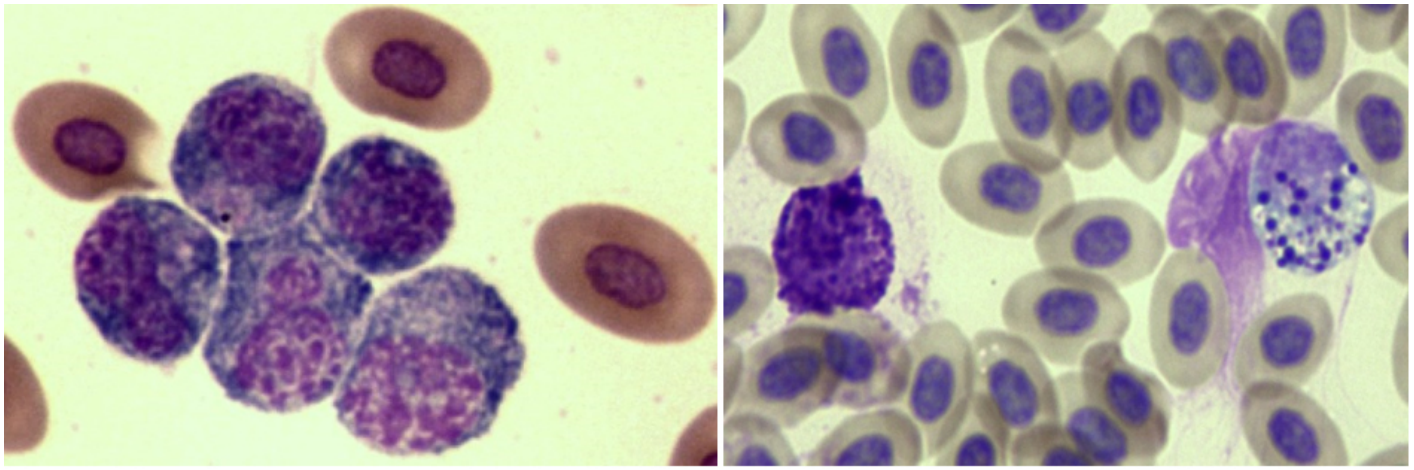
Caged hens with unusual white blood cells

Animal welfare and egg supply sustainability issues are now top priorities. Currently, most eggs are from caged hens whose welfare is a question. To address the issue, microscopic data from blood counts of hens in three cage styles was examined. The principle question - do blood pictures show one cage style is superior? Based on laboratory studies where deliberate exposure to stress changed blood cells; the study measured how laboratory experiences translate to actual farm conditions. Presumably, if some cages were less stressful the blood pictures would show it. Samples from five ages, 18 - 77 wk, over the course of egg laying life, were put to the test.

The method is similar to how blood pictures can aid the diagnosis of human disease. Could hen blood pictures tell about cage stress? To get the necessary information cells are first sorted into categories on microscopic appearance. Proportions, total numbers, and any unusual features are noted.

Many results were surprising. Samples from each age and cage style contained unusual cell types, called “atypia” by scientists. Other samples had high cell numbers; and some had both. Small cells called “resting” lymphocytes are the most numerous in non-stressed hens. Others called “heterophils” should be half as frequent as small lymphocytes. If true, dividing the numbers of heterophils by the small lymphocyte number should give 0.5 as the result. White blood cell of all types should be total to about 25,000 per micro-liter, a number considered normal for poultry. A comparable number in humans would be about 5000.



Left a 5 cell group of large atypical plasmacytes in blood of a 32 wk hen living in an aviary cage. Both the cell architecture and group clustering indicate stress. Right a basophil and a new “sentinel” cell, the “cyanophil,” seen in the blood of a 56 wk hen living in a conventional cage.

High heterophil-lymphocyte ratios and atypical cells were common with no apparent difference due to cage styles. Some cells had features suggesting infection. These “plasmacytes,” are infection-fighting antibody secretors. When more than two or three plasmacytes appear, some sort of inflammation is certain. Other important signs were unusual heterophils, a cell thought to consume a diet of bacteria. Many heterophils showed signs of demise, the nucleus, the location of DNA, was condensed, an indication of impending cell death. In other cases, heterophils swelled to the extent of disintegration. Basophils, a distinct deep purple granulocyte, related to human allergy cells were also quite common. They release powerful substances controlling blood vessel diameters.

As a major surprise, a number of newly described cells were in the blood. One was so unusual it needed a name; “cyanophil” was the choice. It translates to “blue loving” and distinguishes cyanophils from all other kinds. Where a cyanophil is seen, bacteria or fungi are nearby. These “sentinels” give a clear warning.

Total white blood cell numbers, called “TWBC”, were high throughout the study. They peaked around the time of greatest egg-production declining after. Hens in conventional cages live at six per unit, and hundreds are in aviaries. Cells of hens in cages furnished with perches and scratch pads, at 60 per unit, were high too. In the end, these hens had the highest cell numbers. So which cage was best? A more complicated answer than most scientists thought. As far as the blood pictures indicated the conventional cages were as good as those thought to be less stressful.

In the end, the study showed laboratory-developed stress measures may not work so well on the farm. Blood based data are more difficult to interpret than laboratory studies might predict. Cell proportions and numbers are needed, but with atypia, it is a new ballgame. Finally, the discovery of new cells is important to the basic science of blood, aka “hematology”.

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Publication

Atypical lymphocytes and leukocytes in the peripheral circulation of caged hens.
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