

Sensory reduction from a sensory perspective: Challenges and considerations

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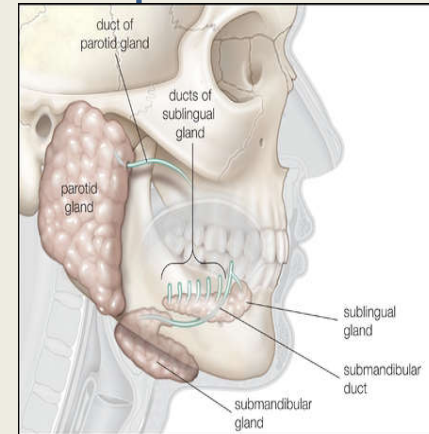
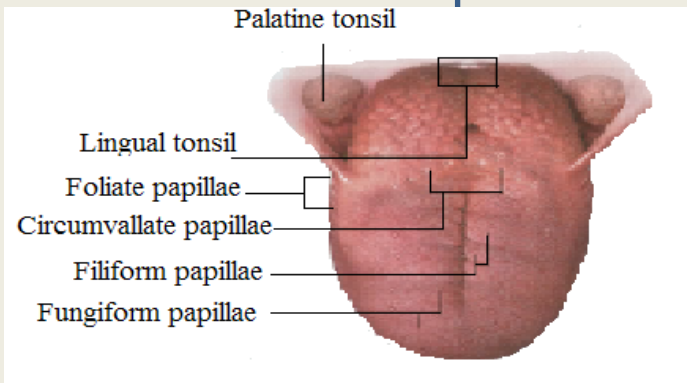
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Salt Taste Perception:

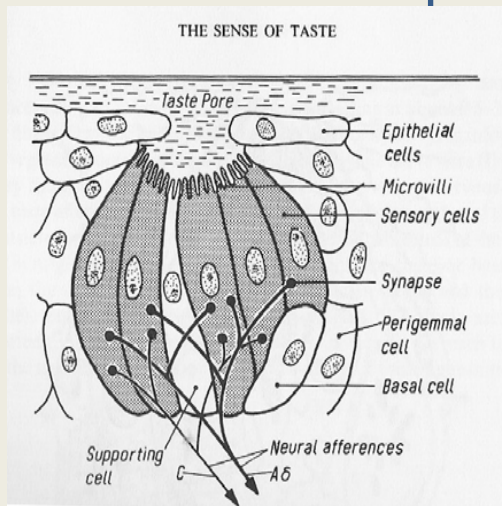
Sodium + Saliva



Receptors

Neural response

Perception



Channels for salt perception

Channel #1

- Sodium specific
- Responds to low Na (10mM)
- Appetitive response

Channel #2

- Not exclusive to sodium
- Activated at high Na (150mM+)
- Aversive response

Aspects of salt taste perception

- Large variations in taste function among humans
 - Genetics
 - Sex hormones
- Optimal saltiness depends on intake

Challenge #1 – Every individual is different

- Given large individual differences, how do you design a food product to ensure that the sodium level is at the right level for consumer acceptability?

The contribution of sodium to food

- Functionality and quality
 - Preservation
 - Moisture control
 - Texture
 - Tastes and flavours

