

## The ups and downs of body temperature

Body temperature is commonly used to make animal health decisions, but are the results always accurate?

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**W**E OFTEN utilize body temperature to check health in cattle. In our research projects, we also use it to learn more about heat stress and heat abatement.

At first glance, measuring body temperature appears to be a simple task. Over the years, though, we have found that there are many details we should consider when measuring it.

Body temperature in cows varies throughout the day. Because of that, when and how we measure it can affect what we find. Also, it is important to understand what body temperature results are telling us. These results can help people manage herds, assuring cattle welfare and productivity.

### Body temperature changes

Cows have biological clocks that follow daily rhythms. These are influenced by ambient temperature and how cooling is provided (Figures 1 and 2). Throughout a day, body temperature can fluctuate as little as 1°F and as much as 6°F. It is often lowest in the morning and highest in the afternoon or evening.

When and how should we measure body temperature in cattle?

In a study we conducted at the University of California during the summer, we found that measuring body temperature once, twice, or three times a day led to inaccurate results (Figure 3). In other words, checking body temperature once after the morning or afternoon milking may not give us the truth.

After morning milking, for example, body temperature can be at its lowest, possibly masking cows with fever. Later in the day, body temperature can be at its highest, inflating results. In both scenarios, the outcomes will not help us make informed decisions about treatment or cooling.

In our study, we found that measuring body temperature every two hours resulted in accurate estimates. Yet, this approach of measuring temperature so often is something that is only possible in a research setting, unless cows were fitted with technology that would record it. Despite the advances of precision livestock farming, there are still not many choices for producers and veterinarians that deliver real-time body temperature results.

### The device used is important

Another consideration when measuring body temperature is device accuracy. In other words, how reliable are the results?

Accuracy is different than resolution. Resolution shows the smallest temperature change that the device can detect. Low-accuracy devices can lead to false temperature results.

In the same study described above, we found that devices that were accurate to ~0.9°F to 1.8°F did not mimic body temperature results obtained using a high-accuracy

device (~0.2°F). For example, when using low-accuracy devices, almost 80% of high body temperature episodes were missed.

These problematic results can have consequences in routine dairy management. Some cows might not have received adequate treatment if, for example, fever was used as the decision tool for whether to give antibiotics. Also, we could think that cooling strategies

were effective while they were not. These all can lead to poor welfare and economic loss.

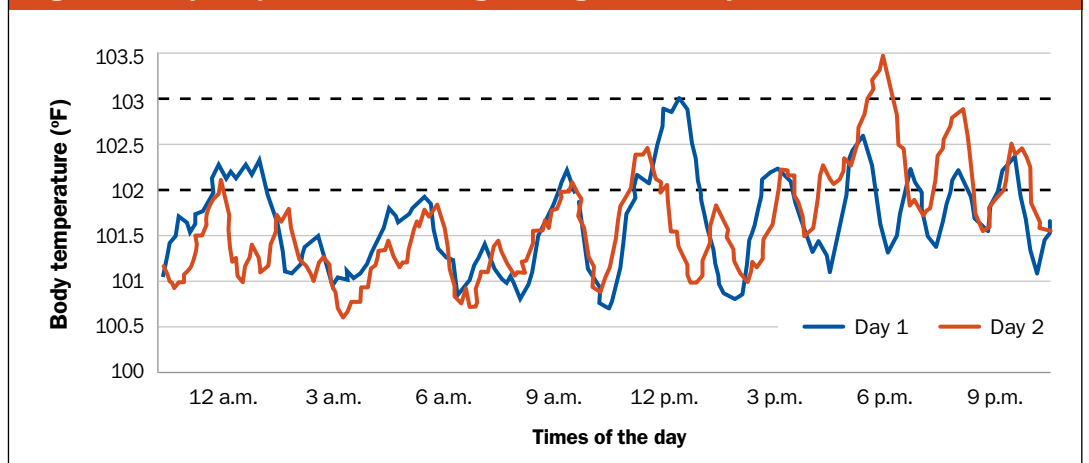
### What does it tell us?

Interpreting body temperature values is not an easy task. For example, high body temperature results obtained in the afternoon are not straightforward. At that time, heat due to weather and disease are difficult to tell apart. So, in warm months, it is good to avoid measuring fever at those times.

