


Brain Injury: An Uphill Road

Where did all these bumps come from?

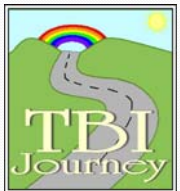
Dr. Ron Skelton



17th Annual G & B Johnson
Brain Injury Conference

Brain Injury: An Uphill Road

- Why so tough?
 - What happens to a brain when injured?
- How do those injuries affect you?
 - What problems does it cause?
- Reasons for hope down the road.



Introductions

- Me: a prof at UVic,
 - Have been working at brain injury research for past 20 years
 - I am an academic, not a clinician.
 - My knowledge of brain injury is overview
- Goal: Two guys in a balloon
- Goal: I will try to give you information that is
 - Accurate
 - Not obvious
 - Useful
 - For survivors, family members, therapists. (How many?)

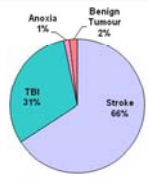
Content and Hope

- My information will cover the basics of
 - What parts of brain are damaged
 - How this produces particular problems
- Purpose: information may lead to
 - Better understanding
 - Less anxiety
 - Better coping
- Hope
 - Information about brain recovery mechanisms
 - Reasons for hope

Brain is a busy place



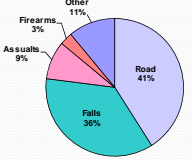
Common Causes: ABI



Cause	Percentage
Stroke	68%
TBI	31%
Anoxia	1%
Benign Tumour	2%

- Stroke
 - Interrupted blood flow
 - Mostly in people over 55
- Traumatic Brain Injury
 - Blow to the head
 - Mostly males, 18-25
- Anoxia – lack of oxygen
- Penetrating brain injuries
 - Tumours, small fast objects

Common Causes: TBI




TBI-related hospitalizations and deaths BC, 1995-2000

- Road accidents
 - Cars, trucks, bikes, pedestrians
- Falls
 - work, home, sports
- Assaults
 - Blows, hitting ground
- Firearms
 - Usually fatal, mostly suicide

Common Effects


- Strokes and Penetrating Head Injury
 - Specific to where the neural tissue was damaged
 - Paralysis, other motor loss, speech loss
- TBI
 - Many different problems
 - All at once.
 - Variable from person to person
 - Deficits
 - Severity
 - Recovery



Common Problems: TBI

Top 10 (Things that impact on everyday life)

1. Fatigue	2
2. Pain	3
3. Organizing	4
4. Language Expressing	4
5. Memory - Recent	4
6. Economic Security	4
7. Health Satisfaction	4
8. Divided Attention	4
9. Emotional Reactivity	4
10. Sustained Attention	4 (10 = "It's fine", 1 = "It's really bad")




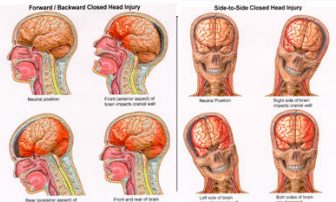
Common Problems: TBI

Top 10 issues: How they cluster

1. Fatigue	2	←	General
2. Pain	3	←	General
3. Organizing	4	←	"Mind"
4. Language Expressing	4	←	"Mind"
5. Memory - Recent	4	←	Memory
6. Economic Security	4	←	Sum of Everything
7. Health Satisfaction	4	←	Sum of Everything
8. Divided Attention	4	←	Sum of Everything
9. Emotional Reactivity	4	←	"Mind"
10. Sustained Attention	4	←	"Mind"

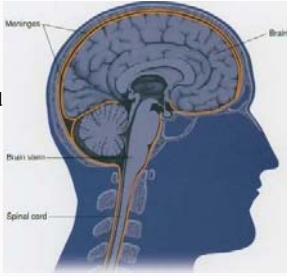
General Problems: Brain Causes

- Skull is hard
- Brain is soft.
- In TBI, brain hits inside of skull

General Problems: Brain Causes

- Skin of brain (meninges) gets bumped and bruised
 - Little blood vessels break or are bruised
- Lots of outer brain gets bumped and bruised
- Stem of brain (brainstem) can be stretched
- Fine connecting fibers (axons) get stretched or broken.
 - → "Diffuse Axonal Injury"



General Problems: Causes and Effects

- Meninges and blood vessels damaged
 - Other sources too
- Outer brain and brainstem damage
 - Working harder
 - Controls sleep wake
- Diffuse axonal injury
 - Cells harder to excite
 - Messages slowed
 - Playing "a man short"

