AMERICAN MEAT INSTITUTE Foundation

Current Events in Case-Ready Packaging: The Challenge of Managing Meat Color

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Overview

- Current state of case ready retail meat in the U.S.
- Review meat color science and packaging challenges
- Review of carbon monoxide technology as an example of an innovative solution

Current State of Fresh Meat Packaging

- National Meat Case Study
  - Conducted twice, 2002 and 2004
  - 104 retail stores
  - 43 metro markets in 29 states
  - 29,000 linear feet of display case
  - Over 117,000 packages sampled

Sponsored by: Cryovac Sealed Air Corporation, National Cattlemen' Beef Association and National Pork Board

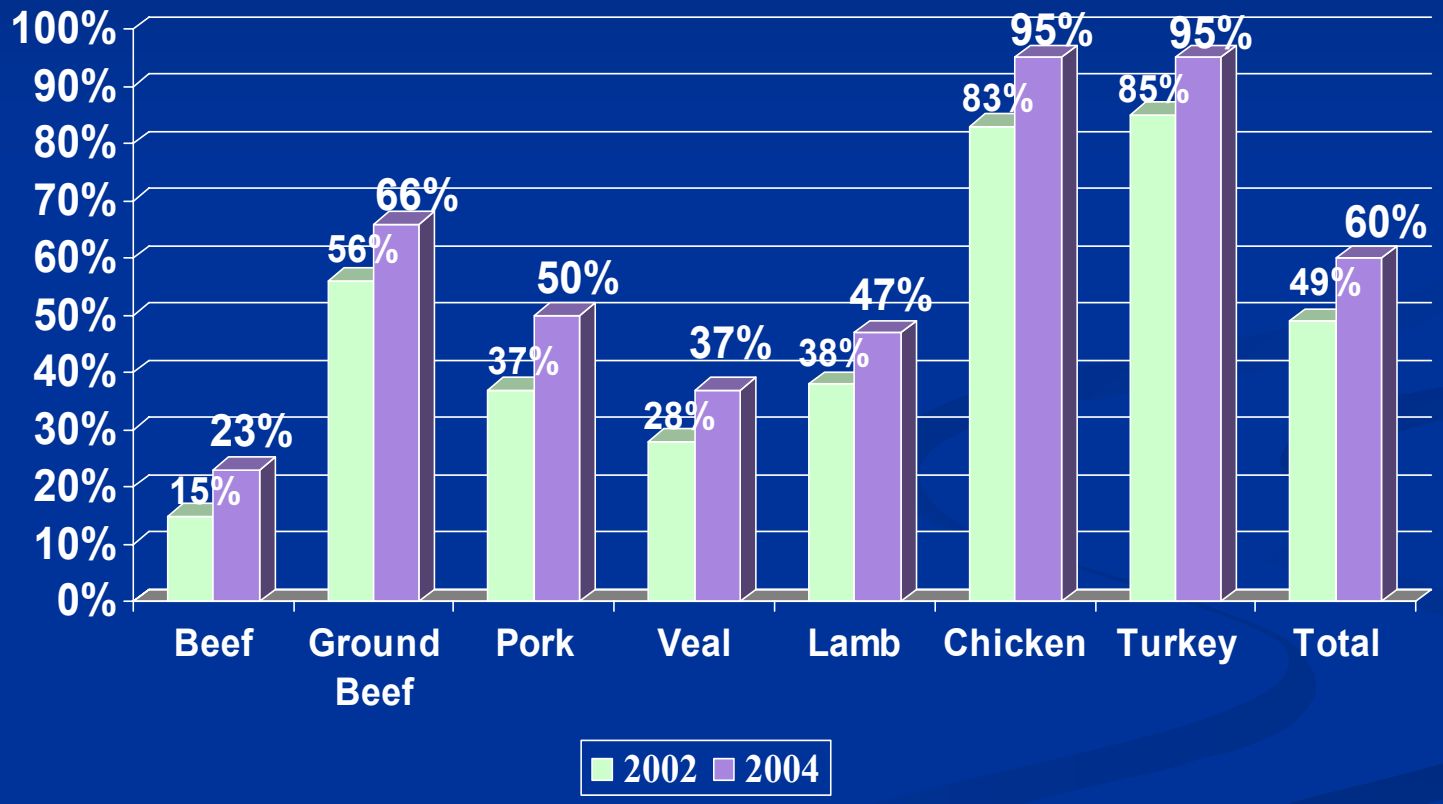
National Meat Case Study

- **2002**
  - 69% of linear feet devoted to fresh
  - Styrofoam tray, PVC overwrap, 51%
  - 49% of fresh meat packages were case ready
  - 9% MAP