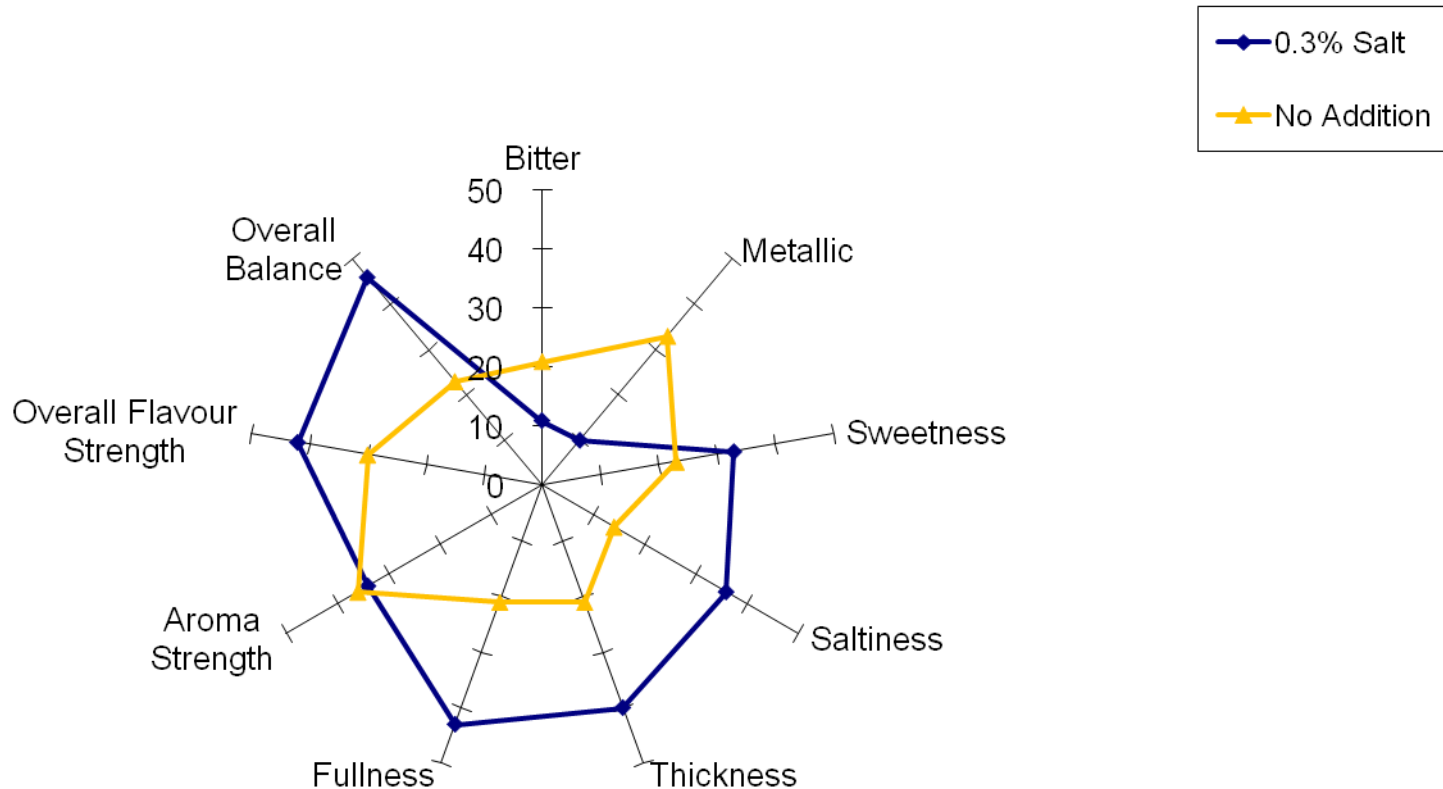
Sodium in water.....

- Mouthfeel
 - Cool
 - Smooth
 - Soft
 - Oily
- Tastes
 - Saltiness
 - Sweetness
- “Rounded” balance
- Off-flavours
 - Metallic
 - Bitter
 - Dishwater

Sodium in foods....

- Cheddar Cheese
 - Increased salt concentrations
 - Increases firmness and decreases springiness
 - Increases sourness and bitterness
 - Affects release of aroma compounds
- Cream cheese
 - Salt has no effect on texture

Split pea soup....



