

The background of the slide is a photograph of a sunset or sunrise. The sun is partially obscured by a large, bright, white cloud in the upper left quadrant. The sky is a gradient of warm colors, from a pale yellow near the horizon to a deep orange at the top. The overall mood is serene and natural.

Competitive Adsorption:

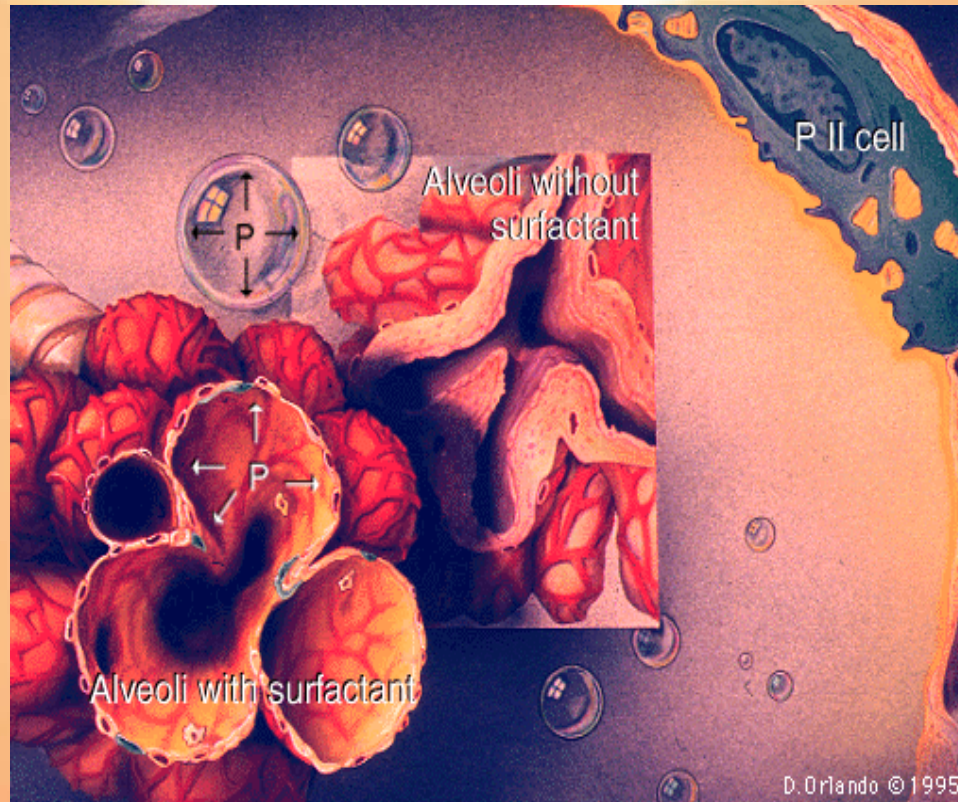
Investigating the Effects of Albumin and Salt on Lung Surfactant

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Lung Surfactant



Lung Surfactant (LS)

- Comprised of mostly lipids and some proteins.
- Keeps lung tissue flexible and permeable.
- Lines the air-water interface of the alveoli.
- Stabilizes alveoli by modulating surface tension.
- Reduces the work of breathing.

Research motivation

Previous research:

Neonatal Respiratory Distress Syndrome (NRDS)

Premature newborns lack functional LS

- Currently treated successfully with animal derived replacement lung surfactant.

