IS YOUR SMARTPHONE A HAZARD IN THE HATCHERY?

Many phone apps are available which allow you to use your smartphone as a convenient tool for hatchery monitoring. However, despite smartphones being useful gadgets, they do present some biosecurity risks if they are taken into the hatchery.

A recent study conducted by Aviagen hatchery specialists quantified bacterial contamination on 36 smartphones whose owners were asked (without prior warning) to remove the phone case and swab the phone's screen and camera lens areas. The swabs were taken to a laboratory, streaked onto non-selective agar plates and incubated overnight. A technician counted the colonies on all plates. In total, 91% of the plates grew some bacteria, carrying up to 2,000 CFU (colony forming units). We did not identify the organisms in this trial, but some of the bacteria that could be living on your phone include E. coli, Staphylococcus aureus, Streptococcus and Pseudomonas, all possible threats for chick livability as they are the main causes of omphalitis and first week mortality.

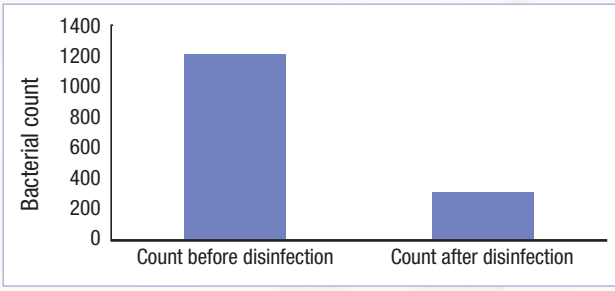
It is for this reason that some companies make the hatchery a 'cell-phone free zone' while others allow the device to be brought inside after some kind of disinfection procedure. If you are taking your phone into the hatchery, a correctly carried out disinfection process should take place every time. Suitable processes include:

- Fumigation with paraformaldehyde – this is the most effective process. Unfortunately, formaldehyde is not permitted in many countries.
- High Intensity Ultra Violet light. An Aviagen study in the UK showed that 10 minutes exposure is enough to inactivate 99.9% of bacterial load. The disadvantage is that UV lamps can be very expensive and need to be replaced regularly.
- Disinfectant wipes – in the study described above participants were asked to completely wipe their phones with ammonium chloride wipes and swab again after some minutes. Wiping the phones with disinfectant wipes significantly reduced the bacterial load.

As well as daily dry cleaning and disinfection there are other everyday practices that will help to reduce the amount of bacteria that is lurking on your phone; such as:

- The phone case should never be taken inside as it may be carrying bacteria and other micro-organisms. Ideally use a silicone or similar case which can be washed, and always remove the case daily while you dry clean and disinfect the phone.
- Avoid taking your phone into the bathroom – this is a great opportunity for micro-organisms to get onto your phone.

Fig. 1. Average bacterial load on 36 mobile phones swabbed before and after disinfection. Before disinfection 91% of the phones had bacteria present. After disinfection only 29% still had bacteria present.



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Hatchery TIPS 45

SENSE-CHECK YOUR CO_2 SENSOR CALIBRATION

CO_2 sensors are used by most manufacturers to adjust the ventilation rates of setters and hatchers. The control systems in those machines will monitor CO_2 level and use the recorded value to reach decisions about ventilation rates. This is a good way of creating dynamic ventilation profiles for flocks with different fertility and egg sizes. High fertility batches will produce more CO_2 and will be ventilated more when running on CO_2 sensors, whereas running on a fixed programme could normally meet only average needs.

However, the level of O_2 in a machine will be highly correlated with the level of CO_2. This means that any calibration inaccuracy of a CO_2 sensor can create serious problems. A drift in the CO_2 sensor will mislead the ventilation programme and create problems, depending on the drifting value. It is very common to see hatchability, chick quality and chick yield issues related to misaligned CO_2 sensors. Therefore, we have to be sure that the calibration of the CO_2 sensors is accurate. Fortunately, in addition to routine calibration, there is a fast and easy way to check CO_2 sensors when a machine is empty.

Outside air contains 300-400ppm (0.03-0.04%) of CO_2. Inside, if the hatchery ventilation is working well, corridors (or air intake plenums) should have 400-600ppm (0.04-0.06%). When we run machines empty with 100% open dampers, we should read CO_2 level similar to that in the corridor. If the readings are too low or too high, we need to recalibrate the CO_2 sensors with a zero-calibration kit. If calibration is not possible, replace the failing sensors.

