet high, and two feet deep, providing pairs are rested in larger accommodations following the breeding season. Although some aviculturists have had success utilizing even smaller enclosures, increased problems such as feather picking, squabbling over space, lack of room for resulting young, etc. can result. If one has the space, ideally, individual flights should be provided, housing one pair per flight for optimum results. The longer the flight, the better.

In nest box design, many aviculturists still prefer to utilize a twelve inch square box, although certainly smaller sizes can be used. The advantage of a larger box allows for more space when raising young, especially if five or six chicks hatch to share the space with their parents. Both cocks and hens share the duties of incubation, feeding and sitting the chicks. In pairs with especially strong bonds, cocks and hens may sit simultaneously, especially through the night. However, larger boxes can be a severe disadvantage, especially if eggs or very young chicks should roll away or wander off. This is especially risky with very young pairs, or virgin hens, who are not yet experienced enough to successfully retrieve these babies thus resulting in losses. A two and a half inch nest entrance hole is usually accepted by most pairs. Males will frequently perch by the nest entrance to guard the opening, especially at night.
Although there are some aviculturists who prefer to use concave nest blocks within the next, boxes need not come equipped with such extras. Often times, cockatiels proceed quite nicely with just a level floor, with the addition of an inch or so of clean, soft wood shavings, and proceed without delay to lay a round of eggs. Although many aviculturists utilize either white pine or cedar shavings as floor cover in pens and next boxes, some fanciers feel it may be risky to expose very young chicks to the resin from cedar shavings in the nest. However, others feel cedar aids in keeping the boxes dry and smelling sweet. Sawdust, however, should be avoided when possible, because it can be inhaled and act as an irritant to the respiratory system of young chicks.

Boxes should be thoroughly disinfected at the conclusion of the breeding season and stored in a cool, dry area. This is more easily accomplished with plastic or other easy to clean materials. Aviculturists utilizing the traditional plywood, pine, or other wooden boxes should consider replacing them at the end of the season, because wood is porous and cannot be completely disinfected. The author uses aluminum nest boxes for this purpose. Aluminum boxes were acquired with the motive of helping recycle and re-using them in the future because the material can be completely washed and disinfected at the end of the season, and quickly and easily stored.

**Breeding Cycle**

As a general rule, no more than two full clutches of young, ten to twelve chicks in total, should be allowed per pair, per breeding season. The only exception is the farming out of an additional clutch to foster parents, or if you are assisting the birds by hand-feeding the young. The conclusion of the breeding cycle should be followed by a minimum of a six month break in a long resting flight.

Encouraging further nesting will only overburden pairs in the long run, exhausting or prematurely limiting their reproductive life span and longevity. Again such exceptions might include pulling young for hand-feeding or fostering out eggs to other under-accomplished pairs, provided all birds are healthy. However, it should be realized that an enormous amount of energy and nutrition go into forming each individual egg, and birds should not be purposely overtaxed, or such birds, and their offspring, will eventually pay the price. The results may, or may not, be seen immediately, but too sadly, will become apparent over time.

**Nurseries and Quarantine**

Many cockatiel breeders plan on hand-feeding at least some of the offspring produced. Therefore, adequate space for a nursery is highly recommended. If the number of babies is great, a separate room to house incubators and keep vulnerable chicks isolated from disease will be an advantage. Several incubators can be set up, with chicks identified by coded leg bands grouped together according to age, size, and developmental stage, to prevent younger, smaller chicks from becoming trampled by older, more developed fledglings. Whenever possible, families of chicks should remain together, preferably for reasons of preventing the transmission of disease or illness and maintaining a “quarantine” to some effect. However, with larger age gaps of a week or more, chicks do better when placed with birds closer to their own age for effective “cuddling,” warmth, and body support, and eliminating the risk of being trampled.
In any large population, a separate area or hospital room may be necessary to isolate sick individuals and prevent contagion from spreading through the healthy population, and to younger, less protected chicks. Ideally, an area on a separate air system will help to quarantine any compromised individuals. Quarantine periods run a minimum of 30 days, to a more conservative 90 days. If new birds are purchased and added to the flock, a separate quarantine area on a different air system from the rest of the flock and the nursery, should be seriously practiced. Even the nursery should be isolated from both the aviary and hospital areas since young chicks and fledglings are more susceptible to disease because their immune systems are not yet fully developed.

**Feather-plucking and Aggression**

Feather-plucking of the young while still in the nest is usually due to rising hormone levels urging the hen, or the cock, to begin work on a second or third round of eggs. This can occur when the chicks are just beginning to develop feather tracks or full feathers, or even, more harmfully, at a younger age. The hen is usually the one to pick if she is commencing to lay a new clutch of eggs and is attempting to make room for the new brood. Cocks may pluck as well, so do not always assume it is the hen at fault.

In this situation, the aviculturist has three options. One option would be to remove the chicks for hand-feeding. However, should the chicks be under the age of two and a half weeks, hand-feeding will be very challenging, and very young chicks (e.g., under seven days) require more frequent feedings, including night feedings, and are difficult to keep alive, even for the experienced feeder who has a great deal of experience.

The second, more preferable option, would be to attach an additional nest box to the breeding pen or cage, and transfer the feathering babies along with some of the old nest shavings from the original nest, to the new box. The babies will huddle together for warmth and the cock should hear their cries and continue to feed them - during which the hen lays another round of eggs in the original box. It is important to always check to see if the original babies are indeed being fed and that their crops are full, or the aviculturist might wish to supplement hand-feed morning and evening meals, or pull the babies completely for hand-feeding if they are not being fed at all.

