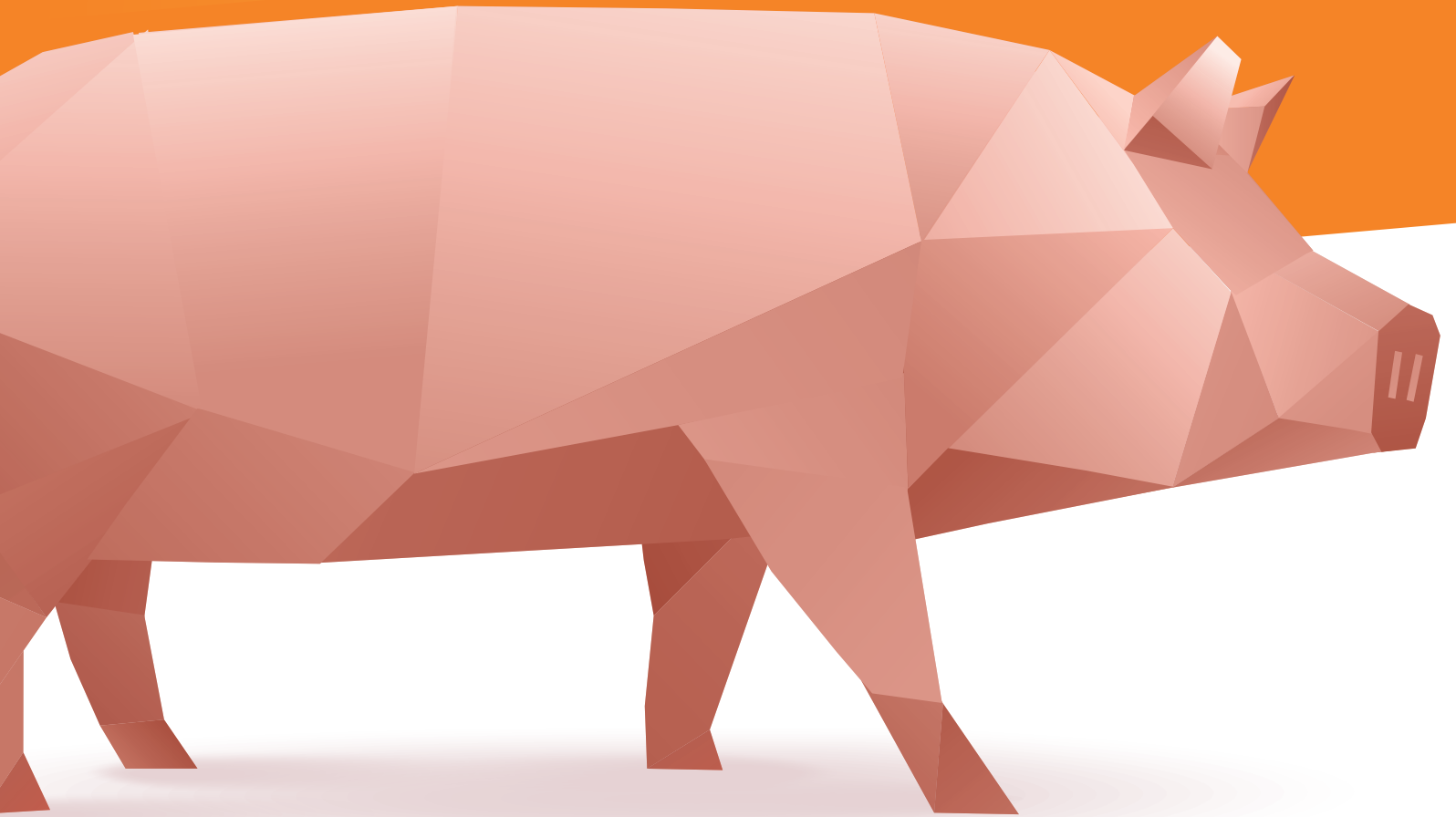


KemTRACE[®]
CHROMIUM
Essential to you and your operation.

