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Katherine Tye (Vedder Crossing)
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hormones come into play. In the early stages of egg production, the hormone levels are low. Low levels may stimulate the growth of male eggs. Thus, the first eggs laid would tend to be male and the last, female. But since the division of chromosomes had occurred early in the process and at random, not all female geese would bear sons first. Some would have four female eggs, some would have one male and three female, and so forth.

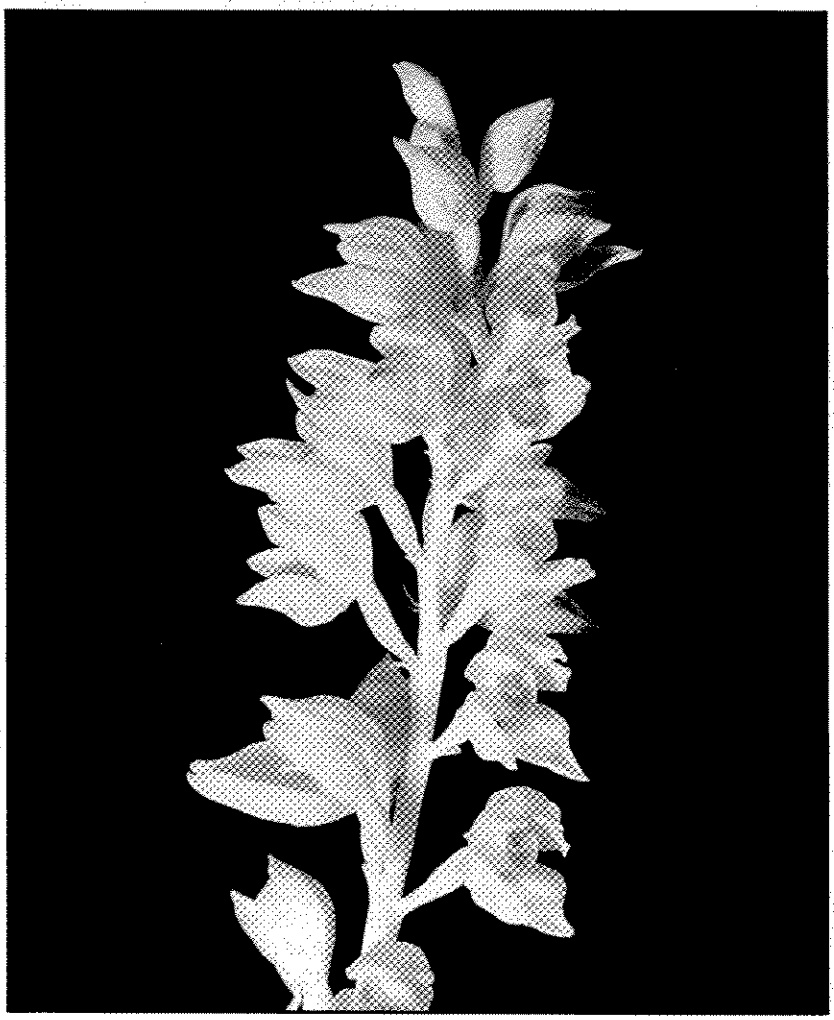
There is also the possibility that any genetic determination of sex can be changed by the temperature the egg is exposed to once it is laid. Since the females usually lay one egg per day and don't normally begin incubating the clutch until the second last egg has appeared, their first eggs (particularly those partially buried in the ground) are subjected to colder temperatures than their last. In several reptile families, the sex of offspring can be controlled by temperature, with cool temperatures during incubation producing males and warm temperatures producing females. This may also be the case in lesser snow geese, since the smaller of the first two eggs, which would have cooled more quickly than the other, produced more males, and the larger of the last two eggs, which would have cooled more slowly, produced more females.

But this theory, like the others, says Dr. Ankney, "is sheer speculation." More data, he feels, are needed to conclusively determine what is behind this phenomenon.