The third option would be to foster the babies out to other pairs that have babies the same age. Chicks must be the same age or only a few days apart - no more - otherwise they can be trampled by older babies or not able to compete begging for meals against stronger, louder cries. It helps to transfer the babies when they have a full crop, or give a supplemental handfed meal so they have the strength to beg loudly for their next meal from their new foster parents. Keep a close eye on the welfare of the babies whenever transferring chicks to be certain that the new foster parents have indeed accepted them and inflict no injuries. Behaviors that demonstrate harm include refusing to brood the chicks or be responsible for retrieving wandering chicks (that can become lost, cold, and die in the shavings), cuts on legs, wing-tips, beak, or face, showing signs of attack, blood, or persistent cries or noises in the box that should alert the aviculturist that either the babies are being harmed or not fed.

Some aviculturists have tried opening the nest box a crack to allow the light in, which in some situations appears to distract the birds from picking; or provide millet spray inside the nest as chewing material to give the hen and sometimes older chicks something else to chew.
Schedules

Cockatiels are creatures of habit and can be quite sensitive to any abrupt changes, or to new, or stressful situations. Therefore, the more routine their day, and the fewer unexpected disruptions or surprises, the less overall stress will be felt by the flock.

It is important to attempt to set up a daily routine the flock will come to expect. A routine schedule should include regular feed and cleaning times by keepers familiar to the flock; plus daily morning inspections for health and safety checks, banding of young in the nest, and final evening checks before dark. During the breeding season, visitors should be kept to a minimum, or limited to another room or area if known to inhibit the security and productivity of producing pairs. An adherence to schedules, freedom from known stresses, and a calm routine will only serve to enhance the cockatiel breeding stud, and in turn, the birds will thrive and produce in a contented, productive environment.

PART TWO: GENETICS

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Chapter Four
CREATING A STUD

Selecting Stock

Whether one plans to produce cockatiels solely for the hobby, pet trade, or exhibition circuit, the thoughtful selection of viable breeding stock, selected from robust bloodlines, is key to establishing any successful cockatiel stud. Such an endeavor should be given considerable thought, as early choices may serve either to enhance, or detract, from future generations of healthy, vigorous young.

It is advisable to begin with careful consideration, no matter which direction one wishes to pursue, by securing good foundation stock. Foundation birds should be selected on the basis of health, appearance, and if possible, family bloodlines. Healthy individuals immediately attract attention. They display a sleek, tightly feathered appearance, bright eyes, and exude vitality. This outward appearance is popularly referred to within the fancy, as “condition.” Top condition goes hand-in-hand with superb health, as such birds demonstrate vigor, enthusiasm, and activity.

Today, aviculturists are faced with a number of breeding techniques, dependent upon the species of birds they raise. Breeding techniques may range from the simplest selection methods, to more elaborate and intricate diagrams to follow. However, generally speaking, there are essentially two major choices when approaching the breeding of most livestock.

The first approach is the planned pairing of unrelated individuals to produce as large and divergent a gene pool as possible. When pairing together unrelated individuals, the emphasis is on a wide divergence of type, with the production of perhaps some outstanding individuals. Such a practice might be quite appropriate for undomesticated species, such as most Psittacines, Passeriformes, and certainly threatened or endangered species. The goal is to assemble as varied and diverse a collection of genes as possible from which to base the future generations of a particular species. Or, put another way, carefully stocking all genes available to a species in its “future bank of survival.”

Line-Breeding

The second approach, and one commonly employed when raising semi-domesticated species such as cockatiels, is the systematic mating of related birds. The goal of pairing birds that are related to one another is to produce uniformity within the stud, while yielding offspring that retain the superior qualities of their parents or family strains. This method of pairing back distantly related relatives, or line-breeding, has been utilized over the years by successful aviculturists and breeders of exhibition birds and other livestock.

However, most aviculturists make the effort to distinguish between line-breeding, i.e., the breeding back of less closely related relatives (e.g., niece to uncle, grandchild to grandparent, cousin to cousin, etc.) and that of inbreeding, i.e., closer unions usually defined as the breeding together of brother to sister. More rigorous proponents often include the mating of offspring to opposite sex parent (father to daughter, mother to son), and the pairing together of half-siblings, under the stricter definition of inbreeding.
While inbreeding may be a beneficial tool to be used under very special conditions by the skilled aviculturist, it should not be practiced indiscriminately by the less informed, or novice breeder. However, line-breeding can be an excellent and responsible system in which to create a family strain, or stud of birds. When practiced correctly, such a method will produce family lines demonstrating very specific attributes, qualities, and uniform family characteristics, which are immediately recognizable as inherent of that line. Without line-breeding, it would be impossible to form a strain of birds, attain consistent high quality, uniformity, and other desirable qualities. It is not a “hit or miss venture,” but rather a carefully planned enterprise.

It may be a distinct advantage if one is able to locate a stud of cockatiels that the owner has been line-breeding. By beginning with line-bred stock, much of the work will have already been done. Aviculturists choose to line-breed because they wish to set certain traits and characteristics in their stock (e.g., such physical attributes as size, color and markings, crest length, etc., or non-tangible traits such as fertility, hardiness, good parenting skills, etc.), which will be inherited in every generation.

By purchasing line-bred birds, such desirable traits or characteristics will have already been set in the line so that one may expect to produce a majority of young that will carry these characteristics outwardly, or visually, in their phenotype. Over time, line-breeding can help to carry on all the stud’s chosen attributes that one is striving to maintain. Only an occasional unrelated outcross may be necessary to rejuvenate bloodlines. If one wishes to reproduce cockatiels that carry a family resemblance and have certain highly valued characteristics set in their lines that will be inherited in their offspring, then one must consider a line-breeding plan.