DESIGNED FOR OPTIMAL
SOW PERFORMANCE



KemTRACE® CHROMIUM

KemTRACE® Chromium — the first product of its kind on the market — is a safe, proven trace mineral for use in swine, broiler, beef, dairy and horse diets.

This highly bioavailable, organic source of chromium propionate helps improve glucose utilization and reduce the negative impacts of stress for increased cellular energy and function, resulting in improved animal maintenance, reproduction, growth and immunity.

FEATURES AND BENEFITS:

- KemTRACE® Chromium-OR — an OMRI Listed, organic-compliant form of chromium propionate — is also available in the U.S. for use in organic diets.
- KemTRACE Chromium and KemTRACE Chromium-OR are manufactured in the U.S., sourced from U.S.-based raw materials and are available in two product concentrations:
 - 0.04% (for use in complete diets)
 - 0.4% (for use in a premix)
- The first organic trace mineral approved in the U.S. for broiler diets in more than 40 years¹
- Highly bioavailable, organic source of chromium
- Designed for optimal absorption to maximize performance
- Capable of improving performance, based on an animal's hierarchy of needs
- Able to reduce cortisol and mobilize more blood glucose into tissue



RESPONSE BASED ON HIERARCHICAL NEEDS

Chromium mobilizes more blood glucose into tissues, allowing for improved performance based on the animal's hierarchy of needs. As the primary source of energy for cells, glucose is critical to an animal's performance and is used in several key metabolic functions.

Key uses of cellular energy for a sow include maintenance, reproduction and muscle or fat deposition. **Depending on a sow's needs, chromium supplementation can result in fewer non-productive sow days, greater feed intake during lactation and improved body condition, ultimately resulting in heavier weaned pigs.**¹⁻⁴

References

1. Chromium Efficacy for Breeding and Lactating Gilts and Sows in Two Reproductive Cycles: Quebec Study, TD-11-00111.
2. Mayorga, E.J., S.K. Stoakes, J.T. Seibert, E.A. Horst, M. Abujamieh, S. Lei, L. Ochoa, B. Kremer, and L.H. Baumgard. (2016). Effects of dietary chromium propionate during heat stress on finishing pigs. *Journal of Animal Science*. 94(2):139.
3. The Effect of Chromium Propionate on Piglets and Sows in a Commercial Swine Herd, TL-11-00145.
4. Collins, C.L., J.R. Pluske, R.S. Morrison, T.N. McDonald, R.J. Smits, D.J. Henman, I. Stensland, and F.R. Dunshea (2016). Post-weaning and whole-of-life performance of pigs is determined by live weight at weaning and the complexity of the diet fed after weaning. *Animal Nutrition*. 3:372-379.
5. Mertz, W. (1992). Chromium: History and nutritional importance. *Biological Trace Element Research*. 32:3-8.
6. Koketsu, Y., G. D. Dial, J. E. Pettigrew, and V. L. King. (1996). Feed intake pattern during lactation and subsequent reproductive performance of sows. *Journal of Animal Science* 74:2875-2884.
7. Mosnier, E., N. Le Floch, M. Etienne, P. Ramaekers, B. Sève, and M. C. Péro. (2010). Reduced feed intake of lactating primiparous sows is associated with increased insulin resistance during the peripartum period and is not modified through supplementation with dietary tryptophan. *Journal of Animal Science*. 88:612-625.
8. Gebregeabraham, E. (2015). The effect of stress on productivity of animals: a review. *Journal of Biology, Agriculture and Healthcare*. 5(15):14-21.
9. Klemcke, H.G. (1995). Placental metabolism of cortisol and mid- and late gestation in swine. *Biology of Reproduction*. 53:1293-1301.
10. Einarsson, S., Y. Brandt, N. Lundheim, and A. Madej. (2008). Stress and its influence on reproduction in pigs: a review. *Acta Veterinaria Scandinavica* 50:48.