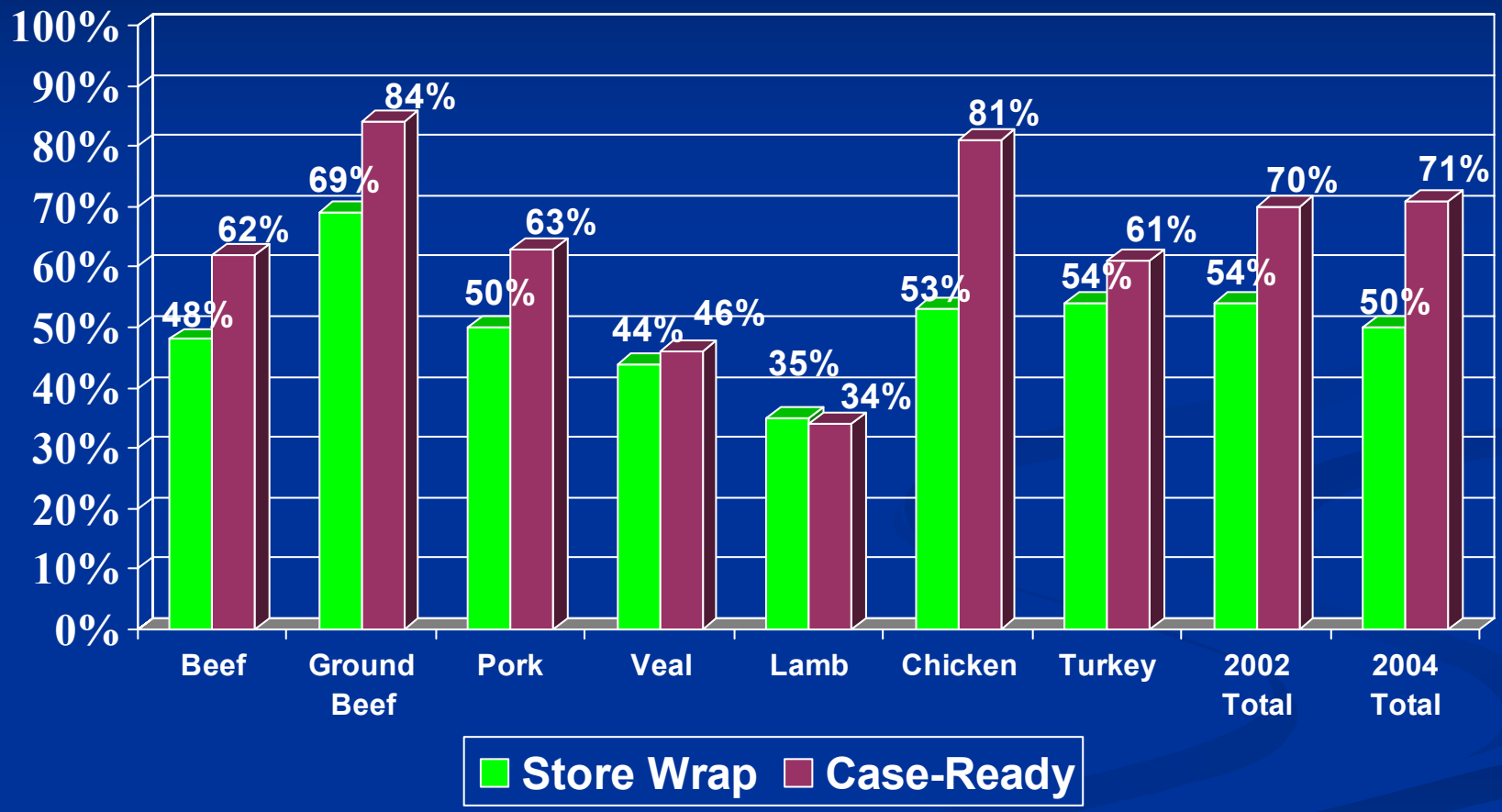
- **2004**
  - 63% of linear feet devoted to fresh
  - Styrofoam tray, PVC overwrap, 47%
  - 60% of fresh meat packages were case ready
  - 13% MAP

Case Ready Penetration Increased for Each Major Specie

Based on Package Counts



In-Stock Position Was Better in Case-Ready than Store-Wrap Packaging



In-Stock is 5 or more packages per SKU displayed. Sausage was excluded.

Current State: Fresh Meat Packaging

- Evolution to case ready continues at a measured pace
  - Driven largely by economic influence
- "Fresh Meat" case continues to shrink
  - Driven largely by need for consumer convenience

The Challenge: Managing Meat Color

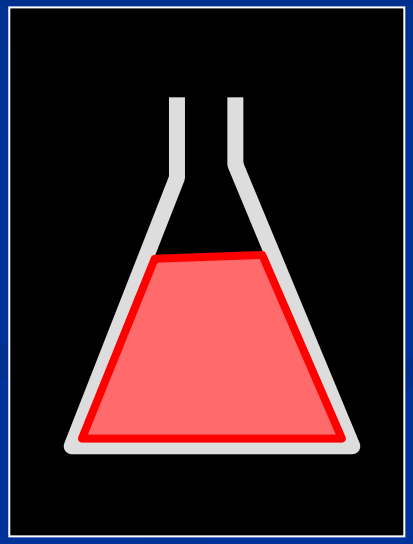
How do we give consumers the color they expect,

With a package they accept,

Combined with an eating experience that will ensure repeat purchase?

