# Presentaciones Murales

(como hacer y presentar un poster)

¿Cuál es el mensaje que quiero dar?

¿Cuál es la historia que quiero contar?

¿Cómo voy a contar esa historia?

Master Thesis

# Fabrication of a New Device for the Preparation of Monodispersed Microspheres Using Solvent Extraction

Didier Hayem[1]; Ute Hüfeli[1], Boris Stoeber[2] and Heinrich Hofmann[3]; [1]Faculty of Pharmaceutical Sciences, [2]Electrical & Computer Engineering, UBC, Vancouver, Canada; [3]Powder Technology Laboratory, EPFL, Lausanne, Switzerland

## Introduction

Breakthrough in medicine has been made by the creation of new molecules or by improving the delivery of existing ones. Magnetic targeting is a promising way to improve delivery, but the efficiency, higher concentration in the targeted area and less adverse effects is...

## Aim

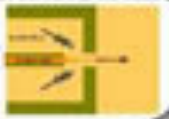
Produce PLA monodispersed microspheres that can be used for drug encapsulation.

## Current Methods Used to Produce Microspheres

Extrusion-reduction: Microscopic glass membrane

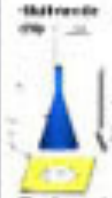
Dripping

Three-dimensional flow focusing



## Proposed Methods to Produce Microspheres

- Multi-needle chip



- Three-dimensional flow focusing

The dispersed phase will go through a chip with an array of needles. Microspheres should form at the tip of each needle

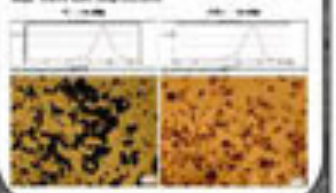
The dispersed phase is injected in the middle of a tube with a opposite flow of the dispersing phase. An opening in the end of the dispersed phase needle tip focuses the flow of the droplets. The causes a great increase in the dispersing phase speed, forcing the inner phase to form droplets. These droplets collide in the outlet tube to form microspheres.

## Multi-Needle Chip

- A chip with an array of needles (diameter of 200 µm with holes of 50 µm) was etched in 4H SiC (Cree) and characterized successfully
- Microspheres were produced using 10% wt/v of PLA (in CHCl3) as the dispersed phase and 1% wt/v PVA in water as the dispersing phase
- The porosity was made with Triton x-114 in ethylene (CHCl3)

## Results and Discussion

- No microspheres were produced with this setup
- Despite etching, the holes were not completely open. An accurate control of the flow rate was therefore impossible
- Surface of the chip was not hydrophilic enough. The dissolution of individual drops on each needle was therefore impossible



## 3D Flow-Focusing Setup

Different setup were designed and built. The first one was made using a PVC rod. Results were not satisfactory (different flow) (control experiment: direct injection into a 1.5mM PVA solution). A partial setup was then built, giving better results. This showed that the problem was due to irregularities in the tapping of the first setup. A new setup was then made in brass.

## 3D Flow-Focusing Results

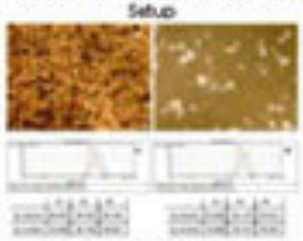
The final setup was used with two pumps (Harvard 33 Dual Syringe Pump) to control the flow of the dispersing and the dispersed phases. The dispersed phase was set at a flow rate of 0.050 ml/min. Different flow rate ratios between both phases were used. Short tips were positioned with a ratio of 1:100. The distance of the needle tip to the outlet channel was also varied.

Stable hexagonal microspheres were formed with this setup, the result were initial good as expected. The particle size distribution was wide. No impact of the distance between the needle tip and the output end of the borosilicate optics were observed. This is certainly due to imperfections within the setup that disrupt the flow and cause turbulences.

## References

[1] ...
[2] ...
[3] ...

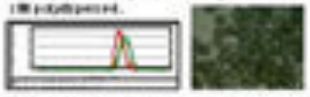
## Influence of Flow Ratio with First Setup



*A image of particles produced at a flow ratio of 1:100, B) particles produced at a flow ratio of 1:150, C) a) size distribution of microspheres shown in A, b) PDD graphs, distribution by number are shown in red, by volume in green.*

## Results with Brass Setup

The brass setup yielded better results, final microspheres were produced. They are however still polydispersed.



*PDD and optical micrograph of a batch produced with the brass setup. Red curve shows distribution by number, green curve by volume.*

## Discussion of Results with Brass Setup

A number of parameters may cause the produced microspheres to be polydispersed.

- The needle and the output channel were not perfectly aligned. This may cause turbulent flow and disturb the droplet formation process.
- Some irregularities on the surface of the input channel were observed. This causes again perturbations to the liquid flow and the microsphere formation.
- The relative position of the setup output to the collecting bath in the beaker was not well defined and could slightly vary from experiment to experiment. As the collecting is believed to be crucial in keeping the particles apart, it may have an impact on the dispersity.

## Outlook

The setup will be improved and the alignment optimized. With the help of CFD simulations and design of experiments, the optimum parameters will be determined. It will allow to reduce the number of setups to be built and of experiments to be run.

## Conclusion

This study has allowed to realize a setup that should be able to produce magnetic microspheres once optimized. Once presented (alignment, dispersion, ...) and experimental flow rate, flow ratio, ... parameters will have to be further studied.

Legible a 3 metros
Bueno uso del espacio en blanco, figuras, títulos
Título corto
De 300 a 800 palabras
Conciso y fácil de leer

# Software

- PowerPoint, LibreOffice Impress
- Illustrator, Corel Draw, Inkscape
- InDesign, Publisher
- Photoshop, Gimp
- Latex (A0Poster, beamerposter y otros)

# Speech Recognition Techniques for a Sign Language Recognition System

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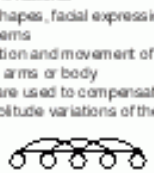
RWTH AACHEN UNIVERSITY

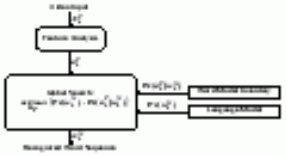
## Introduction

- automatic sign language recognition system
- necessary for communication between deaf and hearing people
- continuous sign language recognition, several speakers, vision-based approach, no special hardware
- large vocabulary speech recognition (LVSR) system to obtain a textual representation of the signed sentences
- evaluation of speech recognition techniques on publicly available sign language corpus

## Automatic Sign Language Recognition (ASLR)

- similar to speech recognition: temporal sequences of images
- important features
  - hand-shapes, facial expressions, lip-patterns
  - orientation and movement of the hands, arms or body
- HMMs are used to compensate time and amplitude variations of the signers
- goal: find the model which best expresses the observation sequence





## Experimental Setup

**Database**

- system evaluation on the RWTH-BOSTON-104 database
- 201 sentences (161 training and 40 test sequences)
- vocabulary size of 104 words
- 3 speakers (2 female, 1 male)
- corpus is annotated in glosses

**Problems**

- 26% of the training data are singletons
- simple sentence structure
- one out-of-vocabulary (OOV) words with whole-word models

**Differences in Comparison to ASR**

- simultaneousness
- signing space
- environment
- speakers and dialects
- coarticulation and movement epenthesis
- silence
- whole-word models and sub-word units

## System Overview

**Visual Modeling (VM)**

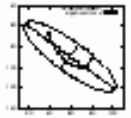
- related to the acoustic model in ASR
- HMM based, with separate GMMs, globally pooled diag. covariance matrix
- monophone whole-word models
- pronunciation handling

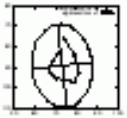
**Language Modeling (LM)**

- according to ASR: LM should have a greater weight than the VM
- trigram LM using the SRILM toolkit, with modified Kneser-Ney discounting with interpolation

**Features**

- appearance-based image features: for baseline system
  - thumbnails of video sequence frames (intensity images scaled to 32x32 pixels)
  - give a global description of all (manual and non-manual) features proposed in linguistic research
- manual features:
  - dominant hand tracking: hand position, hand velocity, and hand trajectory features