For Dr. Ryder, who prompted this discovery, the collection of more data has weakened what appeared to be a similar tendency in ring-billed gulls. "There is a trend there," he says, "but statistically it's not strong." What the research did reveal, though, is a tendency for the gulls to bear more females in poor nesting seasons and an even number of males and females in good seasons. The secret of their ability, however, like that of the lesser snow geese, remains a mystery.

Susan M. Smith

The Phantom and Mrs. Tye



Ron Long

The birth of Sky Meadows Orchid Reserve

For 20 years Mrs. Katherine Tye had watched and worried over the rarest of North American orchids, the phantom orchid, which grew on her property, "Sky Meadows", near Sardis, BC. In 1973, there were no blooms. "I knew there would be none," she said. "I don't know how I knew." In 1976, there were 22 again. Mrs. Tye kept careful count: there had been 75 a decade earlier. But there was no telling with the phantoms. Said Mrs. Tye, "It's the maddest orchid in the world."

Mrs. Tye's long involvement with phantom orchids began in 1964 when she discovered them on a ridge overlooking Cultus Lake, "growing in the shade like little ghosts." *Cephalanthera austinae* lacks chlorophyll, and pushes up stalk and flowers in ghostly whiteness against the dark forest floor. The only touch of colour is a golden spot deep in its throat.

The phantom orchids of Sky Meadows appeared sporadically in new locations. Once, five orchids appeared on the ravine, another by the barn, but they never came again. One came on a goat path to Mrs. Tye's door. "Orchids like paths," she says. She has made some sightings

The delicate, exquisitely scented phantom orchid grows on a stalk little more than a third-of-a-metre high.

It's a Boy!

Can lesser snow geese determine the birth order of their offspring?

During the last week of May, the skies above the lower Arctic wilderness echo with a chorus of shrill cries as flocks of lesser snow geese return home to breed. While some females bury part of their first egg in the ground and gradually build a nest, others find an old nest to restore as their eggs are laid. Some 22 days later, the first creamy-white shell is slowly "pipped" open and a yellowish-grey gosling emerges.

To most of us, the annual birth of the downy offspring is a natural part of the species' survival. But to Dr. C. Davison Ankney, it is nothing less than a source of scientific wonder. According to his findings, the female geese may be able to choose the order in which their male and female goslings are born, which suggests they may actually be able to choose the sex of their young.

For Dr. Ankney, a professor of zoology at the University of Western Ontario, this discovery came as the byproduct of a study comparing the survival and growth of goslings from eggs of different weights. In his studies, he found that the first two eggs in four-egg clutches of snow geese usually weigh more than the last two. (This may be because the females rely heavily on stored nutrient reserves for egg production and are thus in better condition when they lay their first two eggs.) He also found that the goslings hatched from these first two eggs grow faster initially than those from the last two eggs.

But after speaking with Dr. John Ryder, a professor of biology at Lakehead University who had noted a tendency for ring-billed gulls to produce males from their first eggs and females from their second, Dr. Ankney re-examined his data to find a startling result. In the 29 clutches of four eggs he observed, the first two eggs produced 64 percent males, while the last two produced 72 percent females. "The chances of this happening just by chance," he says, "are slim."

Sue Stephenson

The first two eggs laid by lesser snow geese produced mostly males.

Dr. Ankney believes the female geese may actually have an adaptive ability to choose the order in which their sons and daughters are born. Because it was better for survival in their present environment to have larger, more vigorous sons, the females bore their sons first, since goslings from their first two eggs would be larger and grow faster initially than those from their last. (And, since males are normally larger than females and require more food, being first-born also gives them an advantage in obtaining that food.) In this case, "the females are investing slightly more in their male...than in their female offspring," says Dr. Ankney.

