



*Black-capped chickadee, a common songbird.*

## The role of songsters' genes and tutors

# How Songbirds Get Their Tunes

By TINA ADLER

**D**o your friends change the radio station when you start to hum along? Did the director yell "Next!" halfway through your audition for the high school musical? Do you forget most of the words to songs? If so, be glad you're not a songbird.

Songbirds, usually the males, must master their species' melodies to attract mates and to stake out their turf. Birds often stay with one partner for their short lives but may fool around on the side. A study of warblers in Sweden, for example, reported that females look for mates with big repertoires and will indulge in what scientists call extra-pair copulations with males that have even bigger playlists, explains Donald E. Kroodsma of the University of Massachusetts in Amherst.

One ornithologist heard a chickadee that sang another species' song. In the spring mating season—when the bird really started crooning—his winter ladylove left him, recounts Kroodsma, who once discovered two house wrens and a vesper sparrow that sang Bewick's wren songs. Needless to say, no females perched by their sides.

Fortunately, most male songbirds master the appropriate melodies just fine. But because singing is so important, sci-

entists have investigated in detail how birds learn their songs. Many researchers agree that both good genes and good tutors enable young birds to perform, but they argue over which skills are innate and which are learned—the old nature versus nurture debate.

"That's an issue that just won't go away," observes Stephen Nowicki of Duke University in Durham, N.C. New studies, however, may help resolve how songbirds acquire some of their most important talents, such as singing in pure tones, sounding like other members of their own species, and remembering many songs.

**M**ost songbirds usually sing pure tones, like the sound of certain whistles or a well-trained soprano. Researchers once thought birds learned to sing pure tones by listening to family members or neighbors. Studies showed that when song sparrows were raised without hearing other members of their species, about half of the notes they sang had harmonic overtones.

The tendency to produce pure tones, however, may be in part innate, recent research suggests. Nowicki and his colleagues collected from nests in Durham 13 song sparrows (*Melospiza melodia*) 3 to 5 days old. They divided the birds into two groups and played them either 16 normal song sparrow tunes or the same songs with harmonic overtones. Nowicki and Susan Peters, also at Duke, report in an article accepted for publi-

cation in *ETHOLOGY*.

A year later, both groups were singing most of the songs or large parts of them. The birds that had heard the normal songs repeated them almost flawlessly. The birds that had heard the songs with harmonic overtones dropped most of those overtones. About 85 percent of their notes were pure tones. As these birds continue to mature, that proportion is increasing, Nowicki adds.

"Our data demonstrate conclusively that the production of normal, pure-tone songs does not depend on direct exposure to model songs with normal tone quality," they argue. But since birds in earlier studies, raised without hearing their species' tunes, produced too few pure tones, Nowicki believes that hearing some version of their own songs triggers the birds to sing pure tones.

Why songbirds use pure tones remains a mystery. Such tones may give them the biggest bang for their buck—good volume with relatively little energy expended, Nowicki speculates. Indeed, as they vie for territory, males pay less attention to songs with harmonic overtones, Nowicki confirms in an article accepted for publication in *BEHAVIOUR*. He also suspects that their vocal tracts are designed to make loud, pure-tone songs efficiently.

**H**ow do songbirds learn the tunes appropriate to their own species? Scientists once thought that cowbirds represent a classic case of an animal controlled by nature rather than nurture. A cowbird mother leaves her eggs in other birds' nests and lets these females hatch and feed her young. Since cowbirds learn nothing from their true parents, their behavior must be entirely innate, researchers have reasoned.

It's not that simple, asserts Meredith J. West of Indiana University in Blooming-

ton. Even cowbirds acquire singing and mating skills from interacting with members of their species. They don't have the large genetic safety net that some scientists have imagined.

In a recent study designed to see how well cowbirds learn to sing without models, West and her colleagues housed 10 young male cowbirds (*Molothrus ater artemisiae*) with either female cowbirds or canaries (*Serinus canaria*). They used canaries because young birds need companions to develop normally and they thought canaries would not change how cowbirds sing.

After a few months, however, the youngsters with cowbird companions began to sound like cowbirds, and those with canary roommates sang like canaries.