THE FIRST OF ITS KIND. THE FIRST IN ITS CLASS.

Benefits for sows: Fewer non-productive sow days, greater feed intake, improved body condition and increased wean weights¹⁻⁴



INSULIN: KEY TO MAXIMIZING SOW PRODUCTION

Insulin plays a key role in optimum cell function, “unlocking the door” to the cell, so blood glucose can enter and be used for energy. Chromium improves insulin function by increasing insulin receptor activation, leading to efficient clearance of glucose from the bloodstream.⁵ **By increasing the availability of glucose, the sow has more energy for health, body condition maintenance, milk production and reproduction.**



INCREASED FEED INTAKE

A significant driver in sow production is feed intake during lactation, which can impact several performance metrics such as litter wean weights, non-productive sow days and sow longevity.⁶ Maintaining enough feed intake to support maintenance in addition to milk production can be a challenge. A reduction in feed intake creates loss in body mass that can be difficult to recover for the next reproductive cycle. In addition, sows can become insulin-resistant during gestation and lactation, which reduces the amount of glucose cleared from the blood, inhibiting sows from reaching their full genetic potential.⁷

0.6
more pigs
born per sow³

0.3
more pigs
weaned per
sow³

0.7
pounds heavier
weaned pigs³



IMPROVED BODY CONDITION

Studies feeding 200 ppb of chromium propionate to sows during gestation and lactation resulted in **sows with decreased back fat loss** compared to sows fed a control diet without chromium propionate.^{3,8} The reduction in back fat loss indicates the sows did not have to rely as heavily on fat stores to provide their required amount of energy during lactation. Improvements in body condition also led to a reduction in non-productive sow days.



DECREASED NON-PRODUCTIVE SOW DAYS

Non-productive sow days were reduced by five days when sows were fed chromium propionate.^{1,9} In addition to improving non-productive sow days, average herd parity was increased from 2.7 to 2.9 per year as more animals remained in the herd after parturition.⁹

5
fewer
non-productive
sow days



INCREASED PIGS BORN AND WEANED

Other studies evaluating chromium supplementation to sows found increases in total pigs born per sow and number of pigs weaned per sow. Sows fed chromium propionate on average had **0.6 more pigs born per sow and weaned 0.3 more pigs per sow.**^{3,8} Additionally, sows were able to **wean pigs 0.7 pounds heavier**, setting them up to be higher performers over their lifecycle.^{8,10}

FEEDING INSTRUCTIONS:

KemTRACE Chromium fed at 200 ppb has been shown to increase glucose clearance by 45% over the control pigs, thus allowing more energy to reach target tissues to maintain and improve performance.^{11,15}



SOWS AND STRESS

Stress has a tremendous impact on sow performance. Many factors such as health, environment, management practices, stocking density and nutrition contribute to the overall stress load that a sow faces daily. When a sow is experiencing stress conditions, cortisol (a stress hormone) is released, resulting in behavioral, metabolic, immunological and intestinal changes.^{8,11,12} Studies have shown that cortisol can have a negative impact on sow performance.^{9,10,13} **Chromium has been shown to reduce the levels of cortisol, thereby reducing the negative impacts of stress.**¹⁴



WHY BIOAVAILABILITY MATTERS

The chemical form of a nutrient impacts the degree to which it can be absorbed and used to support important metabolic processes in an animal. In order for an animal to absorb minerals — such as chromium — the mineral must either solubilize or dissociate in the digestive system of the animal. KemTRACE Chromium is a highly bioavailable, organic source of chromium propionate.