Current Research:

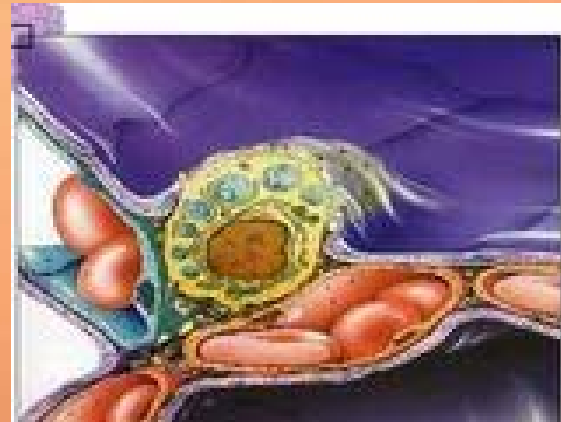
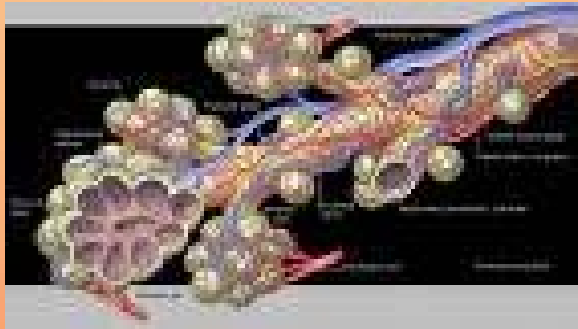
Acute Respiratory Distress Syndrome (ARDS)

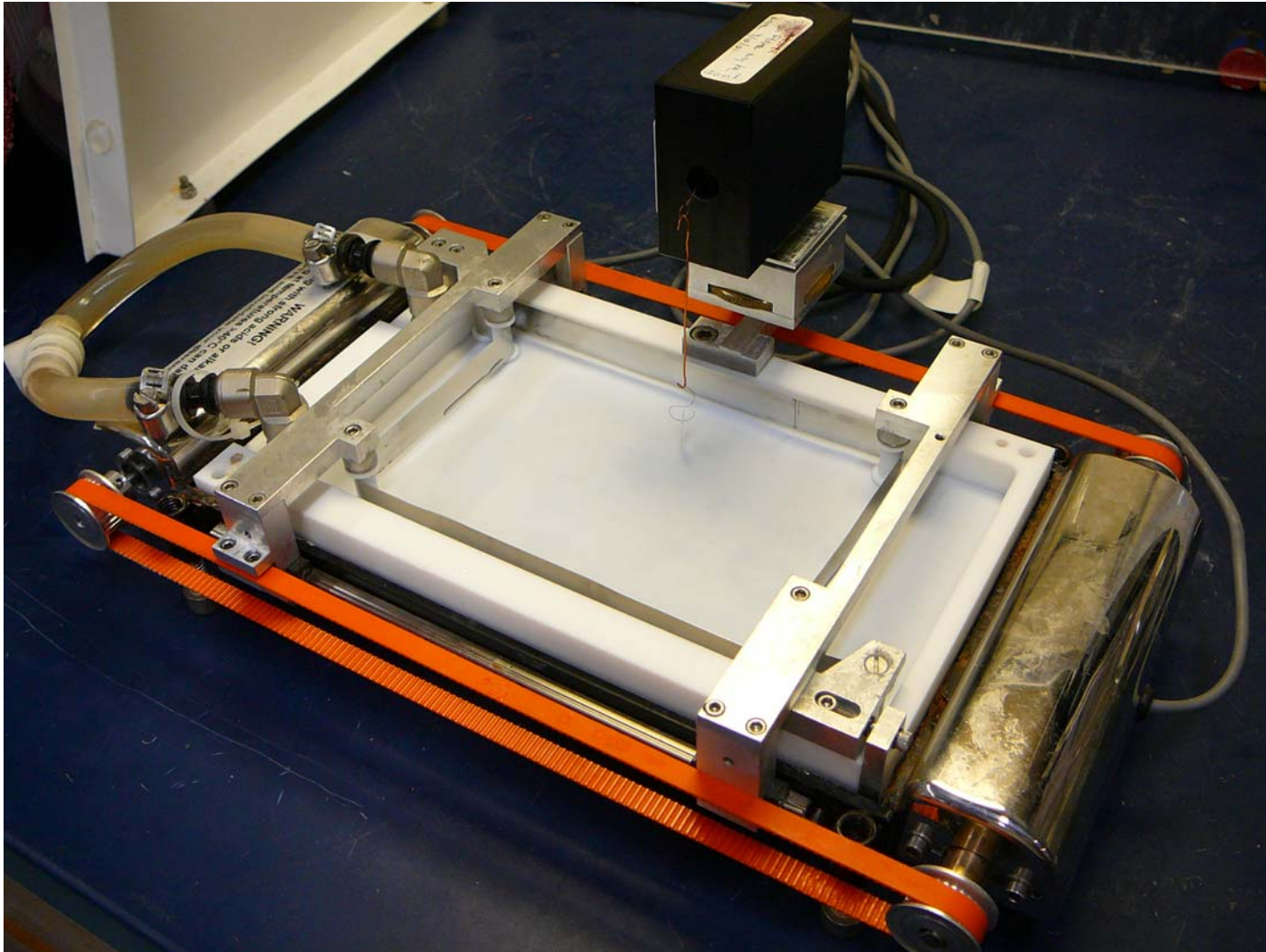
Immune response from blunt trauma, near drowning, and toxic inhalation increases blood proteins, Albumin, in the body fluid of the lungs.