**Selective Breeding**

There is one method of producing uniform family resemblance among individuals and that is through the popular technique of selective breeding. Selective breeding is the deliberate process of choosing individuals who visually, or outwardly demonstrate one or more attributes that the aviculturist wishes to set in a line that will be evident in future generations.

The selective breeding of cockatiels will dovetail a line-breeding program, and may at some point include one or more attempts at inbreeding, to achieve a particular purpose. Such conditions might include ridding individuals of hidden, undesirable traits such as bringing serious faults to the surface; pursuing hidden characteristics, or setting valuable qualities in a line that might otherwise not be obtainable through alternative matings (e.g., rare color mutations, although every other avenue should first be exhausted).

Although selective breeding may be practiced with unrelated outcrosses, such matings of unrelated stock will in no way guarantee that the selected qualities will be inherited as dominant characteristics in future generations - in fact, they are frequently inherited as recessives. This is why experienced breeders of cockatiels will advise against purchasing birds from too many sources, however excellent the individual birds may be. By using birds from numerous lines that are unrelated to one another, one will only breed a *divergence of type*, ultimately losing the original qualities exhibited. This scenario might be likened to that of having too many parts to a jigsaw puzzle; some
parts may be useful, others not, and it takes the player that much longer to figure out and complete the puzzle.

**Setting a Trait**

Indeed, if such a characteristic is inherited as a recessive, it may go unaccounted for, should the breeder fail to recognize its mode of inheritance. At worst, such heterozygous splits may not be used correctly in future breeding programs and the selected trait in future generations may, to the puzzlement of the breeder, ultimately become lost.

When attempting to set a trait, or select a characteristic (be it size, proportion, crest length, or depth and extent of the facial mask, etc.), the superior quality must be outwardly evident in at least one parent. However, should only one parent exhibit a given trait, and that trait is not completely dominant when paired to another bird, the trait may become recessive, or easily lost.

The masking of a recessive gene could easily occur should the partner chosen originate from an unrelated line, lacking a dominant gene for the same trait. It could then take several generations for the hidden trait to resurface, and one will need to reset the qualities back into the line, which had been altered by working with an individual from unrelated bloodlines, or from a different strain. In these instances, such qualities, if not carefully tracked by computer or pen and paper, may become recessive or lost when working with partners outside of the same strain, stud, or bloodlines.

A well-known adage among seasoned aviculturists is “like produces like.” There is little purpose to pairing related individuals together if their visual qualities, or even their hidden traits - which can eventually surface - are in dire need of improvement. Select individuals who have strengths in the qualities you wish to set. And, work only with individuals who do not simultaneously display any major faults that may as easily be inherited along with the good qualities, only to resurface later.

At the same time, heed the well repeated warning, “never pair together two birds with the same fault.” For example, it makes little sense to pair two well-marked or well-colored birds together, if they are both obviously lacking in size. If one is unsure of assessing the qualities of a pair, then better to breed such birds to only very distant relatives, or better yet, to unrelated individuals (i.e., known as an outcross), who show good overall potential, until the young produced can be assessed.

Ideally, each side of the breeding equation must be set for the same given characteristic, if one wishes that characteristic to remain dominant in future generations. Detailed record keeping, journal notes, and the mandatory closed banding of young birds using coded, traceable, seamless metal leg bands, is essential in keeping track of such progress.

**Establishing a Line**

By working with unrelated individuals, one will only continue to breed dissimilar birds, losing the original qualities the aviculturist is attempting to fix in his lines. However, breeding unrelated birds, or a divergence of type, may be a good first step in creating a few outstanding individuals from which to base a family line, should none be available from other sources.
However, the sustaining of such qualities, from generation to generation, may only be accomplished through the systematic and purposeful breeding of related individuals. The overall goal is to produce individuals that demonstrate a uniformity within the stud. Such esteemed qualities can be based either on a particular sire, or dam, and a system of line-breeding back to that individual after several generations, may then be employed.

It is not unusual when an exceptional individual is used - for example, an outstanding cock bird - that such a bird is paired with the top two or three hens the breeder can secure. This beginning will enable the aviculturist to protect and secure the superior genes of the cock bird, while producing several clutches of young from which to choose for the continuance of the line, and the eventual breeding back to this best cock, on which the line is based.

Interestingly, not all aviculturists who maintain an aviary necessarily practice line-breeding! Therefore, you may wish to see the relatives of any birds under consideration to determine whether a family resemblance does in fact exist. If no resemblance is found, it is quite probable that line-breeding was not practiced and that bloodlines, even if line-bred by others, may have come from a number of different sources.

If possible, select the top two or three studs you wish to emulate, and only secure line-bred individuals from these studs that carry the qualities you wish to keep in your lines. Then, work with these individuals for several generations. If you wish to perpetuate such qualities, then you must resist the impulse to keep securing birds from outside of these bloodlines, no matter how excellent they otherwise might be. Or, any gains made may easily be lost, propelling the work accomplished several steps backward in the overall breeding program.

By honestly accessing ones’ progress, the aviculturist will know when it is time to bring in an outcross to revitalize bloodlines. Meanwhile, there is still the challenge of working on one or more lines, and creating new lines, before the next step is necessary.

**Forming a Stud**

Eventually, after one has succeeded in establishing two or more family lines, the goal will be to combine the lines together to form a *stud*. Such a collection of family lines, have each contributed their outstanding traits, which will be reflected in future offspring produced. However, guarded caution must be exercised against allowing any faults to be inherited along with such positive qualities. If the work is thorough and precise to begin with, such major faults should have been eliminated.