This thesis may imply that the female birds, who unlike human mothers possess the chromosome that determines the sex of their young, are somehow able to control which chromosome their eggs receive. Since this ability has been observed in some insects, the theory is not as fantastic as it might at first seem. Suppose that the chromosome that determines the sex of the egg divides just a few hours before ovulation, or very late in the process of creating an egg. If it occurs at random, then the birth order of male and female goslings should also be random. Since it is not, Dr. Ankney speculates that at the last moment most of the mothers "decide" to bear males first, by somehow dictating which chromosome their eggs will receive.

Still, if females *do* have the ability to decide the sex of their young, why are the results not more dramatic? Dr. Ankney has a second explanation that could account for the fact that male first-borns are only a trend, not an absolute. This theory makes the process of sexing a random one, with

above Cultus Lake, but generally when the orchids came, they appeared on her property. One year, a few blooms unexpectedly popped up outside the fence. But that was also the year a new survey was done. It turned out the orchids had been right, and Mrs. Tye's fence had to be moved to enclose them and two additional metres of land.

In the years that blooms were abundant, Mrs. Tye carefully dried specimens for museums and herbariums. When she knew that she could remain with the orchids no longer, Mrs. Tye first sought the interest of the Ecological Reserves Program of the province, but funds were lacking. In 1983, when she was 83, Mrs. Tye left Sky Meadows, still very worried about the fate of her orchids.

Finally, in the spring of 1985, Dr. Louise Goulet, director of the Ecological Reserves Program, enlisted the aid of the Nature Trust of BC, a non-profit organization dedicated to the acquisition of lands of ecological significance. The Trust purchased two hectares, while Mrs. Tye donated another 1.2 hectares to found the Sky Meadows Orchid Reserve. By the fall of 1986, the reserve should be officially established.

In addition to the new reserve, and some isolated sightings Mrs. Tye has made nearby, there are two other known sites in BC where the phantom orchid grows. Strangely, all three habitats are different. Sky Meadows is a second growth forest of conifers, birch and alder; a second site is a dense climax coniferous forest on the Sechelt peninsula; the third is a dry, open slope on Saltspring Island, where the orchids grow in two small plots set aside as ecological reserves less than 100 metres from a busy boat landing.

It is feared these plants will not long survive despite the Ecological Reserves Program. Such small conspicuous areas demand almost constant surveillance and, according to Anna Marie Dahlke of the local nature club which assists in the task of supervision, most of the club members are elderly and would find the 11-kilometre journey out by car on an upgraded former logging road too difficult for frequent travel.

For the present, the orchids of Sky Meadows are safe, but the new overseers will have to mount a protective guard as devoted as Mrs. Tye's. As their guardian, she played host to at least 2000 visitors from across Canada and the United States. A photographer from Ontario phoned one day to ask if the orchids were at their prime, and arrived on her doorstep the next, after a quick flight. Another enthusiast from New York put his camera rather than himself on a plane, with instructions for a camera club to return it after they had photographed the flowers for him. Says Mrs. Tye, "The orchids were the centre of my life."

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Why Does Antler Size Differ?

Fleet-footed deer are more generously endowed

Why does antler size differ at all among deer species? The answer came while reconstructing the ecology of an extinct giant, the Irish elk.

Megaceros giganteus, the Irish elk, had massive, thick-lined antlers that were nevertheless graceful structures, spanning up to three-and-a-half metres in large specimens and weighing from 30 to more than 40 kilograms. Not only was it notable for huge antlers, *Megaceros giganteus* was the most cursorial deer ever to evolve; that is, it was highly specialized as a speedy and enduring runner.

The solution to the mystery of its huge antlers lies, paradoxically, in the giant deer's adaptation to running. Running with great speed and endurance is a means of evading predators and requires a large amount of space. For this trait to promote survival, the young must be as fleet-footed as their mothers soon after birth. Offspring must be born large and highly developed, and fed a supply of milk abundant enough in nutrients and energy to foster rapid growth to "survival size", thus shortening the vulnerable time period after birth. We would therefore expect to find, in living deer dependent on running, a single, highly developed offspring that shared neither womb nor milk with a sibling. In fact, cursorial young are on average the largest young born, much larger than the offspring of forest-adapted species.