- Albumin presence in the lungs inhibits lung surfactant adsorption.
- Current surfactant therapy is unsuccessful.
- Incidence of ~100,000 cases/yr, with Mortality of ~30%.

Research Goals

Understand the mechanisms of competitive adsorption; how albumin inhibits re-adsorption; test salt as an inhibition-reducing agent.



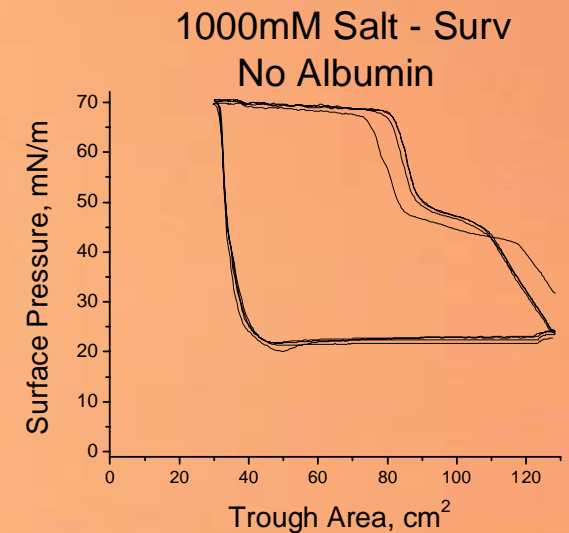
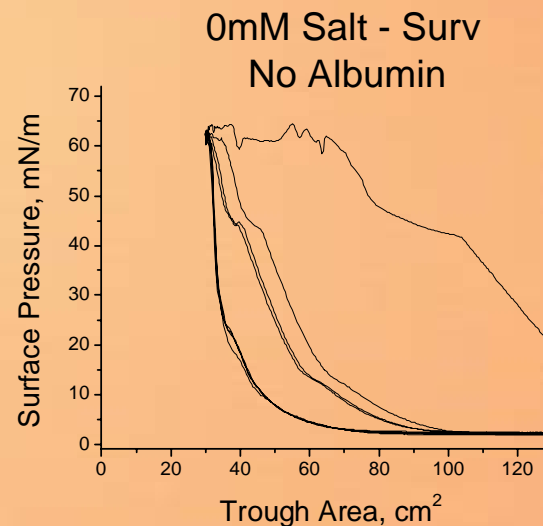
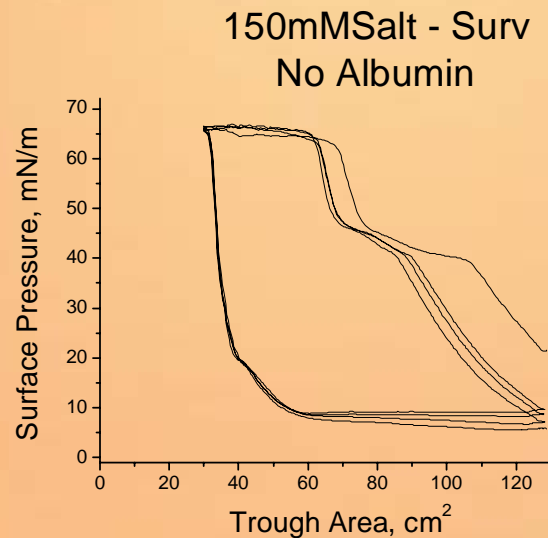