The pictures show control panels of two pairs of setters. In both pairs, the machine on the right hand side (with higher CO_2 reading) will ventilate more than the one on the left. The first machine (0.2% CO_2) will have insufficient ventilation, especially at the last stages while the other three will be over ventilated to a lesser or greater extent.

In setters, insufficient ventilation will cause insufficient weight loss and late embryo mortality. Over-ventilation will cause excessive weight loss and cold spots. In hatchers, insufficient ventilation will cause excessive chick yield, navel problems, late mortality and ascites. Over-ventilation will cause cold spots, wide hatch window and dehydration.

Some examples of CO_2 calibration drift.

0.02% vs 0.16%

0.08% vs 0.17%

A service to hatchery personnel from Aviagen **www.aviagen.com**

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Hatchery TIPS 46

CONTROLLING EGG WATER LOSS DURING STORAGE

The influence of air temperature and relative humidity

To enable their function as incubation vessels, all eggs are enclosed in a porous outer container – the egg shell. The shell must allow gases through so that the developing respiring embryo is able to get rid of carbon dioxide and take in oxygen. Water also passes through the pores in the egg shell, even when embryo development is paused during egg storage. Egg water loss during storage can be assessed by measuring the egg weight at the start and end and calculating the weight loss. Eggs kept in reasonable conditions will commonly lose about 0.5% of their initial weight after a week in storage, which does not seem to harm hatch or chick quality.

Although the number and diameter of pores in an individual egg are fixed, it is possible to affect the rate of water loss by adjusting the conditions in which the eggs are held. This is because the rate of water loss will be governed by the difference in water vapour pressure inside and immediately outside the egg – the water pressure deficit.

Relative humidity inside the egg will remain at 100% at all times, because the egg has a high water content. External conditions will not affect humidity inside the egg. However, the water vapour pressure differential can be changed, because the water vapour pressure of the air in the egg store alters as a function of temperature and relative humidity. Humid air will have most of the available space already occupied by water molecules, and the vapour pressure will be high. If the air is cooled then it can hold less moisture, so the humidity and water vapour pressure both rise. Eventually the dew point is reached and water vapour will condense out of the air.

We tend to try to control water loss of stored eggs by keeping humidity and water vapour pressure in the egg store up. However, this can encourage bacterial or fungal contamination of the eggs, either through using contaminated water to fog or wet the egg store, or through condensation on the egg surface. An alternative way to reduce the water pressure deficit is to lower the air temperature in the store. Table 1 shows that the impact on the water vapour deficit is the same when humidity is raised by 5%, or temperature reduced by 3˚C. Based on calculated values of water vapour deficit, the figures demonstrate that reducing the egg store temperature from 18˚C to 15˚C (64.4-59˚F) will be as effective as increasing its relative humidity by 5%.

In conclusion, a lower storage temperature could help to keep weight loss during egg storage under control without increasing the risk of contamination.

Table 1. The impact on the water vapour deficit when humidity is raised by 5%, or temperature reduced by 3˚C.

	Common conditions	Increase relative humidity	Decrease temperature
Inside	18˚C, 100% = 20.6 mbar	18˚C, 100% = 20.6 mbar	15˚C, 100% = 17.0 mbar
Egg storage room	18˚C, 70% = 14.4 mbar	18˚C, 75% = 15.5 mbar	15˚C, 70% = 11.9 mbar
Water vapour deficit	+6.2mbar	+5.1 mbar	+5.1 mbar

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Hatchery TIPS 47

USING TEMPERATURE & HUMIDITY DATA LOGGERS

Hatcheries control environmental temperature and relative humidity from the egg room through to the chick room to produce and deliver good quality chicks. The room conditions are monitored by thermostats and hygrostats which are connected to the air handling unit (AHU) controller. Some modern hatcheries have additional monitoring software with integrated controls, allowing the hatchery staff to pull up real time and historical data. However, it is necessary to make sure that what the system measures is correct and what is seen on a display is really what the eggs, incubators and hatchers are experiencing.

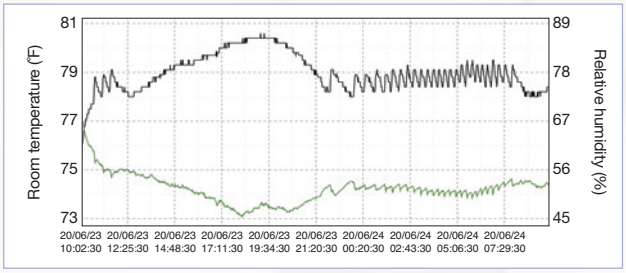
Uncontrolled temperature fluctuations in the egg room will increase embryo mortality and therefore damage hatchability. Unstable conditions in incubator and hatch rooms will force the incubators to work harder trying to maintain optimal conditions. In so doing, they will often create hot and cold spots, which affects embryo growth rate and increases energy use in the hatchery.

