Scoliosis

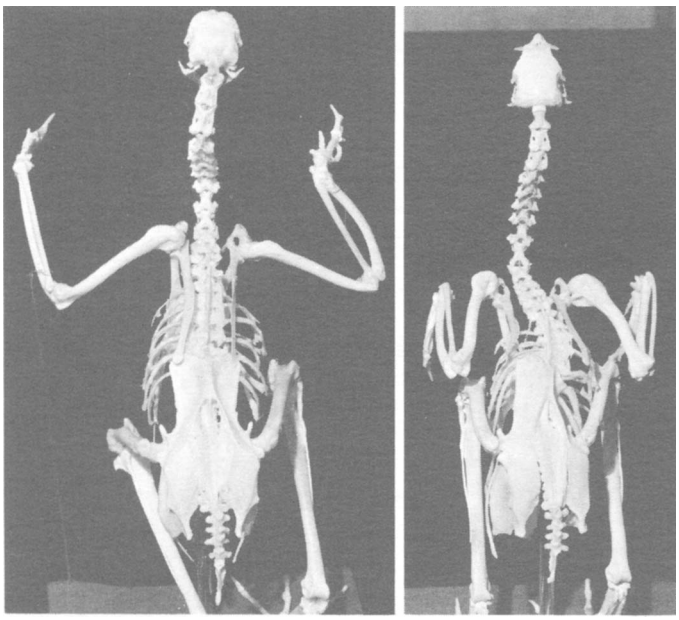
Idiopathic scoliosis (crooked spine) can be a crippling disease in humans. A common form primarily affects adolescent girls. There is clear evidence that idiopathic scoliosis is inherited. However, in humans, the pattern of inheritance is not clear.

Several years ago, Dr. L. W. Taylor of this department (Berkeley campus) developed an inbred strain of chickens in which up to 50 percent of the birds developed scoliosis. Subsequent research revealed a number of striking similarities between scoliosis in these birds and man. A more extensive study, with support from an Orthopaedic Research and Education grant and an NIH grant, is underway.

Cooperating with the UCD Departments of Orthopaedics, Animal Science and Nutrition, we have found that, in the scoliotic strain, the first spinal curves are detected after birds reach four weeks of age, usually between the fifth and sixth weeks. As these birds mature, progressively more severe curves develop until spontaneous fusion of the thoracic vertebrae occurs. The incidence of curved spines in sexually mature adults is now about 55 percent and is more frequent in males than in females. Thus, in chickens as well as in humans, the homogametic sex is more prone to scoliosis.

Our work also shows that abnormalities of growth and development of the spine are not the primary cause of scoliosis, nor is simple muscle imbalance involved.

-U. K. Abbott

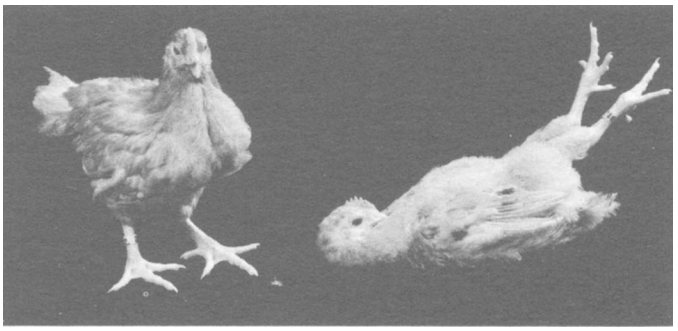


Normal spine (left) and scoliotic spine (right) in chicken skeletons.

Muscular dystrophy

Chickens with muscular dystrophy have become a useful tool in medical and meat research since the first mutant dystrophic chickens were brought to the attention of and diagnosed by UC avian scientists almost 30 years ago.

We now raise dystrophic chickens for worldwide scientific use and are using them in our laboratories to study how muscles grow and how nerves influence muscle development.



Chickens with muscular dystrophy are used in medical research.

This research has revealed some of the events that bring about muscular dystrophy and suggests ways muscular dystrophy might be alleviated.

We show that an enzyme, acetylcholinesterase (AChE) was defective in its regulation in dystrophic chicken muscle and that the levels and properties of this molecule were regulated in part by nerves. AChE is found at the junction of nerves and muscle fibers and plays an important role in regulating how muscles contract. To find out whether the defect was caused by nerves or by muscle, Dr. G. Wendell Yee and Dr. Thomas K. Linkhart, when they were graduate students, operated on young embryos 3½ days old and transplanted the tiny wing buds from embryos of one strain to another. Nerves from the host embryo joined to limbs from the donor. When they studied the chick resulting from these operations, they found that all the properties of dystrophy they studied, including AChE properties, accompanied the wing bud and not the host. They concluded that the nerves of dystrophic birds were normal and that after 3½ days of incubation, dystrophy was brought about by defects in the muscles themselves.

One of the symptoms of dystrophy that accompanied the limbs in the transplants was a hypersensitivity of the muscles to stimulation—a condition known as myotonia. Dr. Richard Entrikin has used this property as a starting point for chemotherapy studies. We found that diphenylhydantoin (DPH) corrected the myotonia and alleviated many of the functional properties of dystrophy for the 30 days of the experiment. In particular, dystrophic chickens were able to turn over and get up when laid on their backs, and levels of AChE in their muscles went down. We are now studying several other drugs with the help of the Muscular Dystrophy Association.