Langmuir Trough

Langmuir Trough

- The sides of the trough slide in and out for compression/expansion cycles. The compression/expansion cycles are made to mimic the exhalation/inhalation action of the lungs, resulting in the movement of substances in and out of the air-water interface.
- Although we typically discuss lung surfactants in terms of surface tension, the Langmuir trough does not measure surface tension. Instead, it measures the reduction in surface tension, also known as surface pressure. Surface pressure is measured and recorded by the sensor flag placed in the air/fluid interface of the trough. Four cycles are recorded.
- Surface pressure results recorded by the Langmuir are the inverse of surface tension. Thus, an increase in surface pressure is a decrease in surface tension.

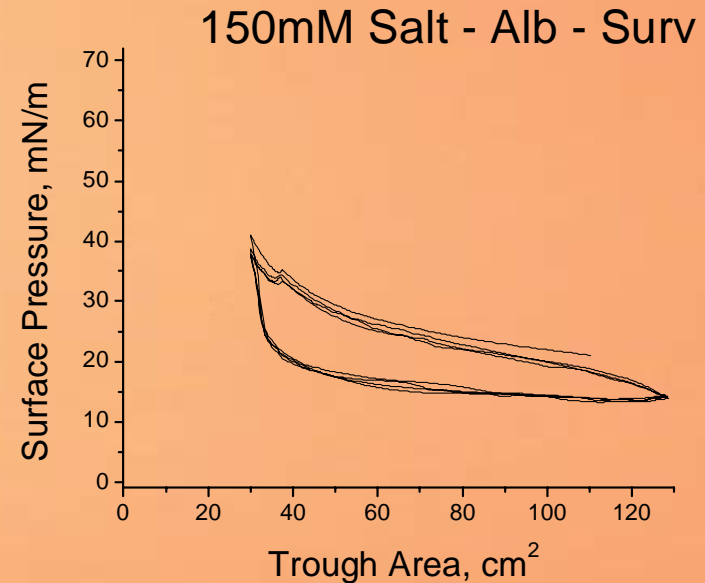
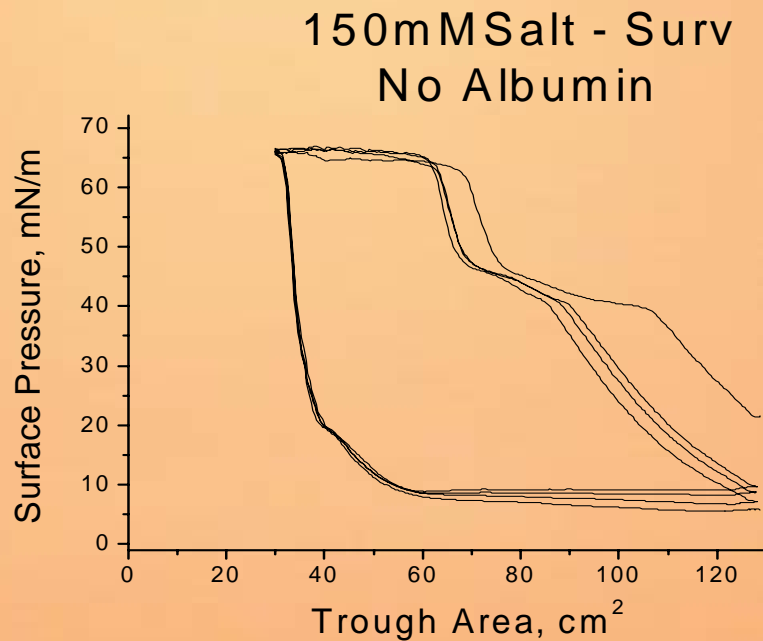
Healthy lungs