What Causes Meat Color?

- Pigments:
  - Myoglobin = Mb
  - Hemoglobin

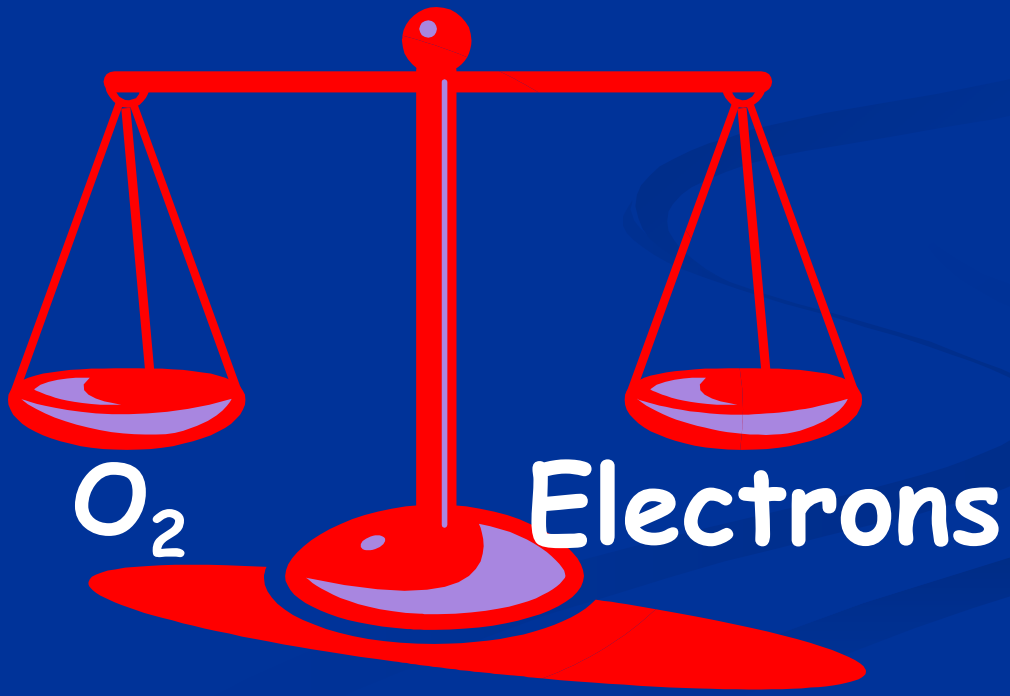


Many Factors of Meat Color

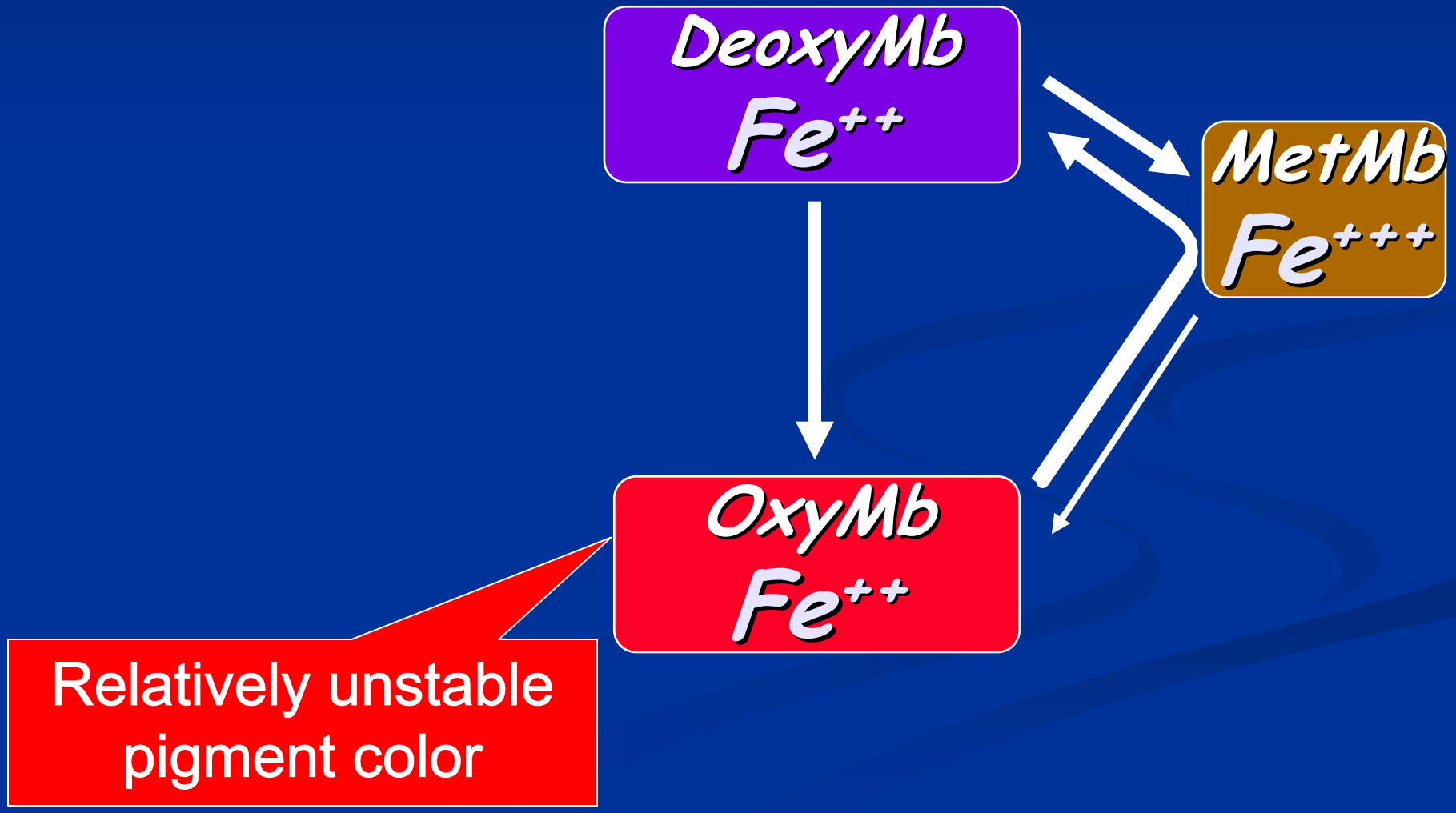
- Animal factors and production
- Temperature
- Meat quality and pH
- Muscle differences
- Postmortem age of the meat
- Ground vs. Whole muscle
- Oxygen & other atmospheres
- Packaging
- Muscle chemistry