Antler tissue is extremely sensitive to food intake, and an excellent barometer of fluctuations in food supply.

Tom W. Hall

To produce rich milk, the mother needs to select highly nutritious forage, and divert the nutrients from body growth and maintenance to milk production. In males, the same genetic ability to divert nutrients means that more material is available for antler growth. Antler tissues are extremely sensitive to food intake and therefore are an excellent barometer not only of the year-to-year fluctuations in food supply but also of the male's ability to find the best food resources. A female choosing a male with relatively large antlers selects one with a hereditary endowment for superior foraging and for diverting nutrients and energy from body growth to antler production.

If this hypothetical scenario is valid, then we would expect to find in deer a close correlation between the antler mass of males, the birth weight of young and the percentage of milk solids in mother's milk. And that is just what we find.

Caribou, the most cursorial living deer, bear one large and highly developed young, which closely follows its dam. The female produces the most concentrated milk of any living deer, and bulls grow the largest antlers. Caribou are specialized in selecting highly nutritious forage and choosing the most digestible of plant parts. For escape terrain, they prefer frozen lakes.

The wapiti prefers more open spaces and grazing than the red deer and, in line with that preference, has a body shape more adapted to running. The wapiti's antlers, however, are relatively smaller. This appears to be a function of grazing; grasses — though fairly digestible, abundant and free of toxic compounds — have lower concentrations of nutrients than forbs and foliage. As expected, wapiti milk is somewhat lower in milk solids than that of red deer, and wapiti young hide from predators.

We can calculate the quality of feed required to grow antlers of any size. A huge 675-kilogram *Megaceros* stag, growing 45 kilograms of antler mass in 120 days would require 40 kilograms a day of fresh forage (wet weight) so high in protein and minerals that only a very few plants could provide it. Even the finest young meadow grass is inadequate for large antler growth. Regardless of his genetic endowment, a stag fed on grasses alone would grow less than six kilograms of antlers because such grasses are low in phosphate, an important nutrient in growing bone. Even on good alfalfa, a giant deer would only grow about 20 kilograms of antlers, because this renowned cattle feed contains far too few nutrients to support maximum antler growth in large-bodied deer.

Only exceptionally nutritious forage will allow maximum antler growth. The young, and even the mature, leaves of several species of willow bushes provide such forage. Willows are abundant in deltas, on rich alluvial deposits and in glacial environments along lakeshores, as well as on loess plains created downwind of glaciers and along glacial melt-off channels. Plant remains scraped from *Megaceros*'s teeth turned out to be willow.

There has been speculation that large antlers can hinder survival of a species. The large antlers of the Irish elk were blamed for its demise, weakening its body by drawing off so many nutrients and leading to death by drowning or by getting stuck in the forest. None of these speculations is valid. Although *Megaceros*'s antlers may appear heavy and unwieldy, they are no more so than the horns of mountain

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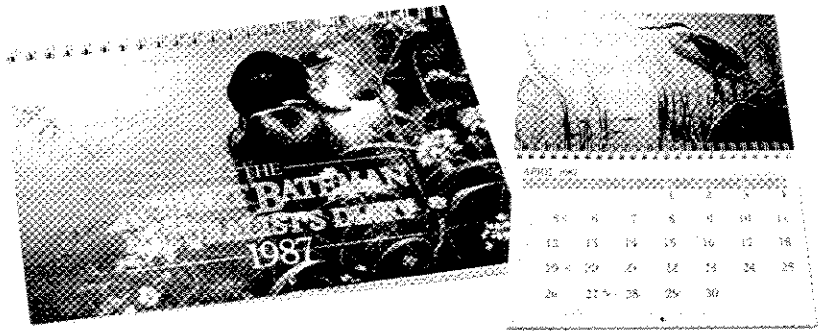

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