Individual strains or entire studs may be noted for several outstanding characteristics, which are composed of those *set* traits that the individual family lines contributed. Such strains may vary accordingly and include any number of traits worked on (e.g., large size, outstanding color, ideal cheek patch shape, high fertility, large clutch size, and so forth). With additional work completed on new family lines, improved strains may also eventually arise. Such outstanding inherited traits, or combinations of individual established lines from one aviary are referred to as a breeders’ *stud*. The stud may continue to work with existing lines, or form new improved strains, over time.

**Chapter Five**
ESTABLISHING MUTATIONS

Have you ever looked into the nest to find a young chick feathering into a uniquely different individual? Or, perhaps those youngsters you raised last year still carry unusual color pigmentation, or depigmentation. As you begin to access all your hopes and dreams, you find yourself embarking on a new journey, a voyage into the world of cockatiel color mutations ... 

“I’ve got a new mutation! My cockatiel is orange where he shouldn’t be, and yellow where no other cockatiel has ever been. In fact, I would even swear the “lavender” hue on his back is getting deeper!”

Is it a sport or a true mutation? I have been asked this question countless times through the years and have been presented with reports about black and orange cockatiels, among other colors, to cockatiels sporting “blue” eyes. When something new or different first appears in the nest, it is extremely tempting - and understandably so - to wish to assign the oddity the longed-for honor of “mutant!” However, both sports and mutations can take the breeder by surprise and it is important, and necessary, to distinguish between the two.

Inherited Mutations

Let’s take a closer look at the definition of the term, “mutation.” First, according to biology, evolution accounts for the occurrence of slight variations that have resulted from successive generations of gradual change. The term mutant, or mutation, is the sudden variation of an inherited characteristic. On the other hand, the term, “sport,” in breeder’s jargon, refers to a variation that differs markedly from the normal but cannot be inherited or passed on to future offspring. As one may gather, the operative word here is inherited.

Therefore, a credible or true mutation is one in which that mutant gene is successfully passed along to the offspring. How then, is one able to tell if the mutant gene is passed along? And, how many generations will it take before the mutation is expressed visually? In other words, how many generations will it take for the mutation to show itself? The answer to these questions lies in test-breeding.

The following paragraphs are excerpts from an earlier work by the author, titled, “The Complete Guide to Cockatiel Color Mutations,” - originally published in the author’s column, “Talk From Tangowood,” in American Cage Bird Magazine. They are relevant to this discussion and therefore worth repeating here:

“Not all characteristics are inherited by recessive or sex-linked modes, but it is a good place to start. Generally, it is best to pair any new color mutation in question to a Normal variety which, in the case of cockatiels, is the dominant Normal Gray. If the young produced are all Normal Greys, we instantly know two pieces of information. First, if the new color was inherited, we ascertain it to be recessive to the Normal Grey. Second, if the new color is believed to be recessive, we then can assume all the young to be heterozygous, or Normal Grey split to the new color.
In order to prove this theory, father to daughter, or mother to son matings could be attempted (using the mutant parent with its opposite sex heterozygous offspring). This type of mating would result in 50% visual mutants and 50% heterozygous or splits. Of course, if no mutants are produced after several clutches (as these ratios are always based on every 100 chicks produced), we can reasonably assume the variation is either not recessive in reproduction, or is only a sport, and cannot be inherited as a legitimate mutation.

As you can see, proving the recessive mode of inheritance can take years of waiting for birds to reach sexual maturity and test-breeding several generations. If one is fortunate enough to produce a new mutation that is sex-linked in reproduction, it certainly can be a shorter and often times quicker route to prove. If the mutation to be tested is found in the male, it can be test-bred to a Normal Grey hen. This will produce mutations immediately in the first generation: 50% mutant daughters and 50% heterozygous or split sons.

If the mutation to be tested is found in the female, it too can be test-bred to a Normal Grey male. However, this will now yield 50% Normal Grey daughters and 50% heterozygous sons split for the mutation. The split male offspring will have to be mated back to the mutant dam in order to prove the theory. This should then produce 25% mutant males, 25% split heterozygous males, 25% mutant females, and 25% pure Normal Grey females.

It is important when test-breeding possible new mutations to try and pair them to pure homozygous Normal Greys. In other words, birds that are not split to any other mutation. There are several important reasons for this procedure. First, it is a drawback when including other colors as often times these mutations may only serve to mask or hide the new variant.

In addition, some mutations may combine or alter the new mutation in a significant way i.e., producing lethal genes, a less attractive color or appearance, etc. Of major importance however, is the fact that in most instances, a new mutation is going to be smaller, weaker, and much less robust than an established color. Therefore, by breeding the new mutation to pure Normal bloodlines, you will begin to increase its size and improve its vitality, resistance and fertility, by adding the vigor and strength of the established, stronger bloodlines.

At this point, I must also warn against the hazards of inbreeding. I would definitely forego the breeding of brother to sister matings if at all possible. Brother to sister matings are one of the fastest methods to encourage lethal genes and inferior quality and should only be attempted under very special circumstances. Once you are able to prove the mutation, you may be better off breeding the rest of the stock back out to homozygous Normal Greys, keeping very good track of breeding records for several generations to establish a healthy family line and strong gene pool from which to build. You may have produced the only source of this new mutation and it would be ill advised to complicate or weaken the initial foundation stock that you will be supplying to other breeders. Only after establishing a firm foundation stock, should you begin to play with other color mutations, if desired.