The absence of salt in the lungs results in surfactant being unable to re-adsorb into the interface after falling out. Additional salt facilitates faster surfactant re-adsorption at higher surface pressures.

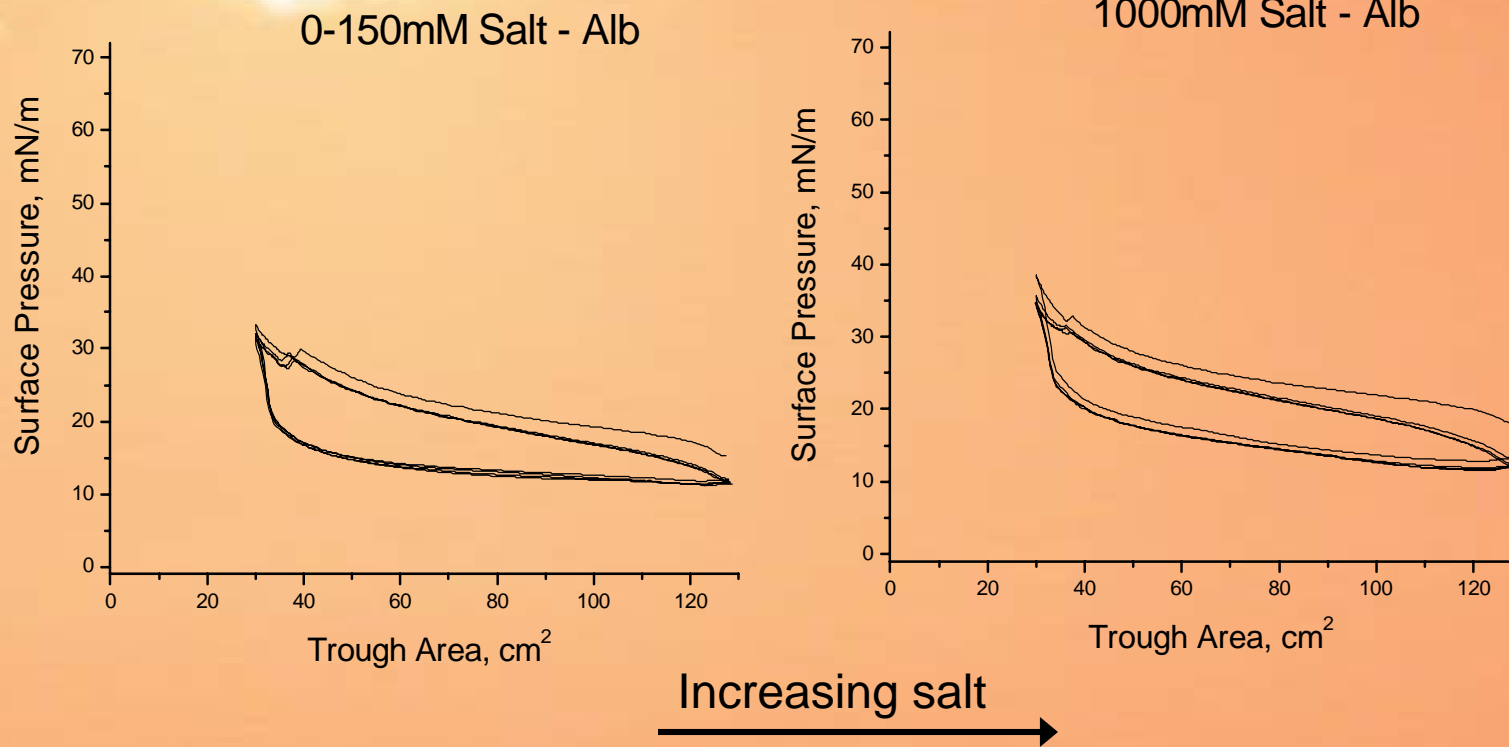
Healthy Lung without Albumin

Inhibited Lung with Albumin



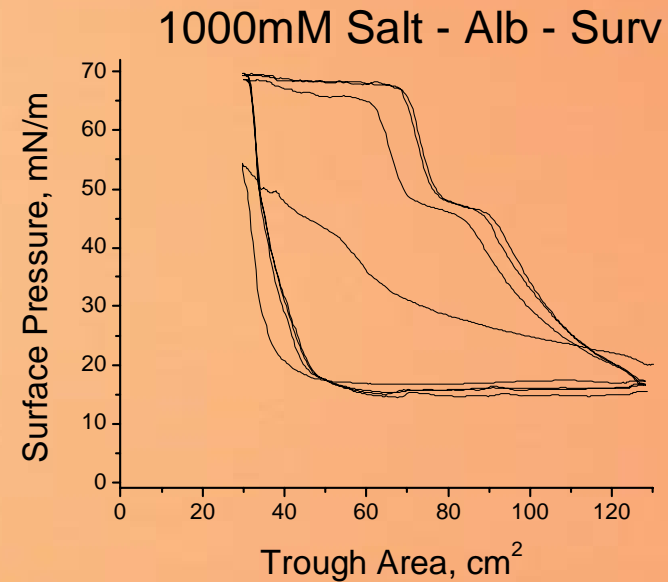