-B. W. Wilson

Newcastle disease research

Among diseases of poultry, Newcastle disease is the greatest threat to the chicken and turkey industry in our country. The virus that causes the disease is unique in that it may appear as a mild asymptomatic infection or as an exotic, highly lethal, rapidly spreading malady referred to as Velogenic Viscerotropic Newcastle Disease (VVND).

The existence of the disease in this country was first recognized and identified by scientists of the University of California in 1940 and an inactivated vaccine for its control developed by 1945. Later, an improved live virus vaccine was developed which gave an excellent protection against overt disease (including a drop in egg production). It was prepared in tissues other than the avian egg which eliminated introduction of transovarian avian pathogens by vaccination; it

could be given to chickens of any age; and the virus did not spread from vaccinated to susceptible pen mates.

In spite of the desirable characteristics of the vaccine against most strains of Newcastle disease virus, studies demonstrated that none of the vaccines can be relied upon to completely prevent infection and the spread of the exotic disease strains of the virus (VVND).

Most recent investigations, however, showed that Newcastle disease virus induces a cellular immune response and that the degree of immunity differed with the strains of the virus and was influenced by the route of their administration.

Of greatest importance among solutions being investigated is the development of a means to protect birds during the first 3 to 5 weeks of age, when they are immunologically incompetent and cannot respond to any vaccine. This period of vulnerability to diseases emphasizes the need for improving our immunization programs for preventing and controlling diseases to maintain healthy and profitable poultry flocks.

-R. A. Bankowski
Veterinary Medicine

Alternative feedstuffs

Food production in California creates a variety of by-products that have potential as poultry feedstuffs. To make the best use of these by-products, we are analyzing their value as poultry feed and are developing ways to overcome any limitations they may have.

Rice bran. In areas where considerable rice is milled, rice bran is readily available for animal feeding. It differs considerably from wheat bran and usually has approximately 12 percent protein, 12 percent fiber, and 12 percent or more fat. When it is used as a substitute for cereals in a feed for chickens, it has been found to depress growth by approximately 30 percent when fed as 60 percent of the feed. This adverse effect cannot be noted at the 10 to 15 percent level.

Such growth depression can be prevented by steam-treating the bran. This treatment destroys both trypsin inhibitor and lipase activity in the raw rice bran; but there is evidence that neither of these is responsible for its growth depression. The metabolizable energy of the rice bran is approximately equivalent to that of wheat and is not altered by the steam treatment. To date, no simple method has been found to treat rice bran to improve growth. Without treatment it can be used satisfactorily in both starting and laying rations at the 10 to 15 percent level. Since the fat in rice bran is very unsaturated, the bran should be used promptly to prevent rancidity. Bran from parboiled rice is of better feeding value than raw paddy rice because the fat is stable and the growth inhibitor has been destroyed by parboiling.

The amino acid composition of rice bran protein is more favorable nutritionally than that of most other cereal proteins. This could simplify the need to supplement rations containing rice bran with other protein sources. The rice seed itself also has better quality protein than most other cereals and one would expect that a by-product based upon rice, such as dried brewer's grains, would have nutritive value superior to similar products derived from other cereals.

Cottonseed meal. Cottonseed meal has had limited use in poultry rations because of the presence of gossypol, which has an adverse effect on egg quality. While its effect can be reduced by using a strain of cotton with low gossypol content or by using a prepress treatment before solvent extraction to remove the oil, these methods have not entirely removed the possible dangers in using this meal in laying rations. Work is in progress testing a new solvent for its potential in producing a meal with lowered gossypol content and possibly reduced aflatoxin content as well.

Triticales. Triticales are newly developed cereals from crosses between wheat and rye. We are evaluating nutritive values of triticales and other cereals. Triticales can replace corn, wheat, and milo in all plant protein diets of growing coturnix. Layer diets for coturnix containing 90 percent triticale can be formulated if the protein content of the triticale sample is about 16 percent. The egg production of birds on such diets is comparable to that of birds on conventional diets.

-F. H. Krtazer
and Pran Vohra

Harris Hawks at the UC Davis Raptor Research Center.

Raptor research

Raptors, or birds of prey, include such familiar forms as hawks, eagles, and owls. Many species of raptors are valuable to agriculture as biological control agents, feeding on rats, mice, and birds such as starlings. Reductions in the populations of some species due to pesticide poisoning has focused attention on these birds, and new knowledge of the basic biology of raptors is essential to any management program.

Our raptor program involves the following major projects: (1) the effects of rodenticides on raptors; (2) development of artificial diets for captive raptors; (3) studies of the seasonal variations in energy requirements and metabolism of owls; (4) development of endocrinological methods to be used in an assessment of the reproductive status of the wild population of California condors; and (5) breeding of Harris' Hawks in captivity.

These studies are in the preliminary stage, and few conclusions are available. However, the rodenticide research indicates that some species of raptors are much more susceptible to the poisons than are others. The work with diets for captive raptors shows that appearance and texture are important in food acceptability by Red-tailed Hawks. Disguising foods by covering them with animal skins resulted in visual acceptance of prepared foods, but acceptable textures of purified diets are yet to be obtained.

-W. W. Weathers