It is better in the long run to be patient and use a sensible plan. After all, if you are ever fortunate enough to produce a new color mutation in your aviary, wouldn’t you prefer to develop strong, sturdy, salable stock? Aviculturists have learned the hard way
through the years and it is best to profit through others’ mistakes. Some past problems with inbreeding new colors have led to such ill results as lethal genes, dead in shell, infant death mortality, blindness, infertility, etc. Again, patience will save you time and torment, in the end.

Although we have discussed the dynamics of working with new color mutations as if they were commonplace, do not interpret this to mean they occur as everyday events. You may go through your entire avicultural career without producing anything new. And, there is nothing wrong with that. However, one point to keep in mind is that cockatiels now seem to be heading in the direction of a rapid growth and expansion of new colors. Up until the sixties, we had only the Pied and Lutino mutations. By the seventies, we added the Pearl and Cinnamon and eventually started working on all the cross mutations. By the late seventies and early eighties, we started producing Fallows and Recessive Silvers, and imported the Whiteface, the latter now used in the production of the “Albino” (Whiteface Lutino), as well as other cross and triple mutations. The point is, we have only just begun!

Certainly, the budgerigar and love bird fancy grew to a point where they were heralded into an explosion of new color mutations and combinations. With the reports I have heard, I have speculated for quite some time now that the cockatiel fancy seems to be heading in this very same direction.

I have been told of, and occasionally seen, a variety of mutations and sports. These birds have ranged from carotenoid pigmentation of deep yellow and orange on wing bars and body, to the so-called marled, zebra, black, and green cockatiels. I have read of “inverted pearl” mutations, among others. Whether they are true mutations only time and avicultural skill will tell. I, myself, produced a deep chocolate colored cockatiel when I first started out, and regrettably, sold it.

I am occasionally amused when new owners tell me of their new colored cockatiel who has a red, green, or blue wing bar or tail, etc. These birds have sometimes been shipped to pet stores marked with non-toxic food coloring for purposes of identification (I would prefer to see these birds color-code banded instead). Of course, in time, the dye eventually wears off or is lost when the bird goes through its molt. Additionally, some birds “molt in” to a new color and a year or two later, revert back to normal. This may point more to a nutritionally deficiency than to anything else.

True color mutations can be very exciting but it does take some skill to interpret what may or may not be valid. For instance, some colors can be intensely affected by nutrition. We know that certain species can be color-fed through the use of carotenoids and this may also be a possibility with cockatiels. This could also be possible through the addition or lack of other certain nutrients in the diet.”

Nutritional or Stress Factors

One such possibility comes to mind. A few years ago, an organization’s cockatiel journal carried several articles on a possible new mutation, the “Zebra” cockatiel. The alleged mutation reportedly exhibited a reduction of melanin pigment (gray coloring) in specific areas resulting in yellow or white feathering.

Some time later, a follow-up article was published speculating the “Zebra” as most probably only a sport and not, as was hoped, a true mutation. As I understood it, this
was substantiated by the fact that “Zebras” are reported to molt in and out of color and that the mutation does not appear to be permanent. The author astutely observed the nutrient, lysine (an essential amino acid), had been proven to affect melanin pigmentation in poultry. The article concluded that “... the “Zebra” is a sport caused by a nutritional break during the pinfeather stage. All reports of “Zebras” indicate that the loss of markings begin to occur around six months and are eventually lost at maturity.”

Although it was the only article on “Zebras” recognizing the possibility of nutritional influences, it also suggested that the specific cause may never be found due to the limited amount of research in cage birds.

Fortunately, today, even more studies are undertaken and some are even published and shared with the fancy publicly. One such study was conducted on cockatiels involving the manipulation of lysine and other nutrients in the diet. The study was conducted at the University of California at Davis and appears to shed some light on formerly held conceptions. Avian researcher, Tom Roudybush, presented the teams’ findings that were funded in part from the American Federation of Aviculture. The initial presentation was made to us at the 1985 AFA national convention in San Francisco.

In essence, the study indicated that insufficient levels of lysine in the diet of cockatiels does not produce a reduction in melanin (gray) pigmentation as experienced in poultry and similar type birds on which most knowledge is based. In the past, it has been found that, in poultry, lysine deprivation can depigment feathers causing them to appear white, with flight and tail feathers being those most commonly affected. To the contrary, lysine deprivation in cockatiels did not produce any depigmentation as was expected.

Further studies on cockatiels by team member, Debbie Nearenberg, with the manipulation of riboflavin (vitamin B2), which normally results in curly toe paralysis in poultry, instead produced unusual results. It was found that deprivation of riboflavin did not produce the expected curly toe paralysis, but did result in depigmentation in the cockatiels tested, producing white feathers.

Furthermore, the team investigated a study with choline deficiency, which in poultry produces perosis (i.e., a slippage of the ligament of the hock joint). Interestingly, choline deficiency resulted in the loss of melanin pigment in both the flight and tail feathers in 30 to 40 per cent of the cockatiels tested!

The conclusion: applying signs of nutritional deficiencies from studies in poultry to cockatiels, and perhaps other cage birds, may not apply. A riboflavin (vitamin B2) or choline deficiency in cockatiels may look like a lysine deficiency in poultry. The study further concludes that further scientific investigation of cage birds is probably a very real necessity.

Surely, the implications are indeed great and would imply that avian veterinarians would need to have access to this type of information in order to correctly diagnose cockatiels and perhaps other cage birds.

### Validating New Mutations

Assessing the validity of a new mutation can be a challenge and all other factors, including possible nutritional deficiencies, should be considered. Most professional organizations won’t even recognize a new mutation until it has been bred for several
generations. For example, the American Federation of Aviculture has a special category of the Silver AVY Award that is presented to qualified aviculturists who have proven a new mutation in captivity, at least through the second generation (i.e., the domestic-bred, parental generation visual for the new mutation, plus their mutation offspring, and their mutation “grandchildren”), and have demonstrated appropriate documentation.