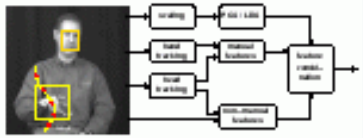




## Feature Selection and Model Combination

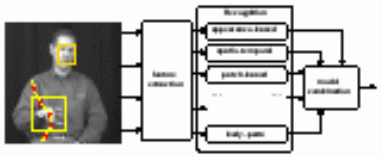
**Feature Selection**

- concatenation of appearance-based and manual features
- sliding window for context modeling
- dimensionality reduction by PCA and/or LDA

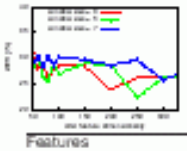


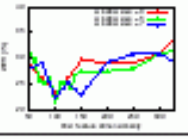
**Model Combination**

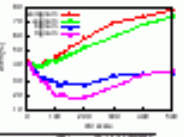
- log-linear combination of independently trained models
- profit from independent alignments (e.g. performing well for long and short words)
- profit from different feature extraction approaches



## Experimental Results







| Features | Dim. | [%WER] |
|---|---|---|
| frame intensity (w/o pronunciations) | 1024 | 54.0 |
| frame intensity (w/ pronunciations) | 1024 | 37.0 |
| frame intensity (w/ pronunciations + tangent distance) | 1024 | 33.7 |
| PCA-frame | 110 | 27.5 |
| PCA-frame, hand-position | 112 | 25.3 |
| PCA-frame, hand-velocity | 112 | 24.2 |
| PCA-frame, hand-trajectory | 112 | 23.6 |
| model-combination | 2x100 | 17.9 |

## Example Results

**Correct Examples**

| | |
|---|---|
| IX-1P | FIND SOMETHING-ONE BOOK |
| IX-1P | FIND SOMETHING-ONE BOOK |
| JOHN | FISH WONT EAT BUT CAN EAT CHICKEN |
| JOHN | FISH WONT EAT BUT CAN EAT CHICKEN |
| LOVE | JOHN WHO |
| LOVE | JOHN WHO |
| JOHN | BUY YESTERDAY WHAT BOOK |
| JOHN | BUY YESTERDAY WHAT BOOK |

**Incorrect Examples**

| | |
|---|---|
| MARY | VEGETABLE KNOW IX LIKE CORN |
| MARY | VEGETABLE KNOW IX LIKE MARY |
| JOHN IX | GIVE MAN IX NEW COAT |
| JOHN IX | WOMAN ___ NEW COAT |
| | LIKE CHOCOLATE WHO |
| JOHN | LIKE CHOCOLATE WHO |
| JOHN | [UNKNOWN] BUY HOUSE |
| JOHN | FUTURE NOT BUY HOUSE |

## RWTH-BOSTON-104 Database

**Corpus Statistics**

| | Training | Test |
|---|---|---|
| sentences | 161 | 40 |
| running words | 710 | 178 |
| frames | 12422 | 3324 |
| vocabulary | 103 | 65 |
| singletons | 27 | 9 |
| OOV | - | 1 |

**LM Perplexities**

| LM type | PP |
|---|---|
| zerogram | 106.0 |
| unigram | 36.8 |
| bigram | 6.7 |
| trigram | 4.7 |

Database is publicly available

## Conclusion

- LVSR system is suitable for vision-based continuous sign language recognition
- many of the principles known from ASR can directly be transfered
- important for ASLR: temporal contexts, pronunciation handling, language modeling, and model combination
- outlook: connection of recognizer output to a statistical machine translation system achieved promising translation results

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# ANTIOXIDANT ACTIVITY OF ANTHOCYANINS OF *Syzygium cumini* FRUIT

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2)Department of Food Science and Technology, Faculty of Agricultural Technology, Bogor Agriculture University, Indonesia
3)Faculty of Veterinary Medicine, Bogor Agriculture University, Indonesia
4)Department of Chemistry, Faculty of Mathematic and Natural Science, Padjadjaran University, Indonesia
Contact: poesputha_s@yahoo.com

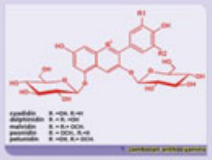
## ABSTRACT

The aim of this study was to determine the potency of jambolan (Syzygium cumini) fruit anthocyanins as antioxidant by evaluating their antioxidant activity using in vitro assays. Several different assays of the antioxidant activity including DPPH radical-scavenging assay, hydroxyl radical-scavenging assay, superoxide radical-scavenging assay, and lipid peroxidation assay using human low density lipoprotein have been conducted. The phenolic compounds in methanolic extract were separated by using a solid phase extraction (C18 Sep-Pak cartridge), providing: (1) anthocyanin phenolic fraction and (2) non-anthocyanin phenolic fraction. The phenolic content and antioxidant activity of the fractions have been compared with that of the methanolic extract. The phenolic content of anthocyanin-phenolic fraction represented approximately 83% (w/w) to the phenolic content of methanolic extract. The antioxidant activity of anthocyanin-phenolic fraction was slightly higher than that of methanolic extract. The antioxidant activity of jambolan extract was mainly contributed by anthocyanin. Moreover, anthocyanins extracted from the jambolan pulp, jambolan peel, and anthocyanin fraction were also evaluated their antioxidant activity. Jambolan pulp extract (JPuE), jambolan peel extract (JPeE), and jambolan anthocyanin fraction (JAF) exhibited significant antioxidant activities, in descending order: JAF > JPeE > JPuE. Among jambolan samples, jambolan anthocyanin fraction was the most effective as antioxidant and the antioxidant activity approached the activity of the standard compounds, quercetin, catechin, ascorbic acid. These results suggest that anthocyanins contained in the jambolan fruit with antioxidative properties are potential utilized for functional natural food colorants and nutraceutical.

Keyword : Syzygium cumini fruit, jambolan, anthocyanins, antioxidant

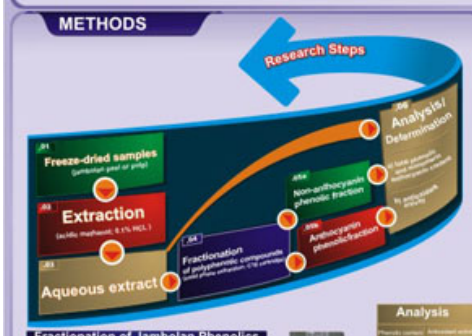
## INTRODUCTION

Jambolan (*Syzygium cumini*) fruit is rich in anthocyanin pigments especially in its peel part. Anthocyanins of jambolan fruit have been studied extensively in our laboratory. Jambolan anthocyanins have been identified as 3,5-diglucoside derivatives of **delphinidin (41.29%), petunidin (27.79%), malvidin (25.60%), cyanidin (4.19%) & peonidin (1.13%).** Other study exhibit that jambolan anthocyanins have better color stability than enocyanine, commercial anthocyanin colorant from grape peel. Through intermolecular copigmentation reaction with ferulic acid, sinapic acid, caffeic acid, and *rosemary* polyphenol extract, color and stability of jambolan anthocyanins can be increased. In the present study, the antioxidant activity of jambolan anthocyanins was evaluated using several different *in vitro* assays.

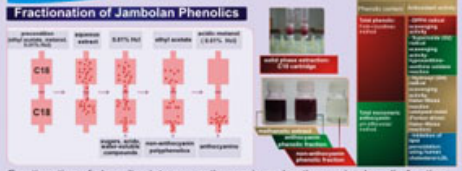




## METHODS




**Fractionation of Jambolan Phenolics**




Fractionation of phenolics into non-anthocyanin and anthocyanin phenolic fraction using C18 cartridge. The sample components are resolved by subsequent wash steps (circles: non-anthocyanin phenolics; squares: anthocyanins; triangles: sugars, acids, and water-soluble compounds).

## RESULTS

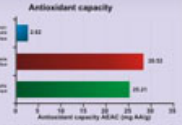
### Contribution of Jambolan Anthocyanins as Antioxidant

**Total phenolic content**

| Sample | Total phenolic | |
|---|---|---|
| | mg GAE/g | wt % |
| Methanolic extract | 15.92 ± 0.20 | 100.00 |
| Anthocyanin phenolic fraction | 21.07 ± 0.05 | 83.25 |
| Non-anthocyanin phenolic fraction | 2.15 ± 0.07 | 8.30 |

*Gallic acid equivalents (dry weight basis); *weight % respect to methanolic extract

**Antioxidant capacity**




The phenolic content of anthocyanin phenolic fraction represented approximately 83% (w/w) to the phenolic content of methanolic extract. The antioxidant activity of anthocyanin phenolic fraction was slightly higher than that of methanolic extract. Thus, the antioxidant activity of jambolan extract was mainly contributed by anthocyanin.