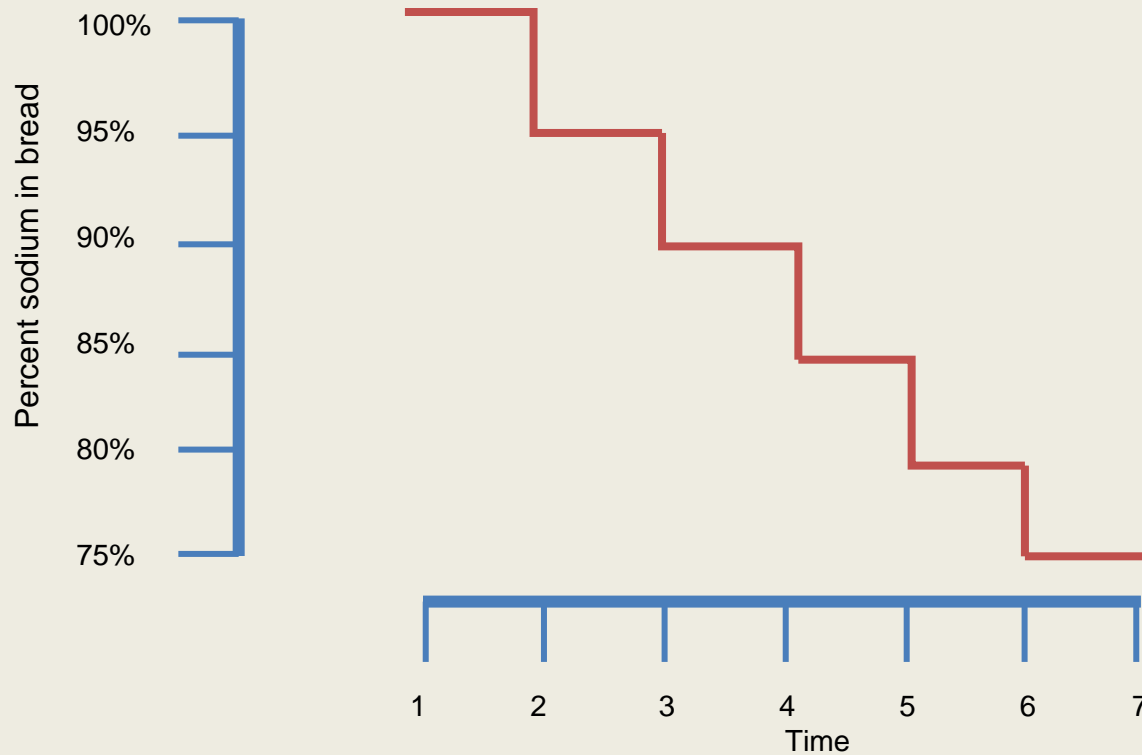
Challenge #2: Sodium contribution differs in all foods

- Sensory changes
 - If you are going to reduce/replace the sodium content of a food be aware of the effects of sodium reduction/replacement on the sensory properties of your food

Sodium reduction strategies

1. Adaptation
2. Other strategies
 - a) Flavour addition
 - b) Enhancers
 - c) Substitution
 - d) Optimizing delivery

Adaptation through gradual reduction



Girgis, Eur J Clin Nutr. 57, 616-620



Challenge #3: Can gradual changes work for all products?