Most national specialty organizations for a species such as cockatiels have show standards and classifications that can be helpful in identifying established mutations, including some of the rares. It may help the breeder of a new mutation to bring the bird(s) to a bird show judged by a nationally certified panel judge, to inquire the judges’ opinion, even if the birds aren’t entered in the show. Similarly, experienced breeders may be consulted to obtain their opinion and the wisdom of their experience.

However, the number of cockatiel color mutations is further escalating at a rapid pace, and it is possible that such new mutants may not be easily classified by either the seasoned breeder, or rare color specialist, or even by a knowledgeable panel judge. Some mutations can be so complicated, that it would be necessary to work with a trained geneticist to learn the true nature and explanation of the mutation in question. Although there are only a handful of such scientists with a background or interest in aviculture, the good news is that we are learning more with each passing decade.

Not all true mutations are necessarily spontaneous. Some may require several stages of development before obtaining the end result. Whether one is faced with the beginning development, or the establishment of a new mutation, there is a great responsibility that accompanies the challenge; a responsibility that will affect the chicks bred into this world for generations to come. We have an obligation to make those generations healthy, for both birds and fanciers, now, and in the future.

Chapter Six
MUTATION OR SPORT

As you are ready to transport your team of well-conditioned cockatiels to the next show, you glance into a show cage and exclaim, “Oh, why hadn’t I noticed this before? I wonder what the judge will think of that!” You have just noticed that both white wing bars of your exquisite Normal Grey hen are flecked with yellow. As you peer anxiously into yet another show cage, you realize the beautiful Lutino-Cinnamon male you proudly raised last year has a very noticeable tannish-brown tint to its wings, back, and tail feathers. What should you do? Will the judge fault your entries, or are you on the verge of something significant?

As we examine such occurrences, we are faced with several choices. In the previous chapter, we discussed the validity and some of the ethical issues involved in establishing a new mutation. We now need to take a look at some of the variations that may be inherent in several existing mutations.

What is a variation? Possibly labeled as a “fault” on the show bench and in existing show standards, these variations may instead present themselves as a challenge to those aviculturists willing to experiment in the development of something new. In order
to understand this discussion further, let us take a brief look at two broad categories of color pigments in cockatiels.

**Color Pigmentation**

The first group of pigments fall under the heading of melanins, which are responsible for producing the gray, to tan, to brown colors in cockatiels. Often times, a varying intensity of shades may be apparent and we will examine this concept further along when we discuss the possibility of dark factors.

A second or weaker group of pigments are known as carotenoids and include the yellow and orange colors found in cockatiels.

The appearance of white in cockatiels represent a lack of all color pigments, both melanins and carotenoids. Here, white is either the total suppression, or more usually, the absence of all color.

It must be stated here that the discussion that follows is based upon my own observations and are in essence, my opinions. The study of cockatiel genetics is still quite young and it will take some time before before enough data is collected to make any absolute statements.

We can examine the production of melanin and carotenoid pigments in cockatiels in two initial ways:

1. **The depth and penetration** of coloration, sometimes referred to in the fancy as the presence, or absence, of dark factors.

2. **The consistency or degree** of coloration (including the emergence of a new color), which covers a wide variety of variations in standard and cross-mutations.

As the genes that govern the operation, intensity, and inheritance of color pigments express themselves, breeders may notice the existence of certain variations in family lines. It is my opinion that first, such variations may possibly be passed from one generation to the next; and second, the manner or mode in which these variations are inherited, if any, may also vary.

Let us first look at several of the most common variations that are sometimes seen in our standard mutations. Are these variations desirable, or are they simply faults? Although most of us would agree that baldness is an inherited and undesirable fault, other variations could have some possible merit. It may depend entirely upon one's own point of view, personal goals, and overall breeding plan. After all, beauty is indeed, in the eye of the beholder.

**Depth of Color and Dark Factors**

As in the budgerigar, love bird, Indian ringneck parakeet, and other frequently line-bred parrots, we appear to be experiencing the presence of dark factors.

To illustrate: the nominate or wild type budgerigar is the Normal Green. Through years of captive breeding, the green series evolved into the Light Green (no dark
factor), Dark Green (one dark factor), and Olive Green (two dark factors) in budgies. For the sake of accuracy, the dark factor green first originated in 1915 in Toulouse, France, dark blue (Cobalts) followed that year, followed by Olive Greens in 1916. The dark factor is known to effect other colors and characters (e.g., Blue, Yellow, Grey, etc.).

Have you ever noticed the different shades of gray exhibited between individual Normal Grey cockatiels? Some may vary from a light grey to a very deep, almost charcoal coloration. What about the Whiteface mutation? Again, individuals may also range from lighter tones to a dark charcoal color. Even Cinnamon cockatiels may show this variation in color density between individuals. Could be dark factors are at work.

Generally speaking, most show standards do not penalize cockatiels on their depth of color, or lack thereof; rather, they require that color be of a uniform depth throughout the bird. Although the dark factor birds may be more pleasing to the eye to some in many of the standard color mutations today, it is my belief that lighter-toned bids may also play a significant role at some point in the development of other colors and their numerous combinations.

Another assumption is that dark factor birds will become more significant when trying to produce well-colored cross mutations (e.g., Albinos). Our “Albinos” at this time, are actually Whiteface Lutino cross-mutations. It may be that both the Whiteface mutation, and the Lutino mutation, originally produced from dark factor stock may issue the best colored “Albinos” that are free of any underlying gray cast showing as a gray sheen tinging those Lutinos informally dubbed as “Lavender-wings.” However, at the moment this remains merely a theory. Accurate breeding records must be kept and compiled before we know the true mode of dark factor inheritance, if any, as it effects cockatiels.