Optimizing Meat Color & Packaging

A balancing act based on pigment chemistry

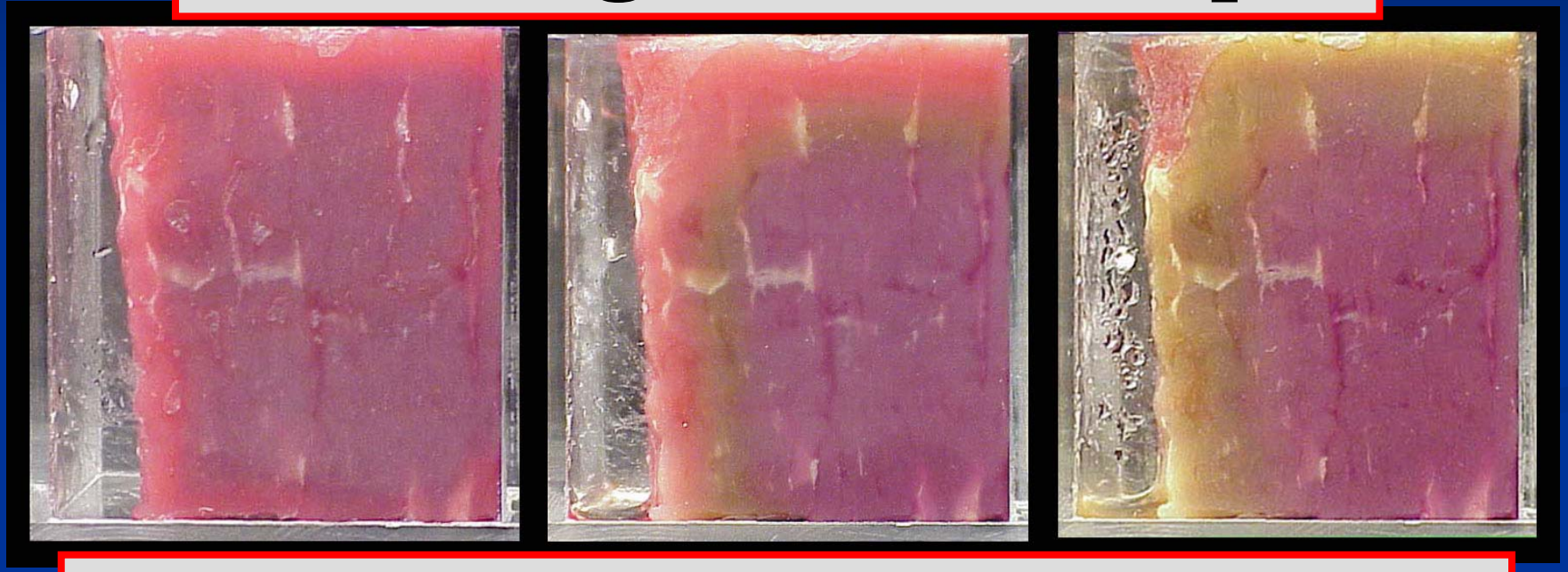


Fresh Meat Color Chemistry



Layering of Mb in Meat

Beef Longissimus: 5d pm



3hr 7d 9d

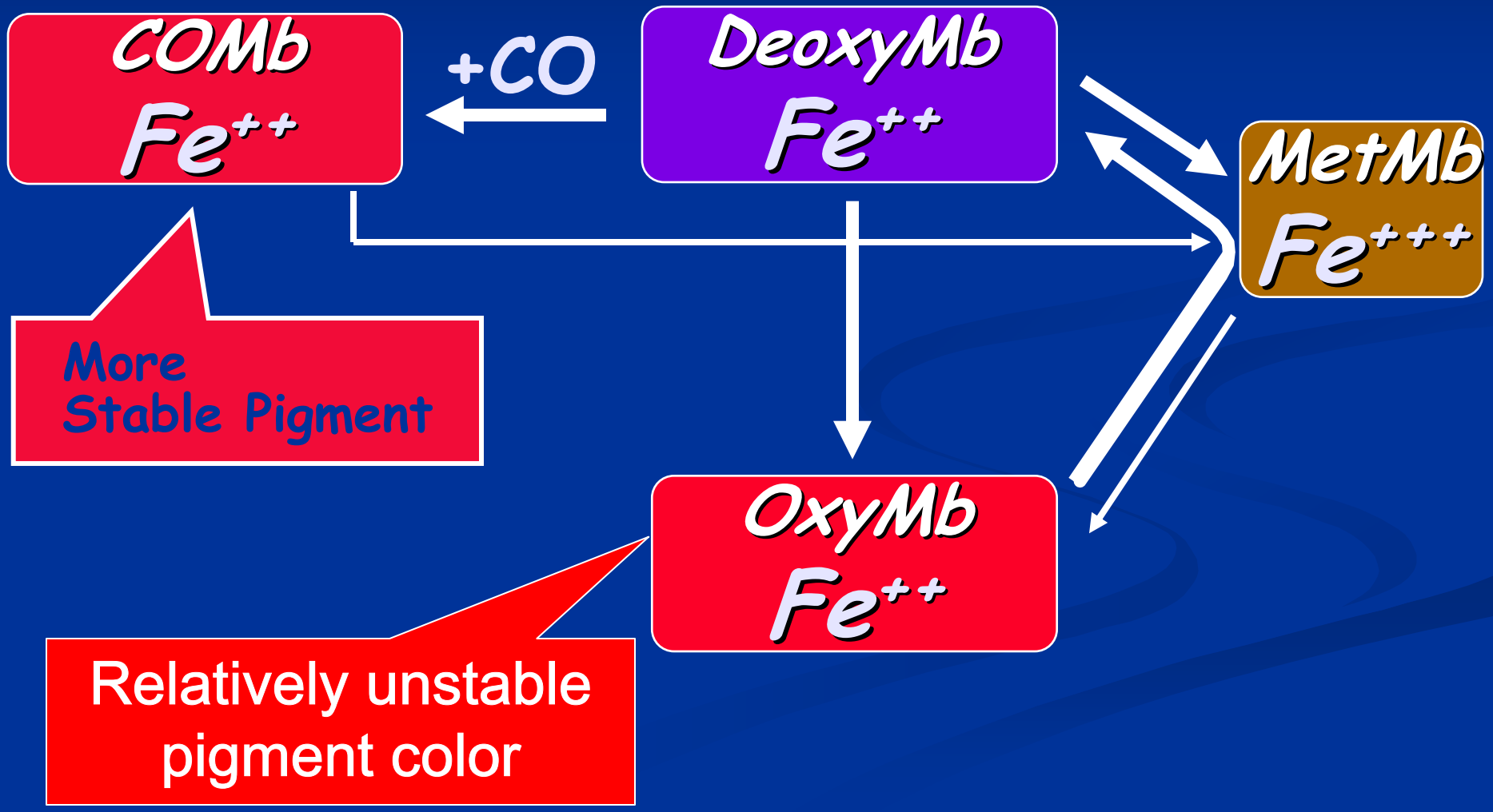
Oxygen Exposure

These changes are independent of microbial growth

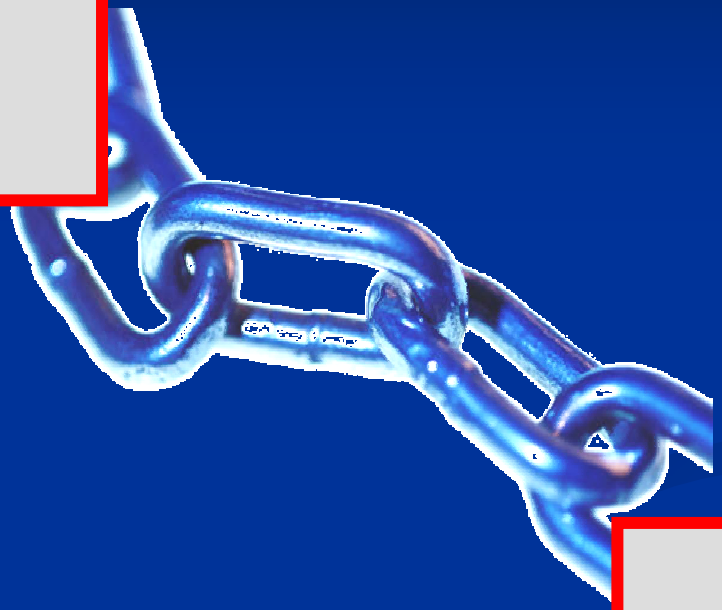
Color Variability Due to Unstable Oxymyoglobin Pigment

These changes are independent of microbial growth

Fresh Meat Color Chemistry



Linking Meat Color



With Packaging

Valued Traits for Meat Packaging

- Fresh Raw Materials
- Sanitation, Sanitation, Sanitation
- Low Microbial Loads
- Normal Meat pH
- Temperature Control
- Minimize Exposure to O2

Control of these factors is critical to case-ready success

Progression of MAP Innovations

- High Oxygen as an industry standard
  - Has worked well for a number of years
  - Some retailers successful in implementation of this format; others find limited shelf life to be a challenge
- The ultimate in low oxygen packaging: Vacuum packaging
  - Consumer acceptance is still an issue

Low Oxygen Innovations

- Carbon monoxide in a low-oxygen environment for fresh meat packaging
  - Used in Norway for almost 20 years
  - Extremely successful means to prevent discoloration and allow for greater distribution flexibility

Low Oxygen-CO Innovations

- **Why not approved until 2002?**
  - Perception that CO was “masking” spoilage
  - Pactiv sought and received the first GRAS affirmation from FDA in 2002
  - Other GRAS determinations followed
  - FDA and USDA position:
    - The low-ox CO process does not mask spoilage
    - Spoilage DOES occur in low-ox CO packages
    - Spoilage manifests itself in form of gas formation and odor formation upon abuse of product

Low Oxygen-CO Innovations

- Consumer Benefits
  - Major benefit is control of oxidation
  - Superior flavor over oxygenated product
  - Removing oxygen prevents pre-mature discoloration.

Consumer Benefit of Low Oxygen -- Protects Meat Flavor!!