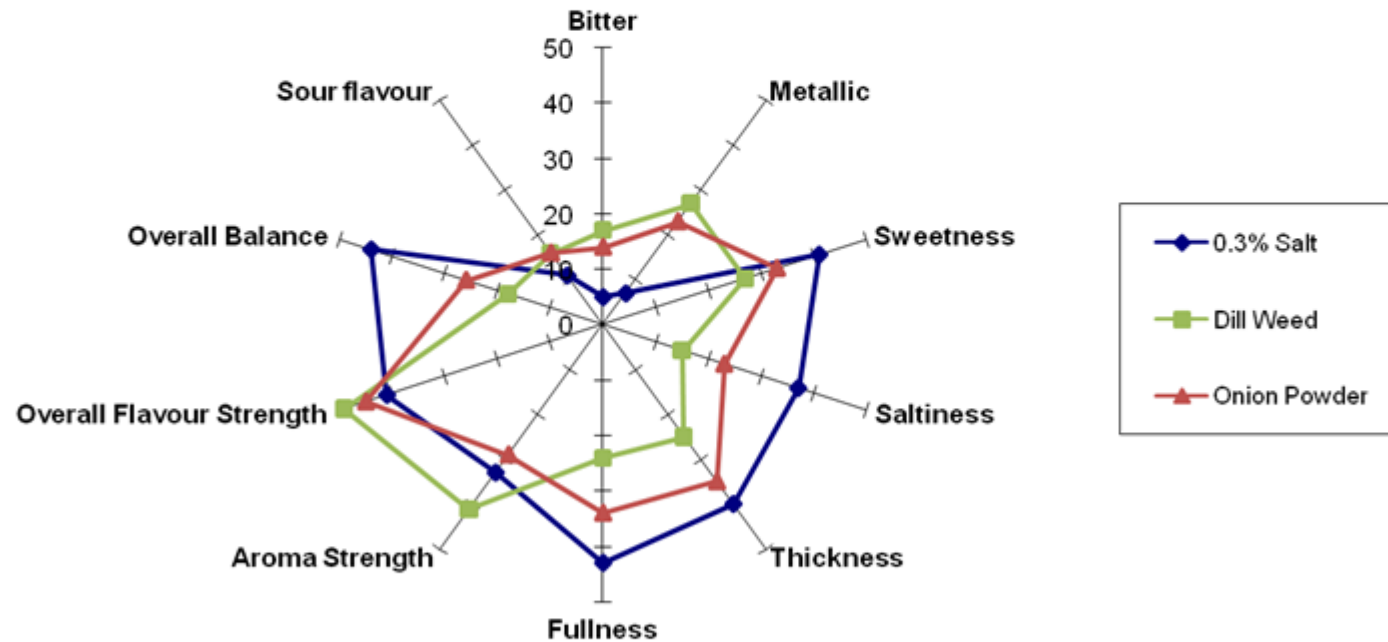
- Gradual changes may not be achievable to the level that is required
 - Processing
 - Microbiology
 - Sensory properties
- Need to find alternative strategies which compliment reduction by stealth

Other strategies: Flavour addition

- Herbs, spices

- Onion, garlic, vinegar, lemon
- An increase in the main components contributing to flavour

Tomato soup: Effect of ingredients



Salt enhancers

- Lactates
- Yeast extracts
- Glutamates
 - MSG, IMP, GMP

Substitutions

Other salts:

- KCl
 - Eg Low-So Salt Replacer – Malabar Super Spice Co.
- Recrystallized mineral salts
 - Eg Solo salt, Eco salt, Lacto salt
- Sea salts
 - Eg Soda-Lo 30 – Main Street Ingredients

