Ultrasonic Velocity in Cheddar Cheese as Affected by Temperature

A. Mulet, J. Benedíto, J. Bon, and C. Rossello

ABSTRACT

The ultrasonic velocity in Cheddar cheese is temperature dependent. This relationship can be used to make corrections when determining ultrasonic texture or to determine mean temperatures in cooling/heating processes. At $0 < T < 35^\circ C$ ultrasonic velocity was 1560 to 1696 m/s, at 0 and 35$^\circ C$, respectively. Differential Scanning Calorimetry thermograms linked the temperature dependence of ultrasonic velocity to fat melting. Three parts are distinguished in the curve as a consequence of the fat melting and the appearance of free oil. The most reliable temperature interval to carry out ultrasonic measurements in Cheddar cheese is identified as 0 to 17$^\circ C$.

Key Words: Cheddar cheese, DSC, fat melting, ultrasonic velocity

INTRODUCTION

ULTRASONIC TECHNIQUES HAVE BEEN USED IN MEDICINE (Wells, 1977), metal testing (Papadakis, 1976), and recently in the food industry. Ultrasonics provide a non-destructive, rapid, automated, and low cost technique for quality evaluation (Povey and Mc Clements, 1988).

Ultrasonic techniques have been used in the beef industry to quantitatively determine carcass value and predict inheritable muscling and quality attributes (Miles et al., 1990; Whittaker et al., 1992; Cross and Belk, 1994). Velocity, attenuation, and frequency spectrum composition are the commonly measured acoustical parameters (Povey and Mc Clements, 1988; Povey, 1989, 1998). The frequency spectrum composition has been used to detect hollow hearts in potatoes (Cheng and Haugh, 1994) and intramuscular fat (Whittaker et al., 1992). Ultrasound velocity measurement has been carried out to determine meat quality (Cross and Belk, 1994); to estimate the solid/liquid ratio in fats, oils, and adipose tissues and changes occur. Differential Scanning Calorimetry (DSC) studies showed that dried cheese underwent a phase transition from about -30 to 38$^\circ C$, primarily due to changes in fat crystallinity (Turck, 1994).

Cooling of Cheddar cheese blocks is the primary means of controlling microbial activity to promote homofermentative metabolism (Fryer, 1982). Cooling rate is a very important factor affecting flavor development during aging (Miah et al., 1974; Grazier et al., 1993). A non-invasive method for monitoring internal temperature would be advantageous.

Ultrasonic temperature determinations are performed by measuring ultrasonic velocity through a material at different temperatures and establishing a temperature-velocity relationship (Lynworth, 1992). The study of the temperature-velocity relationship has been used to determine the composition of food products, such as fish (Glaedean et al., 1998).

Our objective was to quantify the relationship between ultrasonic velocity and sample temperature in Cheddar cheese. This relationship was tested by using an unstable heating experiment to determine the accuracy of the procedure.

MATERIALS & METHODS

Raw material

Cheddar cheese (Kerrygold, Irish Dairy Board, Dublin, Ireland) purchased from a local supermarket was used. The cheese was kept refrigerated at 1$^\circ C$ in a sealed plastic bag to avoid water loss, and all tests were performed within 7 d of purchase.

Proximate analysis of cheese

Protein was determined by a Kjeldahl method (Method 991.22. AOAC, 1996), fat by solvent extraction (Method 933.05. AOAC, 1996), ash by overnight heating at 550$^\circ C$ (Method. 935.42. AOAC, 1995), and moisture by oven drying (Method. 24003. AOAC, 1984).
ABSTRACT

noun: A smaller quantity containing the virtue or power of a greater.

Samuel Johnson.
A Dictionary of the English Language. 1755.
“To attract readers and entice them to read an entire paper, authors need to adopt the art of persuasion—convincing a reader of the worth of reading the paper and perhaps subsequently of using and citing it. The first step in this type of persuasion is to select a title for the paper that is inviting and not off-putting. Next comes the abstract, in which the author should speak in part to the value of the study and its importance. In essence, the author tries to encourage readers not to abandon the paper but to read on. The first sentence sets the stage and requires good (effective) writing to draw in the reader (who in some cases will be a peer reviewer). The abstract highlights the problem and discusses why readers should care about it. It also reviews the procedures, major findings, recommendations, and conclusions. The abstract might conclude with a few sentences about the value of the study. A good abstract may be the only opportunity to attract readers. For this reason, it is not an afterthought; time should go into its development and presentation.”