### Antioxidant Activity of Extract and Anthocyanin Fraction

**Total phenolic content**

| Sample | Total phenolic (mg GAE/g)[a] |
|---|---|
| Jambolan pulp extract (JPuE) | 15.86 ± 0.10 |
| Jambolan peel extract (JPeE) | 27.62 ± 1.42 |
| Jambolan anthocyanin fraction (JAF) | 379.69 ± 12.32 |
| Red cabbage extract (RcE) | 27.70 ± 0.48 |

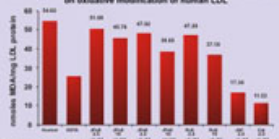
[a]Gallic acid equivalents (dry weight basis).

**Free radical scavenging activity (expressed as $IC_{50}$ value)**

| Sample | DPPH radical scavenging | $IC_{50}$ value[a] (µg/mL) Superoxide radical scavenging | Hydroxyl radical scavenging |
|---|---|---|---|
| Jambolan pulp extract (JPuE) | 1756.88 ± 11.73 | 35.06 ± 0.88 | 446.48 ± 16.12 |
| Jambolan peel extract (JPeE) | 915.85 ± 8.52 | 22.16 ± 0.49 | 357.19 ± 10.68 |
| Jambolan anthocyanin fraction (JAF) | 23.02 ± 0.88 | 1.85 ± 0.04 | 257.27 ± 4.32 |
| Red cabbage extract (RcE) | 434.34 ± 11.34 | 20.67 ± 0.23 | 332.65 ± 14.14 |
| Catechin | 16.69 ± 0.20 | 1.27 ± 0.04 | 167.52 ± 2.63 |
| Quercetin | 9.30 ± 0.25 | - | - |
| Ascorbic acid | 13.48 ± 0.06 | 6.59 ± 0.08 | - |

[a]Concentration of sample required to scavenge 50% of free radicals.

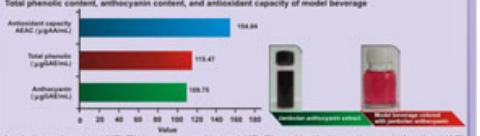
**Inhibitory effect of extract and anthocyanin fraction of jambolan fruit on oxidative modification of human LDL**




JPuE: jambolan pulp extract, JPeE: jambolan peel extract, JAF: jambolan anthocyanin fraction, RcE: red cabbage extract,Cat: catechin. Control: LDL + $Cu^{2+}$; EDTA: LDL + $Cu^{2+}$ + EDTA

### Antioxidant Activity of Model Beverage

**Total phenolic content, anthocyanin content, and antioxidant capacity of model beverage**




Jambolan pulp extract (JPuE), jambolan peel extract (JPeE), and jambolan anthocyanin fraction (JAF) exhibited significant antioxidant activities, in descending order: JAF > JPeE > JPuE. Jambolan anthocyanin fraction (JAF) was the most effective as antioxidant and the antioxidant activity approached the activity of the standard compounds, quercetin, catechin, ascorbic acid. Jambolan anthocyanins that added to a model beverage as colorant also exhibited antioxidant activity.

## CONCLUSION

The antioxidant activity of jambolan fruit was mainly contributed by anthocyanin. The phenolic extract and anthocyanin fraction of jambolan fruit were effective both in scavenging reactive oxygen species/ROS and in inhibiting lipoprotein oxidation. The anthocyanins of jambolan fruit with antioxidative properties are potential utilized for functional natural food colorants and nutraceutical.

**ACKNOWLEDGEMENT**

**Puspita Sari** is grateful to the International Foundation for Science (IFS), Stockholm, Sweden and Organisation for the Prohibition of Chemical Weapons (OPCW), The Hague, The Netherlands for the financial support (Research Project of First IFS Research Grant).

# NANOFORCE

## Nanotechnology for Chemical enterprises – how to link scientific knowledge to the business in the Central Europe

**General Information**

## Background

## Objectives

## Outputs/Goals

## Workpackages

## Methods

## Target Groups

## Results

## Next Steps

Participating Organizations

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

CENTRAL EUROPE

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

nano FORCE

# Chaotic Psychedelic Poster

*Be thankful you name*
*Isn't on this poster*

## Introduction

Insert your text here. You can place your organizations logos on either side of the title of the poster. Insert your text here.

Remember to size your font to fit your information into the space. The larger your font, the easier it will be for others to read your poster. Insert your text here.

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## Purpose

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## Methods

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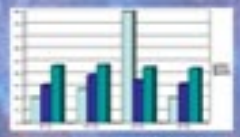

## Tools

## Doctors Technician Training Module

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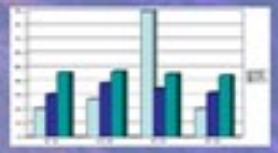

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## Expected Results

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## Literature Cited

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## Disclosure

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# Using a Windbreak Habitat Model Across Broad Landscapes: The Effect of Local Landscape Composition and Geographic Location

George Hess[1], John Poulsen[2], Raymond O'Connor[2], Jeff Bay[3]

## 1. Windbreaks as Habitat

Agricultural lands — fields, pastures, and orchards — are managed to produce food and fiber for people. In the U.S. Great Plains, an extensive agricultural landscape, windbreaks have been planted to protect fields, crops, livestock, and farmsteads from the prevailing winds. ***Windbreaks provide some of the scarce wooded habitat for birds and other wildlife that people have come to value.*** Windbreaks make up about 25% of the wooded cover in Nebraska; much of the other wooded cover occurs along riparian corridors.

***Although they protect soil from wind erosion and provide habitat for some species, windbreaks also contribute to the fragmentation of prairie grasslands.*** Prairie fragmentation negatively impacts grassland wildlife such as prairie chickens, upland sandpipers, and grasshopper sparrows.

## 2. Regional Evaluation of Windbreaks

The Environmental Monitoring and Assessment Program's Agricultural Lands Group — charged with assessing the ecological condition of U.S. agricultural lands — undertook a *pilot study to evaluate the habitat value of windbreaks on a regional basis.* We decided to use a bird species richness index to measure the habitat value of individual windbreaks.

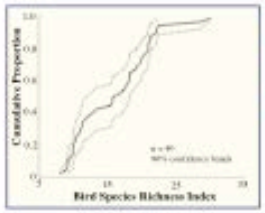
We selected a random sample of 60 windbreaks in Nebraska, based on a screening question on a USDA National Agricultural Statistics Service agricultural survey. In July 1994, field crews measured attributes of 40 windbreaks (one third of the farmers refused to participate). The data were used to estimate the value of windbreaks as breeding bird habitat in Nebraska.

## 3. Bird Species Richness Index

We used the U.S. Fish and Wildlife Service's Bird Species Richness Index (BSRI), which *estimates the number of breeding bird species a single windbreak can support based on four windbreak attributes.*

- ***Area*** has the greatest impact on bird diversity; larger windbreaks support more species. Area was ***measured by calibrated pacing.***
- ***Height:*** Taller windbreaks provide more niches. Height was ***measured by photographic analysis.***
- ***Vertical Structure:*** A more structurally complex windbreak provides more habitat niches; ***measured by point sampling.***
- ***Gaps*** provide another habitat niche. Gaps were counted.

- **Forty windbreaks were sampled using two-stage sampling with a frame stratified by intensity of cultivation.**
- **Most sample windbreaks fell in or near extensive cropland.**
- **Habitat characteristics of each windbreak were measured in 1994.**
- **Thirty-five farmers allowed ornithologists to return in 1995**

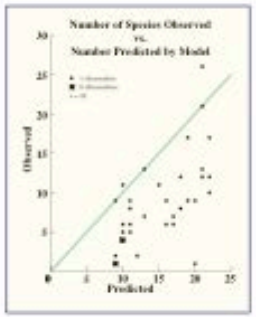

- **Using expansion factors associated with each sample, we estimated the habitat value of windbreaks for the region (graph left).**
- **We estimated that half of Nebraska's windbreaks support fewer than 16 breeding bird species (graph left).**
- **We also estimated that between 87% and 100% of windbreaks are smaller than 1.5 hectares (data not shown), suggesting that few Nebraskan windbreaks provide habitat for forest interior or area sensitive birds.**

## 4. Validating BSRI Model

In 1995, *a team of five ornithologists revisited 39 of the 40 windbreaks* (1 farmers refused further visits) between late May and early July.