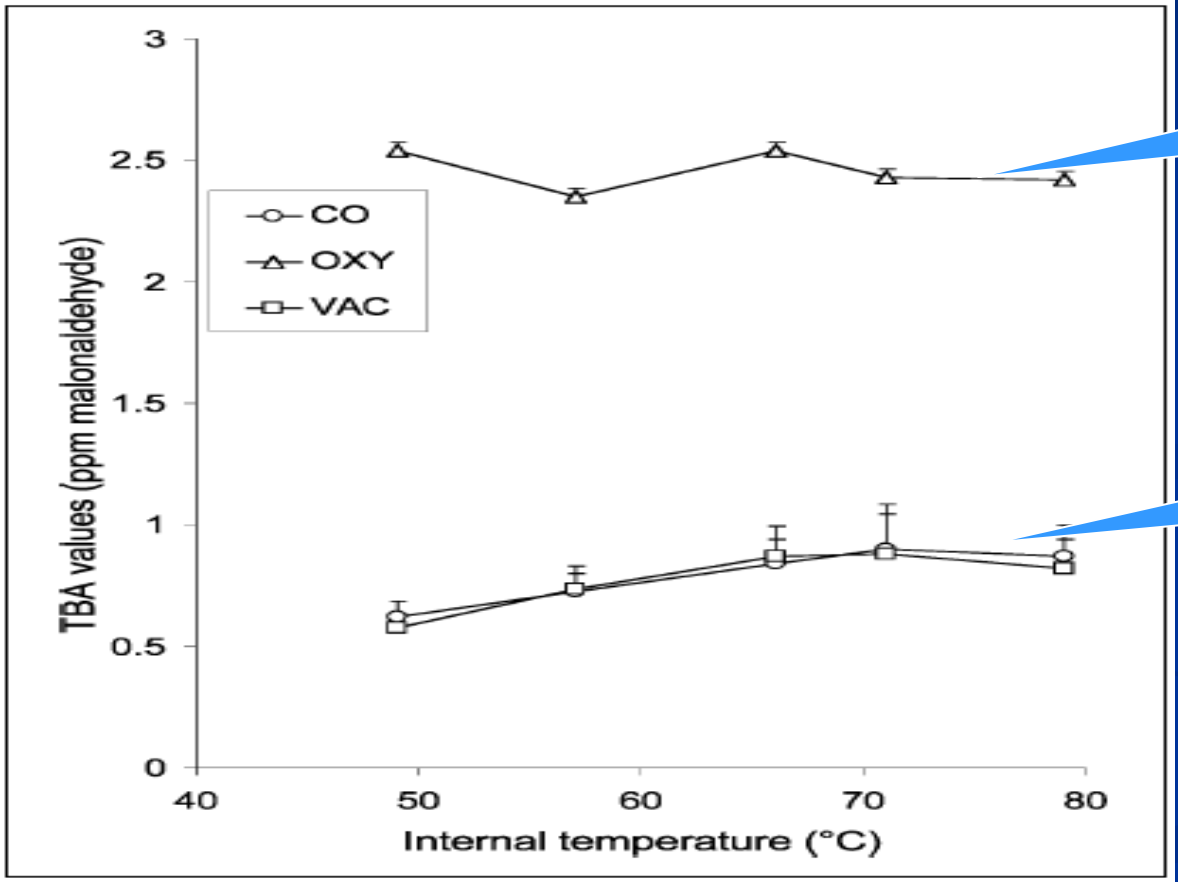


Figure 3—Mean TBA values of cooked ground beef interior as affected by raw meat packaging method and internal cooking temperature. Means (n = 18) were pooled for meat source (chuck, loin, trim), storage time before cooking (7, 14, 21 d), and replication.

Hi Ox

CO and VP

John et al., *J. Food Sci.*, 2004