"The males incorporated both phonological and structural patterns from their canary companions," Todd M. Freeberg, Andrew P. King, and West report in the December 1995 *JOURNAL OF COMPARATIVE PSYCHOLOGY*. The cowbirds managed to trill rapidly like canaries. They also mimicked the canary greeting so well that the researchers at first couldn't tell them apart.

After 8 months, the scientists let the male cowbirds mingle with female cowbirds and with male and female canaries in an aviary. The birds preferred the familiar. Canary-raised birds made a beeline for the canaries and sang only to them. The cowbird-raised fellows flirted with the female cowbirds.

The Indiana team also got a surprise when it introduced normal, adult male cowbirds into the aviary. Both groups of now 1-year-old cowbirds, not knowing how to respond to the older males, stopped courting and instead began singing to each other.

In nature, because they are attracted to the same habitats and food, young cowbirds meet their elders. For 6 to 12 weeks, the adults teach the youngsters about such practices as staking out territory. West suspects that the young males in the experiment had never learned how to vie for dominance by singing back and forth with adult males, nor did they have an innate understanding of that process.

The researchers then moved some of the young males raised with canaries into aviaries that held mature female and male cowbirds. The novices that once sang to each other learned from their elders how to act like normal cowbirds. They quickly became expert crooners and courtiers, changing "from duds to studs," she says.

**T**o develop a rich repertoire, most songbirds must hear other members of their species sing, and most learn all their songs after leaving the nest. The need for tutors is an important characteristic of many songbirds, such as robins, cardinals, and titmice, although

some exceptions exist. The gray catbird, for example, can develop his singing skills with no help from teachers.

The need for role models connects songbirds to humans, one of the few other types of animals that must learn how to vocalize. Like human infants, young birds pick up language easily. When only a few weeks old, they often start babbling—stringing together in a nonsensical fashion snatches of songs that their elders sing, Kroodsma explains. By following the dictum "practice, practice, practice," the young male birds usually become master vocalists within just a few months.

But how many different songs birds actually learn or perform varies considerably from species to species. Birds with large territories, such as eastern marsh wrens, tend to have smaller playlists than those, such as western marsh wrens, that have to jockey for position on tiny plots, Kroodsma finds.

**S**ome birds may be genetically predisposed to learn more songs, researchers assert. Douglas A. Nelson of Ohio State University in Columbus and his colleagues compared the song-learning abilities of two subspecies of white-crowned sparrow, *Zonotrichia leucophrys*. A member of the more sedentary group, *Z. l. nuttalli*, moves only 100 to 300 meters from its birthplace to establish its breeding territory, while the migratory *Z. l. oriantha* travels up to 10 times that distance.

The researchers reared 48 individuals of the two subspecies, collected from the wild in California when the birds were 2 to 8 days old. During the next 40 to 50 days, the birds heard either a sequence that repeated 16 different *Z. l. nuttalli* and *Z. l. oriantha* songs, or five pairs of tunes that had one song of each subspecies. In the following 40 to 50 days, the researchers repeated the regimes but used new songs.

"The two regimes were designed to simulate extremes in the variety of songs young males might experience," Nelson's team explains in an article accepted for publication in *ANIMAL BEHAVIOUR*.

The migratory birds benefited from a rich musical upbringing: On average, the individuals that heard the 32 songs performed a total of 18 phrases from five different songs. The birds that heard the 10 pairs sang an average of five phrases from

two songs.

Both groups of sedentary birds, in contrast, performed the same number of songs and learned fewer tunes than the musically enriched migrants. The sedentary songsters sang only five phrases from two and one-half songs.

"A migratory annual cycle introduces greater uncertainty into where a young male will breed for the first time," they note. This uncertainty may favor migrants with a genetic predisposition to learn many songs, Nelson contends. The bigger their repertoire, the more likely they are to sound like their neighbors wherever they settle. That versatility might help them find a mate and defend their territory.

The difference between the white-crowned sparrow subspecies demonstrates that genetic variation among males from the same species influences their memorization capacity and their processing, storing, and recalling of songs, Nelson asserts. These findings support work done by Kroodsma in the early 1980s. He showed that adult western and eastern marsh wrens develop different-sized repertoires when given similar tutoring as youngsters.

Clearly, people don't benefit equally from music lessons either. But at least when someone breaks out in song and forgets the verses, his or her mate will probably reach for earplugs rather than a suitcase. □



Eastern marsh wren.