Each windbreak was visited four times. Data were collected between one-half hour before and four hours after sunrise. ***All observed birds were identified to species and recorded using spot mapping techniques.*** Tape recorded vocalizations of the eastern towhee and were played on the final pass through the windbreak for each visit.

Because the windbreaks were narrow, we assumed all species were detected.




## 5. Results of Validation

*The model overestimates the number of bird species in the Nebraska windbreaks* (graph left). However, the relative qualitative ranking of windbreaks is generally preserved. A total of 51 species were observed.

***No strong, significant relationship was found between deviation of observed from predicted number of species and any windbreak attribute or the geographic location of individual windbreaks.***

Forest interior, area-sensitive, and forest edge species occurred in the larger, taller, more complex windbreaks.

Open-land and grassland species occurred in the smaller, shorter, less complex windbreaks.

## 6. Failure of the Model

There are several ***possible explanations*** for the failure of the model to predict accurately the number of birds species in the windbreaks.

1) ***Geographic differences in species richness.*** The model was developed in Kansas, which has 5-20 more species of bird than Nebraska (Breeding Bird Survey's species richness map of North America).

2) ***Dependence on different windbreak characteristics.*** The number of species in Nebraska's windbreaks depends differently on windbreak characteristics than did the number of species in Kansas.

3) ***Dependence on landscape-scale characteristics.*** The number of species in Nebraska's windbreaks depends on characteristics of the surrounding landscape.

## 7. Local Landscape-Scale Effects

***Land cover data were collected for the quarter-section*** (160 acres, 65 ha) containing the sample windbreak. Cover categories were tree, wetland, crop, grass / herbaceous, barren / non-vegetated, and water. Fences and cattle grazing were also recorded (present / absent).

***Landscape metrics computed*** included relative cover distributions, total edge length, edge / area ratio, number of patches, mean patch size, mean perimeter per patch, and size of largest field.

***The deviation between observed and predicted number of species was not significantly related to any of the landscape metrics.*** This suggests that within a region the number of species using a windbreak depends primarily on windbreak attributes.

## 8. Conclusions

1) ***The Bird Species Richness Index for windbreaks cannot be extended simply to describe species richness at large regional scales*** without either recalibrating regionally or adding terms that account for differences in regional species pools.

2) ***Local landscape-scale composition and structure do not explain the failure of the model.***

3) ***The presence of species guilds in windbreaks*** (e.g., forest interior, grassland) ***may be explained by windbreak size and complexity.*** The model may be more useful for predicting the presence or absence of species guilds than for predicting the total number of species present.

**Acknowledgements:** This work could not have been done without the many dedicated people at the National Agricultural Statistics Service who helped plan and execute the 1994 data collection effort; the kind farmers who allowed us to survey their windbreaks; the five ornithologists who spent six weeks traveling around Nebraska; and many other people from the University of Nebraska, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, and the Environmental Protection Agency. Funding was provided by the Environmental Protection Agency and the USDA Agricultural Research Service.

1. North Carolina State University, Forestry Department, Raleigh, NC
2. University of Maine, Department of Wildlife Ecology, Orono, ME
3. North Carolina State University, Statistics Department, Raleigh, NC

11 March 1997

# Determining the Wear Resistance of Occlusal Splints in a Prospective Clinical Study

**P. Ottl, P. Schmelz, A. Piwowarczyk, H.-Ch. Lauer**

Dept. of Prosthodontics, School of Dentistry (Director: Prof. Dr. H.-Ch. Lauer), ZZMK (Carolinum), J. W. Goethe University, Frankfurt, Germany

## Objective

- To determine quantitatively the wear resistance of a newly developed light-curing splint resin over a period in situ of six months.

## Materials and Methods

- **Patients**

  n = 20 consecutive patients

  (mean age: 34.7 years; 12 F, 8 M)

- **Inclusion criteria**

  - Natural dentition/fixed denture
  - Complete dentition to at least the 1st molar

  **and**

  for the stabilization splint sample:
  - Insufficient occlusal support
  - Increased occlusal loss of dental hard tissue

  for the distraction splint sample:
  - TMJ pain **and**
  - Complete anterior dislocation of the disk without reduction/with terminal reduction
  - TMJ osteoarthrosis

Fig. 1: Stabilization splint in situ

- **Resin splint material (Fig. 1)**
  - Light-curing (400–500 nm) resin made of high-molecular dimethacrylates with organic and inorganic fillers
  - Does not contain methyl methacrylate

- **Study design**
  - **Duration**: 6 months
  - **Types of splints** (maxilla, n = 10 each): stabilization splints, distraction splints
  - **Splint wear mode**: 24 hours
  - **Examinations**: before insertion (BI), at 4 weeks (4W), at 3 months (3M), at 6 months (6M)
  - **Occlusal adjustments** were restricted to the time before 4W.

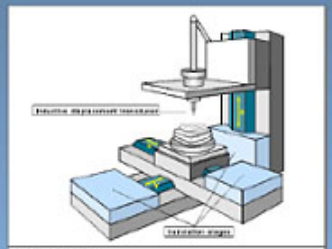


Fig. 2: Test setup

- **Measuring technology (Fig. 2)**
  - Vibration-isolated table framework
  - 3 translation stages (for directions x, y, and z) ( DC-Motor) (PI, Waldbronn)
  - DV 4 stereomicroscope (Zeiss, Oberkochen)
  - WA 20 inductive displacement transducer/ Spider8 digital 8-channel measurement unit/ Catman 32 software V2.1 (HBM, Darmstadt)
  - Local coordinate storage for occlusal contacts during baseline measurements
  - Ten measurements each in regions 13, 23, 16, 26 (BI, 4W, 3M, 6M)
  - Splint repositioned on remount cast

## Results

- The medians of the occlusal vertical gains/losses (wear, resin torsion, water sorption, etc.) are shown in **Fig. 3** (stabilization splints) and **Fig. 4** (distraction splints).

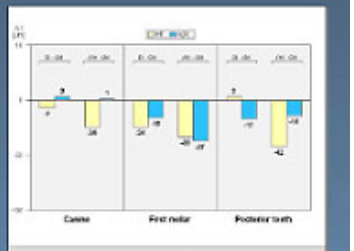


Fig. 3: Occlusal vertical gain/losses (medians) of the resin in vivo over a period in situ of six months (n = 10 occlusion splints)

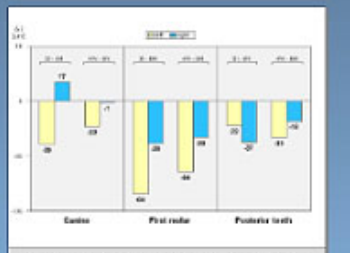
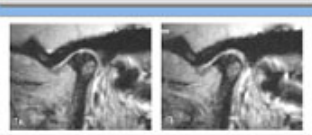


Fig. 4: Occlusal vertical gain/losses (medians) of the resin in vivo over a period in situ of six months (n = 10 distraction splints)

- **Statistical analysis** (Mann-Whitney U-test, $p \leq 0.05$) showed no significant differences when comparing the corresponding results of stabilization and distraction splints.



Figs. 5a and b: Sagittal oblique images (MR) of the condyle/fossa relationship without splint (Fig. 5a) and with distraction splint inserted (Fig. 5b) following six months of wearing

## Conclusions

- The present study *clinically* confirms the good wear resistance results of the new resin splint material obtained in a previous *in-vitro* study [OTTL et al., Dtsch Zahnärztl Z 52, 342 (1997)].
- Good wear resistance is of great importance for maintaining the therapeutic mandibular position during the treatment period (Figs. 5a and b).

# A Framework for Assessing the Condition of Agricultural Lands

George Hess[1], Anne Hellkamp[2], Mike Munster[3], Steve Peck[3], Lee Campbell[3], Betty McQuaid[4], Steve Shafer[3,5]

**Mission:** To develop indicators of the condition of agricultural lands within an ecological framework, and to monitor and evaluate this condition on a regional basis.


***Sustainable agriculture*** has been discussed, defined, and dissected in countless papers.

Definitions tend to be broad and encompass ecological, economic, social, and even policy dimensions. Although these dimensions are interlocked, each may be examined independently.