It would be interesting to discover whether “Lavender-wing” Lutinos are actually dark factor birds, or rather, the result of a genetic inability to mask melanin pigment, allowing a gray cast to be seen under strong lighting (e.g., under the judges’ bench). Some aviculturists have speculated that by breeding “Lavender-wing” Lutinos to one another over time, selectively working with the darkest birds, we will ultimately produce only Normal Greys. Likewise, some Lutino-Cinnamons that should appear as a visual Lutino masking the Cinnamon color, have at times been seen with a tannish cast to flight, wing, and tail feathers. Again, show standards generally state that depth and uniformity of color is required, even in Lutinos and Albinos, and therefore any bird with a melanin pigmented cast would be faulted. However, off the show bench, what will we find one day? The emergence of a Normal Grey from selectively bred Lutino “Lavender-wings,” or a Cinnamon from selectively bred Lutino-Cinnamons as speculated above, or would we find something else?

**Consistency of Markings**

Like the various shades and tones of gray we see that vary among individual Normal Grey birds, the genes that control the melanin pigment within the same individual may also vary. This may account for some individual Normal Greys, Cinnamons, or Recessive Silvers, etc. exhibiting a lighter breast, with darker colored wings, back, and tail feathers. Consistency of markings may be seen in a number of ways, as discussed below.
Breast Flecking

Certainly the genes controlling the melanin and carotenoid pigments are responsible for our Pearl mutation. In this case, it is thought the gray (melanin) is suppressed in selected areas, allowing the yellow (carotenoid) lacings, or white lacings (a lack of all pigment) to show through. Similarly, this light colored “breast-flecking” usually found in the more heavily marked Pearls is also thought to be due to a reduction of the melanin grey pigment at the top of selected chest feathers that allow the yellow or white “flecked” tips to show through.

Scallopings

A variation of breast flecking, scallop markings - due presumably to another reduction in melanin pigment - appear as faint lacings cast through the breast of heavier marked Pearls and their cross-mutations.

Marbling

These faint, light, “ghost-like markings” as found on the wing covert feathers or on the backs of some Normal Greys, Cinnamons, Recessive Silvers, and other mutations - especially noted in males - may also be due to a partial suppression of melanin pigment. This suppression of pigment would account for allowing the lighter ghost-white hue (i.e., a lack of pigment) to express itself. However, this is once again considered a fault according to most show standards, especially with the Cinnamon variety - more often found in males. Although inappropriate for the show bench, there are some individuals who are attempting to selectively breed for this trait which, ultimately over time, may prove to eliminate most, to near-all, melanin coloration in affected areas.

Miscellaneous Faults

Occasionally, cockatiels are seen with other “faults” such as yellow or orange wing-bands, overly “bleeding” orange cheek patches (usually a sign of breeding condition or molt), with some reportedly almost entirely coloring the face. Other reports range from yellow, orange, or tan colored flight or tail feathers, to changes in eye color, among other expressions. Different patterns have been found such as inverse Pearl markings, orange pearl lacings, heavy marbling, mosaic Pieds, and tri-colored (grey, cinnamon, and creamy white) Pieds - and even frizzling of feathers.

There have been birds reported as early as the 1970’s with a heavily suffused layer of yellow carotenoid pigment creating a dark, “olive-greenish” appearance in several of the established mutations, referred to loosely as “Greens.” The author, herself, visited one such “Cinnamon Green” in New Hampshire during 1978. Whether such “green” specimens were the foundation for today’s US Suffused Silvers (nicknamed “emeralds” and “greens”) from the mid-1980’s, is not known for sure. Additionally, heavily melanin pigmented birds, appearing nearly black, have been seen (including by the author).

Sports
The term “sport” is avicultural argot that refers to an anomaly that appears suddenly; the challenge is figuring out whether it is, in actuality, a mutation. By definition, a sport is an anomaly that is not inherited or reproducible in the offspring. Some rare sports that can appear when very large numbers of birds are bred are called bi-colors, or more specifically, quarter-siders and half-siders.

For example, Half-siders are birds that appear with one or more colors on one side of the body, accompanied by one or more different color mutations on the opposite side of the body that are not supposed to be visible. In perfect specimens, there is a clear, even division between the colors straight down the center of the head, breast and back.

To the best of my knowledge, it is generally thought that half-siders and tri-colors occur during the process of sex cell division, when, during the doubling and subsequent division of chromosomes, a single chromosome may fall behind and miss being included in the newly formed divided cells. The result is that one of the new cells lacks a chromosome, and the cells that divide from this faulty cell will replicate the same loss. Because each side of the bird develops from a single cell, if the content of the original cells differ from the known pedigree or hereditary factors, it is possible for this difference to appear in the offspring.

The odds of producing a bi-color are extremely rare, and while completely unpredictable, they are so remote that it is only minutely possible after producing an extremely large number of birds; the more birds produced, the greater the possibility. However, think of these extremely lofty odds akin to winning the lottery. I once had the thrill of producing a quarter-sider budgerigar that was ¾ green and ¼ sky blue in the upper left breast quadrant. That was after producing a great number of budgies every season for many years.

There are however, some Pied cockatiels that the author has seen that show both grey and cinnamon simultaneously in its pied pattern and that are reportedly reproduced by others. This would, therefore, not be a sport or related to the above example. There are many examples of sports (e.g., “Zebra cockatiels,” etc.), but the challenge is to figure out which ones may be able to be reproduced and inherited in the offspring. Be careful not to allow yourself to believe any false claims without seeing additional proof! New mutations are more rare than they are common or available. Wait until something is validated unless you are very sure of what you are buying.