KemTRACE[®] CHROMIUM

ACTIVATES INSULIN RECEPTORS

MORE GLUCOSE ENTERS CELLS

MORE ENERGY AVAILABLE

IMPROVED SOW PERFORMANCE

CHROMIUM PROPIONATE vs. CHROMIUM PICOLINATE

KemTRACE Chromium, **chromium (Cr) propionate**, has been shown to be **three times more soluble than other sources of chromium, such as chromium picolinate**. In addition, chromium propionate has a Pka (the unit of dissociation equilibrium) of 4.8 compared to chromium picolinate at 1.5, resulting in a higher dissociation and availability of chromium for absorption within the intestines.

Studies in mice have shown chromium propionate has an absorption value of 51-78% compared to only 0.4-2% for chromium picolinate.¹⁶ This indicates chromium propionate is a higher value product. Higher absorption ensures more of the nutrient is available in a form the animal can use for optimal benefits.

Blood glucose clearance provides further evidence that chromium propionate delivers a higher value than chromium picolinate. In an insulin challenge study, pigs were given 0.1 IU porcine insulin/kg of body weight to determine the bioavailability and resulting insulin sensitivity (Figure 1). **Pigs fed chromium propionate showed a 45% increase of glucose clearance compared to the control and an 18% increase compared to chromium picolinate** — providing more glucose for the pig to use.

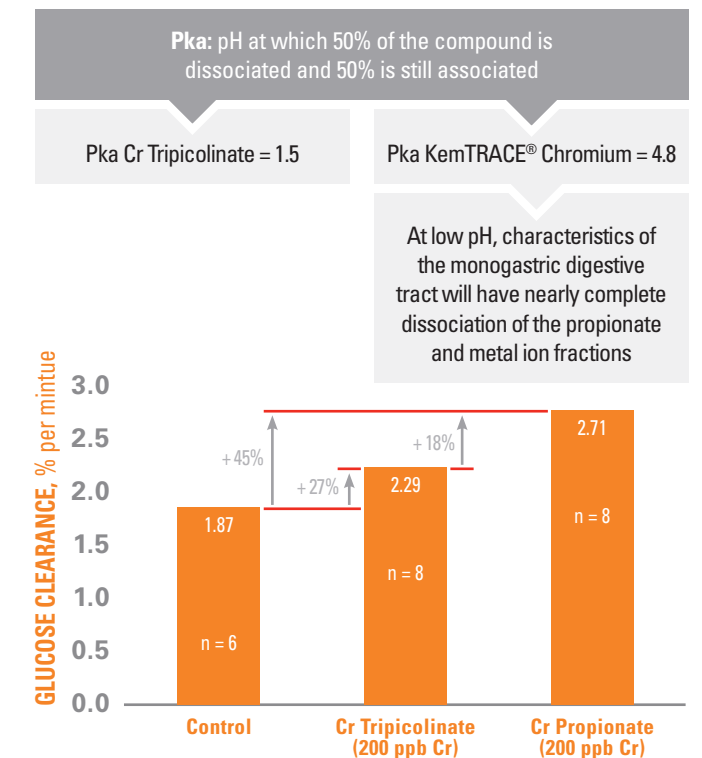


Figure 1: Effect of dietary chromium source on glucose kinetics during an intravenous insulin challenge test (IVICT) in growing barrows (0.1 IU porcine insulin/kg BW)¹⁵

References
 15. Matthews, J.O., L.L. Southern, J.M. Fernandez, J.E. Pontif, T.D. Bidner, and R.L. Odgaard. (2001). Effect of chromium picolinate and chromium propionate on glucose and insulin kinetics of growing barrows and on growth and carcass traits of growing-finishing barrows. *Journal of Animal Science*. 79:2172-2178.
 16. Unpublished data on file at Kem Industries, 2007.