Also, as dairy scientists, we sometimes work hard to understand what our results mean, and we often disagree among ourselves. This scientific disagreement can be seen in the fever or high body temperature thresholds used by veterinarians and scientists. It can vary from 102°F to 104°F, when measuring rectal or vaginal temperature. We often go for using a more conservative approach because it is more beneficial for cattle welfare and productivity.

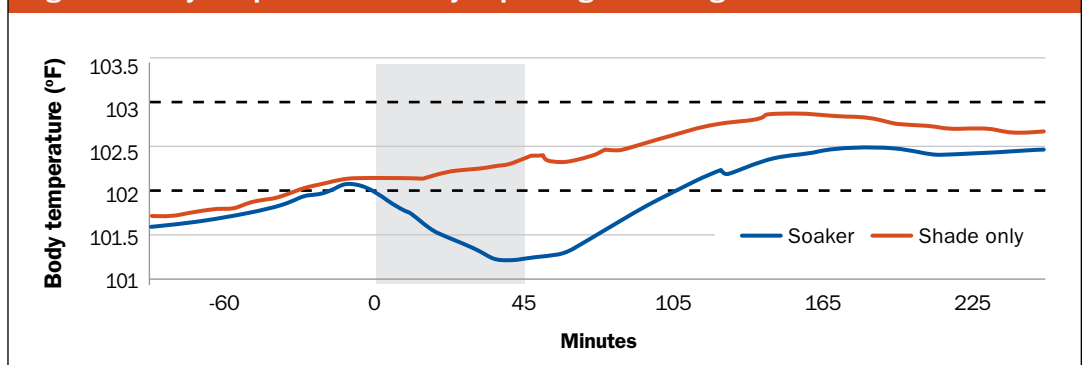
Daily body temperature should average between 101.6°F and 101.8°F. Many have shown that this temperature range is maintained in healthy cows and those provided plenty of cooling opportunities. 🐄

Figure 1. Body temperature can change throughout the day



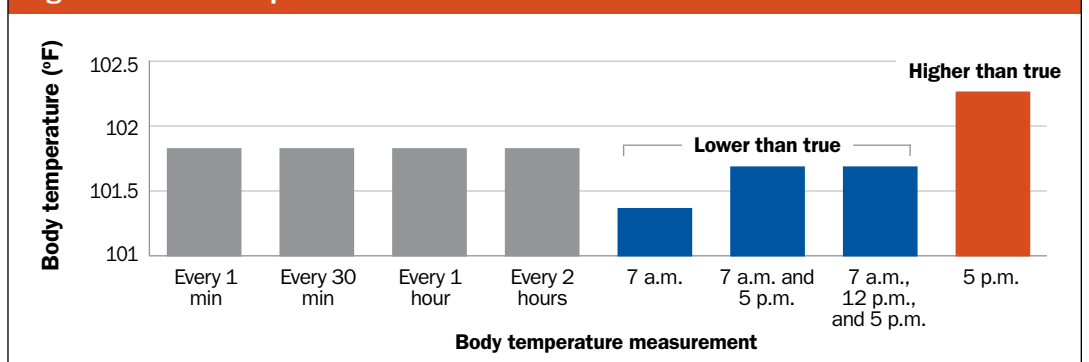
This graph shows how body temperature can vary over a day. The two lines represent the same cow on two different days. Maximum body temperature on Day 1 (blue) was reached at 1 p.m., while on Day 2 (orange) it happened at 7 p.m. Black, dashed-lines represent either a conservative (102°F) or a commonly used (103°F) fever threshold.

Figure 2. Body temperature can vary depending on cooling



In this ~5 hour snapshot, the gray area represents a 45-minute section in which cows were kept under shade or were sprayed with water (soakers). While body temperature dropped almost 1°F for cows that were sprayed, it slowly increased for cows that only had shade. The black, dashed-lines represent either a conservative (102°F) or a commonly used (103°F) fever threshold.

Figure 3. Check temperatures more often for accurate results



When sampling body temperature one to three times a day, we failed to get a good picture about what is happening to the cow throughout the day. To get a full picture of the entire 24 hours, we would have to check cows at least every two hours (gray bars).

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