Purpose

Summary?

Application?

Competitive Application?

Grant Proposal?
Location

Journal article

Conference abstract book

Application
FAST TRACK COMMUNICATION

Can apparent superluminal neutrino speeds be explained as a quantum weak measurement?

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Abstract
Probably not.

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If recent measurements [1] suggesting that neutrinos travel faster than light survive scrutiny, the question of their theoretical interpretation will arise. Here we discuss the possibility that the apparent superluminality is a quantum interference effect, that can be interpreted as a weak measurement [2–5]. Although the available numbers strongly indicate that this explanation is not correct, we consider the idea worth exploring and reporting—also because it might suggest interesting experiments, for example on electron neutrinos, about which relatively little is known. Similar suggestions, though not interpreted as a weak measurement [6, 7] or not accompanied by numerical estimates [6, 8], have been proposed independently.

The idea, following analogous theory and experiment [9] involving light in a birefringent optical fibre, is based on the fact that the vacuum is birefringent for neutrinos. We consider the initial choice of neutrino flavour as a preselected polarization state, together with a spatially localized initial wavepacket. Since a given flavour is a superposition of mass eigenstates, which travel at different speeds, the polarization state will change during propagation, evolving into a superposition of flavours. The detection procedure postselects a polarization state, and this distorts the wavepacket and can shift its centre of mass from that expected from the mean of the neutrino velocities corresponding to the different masses. This shift can be large enough to correspond to an apparent superluminal velocity (though not one that violates relativistic...
Research

Identify problem
Gather info
Form hypothesis
Test hypothesis
Analyze data
Form conclusions

= Paper • Presentation

Introduction
Discussion
Methods
Results
Conclusions

ABSTRACT
# Denman

- General background information
- Facts about the topic
- Statement of the problem
- Statement of the purpose

## Methods

- Results
- Discussion

## Conclusion/ importance

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ABSTRACT:

Background

Methods

Results

Conclusions

Introduction

Discussion

Methods

Results

Conclusions
"What does it mean?":
- Importance
- Future directions

Background*

"Why did you start?:
- Where we are at
- What we know and do not know

Purpose

"What did you find?:
- Analysis results
- Findings
- Discussion

Results!

"What did you do?:
- Materials
- Experiments
- Analyses

Methods

Conclusion

ABSTRACT
Virtue or power of greater
Main points
Value of study

"What did you do?:
- Materials
- Experiments
- Analyses

Discussion
Thought Process

How much background information do you need to convey?
- Some topics may take more time to set the stage.
- If much background is needed, consider starting with purpose, then move to background.
- Best practice: keep as short as possible.

How much do readers need to know about your methods?
Are methods a focus of your work, e.g., unique/new methodology?

How much detail should the results include?
Is an overview sufficient? Is there a significant result that should be highlighted?
Are the results groundbreaking?

How should the conclusion be framed?
Sometimes you do not have a conclusion; further work is needed. Maybe importance is better perspective.
An abstract is not a suspense novel.
Not an order but a thought picture:

The reader should understand why you did this research.

→ What is the setting of this research?
→ What can a reader take away from this research?

You took on a challenge (e.g., question, hypothesis, need) and found out something in your research. This is the foundation of your work.
Abstracts: Possible route:

Capture attention. First sentence
Show relevance. Purpose Background
Provide context. Methods Objectives
Convey information. Results
Complete the story. Conclusion/importance
“By the year 2050, the world’s population is expected to reach 9 billion people.”

“Livestock production is an important contributor to sustainable food security for many nations, particularly in low-income areas and marginal habitats that are unsuitable for crop production.”

Follow instructions

Review similar

Use formal writing

Avoid citations

Avoid new information

Word or character limit?
Third person only?
No acronyms?
Order?