References
 8. Gebregziabhe, E. (2015). The effect of stress on productivity of animals: a review. *Journal of Biology, Agriculture and Healthcare*. 5(15):14-21.
 9. Klemcke, H.G. (1995). Placental metabolism of cortisol and mid- and late gestation in swine. *Biology of Reproduction*. 53:1293-1301.
 10. Einarsson, S., Y. Brandt, N. Lundheim, and A. Madaj. (2008). Stress and its influence on reproduction in pigs: a review. *Acta Veterinaria Scandinavica* 50:48.
 11. Martínez-Miró, S., F. Tecles, M. Ramon, D. Escobedo, F. Hernandez, J. Madrid, J. Orengo, S. Martínez-Subiela, X. Manteca, and J.J. Ceron. (2016). Causes, consequences and biomarkers of stress in swine: an update. *BMC Veterinary Research*. 12:171.
 12. Paredes, A.H., N.R. Salvetti, A.E. Diaz, B.E. Dallard, H.H. Ortega, and H.E. Lara. (2011). Sympathetic nerve activity in normal and cystic follicles from isolated bovine ovary: Local effect of beta-adrenergic stimulation on steroid secretion. *Reproductive Biology and Endocrinology*. 9:66.
 13. C. Mohling, A.K. Johnson, L.A. Kammer, K.J. Stalder, S.M. Millman, and J. Coetzee. (2018, May). Blood cortisol levels higher in lame sows. *National Hog Farmer*. nationalhogfarmer.com/animal-well-being/blood-cortisol-levels-higher-lame-sows
 14. Hung, A.T., B.J. Leury, M.A. Sabin, C.L. Collins, and F.R. Dunshea. (2014). Dietary nano-chromium tripicolinate increases feed intake and decreases plasma cortisol in finisher gilts during summer. *Tropical Animal Health and Production*. 46:1483-1489.

KemTRACE® CHROMIUM MODE OF ACTION

1

Insulin stimulates glucose uptake by cells.¹⁷

2

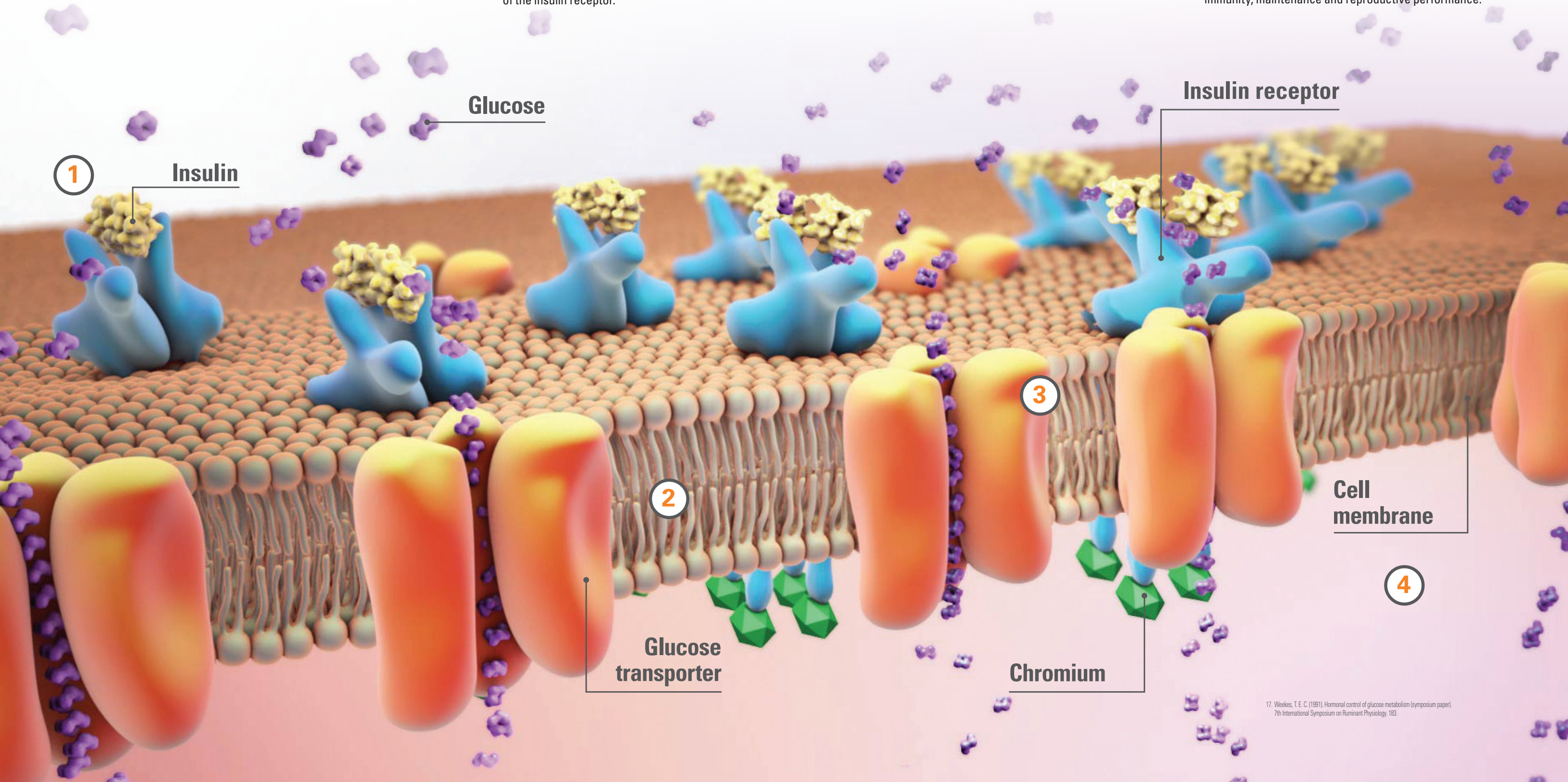
Readily available chromium propionate from KemTRACE® Chromium optimizes the activation of the insulin receptor.