*In our efforts, we sought methods to examine only the ecological aspects of sustainability.*

***People place values*** on agricultural lands that must be addressed if monitoring is to be relevant.

*The foremost goal for agricultural lands is to produce food and fiber for human use.*

*Other desired outcomes* can be considered goals for the larger landscape and sometimes function as constraints on production. These *include clean air and water, wildlife habitat, and aesthetically pleasing landscapes.*

***The ecological condition*** of agricultural land is defined by its productivity and the degree to which valued biotic and abiotic resources are conserved and protected.

*Agricultural land in good condition is productive and does not compromise valued resources. Sustainability is the ability to maintain good condition over time.*


***Indicators were selected to reflect crop productivity and land stewardship.***

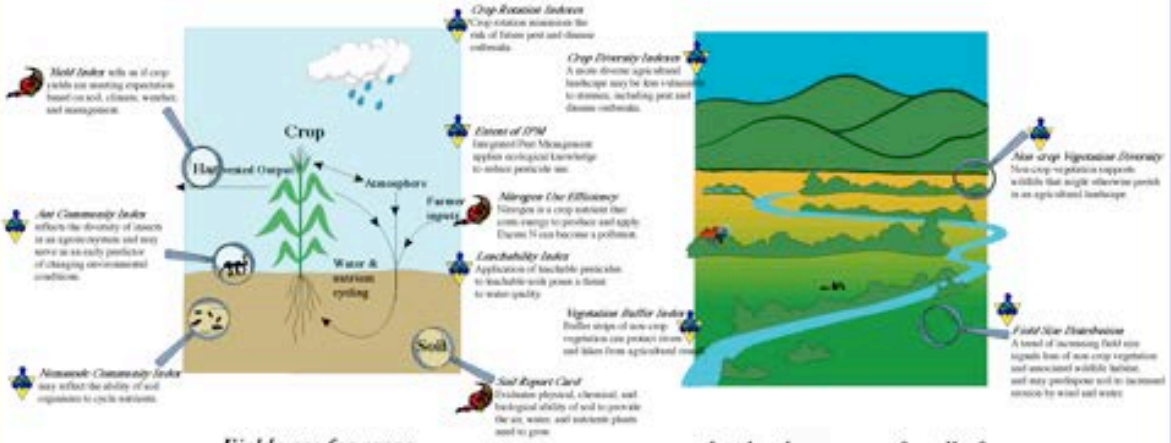
In making an assessment, condition is reported for each indicator. An overall condition may also be reported, but depends critically on the relative weighting of the goals for agricultural lands.

For sustainability, one can examine trends in crop productivity and stewardship practices.

## Potential Indicators for Annually Harvested Herbaceous Cropland

As a starting point, we chose to concentrate our efforts on developing indicators for ***annually harvested herbaceous cropland*** — *land planted with crops that are harvested every year* whether the plants are annual or perennial. Common examples are corn, wheat, soybeans, alfalfa hay, and strawberries.

We also endeavored to supplement, rather than duplicate, existing efforts. Our conceptual framework is flexible enough to incorporate indicators based on data from other monitoring efforts. For example, an erosion indicator could be developed using the USDA Natural Resources Conservation Service's Natural Resource Inventory data.




*Fields are for crops . . .*

*. . . but landscapes are for all of us.*

**Acknowledgements:** The EMAP Agricultural Lands Resource Group thanks the many individuals and organizations that made this effort a success. The individuals are too numerous to mention, but organizations include the USDA's Agricultural Research Service, Forest Service, National Agricultural Statistics Service, and Natural Resources Conservation Service; the U.S. Environmental Protection Agency; North Carolina State University, University of Maine, Oregon State University, University of Nebraska, and, well, I guess the list of organizations is pretty long, too. Thanks to all!!

1. North Carolina State University, Forestry Department, Raleigh NC
2. Duke University Medical Center, Durham NC
3. North Carolina State University, Department of Plant Pathology, Raleigh NC
4. USDA Natural Resources Conservation Service, Raleigh NC
5. USDA Agricultural Research Service, Raleigh NC

28 March 1997

# PREVALENCE OF OBESITY AMONG INNER CITY LATINO CHILDREN AND ADOLESCENTS

Nazrat M. Mirza MD. ScD. Jill Merchant MS. Leslie Beker, PhD

Children's National Medical Center and George Washington University School of Medicine and Health Sciences, Washington, DC

**Background**

Obesity is a major clinical and public health problem facing children and adolescents in the U.S. Of particular significance is the increasing prevalence of obesity and its complications among the Latino population. Among this ethnic group there is a strong sense of family and children are a priority. Because of the premium placed on childhood, there may be a misplaced assumption that children overdo not for dental, food or other lifestyle such as TV. Obesity in children and adolescents is concerning not only because of the associated health and psychosocial complications, but also because obese children tend to become obese adults. Since obesity is associated with many chronic diseases, it will have an enormous impact on the healthcare system.

**Purpose of Study:** To estimate the extent of obesity among inner city Latino children and adolescents with the overall goal of assessing the need for an obesity intervention program.

**Study Design**

One hundred and twenty five charts of children and adolescents aged 4 to 18 years were randomly selected from well child visits to Children's Hospital's Adams Morgan Clinic for the calendar year 2000. This clinic sees an average of 8,000 patients a month, approximately 90-95% are Latinos, predominantly from El Salvador. Information extracted from the charts included height, height record presence, Tanner classification, history and physical findings associated with obesity complications. Body Mass Index (BMI) was calculated from recorded height and weight. Data analysis was done using SAS version 8.1.

**Results**

The distribution of the study sample is shown in Table 1. About 54% were females. The mean age was 10.6 years with a SD of 3.3 and a range of 4.0 to 18.7 years. The mean BMI was 20.8 with a SD of 5.6 and a range of 13.3-47.6. Overall, 40% of the children and youth were overweight (BMI $\geq$ 95$^{th}$ percentile) or at risk for overweight (BMI $\geq$ 85-94$^{th}$ percentile), with an almost equal distribution between the two categories (Table 2). Males were more overweight and at risk for overweight than females, but the gender difference was not statistically significant. The prevalence of overweight was highest for youth ages 10 to 14 years.

**Table 1 – Frequency statistics**

| Variable | Frequency (%) |
|---|---|
| Gender | |
| Males | 46.4 |
| Females | 53.6 |
| Age Category (years) | $\chi^2$=3.21 |
| 4-5 | 8.0 |
| 6-9 | 22.8 |
| 10-13 | 37.6 |
| 14-15 | 19.2 |
| 16-17 | 8.8 |
| 18-19 | 3.6 |

**Results continued:**

Table 3 shows the distribution of overweight and at risk for overweight by age category. These data show that prevalence of overweight and at risk for overweight is high in children as young as 4 to 5 years. Although the prevalence of overweight and at risk for overweight was lowest in the age group 6-9 years, the differences were not statistically significant (Pearson Prob>$\chi^2$ 0.84 and 0.0550 respectively).

Asthma frequency was higher among the overweight than the non-overweight children and youth ($\chi^2$=3.68; Fishers Exact Test). There was no difference in the frequency of occurrence of other symptoms such as obstructive sleep apnea, learning difficulties, behavioral problems, seizures, and ADHD between the overweight and non-overweight group. Only 2% of all the overweight children had their cholesterol levels checked. The cholesterol levels ranged from 112-210 mg/dl. Two percent of the children had their serum triglyceride assayed, and the range was 174-178 mg/dl. There was no significant association between overweight and systolic or diastolic blood pressure in this small sample. Only 28% of the overweight children and youth were diagnosed and so documented in their charts regarding their overweight status by their health care providers. There were no referrals for overweight intervention noted in their charts.

**Table 2 – BMI distribution**

| BMI Category | Frequency % |
|---|---|
| At Risk for overweight (BMI= 85-94$^{th}$) | |
| 1 Both Sexes (n=125) | 20.8 |
| 2 Males (n=58) | 22.4 |
| 3 Females (n=67) | 19.4 |
| Overweight (BMI >95$^{th}$ Percentile) | |
| 1 Both Sexes (n=125) | 20.8 |
| 2 Males (n=58) | 18.1 |
| 3 Females (n=67) | 20.9 |

**Table 3 – At Risk for Overweight and Overweight by Age Category**

| Age Category (Yrs) | At Risk for Overweight (%) (BMI 85-95$^{th}$ %ile) | Overweight (%) (BMI >95$^{th}$ %ile) |
|---|---|---|
| 4-5 yrs (n=10) | 30.0 | 10.0 |
| 6-9 yrs (n=28) | 28.6 | 21.4 |
| 10-13 yrs (n=47) | 19.1 | 19.2 |
| 14-15 yrs (n=24) | 16.7 | 37.5 |
| 16-17 yrs (n=11) | 27.3 | 18.2 |
| 18-19 yrs (n=5) | 25.0 | 75.0 |

**Conclusions & Recommendations:**

The prevalence rate for overweight and at risk for overweight among children and youth in this inner city Latino community is more than twice the national average. Primary health care providers need to acknowledge and correct the presence of obesity and overweight in children and adolescents early and provide appropriate management of the problem. Targeted preventive and intervention strategies for overweight and obesity in children and adolescents are urgently needed to halt this prevalence.

