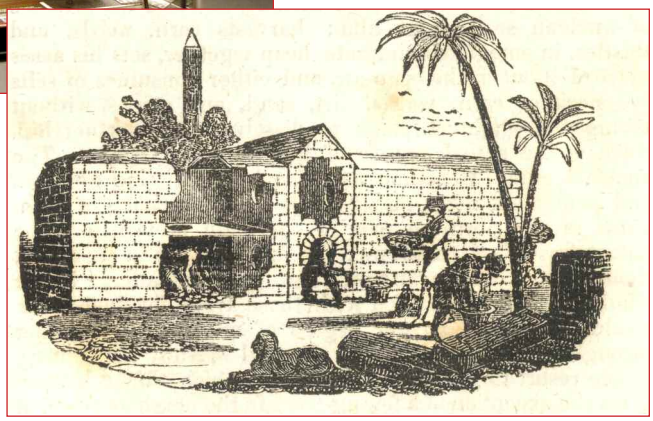
Incubators

Incubators in general

In order for life to flourish, all organisms require a certain level of moisture, oxygen, sunshine and CO_2 . Plant life requires a certain soil quality to ensure successful growth rates. Each and every living organism also has its specific requirement for optimal reproduction. For scientists and researchers to study these qualities of life, they must be able to artificially generate an organism's ideal environment. To achieve the environment, an incubator is used. Ancient Egyptians learned that the rate of successfully hatched chickens increased drastically when they put the fertilized eggs in a big oven built out of bricks. Although, in that case, only the temperature was controlled. The Egyptian egg oven can be considered the first known incubator. Hatching chicken eggs is only one application where incubators are used. Other important uses of the incubator are the growth of bacteria, viruses and spores for research or diagnostic analyses.

Facts & Figures

- India's poultry industry has to expand at an annual rate of 12 – 15% to fulfill local demand.
- The average weight of a chicken has doubled since 1934 and is now around 5.5 pounds.
- The US chicken consumption grew from 49 pounds per capita in 1980 to 86 pounds in 2011.



Clockwise from top: modern day incubator . . . baby chicks . . . Egyptian egg oven, can be considered the first known incubator.

Why the need to measure?

Various elements of the incubator environment must be measured in order to provide an ideal environment for organisms to survive and/or reproduce.

Temperature

As an example, incubators used for chicken hatching must maintain a temperature between 37.2°C to 37.7°C if the incubator has fan circulation. If the incubator has no fan, 38.8°C is recommended for best results. As another example, most bacteria grow best at 35°C.

Humidity

A high level of humidity is required for growing bacteria. Most types of bacteria need 90% RH or higher for growth and reproduction. For example the widely known food poisoning bacteria "Salmonella" only grows at 95% RH and above.

continued

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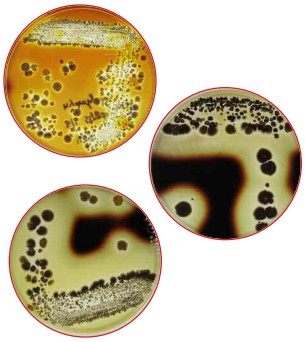
Why the need to measure?

Humidity *(continued)*

Most molds require 80% RH for growth.

A proper level of humidity is also extremely important for hatching chicken eggs. Within the egg is a tiny air bubble that gets bigger during the growth of the embryo, but if the humidity level is too low the fluids essential to the final growth of the embryos are lost too quickly. A humidity level between 50-60% RH is considered ideal for hatching chicken eggs.



Chicks in incubator . . . bacteria cultures.

Carbon dioxide

In nature, the CO_2 level in a chicken nest is around 0.4% or 4000ppm compared to the surrounding air that has only 400ppm. Maintaining the CO_2 level in an incubator between 4000ppm to 6000ppm is necessary for normal development of the chicken fetus. During the late development of the eggs, the embryonic production of CO_2 increases as incubation proceeds and therefore should be removed from the environment to keep the CO_2 at a safe level.

Research of crossbreeding or genetically modifying plants requires a controlled CO_2 environment to speed up the development process.

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