3

The cell increases glucose uptake.

4

The additional glucose allows for more energy to be available for proper cell function, which can boost immune immunity, maintenance and reproductive performance.



Glucose

1

Insulin

Insulin receptor

3

Cell membrane


2

Glucose transporter

Chromium

4

17. Weekes, T. E. C. (1991). Hormonal control of glucose metabolism (symposium paper). 7th International Symposium on Ruminant Physiology, 183.



Only Kemin has invested more than 20 years and millions of dollars toward scientific research, validating the benefits of chromium propionate while bringing this essential trace mineral to millions of animals around the globe. Kemin has conducted more than 50 peer-reviewed chromium research trials in order to add further assurances regarding product safety, efficacy and traceability. Our rigorous regulatory approach demonstrates our commitment to safety and science.

COMMITMENT TO QUALITY

KemTRACE Chromium is manufactured from materials sourced entirely from the United States, under strict quality control specifications that meet the food additive standards published in 21 CFR 573.304. Kemin also maintains a Food Safety System Certification (FSSC) 22000 — recognized under the Global Food Safety Initiative — for its manufacturing facility in Des Moines, Iowa.

CONFIDENCE STARTS IN THE LABORATORY

The quality and safety of our products are paramount at Kemin, and processes are in place for testing not only our final products, but also our raw materials. With our quality control program, customers can have confidence we understand our technology, how our molecules work and that the ingredients are safe and efficacious.

TECHNICAL EXPERTISE AT EVERY TURN

At Kemin, we are devoted to ensuring customers receive trusted nutritional advice when evaluating animal performance. KemTRACE Chromium is supported by our technical service team comprised of respected Ph.D. nutrition and animal health experts with an array of valuable experience in research and production.



KemTRACE Chromium is the only FDA-reviewed source of chromium propionate on the market today.

KEMIN[®]

KemTRACE[®]
CHROMIUM
Essential to you and your operation

Learn more about how KemTRACE Chromium can optimize sow performance at kemin.com/chromium.

1-800-752-2864