Call for abstracts
Subject area

Complete sentences
Proper grammar
Proper punctuation
Abstracts are difficult to write and take time.
Brevity is key.
Abnormal activity in the medial prefrontal cortex (mPFC) is consistently observed in neuropsychiatric disorders, but the mechanisms involved remain unclear. Chronic aberrant excitation and/or inhibition of mPFC neurons were proposed to cause cognitive impairments. However, direct evidence for this hypothesis is lacking because it is technically challenging to control synaptic properties in a chronic and locally restricted, yet specific, manner. Here, we generated conditional knockout (cKO) mice of neuroligin-2 (Nlgn2), a postsynaptic cell-adhesion molecule of inhibitory synapses linked to neuropsychiatric disorders. cKO of Nlgn2 in adult mPFC rendered Nlgn2 protein undetectable after already 2–3 weeks, but induced major reductions in synaptic inhibition after only 6–7 weeks, and caused parallel impairments in anxiety, fear memory and social interaction behaviors. Moreover, cKO of Nlgn2 severely impaired behavioral stimulation of immediate-early gene expression in the mPFC, suggesting that chronic reduction in synaptic inhibition uncoupled the mPFC from experience-dependent inputs. Our results indicate that Nlgn2 is required for continuous maintenance of inhibitory synapses in the adult mPFC, and that chronic impairment of local inhibition disengages the mPFC from its cognitive functions by partially uncoupling the mPFC from experience-induced inputs.

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Influence of dietary electrolyte balance on feed preference and growth performance of postweaned piglets

A total of 672 male and female piglets (21 d postweaning; approximately 13 kg BW) were selected to be used in 3 different experiments to assess the influence of dietary electrolyte balance (dEB; Na + K – Cl, in mEq/kg of diet) on feed preference and growth performance. In Exp. 1, piglets were fed 4 isoenergetic diets differing in dEB level: 16, 133, 152, and 269 mEq/kg diets. Changes on dEB were obtained by changing the levels of sodium and chloride with calcium chloride, calcium carbonate, and sodium bicarbonate. Piglets fed the 16 and 133 mEq/kg diets achieved a greater ADG (P < 0.04), BW (P < 0.04), and apparent total-tract digestibility of CP and Zn (P < 0.05) than did piglets fed the 269 mEq/kg diet. The 16 mEq/kg level also reduced blood total CO2 (P < 0.01), bicarbonate (P < 0.01), and base excess (P < 0.02) concentrations compared with the rest of the dietary treatments. Three diets differing in dEB were designed for Exp. 2 and 3: –16, 151, and 388 mEq/kg diets. In Exp. 2, greater ADFI (P = 0.03), BW (P = 0.02), ADG (P < 0.001), and G:F (P < 0.01) were observed for piglets fed the –16 mEq/kg diet than those fed the 388 mEq/kg diet. Subsequently, their short-term preference for these diets was assessed by using a 2-d choice-test protocol (30 min). Piglets preferred (P < 0.001) the 388 mEq/kg diet to the –16 mEq/kg diet, independently of the dietary treatment they received before. Pigs also preferred (P < 0.001) the 151 mEq/kg diet when compared with the –16 mEq/kg diet. Experiment 3 assessed the long-term preference and short-term consumption of the –16 and 388 mEq/kg diets. Similar to Exp. 2, animals showed a greater (P < 0.001) intake of the 388 mEq/kg diet than they did of the –16 mEq/kg diet during both the preference (14 d) and 1-feeder (2 h) tests conducted. Results show that low rather than high dEB levels optimize growth performance of piglets. When they have the opportunity to choose, piglets are unable to select the diet that optimizes their performance, either in short- or in long-term preference tests, showing also a greater short-term consumption of high instead of low dEB levels.

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Humans imitate each other during social interaction. This imitative behavior streamlines social interaction and aids in learning to replicate actions. However, the effect of imitation on action comprehension is unclear. This study investigated whether vocal imitation of an unfamiliar accent improved spoken-language comprehension. Following a pretraining accent comprehension test, participants were assigned to one of six groups. The baseline group received no training, but participants in the other five groups listened to accented sentences, listened to and repeated accented sentences in their own accent, listened to and transcribed accented sentences, listened to and imitated accented sentences, or listened to and imitated accented sentences without being able to hear their own vocalizations. Posttraining measures showed that accent comprehension was most improved for participants who imitated the speaker’s accent. These results show that imitation may aid in streamlining interaction by improving spoken-language comprehension under adverse listening conditions.
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Direct liquid injection chemical vapor deposition of platinum doped cerium oxide thin films