Optimizing delivery

– Topical

- Particle size changes
- Crystal shapes

– In foods

- Pulsed delivery
- Emulsions

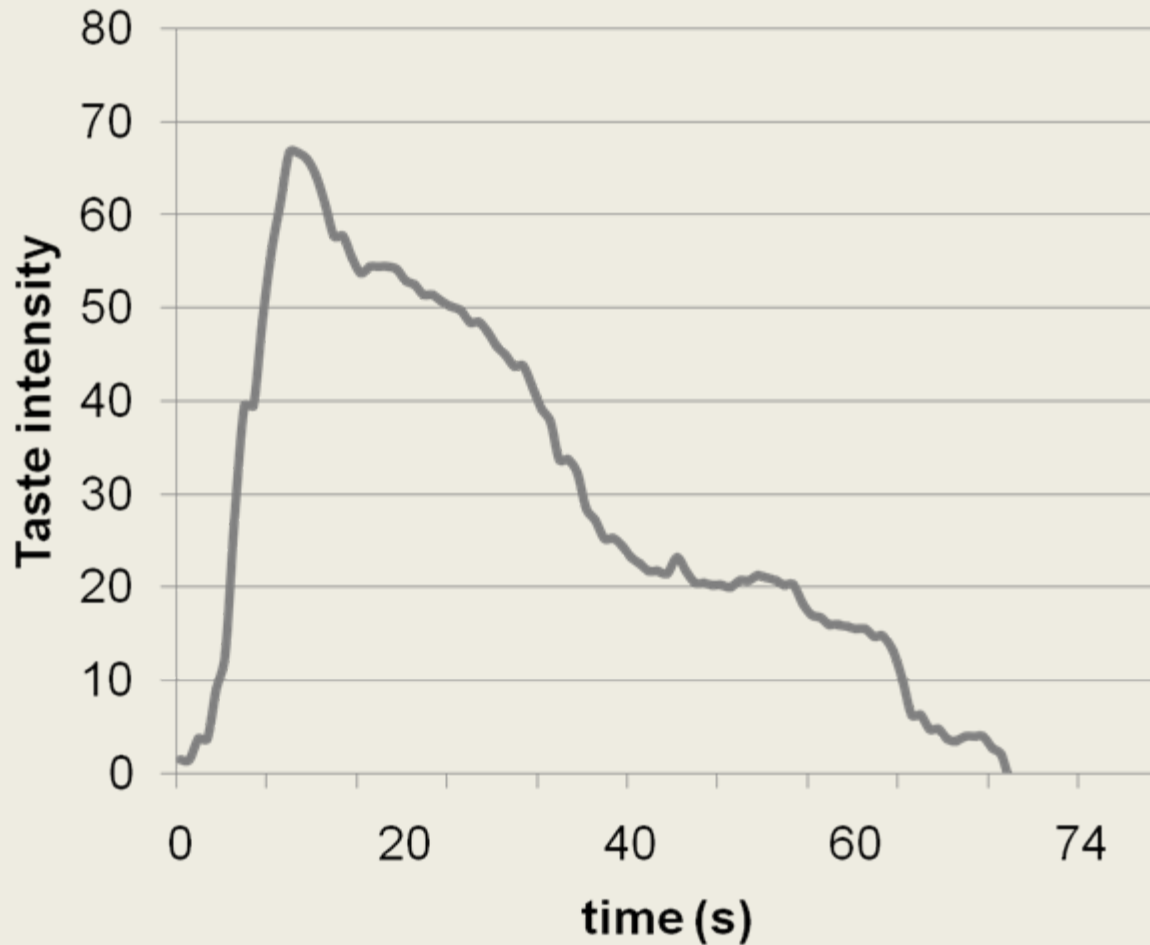
Topical sodium delivery

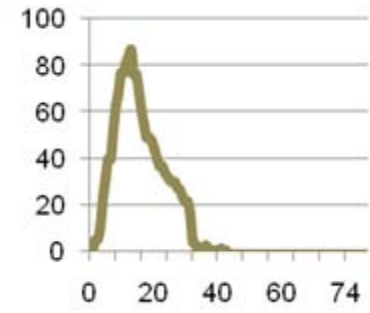
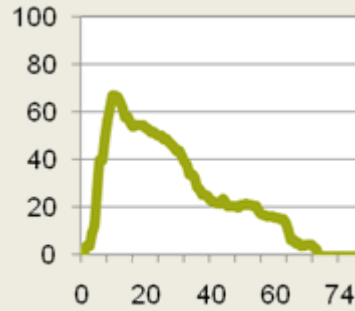
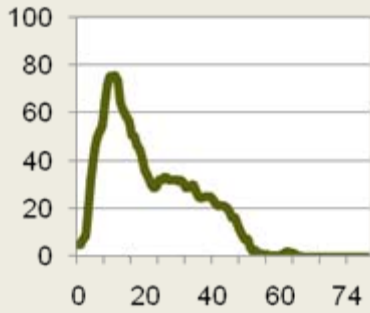
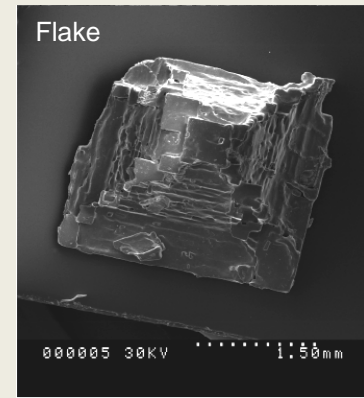
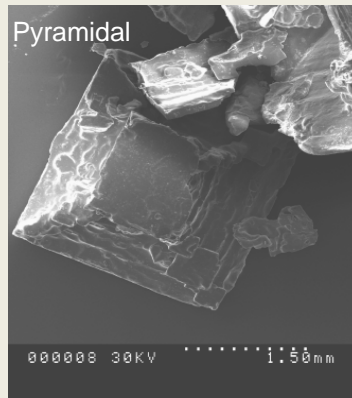
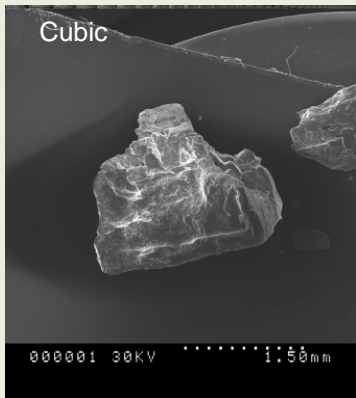
- Particle size and shape