Most hatcheries perform daily spot checks on temperature and humidity and record them. Others will look at the averages displayed by their integrated automatic monitoring tools. Even when temperature or humidity are seen to be out of the optimal range, action is not always taken. Using a temperature and humidity data logger, which is capable of autonomously recording temperature and humidity over a defined period at certain intervals, comes in very handy to check on the integrated systems. The digitally stored information can be downloaded into an excel spreadsheet or directly viewed as a graph as seen in Fig. 1.

The logging summary of the incubator room shows an average room temperature of 26.1˚C (79˚F) and an average relative humidity of 51.7%. A closer look reveals that the room was running warmer for several hours during the day compared to a more stable temperature during the night. Humidity was also slightly affected during the day. By just looking at averages one would think everything is fine when in reality it is not. The temperature fluctuation was caused by doors being left open.

Loggers can be placed at different positions within the room to find out if the temperature or humidity levels are even throughout the room. It is good practice to locate the loggers at egg level in various locations throughout the egg room or at the actual air intakes of the incubation equipment. This way it is possible to learn and understand the behaviour of the hatchery ventilation and control systems, and if everything is as it should be. Loggers can also be used inside the machines to monitor machine stability. There are many types of affordable small temperature and humidity loggers available on the market. It is important to look for good quality ones that give accurate readings, and have the option to be adjusted when needed after calibration. Look for configurable parameters, good battery life and a sturdy, waterproof design capable of withstanding the hatchery environment.

Fig. 1. Incubator room temperature and relative humidity.



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WHICH THERMOMETER GIVES THE BEST ESTIMATE OF EMBRYO TEMPERATURE DURING INCUBATION?

For optimal hatchability, chick quality and broiler performance, embryo temperature should be held at 100-101°F (37.8-38.3°C) for the full 21 days of incubation. Embryo temperature will be affected by four factors: the machine air temperature, the temperature gradient between the embryo and the machine environment, air speed across the eggs and embryo metabolic heat production.

As the embryo grows its metabolic heat production increases, changing from an endothermic stage where heat needs to be supplied from an external source to an exothermic stage, at which point heat production increases and excess heat must be removed.

There are various ways of evaluating embryonic temperature, the most accurate being to puncture the eggshell and use an internal probe thermometer, such as the Testo 103. This method measures the true body temperature of the embryo, but is not suitable for everyday use because it requires the eggs to be destroyed in order to collect the data. Measured correctly, egg surface temperature (EST) is very close to embryo temperature, which allows us to assess embryo temperature without destroying the egg.

A recent study conducted by Aviagen compared EST measured with three alternative devices to the internal temperature measured using a Testo 103 probe thermometer. The devices were the Exergen DX501, the Braun ThermoScan ExacTemp (Model IRT 6500) and Tiny Tags Talk 2 (all shown from left to right in Fig. 1 above).

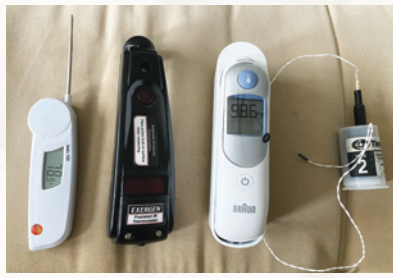

Fig. 1. Thermometers suitable for measuring embryonic or egg surface temperature.

The temperature inside the egg measured with the Testo 103 was the base temperature used for the comparison. Temperatures were taken both during the endothermic stage (3 and 6 days) and the ectothermic stage (16 and 18 days) with each of the compared devices, as well as the Testo 103 (internal base temperature). The Tiny Tags gave values of EST within 0.1°F of the Testo internal reading in both the endothermic and the exothermic phases. The Braun ThermoScan and Exergen were less predictable, with the Exergen deviating from the Testo value by -0.3°F early in incubation and by -0.8°F in late incubation, while the Thermoscan was 0.45°F lower early on and much closer later on as the embryos produced more heat (-0.1°F).

Regardless of the method used to measure EST it is important to be aware of possible deviations from the true embryo temperature and ensure that the selected device is calibrated and working properly. If a new make or type of device is offered to you, this Tip describes a practical way of checking its accuracy compared to devices currently in use in hatcheries.

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