# Early Outcomes of the First 1471 Consecutive Kyphoplasty Procedures in the United States for the Fixation of Painful Osteopenic Vertebral Body Compression Fractures (VCF)

Steven R. Garfin[1], M.D., Isador H. Lieberman[2], M.D., Mark A. Reiley[3], M.D., Joseph M. Lane[4], M.D., Frank M. Phillips[5], M.D., Haleitt B. Mathews[6], M.D., Hansen A. Yuan[7], M.D., Barton H. Sachs[8], M.D., for the Kyphoplasty Study Group

[1]University of California, San Diego, Medical Center, San Diego, CA; [2]Cleveland Clinic, Cleveland, OH; [3]Berkeley Orthopedic Medical Group, Berkeley, CA; [4]Hospital for Special Surgery, New York, NY; [5]University of Chicago Spine Center, Chicago, IL; [6]Mid-Atlantic Spine Specialists, Richmond, VA; [7]State University of New York Health Sciences Center, Syracuse, NY; [8]Albany Medical Center, Albany, NY

## BACKGROUND

- 700,000 VCF's per year
- 275,000 diagnosed, >80% due to pain
- Spinal deformity associated with
  - Significant morbidity
  - 23% increased mortality (Kado, Ann Int Med 1999)
- Current treatments ineffective
  - Open surgeries fail
  - Medical management palliative
- Vertebroplasty
  - Bilateral transpedicular cement fill
  - Relieves pain
  - Requires high pressure and runny cement
  - High risk of cement leaks
    - Up to 73% where documented (Weill et al., Radiology 1996[1])
  - Major complications (Chiras, J Int Neurorad 1997)
    - 1.3% in osteoporosis
    - 10% in metastatic cancers

## KYPHOPLASTY

Kyphoplasty is a minimally invasive orthopedic procedure for reducing and fixing painful vertebral body compression fractures secondary to osteopenia. Using a posterior approach, one or two inflatable Bone Tamps (Fig. 1) are inserted into the fractured vertebral body, generally using a bilateral transpedicular approach (Fig. 2). The surgeon carefully inflates the balloon tamps (Fig. 2) using radiopaque contrast medium with image, volume and pressure control. The increased balloon tamp volume compacts the inner cancellous bone as it pushes the fractured outer cortical bone back toward its normal position. The inflation path is also controlled by placement, volume and balloon design. After reduction, the balloon tamp is removed, and the resulting void is filled with thick PMMA under fine manual control and low pressure. The steps of Kyphoplasty are illustrated in Fig 3.

Kyphx™ Inflatable Bone Tamp (IBT)

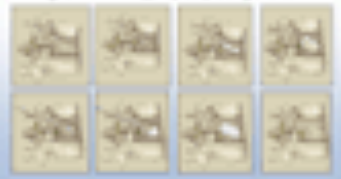
Fig. 1

Cleared in the U.S. for the reduction of fractures and/or creation of a void in cancellous bone

Fig. 2

Bilateral, Transpedicular Fracture Reduction with the IBT

Fig. 3 Kyphoplasty Using the IBT



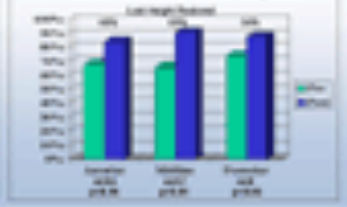
## STUDY DESIGN AND METHODS

A retrospective multi-center review to assess early outcomes with Kyphoplasty. Pain was localized by physical examination. The presence of marrow edema and collapse was confirmed on MRI. General or deep local anesthesia was chosen based on anatomy, number of levels and patient status. The first 135 patients at our centers were asked to characterize their back pain as improved, the same or worse 24 hours post-op and at last follow-up. Fractured and nearest normal vertebral body heights were measured anterior, midline and posterior in the first 27 vertebral body fractures treated by one surgeon (MAR). The height of the nearest normal vertebral body was used to calculate the % of predicted height for all the vertebral bodies (Fig. 4A) and for the sub-set where which had lost 15% or more of height before treatment (Fig. 4B).

The pre-treatment height was subtracted from the predicted height, then divided by the post-treatment height subtracted from the predicted height, to find the percentage of lost height restored. One set of X-rays by one surgeon (FMP) are used to show an example height restoration (Fig. 5A) and deformity correction (Fig. 5B). Device-related major complications from all procedures are reported. PMMA leaks in the first 70 procedures performed by one surgeon (IHL) were assessed with X-ray and MRI.

Figure 4A:
Percent of Predicted Height Pre- and Post-Kyphoplasty (n=27)

Figure 4B:
Percent of Predicted Height Pre- and Post-Kyphoplasty in Fractures With a 15% or Greater Compression



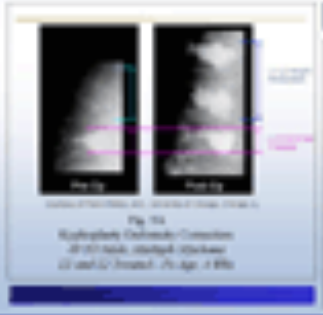


Fig. 5A
Kyphoplasty Deformity Correction
(F.M.P.) Adult, Adult/Adult Attachment
(2 Level (L) Treated - Pre Age: 4 Wks

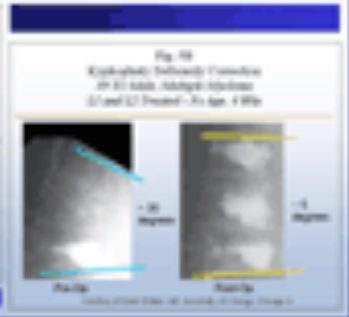


Fig. 5B
Kyphoplasty Deformity Correction
(F.M.P.) Adult, Adult/Adult Attachment
(2 Level (L) Treated - Pre Age: 4 Wks

## PRELIMINARY RESULTS

- 1471 fractures (levels Table 1)
  - Average fracture age: 10 months
  - Range: 11 days to 11 years
- 660 sprinters
- 344 patients (profile Table 2)
- Average vas score/box 2.7
- Average maximum pressure, 150 psi (range, 80-270)
- Average Tamp inflation volume: 5 cc (range, 2-10 cc)
- More than 90% experience pain relief
  - Most immediately
- 68% report pain improvement at 6 months
- 85% (95% restoration of local height (Figs. 4A, 4B, 5A, 5B)
- No increased incidence of adjacent fracture
- 1.5% device related major complications
  - 8 neurological
  - 1 pulmonary
  - 1 bleeding
  - 0 deaths
- 0.9% leak rate (learning/learning curve)

## CONCLUSIONS

Kyphoplasty is an important treatment option that provides immediate mobility and return to activities of daily living to patients with acutely painful vertebral body compression fractures secondary to osteoporosis. Kyphoplasty facilitates fracture reduction and deformity correction. While reduction is more likely in acute fractures (four months or less), it has been seen in fractures over one year old. Kyphoplasty also provides rapid pain relief in the nearly all patients, and this result is independent of fracture reduction. The safety profile of Kyphoplasty compares favorably to the published safety profile of vertebroplasty.

# A Large-Scale Public Library Renovation in Taiwan

Library Association of R.O.C
National Taichung Library of Taiwan

ABSTRACT

There are 535 public libraries, including [illegible] county, and village public libraries, in Taiwan. As most of them were built in 1960s, they are not fit in the digital environment to meet users needs.

In order to upgrade the quality of public library services in Taiwan to meet users needs and to fulfill lifelong learning, in 2002, the central government of Taiwan approved a budget of NT$1.2 billion (US$ 4 million) as a large-scale public library renovation project in 301 public libraries.