Consumer Benefit of Low Oxygen -- Protects Meat Flavor!!

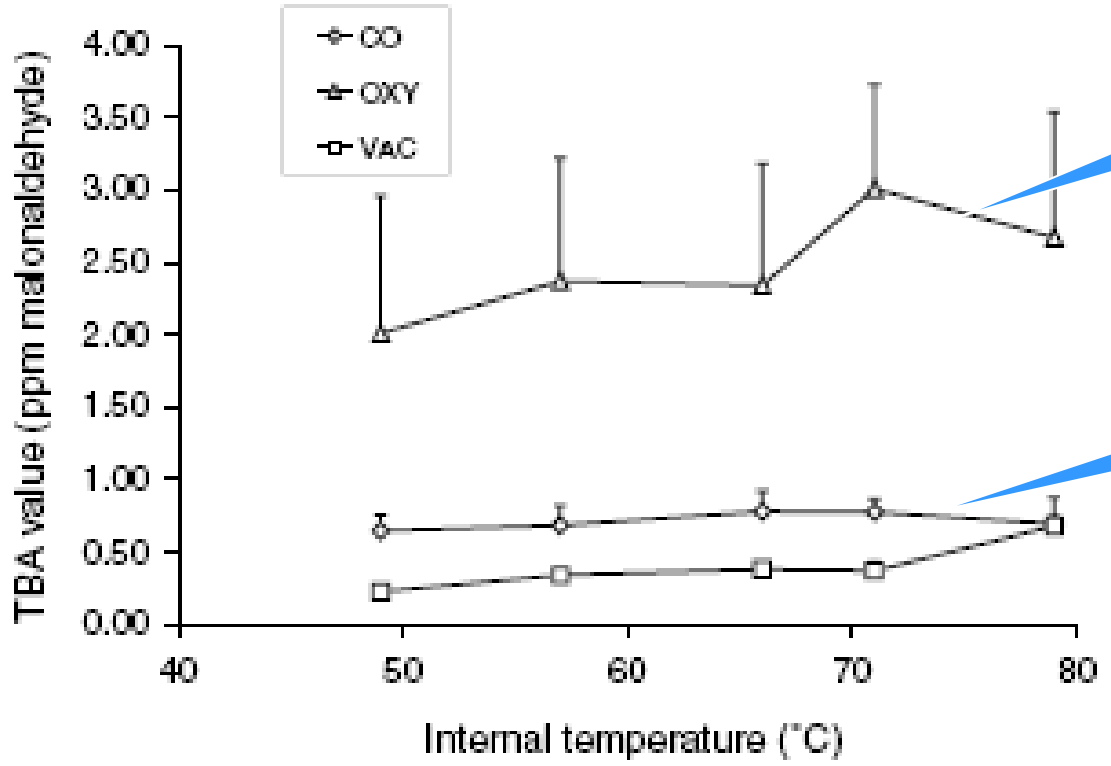


Fig. 3. Mean thiobarbituric acid (TBA) values of cooked top sirloin steaks as affected by raw meat packaging method and internal cooking temperature. Means ($n = 6$) were pooled for storage time before cooking (7, 14, and 21 days), and replication.