- A small crystal size = faster dissolution
- Faster dissolution = more intense salt taste

- More intense salt taste = less sodium required

Time-intensity sensory evaluation





Sample	Time to Max(s)	Max Intensity	Duration (s)	Area under the curve	Increase Angle	Decrease Angle
Cubic	16	76	59	1743	52.7	27.6
Pyramidal	15	67	71	2201	51.4	31.6
Flake	12	87	42	1370	58.6	48.7

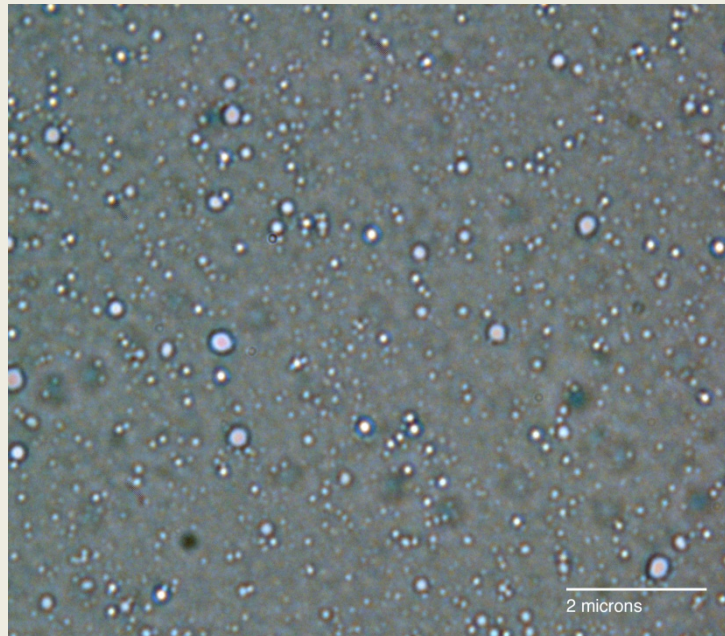
Pulsed delivery systems

- Pulsed delivery systems
 - In a bouillon system salt taste profiles differ based on pulse time
 - short pulses – longer time to maximum saltiness
 - This may affect overall flavour profile of food