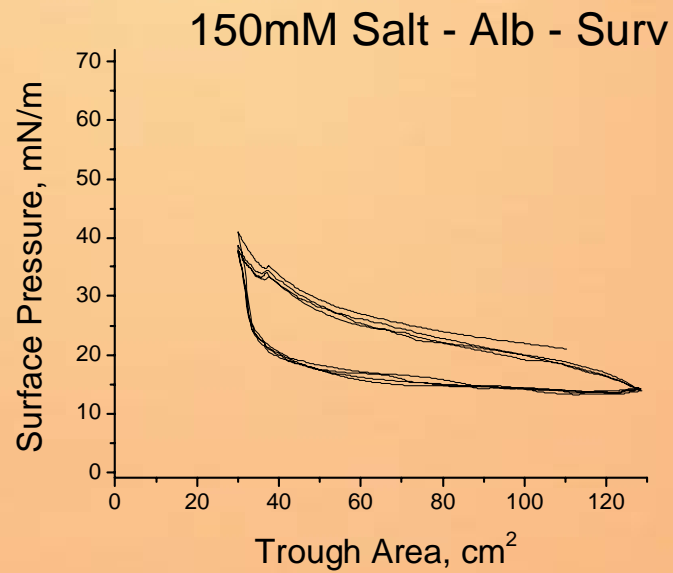
Albumin out-competes surfactant for interface adsorption, inhibiting lung surfactant from adsorbing into the interface.

Effect of Salt on Albumin



Salt has no effect on albumin adsorption into the interface. The absence of albumin on the interface would result in a flat-line graph like that of water.