Thin films of Pt-doped CeO$_2$ were grown by direct liquid injection chemical vapor deposition on silicon wafer covered by native oxide at 400 °C using Ce(IV) alkoxide and organoplatinum(IV) as precursors. X-ray photoelectron spectra evidenced that the platinum oxidation state is linked to the deposition way. For platinum deposited on top of cerium oxide thin films previously grown, metallic platinum particles were obtained. Cerium and platinum codeposition allowed obtaining a Pt$^0$ and Pt$^{2+}$ mixture with the Pt$^{2+}$ to Pt ratio strongly dependent on the platinum flow rate during the deposition. Indeed, the lower the platinum precursor flow rate is, the higher the Pt$^{2+}$ to Pt ratio is. Moreover, surface and cross-sectional morphologies obtained by scanning electron microscopy evidenced porous layers in any case.
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Effects of beet pulp supplementation on growth performance, fecal moisture, serum hormones and litter performance in lactating sows

This study was conducted to evaluate effects of beet pulp supplementation on growth performance, fecal moisture, serum hormones and litter performance in lactating sows. Ninety primiparous sows (Landrace × Yorkshire) were randomly allotted to one of three dietary treatments in a 21-day trial starting 3 days before parturition. The three dietary treatments were supplemented with 0, 10 and 20% beet pulp, respectively. Backfat loss and fecal moisture content were increased ($P < 0.05$), where cortisol and norepinephrine levels were decreased ($P < 0.05$) in sows fed beet pulp supplementation diets compared with control diet, but there was no difference between 10% and 20% beet pulp supplementation treatments. No effect was observed on bodyweight, average daily intake, weaning to estrus interval, epinephrine level in sows and litter weight, litter size, survivability in piglets among dietary treatments. Taken together, beet pulp supplementation has no significant effect of growth performance of lactating sows and piglets with decreased cortisol and norepinephrine levels in lactating sows, but it can increase fecal moisture content which is beneficial for sow feces excretion.

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Beyond Strong and Weak: Rethinking Postdictatorship Civil Societies

What is the impact of dictatorships on postdictatorial civil societies? Bottom-up theories suggest that totalitarian dictatorships destroy civil society while authoritarian ones allow for its development. Top-down theories of civil society suggest that totalitarianism can create civil societies while authoritarianism is unlikely to. This article argues that both these perspectives suffer from a one-dimensional understanding of civil society that conflates strength and autonomy. Accordingly we distinguish these two dimensions and argue that totalitarian dictatorships tend to create organizationally strong but heteronomous civil societies, while authoritarian ones tend to create relatively autonomous but organizationally weak civil societies. We then test this conceptualization by closely examining the historical connection between dictatorship and civil society development in Italy (a posttotalitarian case) and Spain (a postauthoritarian one). Our article concludes by reflecting on the implications of our argument for democratic theory, civil society theory, and theories of regime variation.
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Orbit portraits were introduced by Goldberg and Milnor as a combinatorial tool to describe the patterns of all periodic dynamical rays landing on a periodic cycle of a quadratic polynomial. This encodes information about the dynamics and the parameter spaces of these maps. We carry out a similar analysis for unicritical antiholomorphic polynomials, and give an explicit description of the orbit portraits that can occur for such maps in terms of their characteristic angles, which turns out to be rather restricted when compared with the holomorphic case. Finally, we prove a realization theorem for these combinatorial objects. The results obtained in this paper serve as a combinatorial foundation for a detailed understanding of the combinatorics and topology of the parameter spaces of unicritical antiholomorphic polynomials and their connectedness loci, known as the multicorns.
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This essay considers a remarkable group of fifteenth-century Italian portraits that were based on masks cast directly from the sitter's face, either during life or shortly after death. All of them explicate their origins in a cast. Rather than arguing that some fifteenth-century artists were simply not skilled enough to overcome the traces of death, I submit that the traces of these masks served a kind of faithfulness to documentation and replication. These portraits are informed by a highly motivated kind of realism, formulated in response to doubts about the veracity of naturalistic pictures around the middle of the fifteenth century. They are better understood, I argue, in terms of imprint or reproduction rather than in terms of invention or enlivenment.
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Spitting cobras, which defend themselves by streaming venom towards the face and/or eyes of a predator, must be highly accurate because the venom they spit is only an effective deterrent if it lands on the predator's cornea. Several factors make this level of accuracy difficult to achieve; the target is moving, is frequently >1 m away from the snake and the venom stream is released in approximately 50 ms. In the present study we show that spitting cobras can accurately track the movements of a potentially threatening vertebrate, and by anticipating its subsequent (short-term) movements direct their venom to maximize the likelihood of striking the target's eye. Unlike other animals that project material, in spitting cobras the discharge orifice (the fang) is relatively fixed so directing the venom stream requires rapid movements of the entire head. The cobra's ability to track and anticipate the target's movement, and to perform rapid cephalic oscillations that coordinate with the target's movements suggest a level of neural processing that has not been attributed to snakes, or other reptiles, previously.
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Mortality rates for advanced cancers have not drastically improved in almost 40 years and are a major cause for concern. Current chemotherapeutic approaches involve application of the free drug, causing toxicity to a majority of the rapidly dividing healthy cells in our body leading to disastrous side effects. Furthermore, it has been found that most tumors become resistant to chemotherapy by upregulating drug-efflux pumps such as P-gp and represent an even greater obstacle to effective cancer treatment. The use of lipid-based nanoparticles such as liposomes represents an efficient approach for the delivery of potent anti-cancer drugs as it imparts favorable pharmacokinetic and pharmacodynamic properties. It has been shown that many malignant tumors are characterized by ‘leaky’ vasculature and that nanoparticles are able to extravasate through these gaps to reach the tumor space by the enhanced permeability and retention effect.