National Taichung library was designated as coordinate library to execute the project from February 2002 to June 2004. 301 public libraries were divided into eight groups according to the geographical area, and a steering committee was formed, consisting 96 committee members from the fields of library and information science, architecture, space design, literature, and history. 96 committee members were assigned to one of eight groups of 301 public libraries to help and to give suggestions of renovation, improvement, replacement, service progress of each library.

The project was executed and completed efficiently and effectively in June 2004. This poster presentation will display the results of the renovation, improvement, replacement, library management, and services of 301 public libraries in Taiwan. The contents of the posters will be explained by words, pictures, and statistical tables.

Keyword: Public libraries
http://www.ntl.gov.tw

# WHICH IS MORE IMPORTANT: NUMBER OF PATCHES OR CONNECTIVITY?

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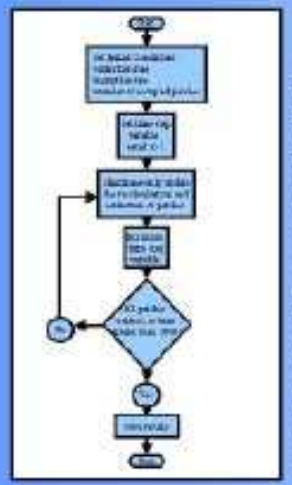
## INTRODUCTION AND OBJECTIVES

Metapopulation conservation efforts with limited resources would benefit from a clear understanding of the effects of different conservation strategies so that the conservationist can decide how to best spend their resources. In particular, a metapopulation with multiple existing patches and corridors may ask if it is possible to know what conservation strategy is more effective: is it better to spend effort to add new patches to the metapopulation, or is it better to spend effort to facilitate migration between patches?

[illegible] to the complexity of this question. My model might be useful in answering these questions. For example, if the conservationist knew that an additional patch would only lead to a small increase in long-term persistence, it would not be worth the money and effort to create another patch. On the other hand, if the addition of a patch would greatly increase the persistence of the metapopulation, then the conservationist would know that the money and effort to create another patch would be worthwhile.

I developed a simple metapopulation model to investigate this issue. I ran the model using varying numbers of patches, which each patch was assigned a probability to be either extinct or occupied, and various average distances between patches. The distance between patches was considered to be the number of steps it takes for a migrant to travel between patches. The effects of metapopulation persistence were then observed.

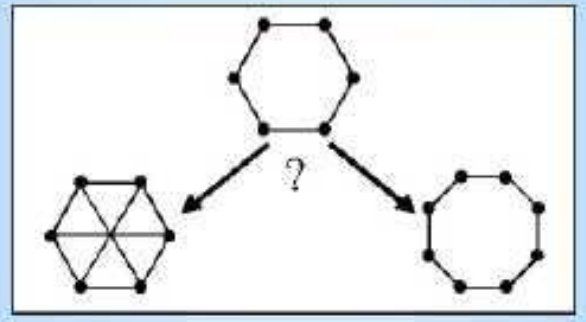
## THE PROGRAM



### ASSUMPTIONS AND LIMITATIONS

- Additional migration pathways were added in a manner which held the number of pathways to each patch fairly constant. In effect this was done to investigate the effects of less connective configurations.
- Starting patch distribution was randomly determined, and is the simulation was always presumed that a specific metapopulation will face the starting conditions.
- All patches were assumed to be structurally equivalent and of equal value to the metapopulation.
- All migration pathways were equivalent, regardless of spatial distances or distribution involved.
- The model had a few restrictions for differing probabilities of extinction and migration.
- The model was generated results from differing extinction and migration probabilities within a number of patches. It is possible that the specific parameter values that were chosen for this model may not be truly representative of the overall migration function.

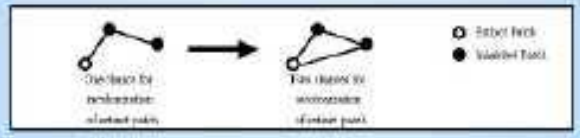
## THE ISSUE




A metapopulation is a collection of discrete population patches, in which individual patches may [illegible] go extinct and be re-colonized. In the long-term viability of the metapopulation helped more by adding new patches or by increasing the number of migration pathways between existing patches?

Adding patches increases the overall population of the organism, and creates a total extinction less likely by increasing the sheer number of patches which would have to go extinct.

Adding migration pathways increases the likelihood of re-colonization of extinct pathways, by giving extinct patches more sources for immigration.

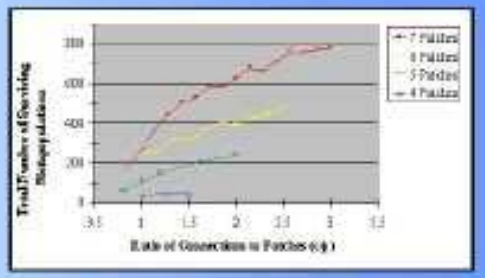



## RESULTS

I tested the model by running simulations which considered five parameters:

- number of patches (values 4, 5, 6, and 7)
- minimally connected vs. maximally connected representation
  - the ratio of migration pathways to number of patches, or c/p
- nine-step-stationary probabilities of .2, .4, .6, and .8
- nine-step-migratory probabilities of .2, .4, .6, and .8

For every combination of these parameters, I ran 100 simulations over 1,000 time-steps each, and recorded the number of persistences out of those 100 runs that the metapopulation did not go extinct. For each number of patches, I then created the equation of the linear regression line to the equation relating the ratio of migration pathways to number of patches, or c/p, to the number of persistences out of 100 runs. The results are graphed below. The model showed that increasing the number of patches by only one patch has a far greater effect on metapopulation survival than did increasing the connectivity between patches. As [illegible] for example, increasing two total connections at each situation, about the ratio of connectivity necessary to achieve the same survival rate by adding the two metapopulations. In every case, the metapopulation with the greater number of patches survived more frequently than the metapopulation with the greater connectivity. In other words, it was more beneficial to add patches than to increase the connectivity between patches.




## CONCLUSIONS

The results of the model indicate that when possible, adding patches to a metapopulation is the preferable conservation measure to addition of migration pathways. There is a clear, linear relationship between the number of patches and the long-term viability of the metapopulation compared to addition of c/p ratio. While the costs of these additional pathways is relatively low, the results of a conservation effort to increase connectivity between patches would be greater because of the increased chance of a migrant finding a suitable habitat.

It is worth noting that in my model, the curve for each additional patch was steeper than the last. It may be that the correct number of patches [illegible] a metapopulation's level of connectivity. Conservation using large numbers of patches may show that increased connectivity can have a greater effect on metapopulation survival than a few patches.

# Fusing $^{18}$FDG-hybrid PET To CT Images Significantly Alters Treatment Planning In The Radical Treatment Of Non-Small Cell Lung Carcinoma

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## Abstract

A prospective clinical study was conducted to determine the impact of integrating $^{18}$FDG-hybrid PET images with CT after chart to radical treatment of non-small cell lung cancer. Twenty-six patients were enrolled. All underwent positron emission tomography (PET) and computed tomography (CT) scans in the treatment position. PET and CT images were co-registered using a 3D, rigid body translation, rotation program and eight fiducial markers. Gross tumour volume (GTV) was contoured on CT only and then on CT-PET data. Separate treatment plans were created for each GTV. Dose-volume histograms were generated for the two GTVs. In 5 (19%) cases, management was changed from radical to palliative based on the combined data. In 9 (34.6%) cases, the planning target volume based on CT-PET would have been inadequately dosed by the CT only plan. In 10 (38.5%) cases, the spinal cord dose was reduced by 200 cGy or more with the PET data. In summary, PET-hybrid PET altered treatment plans in 65% of cases.

## Problem

Local control with radical radiation therapy for non-small cell lung carcinoma (NSCLC) is often poor. Dose escalation with SBCRT has the potential to improve outcome. The weakest link with any dose escalation approach is the ability to accurately define the gross tumour volume (GTV). With anatomic imaging techniques such as CT or MRI, it is often difficult to distinguish malignant from normal tissues, particularly when atelectasis, pneumonitis, or normal tissue displacement occurs. CT and MRI are also not well suited for determining which, if any, mediastinal lymph nodes are involved. A method more sensitive to lymph node involvement would help guide treatment strategies.