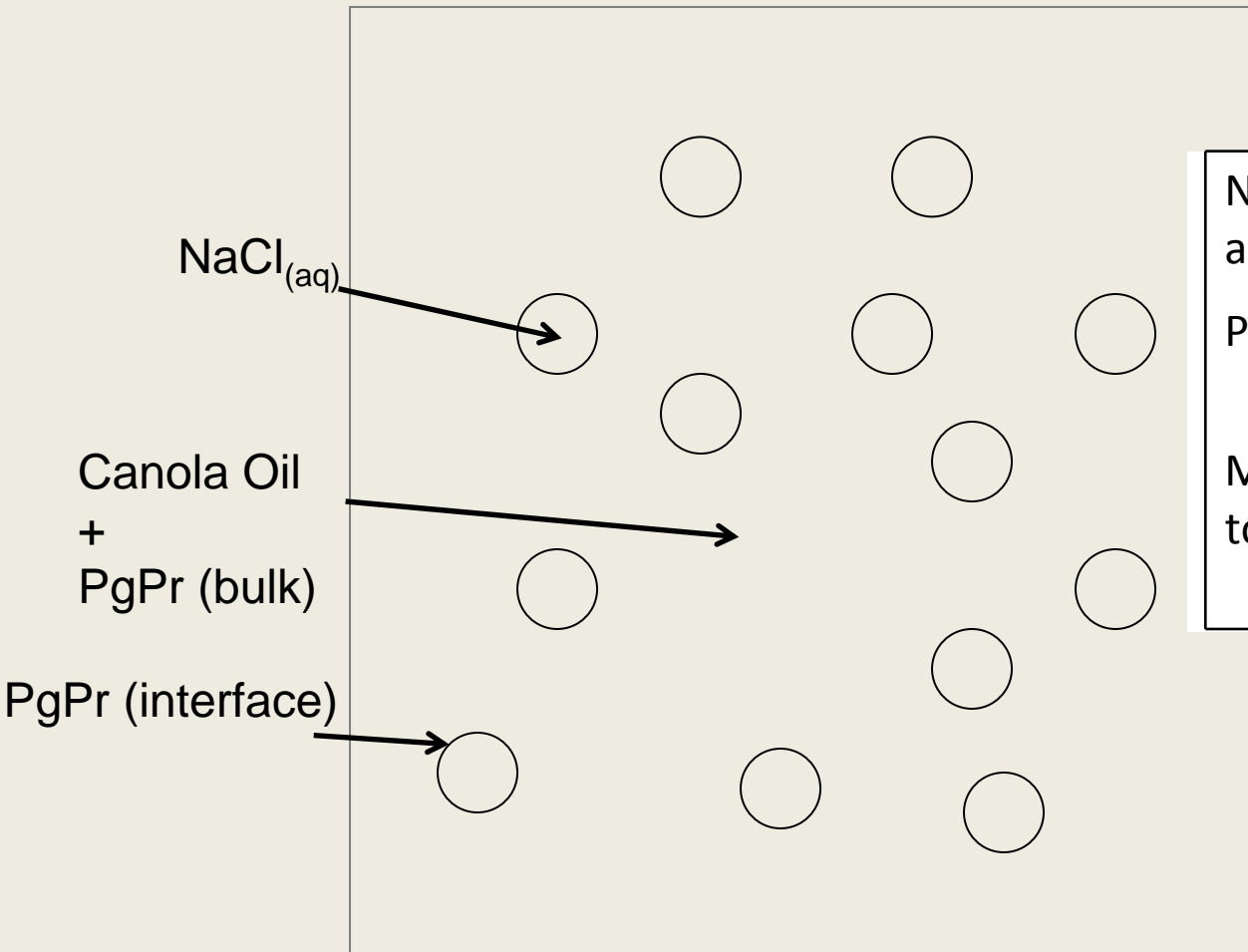
Morris, Chem Percept 2:1-8

Emulsions

- Modify emulsion structure, modify salt delivery
 - o/w emulsion vs w/o emulsion
 - Double emulsions?



Schematic of water-in-oil emulsion



NaCl (wt% aq)	:	0.66	—	1.3
PgPr (wt% oil)	:	0.34	—	7.4
MFAP (wt% total)	:	10	—	48

Salt taste perception:

- Salt taste is dependent on NaCl, MFAP and PGPR
- NaCl content is not as important as other factors
- MFAP is by far the most influential for salt taste

$$R_s = 1.651 + 15.65 MFAP^{***} + 0.0868(NaCl \cdot PgPr)^* - 0.514 PgPr^{**} \quad (R^2=0.57)$$

Summary

- From a sensory perspective:
 - There are many challenges to developing sodium reduced products
 - Reduction must be done on a product by product basis
 - Different strategies will need to be adopted for each product category
 - Can't forget about safety and processability of the food