With this in mind, we have developed a liposomal platform for the co-delivery of tariquidar (XR) a 3rd generation P-gp inhibitor and a chemotherapeutic drug paclitaxel (PCT). In vitro cytotoxicity experiments showed that the drug co-loaded formulation was able to effectively overcome resistance to PCT even at low PCT doses. Using live cell imaging, paclitaxel-induced arrest of cell cycle progression and onset of apoptosis following this mitotic catastrophe was clearly visible only with the co-loaded liposomes. The cell cycle arrest was further visualized using time-lapse phase holographic imaging which showed the increasing incidence of cells undergoing PCT-induced mitotic arrest over time. Using fluorescence microscopy, we were able to clearly visualize the presence of polymerized microtubules around the cell nucleus as a result of this PCT-mediated microtubule dysfunction. Currently, we are investigating the therapeutic efficiency of these liposomes on a drug-resistant ovarian cancer xenograft mouse model.

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Defining and measuring losses (shrink) from well-managed corn silage silos, and identifying stages in silo life where losses occur.

Silage shrink (weight lost between ensiling and feedout) represent loss of nutrients to dairy producers, and the potential to degrade air quality if that loss is as volatile carbon compounds, or degrade water quality due to weepage to surface water and seepage to subsurface aquifers. No research has documented silage shrink in large commercial silage structures (silos) common in the SW US. ‘Shrink’ can be expressed as loss of wet weight (WW), oven dry weight (oDM) and oDM corrected for volatiles lost in the oven (vcoDM). Shrink losses, and the phase of the process where losses occurred, were measured using 7 corn silage silos (2 rollover, 1 bunker, 4 wedge) from the 2013 crop year on 4 dairy farms in 2 San Joaquin Valley areas, all covered within 48 h with an oxygen barrier inner film and black/white outer plastic weighted with tire chains. Total WW, oDM and vcoDM losses (not including wastage) calculated from weights of fresh chop delivered to the silo and silage placed in a feed mixer (n = 7) were 9.0 ± 1.69, 6.8 ± 1.82 and 2.8 ± 2.08%, suggesting that much of the WW shrink was water and much of the oDM shrink was volatiles driven off during oven drying. The largest part of shrink occurred in the silage mass (measured using in/out weights of 9–15 buried bags in each of 4 silos) before face exposure (WW, oDW and vcoDW losses from the mass were 3.9 ± 2.40, 7.2 ± 1.12 and 3.5 ± 1.27% respectively), with losses from the exposed face (measured as loss in core weight between freshly exposed faces and ~21 h exposed faces from 4 cores of 50 cm depth on 2 occasions in each silo), as well as between face removal and the mixer (measured between compositional changes between freshly exposed faces and silage placed in the mixer on 2 occasions in 4 silos), being negligible. Silo bulk density, face management, rate of face use and face orientation had no obvious effects on shrink. Real shrink losses (i.e., vcoDM) of well managed corn silages piles are much lower than has been generally assumed, the exposed face is a very small portion of those losses, and many of the proposed mitigations may not be effective in reducing shrink, possibly because it is quantitatively so small in large well managed silos.
Defining and measuring losses (shrink) from well-managed corn silage silos, and identifying stages in silo life where losses occur.