## Potential of $^{18}$FDG-hybrid PET for Radiation Therapy Planning

"Fluoro-deoxyglucose (FDG) is a glucose analogue that is metabolically trapped in cells. Many malignant tissues are associated with increased glycolysis and thus demonstrate increased uptake of FDG. In lung cancer staging, FDG-PET has proven to have greater sensitivity and specificity than CT[1,2] in radiation planning, it may help to distinguish tumour from other processes such as atelectasis. As a functional imaging modality, FDG-PET may complement the anatomic data from CT.

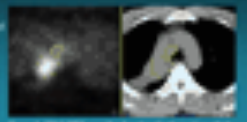

Figure 1. FDG-PET provides functional information which distinguishes malignant tissue from atelectasis. Tissue and airless contrasts are found on the PET and CT, respectively.

**Study Objective: To determine the impact of integrating $^{18}$FDG-hybrid PET images with CT planning images on treatment planning of patients with NSCLC.**

## Prospective Study Design

### Imaging: in treatment position and same day

**FDG-hybrid PET**
- Minimum 4 hours fasting prior
- 4 – 5 mCi $^{18}$FDG injected
- Eight 5 bed (1 or 2 $^{18}$FDG/$^{18}$Fe scanners)
- Philips BGO camera
- 30 – 45 min single transmission acquisition
- Voxel size 4.0 x 4.0 x 4.0 mm

**CT simulation**
- Eight 5 mm axial fiducials
- Philips PQ5000 CT
- Spiral CT with 1mm slice thickness and 1mm inter-slice interval
- Voxel size 0.9 x 0.9 x 1 mm

Image Registration

The CT and FDG-PET image sets were co-registered using a 3D, rigid body translation, rotation program and eight fiducial markers. All registrations achieved a conjugate deviation of less than 5 mm.

### Patient Selection

- referred for radical radiation therapy
- able to lie in treatment position (i.e. fit) window
- agreeable to informed consent
- preferential selection for poorly-defined tumours on diagnostic CT

### Treatment Planning

- GTV localized using CT only and then with PET/CT by each of 3 physicians
- Separate plans generated for CT-based PTVs and CT-FDG-based PTVs
- AP-PA fields for 40 Gy and oblique boost fields for 20 Gy to the mediastinum
- Cord dose restricted to 46 Gy
- DVHs generated for PTVs and cord

## Impact of FDG-hybrid PET on Patient Management

- In 5/26 (19%) patients, radiation therapy was changed from radical to palliative intent because of the recognition of FDG-PET data. (a) FDG-PET image showing FDG-avid node (arrow), previously interpreted on diagnostic CT. (b) Co-registered CT at the same anatomic position. (c) AP pilot image showing GTV (red) and FDG-detected nodes labeled in (a) (purple).

## Impact of Co-registered FDG-hybrid PET on PTV Coverage

- In 9/26 (35%) patients, the volume of $PTV_{CT/FDG}$ receiving at least 90% of the prescribed dose with the CT-only-based plan was less than 90%.

Figure 3. Three examples in which our having the FDG-PET would have resulted in a geographic miss. (a) FDG-PET fused with CT demonstrates an FDG-avid node inferior to the vertebral cut directed on CT. (b) CT image displaying the AP and inferior oblique beams used for the CT only-based plan. The isocentre lines are shown. Without FDG-data, only 75% of the CT/FDG-based PTV (blue) would have received at least 90% of the prescribed dose.


Figure 4. Coverage of $PTV_{CT/FDG}$ based on the CT only plan. The results are the average of 3 physicians. In 9 cases, less than 90% of the PTV would have received 90% of the isocentre dose (left column). In 10 cases, the minimum dose to the $PTV_{CT/FDG}$ would have been less than 40% of the isocentre dose (right column).

## Impact of FDG-hybrid PET on Spinal Cord Dose

- In 10/26 (40%) cases, the maximum cord dose was reduced by more than 200 cGy with CT-FDG data.

Figure 5. The maximum dose to the spinal cord in the CT-only and CT-FDG plans are shown for each patient. The results are the average of the physicians' plans. A dose reduction of > 200 cGy was achieved in 10/26 cases, when FDG data was added to the CT.


## Discussion

The impact of integrating $^{18}$FDG-hybrid PET with CT simulation was assessed in terms of patient management, PTV coverage, and maximum dose to spinal cord. In 5 (19%) of 26 patients, FDG findings resulted in a change in management, in 9 (35%) of 26 the CT-based plan would have resulted in significant geographic miss, and in 10 (38%) of 26 the cord dose was reduced by 200 cGy or more. The impact was most significant in those with mediastinal or previously unresected/irradiated mediastinum. For the former group, others have reported changes in field size when using FDG-PET data.[3]

In this work, plans were generated separately for the GTVs localized independently by two physicians and results based on the average. Inter-observer variability can vary and FDG-PET can play a role in reducing physician variation in localization.[4]

## Conclusions

The fusing of $^{18}$FDG-hybrid PET images to CT planning images significantly altered treatment plans in 65% of our cases. Integration of $^{18}$FDG-hybrid PET into beam planning minimizes the possibility of geographical misses and should be a fundamental step in SBCRT for lung cancer.

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### Acknowledgements

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# LESSONS LEARNED FROM AIRWAY PRESSURE RELEASE VENTILATION (APRV)

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## INTRODUCTION

Airway Pressure Release Ventilation (APRV, a.k.a. BIPAP) has been previously demonstrated to be a useful modality to manage patients with acute lung injury (ALI) or the acute respiratory distress syndrome (ARDS). As this is a fundamentally different mode than conventional cyclic ventilation, we reviewed a single institution's experience with APRV to determine safety, complication detection, and efficacy at resolving hypoxemia and hypercarbia.

## METHODS

Consecutive patients transitioned from either volume or pressure targeted ventilation to APRV (Dräger Evita 4 Pulmonary Workstation) at a University hospital surgical ICU were retrospectively reviewed. Patients initially ventilated with APRV were excluded. Initial ARPV settings to correct hypoxemia ($pO_2 \leq 60$ torr on $FIO_2 \geq 0.9$) were a $P_{high}$ at the prior plateau pressure, a $T_{high}$ of 6.0 sec and a $T_{low}$ of 0.8 sec. Hypercarbic ($pCO_2 \geq 55$ torr and $pH \leq 7.3$) patients were set at a $T_{high}$ of 5.0 sec and a $T_{low}$ of 1.0 sec. Settings were adjusted to resolve hypoxemia and hypercarbia. IRB approved abstracted data included principal diagnoses, ventilation parameters, laboratory values and ventilator associated complications. Data before and after APRV were compared using a two-tailed paired t-test or Chi-square as appropriate; significance was assumed for $p < 0.05$ (*).

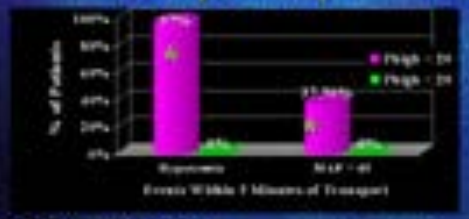
## RESULTS

### Demographics

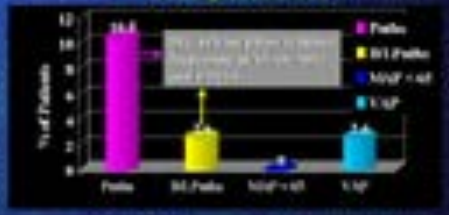

### APRV


| Element | Value |
|---|---|
| % Hypoxemia | 88% |
| % Hypercarbia | 12% |
| Time to $S_aO_2 \geq 92\%$ | 7 ± 4 min |
| Time to $FIO_2 \leq 0.6$ | 5.2 ± 0.9 hr |
| Time to $pCO_2 \leq 40$ torr | 42 ± 7 min |
| Time to max Δ $pCO_2$ | 76 ± 12 min |
| Mean change in $V_T$ | -3.3 ± 0.9 L/min* |

### Transport Safety




### Complications




## CONCLUSIONS

1. APRV is a safe rescue mode for hypoxemic or hypercarbic respiratory failure and requires a significantly lower $V_T$ than conventional ventilation.
2. Decreasing release phase volumes and a rising $pCO_2$ are strong indicators of pneumothorax in a patient on APRV. Routine end-tidal $CO_2$ monitoring is recommended.
3. Preparation for safe intra-hospital transport may be keyed to the $P_{high}$ required for oxygenation and ventilation. Patients requiring a $P_{high} > 20$ cm $H_2O$ should be transported on the ventilator.