Inhibition Reversal with Salt



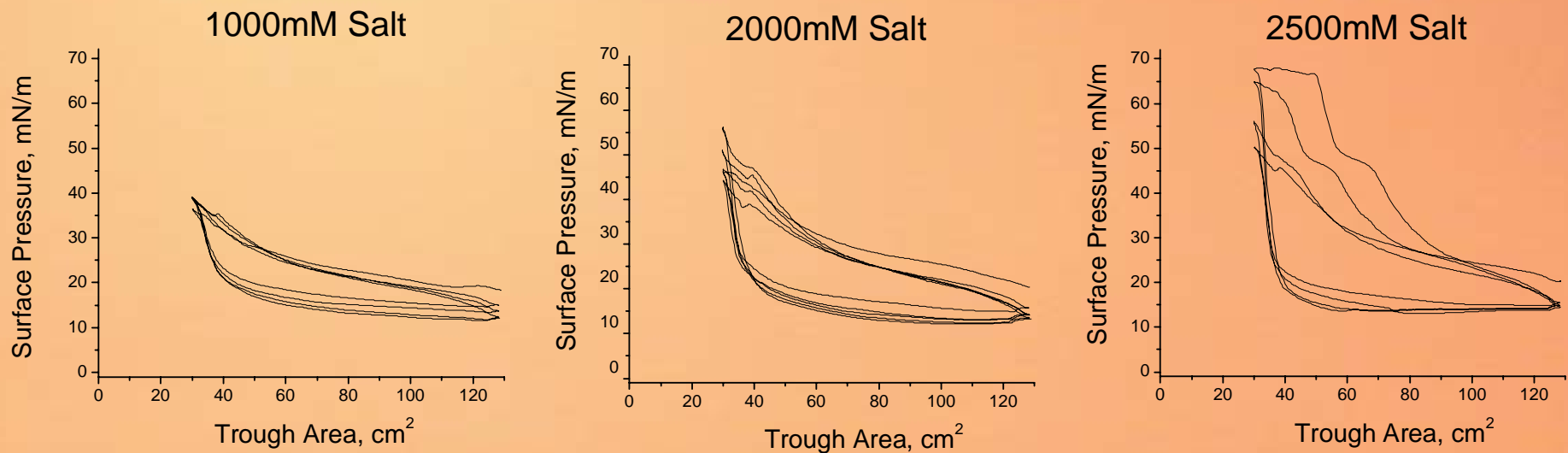
Increasing salt



Salt reverses the inhibition effect of albumin on surfactant adsorption into the interface.