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Co-aggregation ability of cell wall components of Saccharomyces cerevisiae to pathogenic bacteria.

Autoaggregation in bacteria is the phenomenon of aggregation between cells of the same strain, whereas coaggregation is due to aggregation occurring among different species. Aggregation ability of prebiotic bacteria is related to adhesion ability, which is a prerequisite for the colonization and protection of the gastrointestinal tract in all animal species; however, coaggregation ability of prebiotic bacteria offers a possibility of close interaction with pathogenic bacteria. Coaggregation ability of cell wall components of Saccharomyces cerevisiae is known, because of their mannan content, but literature offers little information on this topic. The aim of this experiment was to assess the ability of coaggregation of 2 preparations of S. cerevisiae cell walls to 3 pathogenic bacteria (Staphylococcus aureus hemolytic enterotoxin A, Salmonella enteritidis and Escherichia coli serotype O157:H/7). Cell wall preparations consisted on either the distillery cream (DT), a byproduct of sugar cane, or a hydrolyzate (HT) obtained by enzymatic methods. Pathogens were grown in nutritive broth medium for 18 h at 37°C. After that, cultures were diluted (1:1) with DT and HT, and absorbance (560\(\text{\mu m}\)) was measured at 0 and 5 h. Both DT and HT showed the ability of coaggregate to the 3 pathogenic strains, and no bacterial strain × cell wall preparation interaction (\(P = 0.379\)) was detected. Coaggregation was higher (\(P < 0.001; \text{SEM} = 0.36\)) with HT (mean values of 85.3, 78.6 and 77.8% for S. aureus, S. enteritidis, and E. coli, respectively) compared with DT (mean values of 16.5, 5.8 and 6.0% for S. aureus, S. enteritidis, and E. coli, respectively). If confirmed with other pathogen species, these results support further research on the use of the HT from S. cerevisiae as a possible prebiotic additive for animal feed.
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Metal-to-insulator phase transition in complex oxide thin films is an exciting phenomenon, which may be useful for device applications, but the physical mechanism responsible for it is not fully understood. Here we demonstrate the effect of epitaxial strain on oxygen stoichiometry affecting metal-to-insulator phase transition in epitaxially grown RNiO$_3$ (R = Nd, Sm) (001) films. Theoretically, we predict an increase in oxygen vacancy concentration in the rare-earth nickelates with increasing in-plane biaxial tensile strain. Oxygen vacancies enhance charge disproportionation, resulting in an oxidation state close to Ni$^{4+}$ that stabilizes an insulating phase. Experimentally, we find an increase in resistivity and cell volume with increasing biaxial tensile strain and decreasing oxygen partial pressure corroborating our theoretical predictions. These results clearly indicate that epitaxial strain modifies oxygen stoichiometry of rare-earth perovskite thin films and through this mechanism affects metal-to-insulator phase transition in these compounds.
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Biobanks are becoming critical components in researchers’ efforts to cure, treat, or prevent cancer, diabetes, and many other diseases. In the past years, research of genetic associations with common complex diseases has created a drive for larger numbers of specimens as a statistical requirement. Some scholars have aptly noted this move from biobanking for science to a science of biobanking and raised the issue of biobank size as an ethical issue. Drawing on interviews with employees of six US biobanks, we look at how biobank size matters in their everyday work. We argue that the drive to collect more specimens despite employees’ concern that they will be underutilized reveals a certain value in collecting itself, which we call an imperative to collect. We contend that this imperative to collect demonstrates the necessity to consider specimens as objects and thus situates biobanks within other collecting practices in European art and science.
**Imperative to Collect: A Case Study of Six Biobanks**

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Dragana Lassiter, Jean Cadigan, and Henderson Gail. Sociedad Latinoamericana de Estudios Sociales de la Ciencia y la Tecnología (ESOCITE) and Society for Social Studies of Science, 2014, Buenos Aires.