Determining Mutations

If color feeding, nutritional deficiencies, and breeding condition are all rules out (categories that many birds do fall under), you may find something genuinely different and worthwhile to work with. A general rule of thumb to go by is:

1. Check written observations to verify whether the chick was born with the variation i.e., exhibiting the variation starting with its first pinfeathers through to its complete adult (two year) molt.
2. Verify that the bird never loses the variation or anomaly during its entire life span. For example, it is well-known that birds sporting a nutritional deficiency will show a variation, lose it, and possibly regain it again. This is usually the clue that the variation is not an inherited anomaly to be passed down to its offspring.
3. Employ proper breeding techniques and prove the variation is inherited to the F2 generation (i.e., the visual mutation’s grandchildren), at minimum. Ultimately, the variation should be passed along to the offspring, who in turn should be able to pass it along to future generations.

Indeed, as far as exhibition goes, faults are discouraging on the show bench. However, that is not to say that something genuine, new, or desirable, may suddenly arise from slight variations to spontaneous new mutations. Selective breeding may be attempted to shape and fix the new pattern or color, if it is indeed a true mutation. And, certainly, not all mutations in birds are spontaneous or instantly apparent. Some variations may appear in a beginning or intermediate phase and may have to be developed over a number of years and even several generations.

Chapter Seven
WISDOM BEHIND SELECTING COCKATIELS FOR EXHIBITION

When first selecting stock, although tempting, it is best to forego selection based on color. This is difficult, since often times it is the delight in one or more mutations, or cross-mutations, which may first entice the fancier to pursue the art of exhibition. However, such a less than desirable emphasis, if allowed, would only serve to hinder the initial objective of securing good foundation stock.

This is a fair assessment if one were to consider that color and markings form only a small percentage of USA show standards (e.g., 10%). And, knowledgeable judges point out that in both color and markings, only five percent is applied towards depth and uniformity of color, while the remaining five percent is distributed towards degree and consistency of markings. Then, there is the other 90 percent of the bird (i.e., conformation, condition, and deportment, including five percent for staging).

It is therefore best to ignore color and markings to the extent that this will be the last area of the bird you will be working on - the icing on the cake, as it were. As enticing as some of the colorful or more difficult mutations are, if they don’t possess the remaining 90 percent of the necessary qualities such as size, proportions and shape, wing carriage, back-line, deportment, crest length and density, feather condition, etc. (granted five of the 90 percent is assigned to the show cage), they seldom consistently do well.

Occasionally, the odd color or two that may be lacking in other areas is put up on the top bench however, such trends seldom last. Most national organizations that exhibit birds denounce the awarding of show placement based merely on rarity. Such an occurrence may (or may not), be popular in the short-run, but tends to delay the development towards any real work with aspiring to the Standard, once judges become familiar with the unusual bird, or coloration, and begin to judge them as they do others.

Most USA show standards maintain that all mutations should attempt to meet the written profile description that applies to all exhibition cockatiels. When this is ignored, it tends to dilute the integrity of the mutation, as the fancier is not encouraged to continue to upgrade the color or markings while maintaining the other important attributes of the bird - such as size, proportions, shape, carriage, and crest - equal to that of other exhibition birds. In the long run, if the mutation continues to be rewarded over the other
properties of the bird, then the work of getting it bred up to standard will not be done. This has sadly been demonstrated often enough in other areas of the fancy.

Although most organizations use a weighted scale as a reference guide, in actuality, the birds are judged by a one-on-one direct comparison method. This is why the full reading of the show standards are much more beneficial whenever selecting one’s show team for the upcoming shows, or just as important, when selecting pairs to put up for the breeding season that will ultimately produce future show winners and champions.

Epilogue
ETHICS AND AVICULTURE

For the most part, many experienced aviculturists and show judges are eager to help those that share the fancy with them, especially the novice or beginning breeder. By helping our fellow fancier, we all benefit. Our birds will have better care by benefiting from the advice of other successful breeders, and we can enjoy the array of new mutations by helping others to work with and establish them, perhaps owning some ourselves in the future. In this scenario, we all win.

However, care must be taken to guard against the unscrupulous, or dishonest, who wish only to profit at your expense. Before investing any money or time, always secure references! But, most importantly, share the hobby of aviculture willingly, as have others who’ve helped you. You’ll get back many more times your original investment.

Additional Recommended Reading

CockatielsPlusParrots.com - Linda S. Rubin’s website
www.CockatielsPlusParrots.com

Cockatiel Foundation, Inc.
www.CockatielFoundation.com

American Federation of Aviculture, Inc.
www.afabirds.org

Footnotes

Other Books by LINDA S. RUBIN
Available through www.CockatielsPlusParrots.com
or inquire at: Aves@CockatielsPlusParrots.com

Hard Cover

Computer CD
Cockatiel Genetics Made Easy, Newly Revised
Second Edition with new information, examples, quizzes and chapters

Digital-Books
The Complete Guide To Cockatiel Color Mutations, Volume 1
The primary colors and their crosses based on the author’s original column
“Talk From Tangowood,” in American Cage Bird Magazine
The Complete Guide To Cockatiel Color Mutations, Volume 2
A continuation of the series: the rares and their crosses
Cockatiels: Breeding Smart!
An insightful perspective on cockatiel husbandry and breeding genetics
Cockatiels in Color
A collection of the author’s column, “The Cockatiel Connection,” in the AFA Watchbird Magazine of the American Federation of Aviculture, Inc.