Effect of Salt on Albumin Inhibition

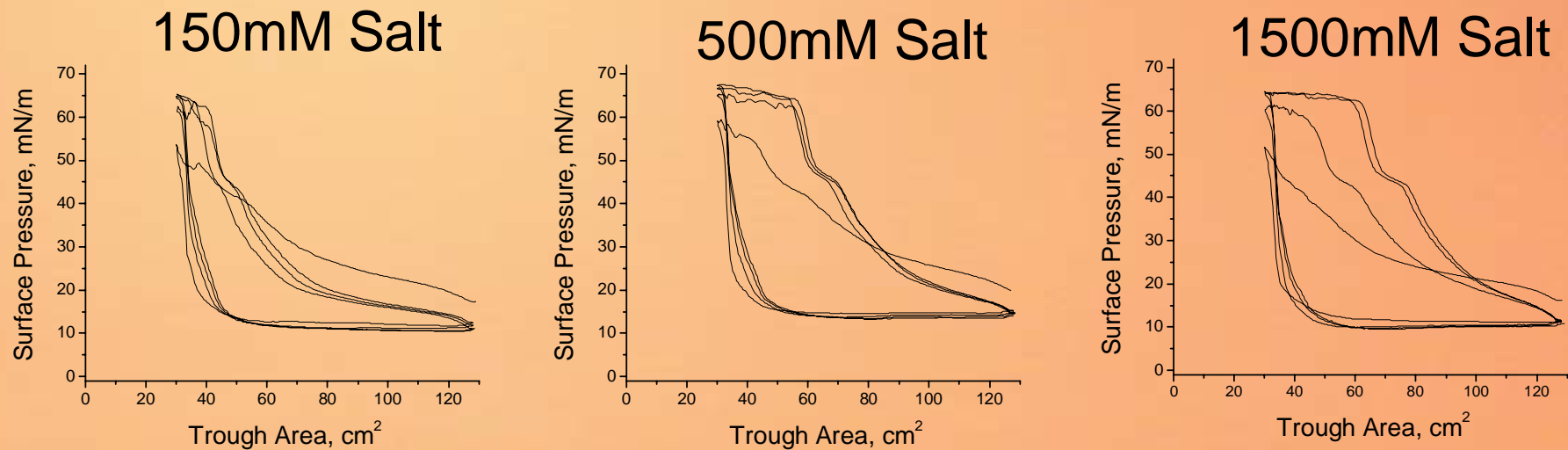
Survanta Series A



Increasing salt →

Increasing the amount of salt reduces albumin's competitive adsorption with lung surfactant

Effect on Salt on Albumin Inhibition Survanta Series B

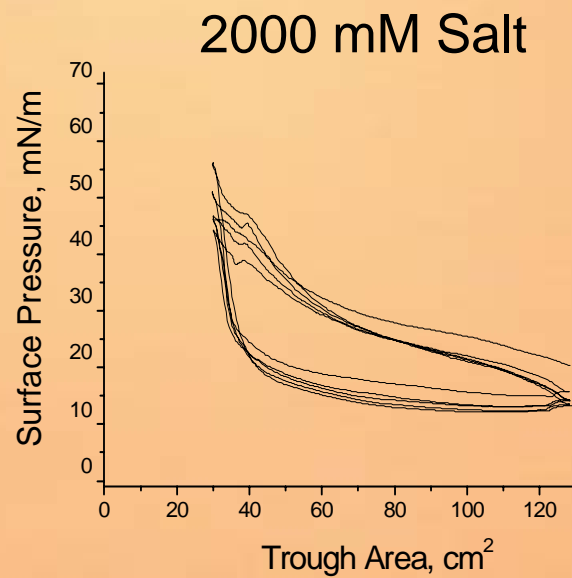


Increased salt

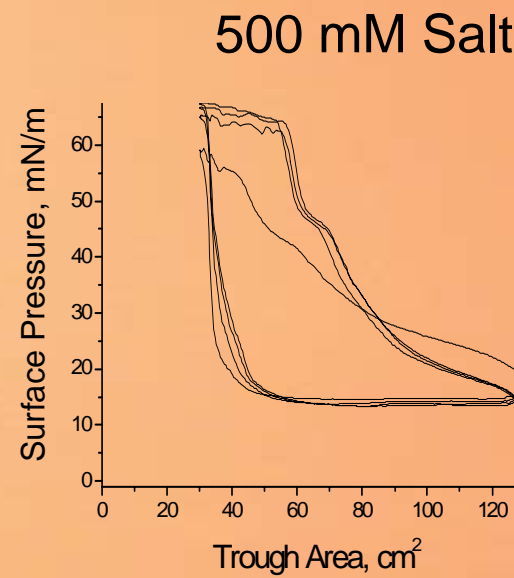


Increasing the amount of salt reduces albumin's competitive adsorption with lung surfactant

Comparing Adsorption Between Survanta Series



Survanta A



Survanta B

Inhibition reversal trends are consistent within each survanta series. However, the degree of reversal varied significantly between series. Causes: supplier samples varied, lack of lab quality control.

Re-adsorption of Surfactant During Expansion Phase



Albumin\Survanta Regions During expansion phase



Conclusions

- Salt reverses albumin inhibition, allowing competitive adsorption of lung surfactant.
- Consistent supply of surfactant is required for accurate tests.
- Quality control must be maintained within the lab.
- The learning curve is steep when learning new science languages. It has been enlightening for me to feel the frustration students feel. This has been a powerful lesson for me as a teacher.
- Last, but most importantly, people make a place feel like home!!!



Acknowledgements

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