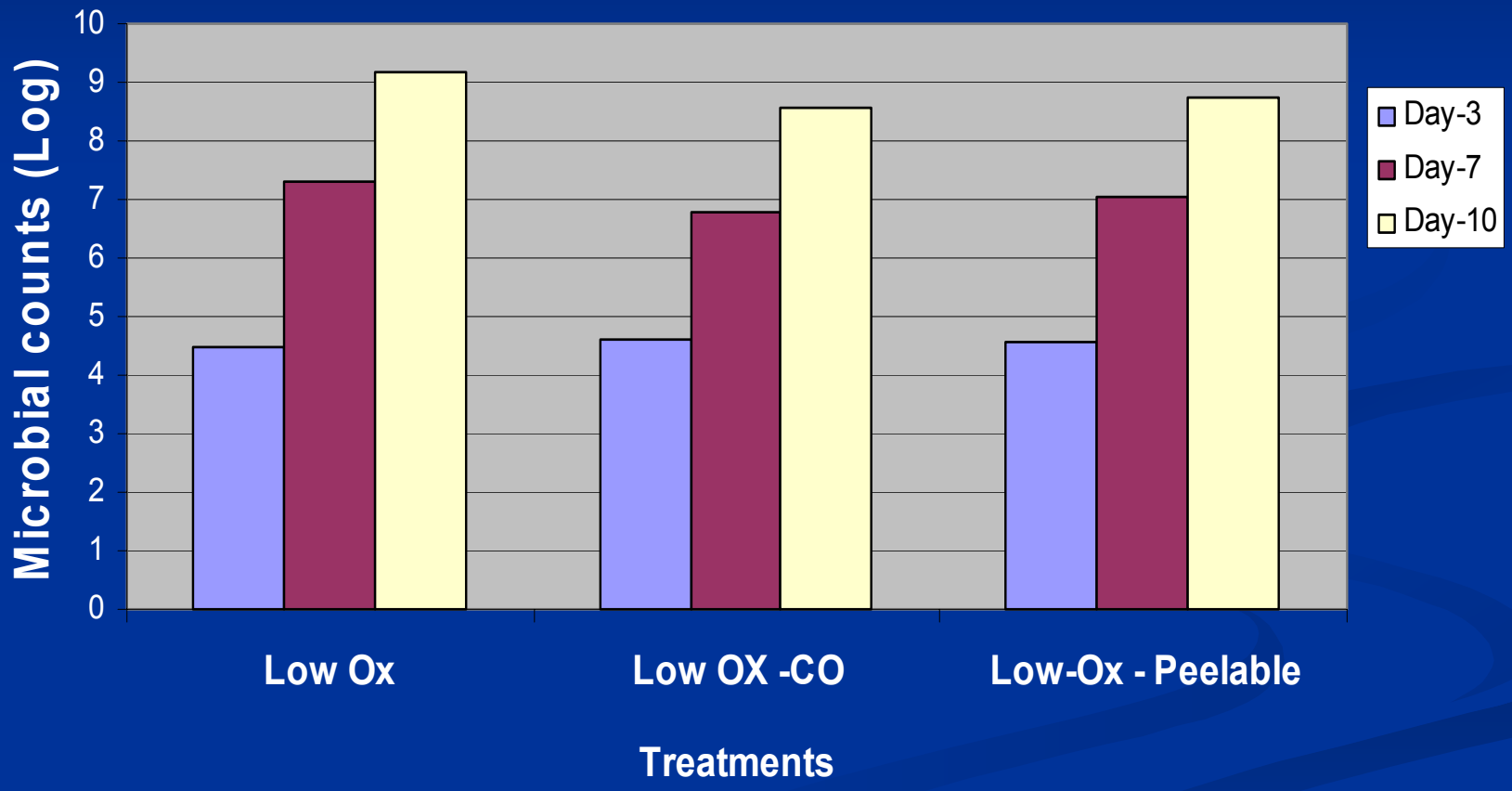
Hi Ox

CO and VP

John et al., *Meat Sci.*, 2005

Low Oxygen – Ground Beef Abuse Study
(From FDA - GRAS notice #143)

Comparison of microbial counts for the treatments



No Difference in Microbial Counts

Low Oxygen- CO Innovations

- CO Technology is a win-win-win case-ready packaging option:
  - **Economics**: enables case-ready growth;
  - **Retail**: Greater display flexibility, increased in-stock position, reduced mark-downs and discards;
  - **Consumer**: Greater freshness by reduced off-flavors, and ultimately reduced waste in system will prevent rising consumer prices.

Key Questions

Does CO:

- "Add" color to meat? NO
- Modify microbial growth? NO
- Mask spoilage? NO
- Form a more stable color? YES
- Promote premature browning? NO
- Create a food safety risk? NO

Source: Dr. Melvin Hunt, Kansas State University

Summary - Take-Home messages

- Case ready growth has been sustained and consistent, yet far from a complete transition.
- Management of meat color requires a balance between science, hygiene and packaging.
- **Low-oxygen CO is an innovative, scientifically sound, and safe case-ready packaging option that deserves fair evaluation.**

Acknowledgements

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Thank you.

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