➔


- Pain: Headache
 - Possibly migraine
 - Chronic (for 6-12 mo)
- Fatigue and sleep
 - Tired more
 - Trouble sleeping
 - Circadian rhythms off
- Everything harder to do
 - takes more time
 - takes more effort

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Mind Issues: Brain Causes

Frontal Lobe Damage

- Front of brain
 - Hits front of skull
- Brain above eyeballs
 - Hits skull above eyeballs
- Frontal lobe – Control centre
 - Planning, organizing
 - Action coordinator
 - Emotion Interpreter
 - Inhibitions



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Mind Issues: Causes and Effects

<h4>Control Center</h4> <ul style="list-style-type: none"> • Planning, organizing • Action coordinator 	➔	<h4>Frontal Problems</h4> <ul style="list-style-type: none"> • Disorganized <ul style="list-style-type: none"> • Putting things in order • Being on time • Attention problems <ul style="list-style-type: none"> • Focusing on 1 thing • Doing 2 things at once • Sequencing <ul style="list-style-type: none"> • thoughts, words, actions
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Mind Issues: Causes and Effects

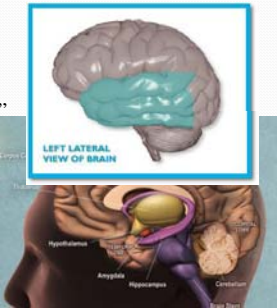
<h4>Control Centre</h4> <ul style="list-style-type: none"> • Emotion Interpreter <ul style="list-style-type: none"> • Internal • Context • Awareness – self, others • Inhibitions <ul style="list-style-type: none"> • "Second thought" • Social inhibitions 	➔	<h4>Frontal Problems</h4> <ul style="list-style-type: none"> • Emotional reactivity <ul style="list-style-type: none"> • Intense emotions • Poor emotional control • Social blindness • Social Problems <ul style="list-style-type: none"> • Impulsiveness <ul style="list-style-type: none"> • words, actions • Loss of "manners"
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Memory Issues: Brain Causes

Temporal Lobe Damage

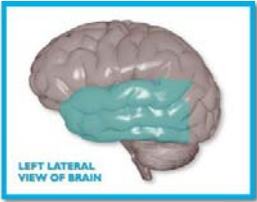
- Front of temporal lobes
 - hits front of temporal "caves"
- Hippocampus
 - Deep in temporal lobe
 - Most vulnerable
 - Canary in mine-shaft
 - Oxygen and blood flow
 - Input and output fibres
 - Stretched and broken



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Memory Issues: Causes and Effects

- Front of temporal lobes
 - Object identification
- "Tip-of-the" tongue
 - Object naming
 - Word finding



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Memory Issues: Causes and Effects

- Hippocampus
 - Effortless learning
 - Time and space
- Navigation by intuition
- Memory problems
 - Sketchy “recent memory”
 - Names and places
 - Events (episodes)
 - Getting lost
 - Spared
 - Pre-injury memories
 - Emotional associations
 - Partner
 - Smells, food



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Hope: Neuroplasticity

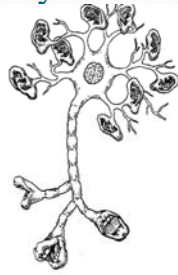
- Problem for recovery
 - No new neurons. ☹
 - No axon healing. ☹
- “Neuroplasticity”
 - = the brain’s ability to change ☺
 - By rewiring connections between neurons
 - Connections = “synapses”
 - Weak synapses can strengthen
 - New synapses can be formed



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Hope: Neuroplasticity

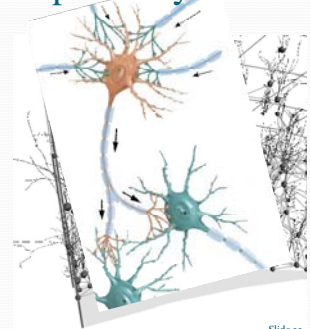
- Synapses – gateway of information
- Cells need activity from many inputs
- Analogy: collecting money for office gift
 - \$5 from 30 → great gift (exciting)
 - If staff cutbacks (2/3)
 - \$5 from 10 → ok gift.
 - Harder, slower to get exciting gift
 - Unless each gives \$10
 - and expectations reduced
- Synapses change in same way



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Hope: Neuroplasticity

- Neurons connected to many other neurons
- Information comes in through synapses
 - Cells need input from many inputs (5,000)
- Form networks of interconnected cells



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Hope: Neuroplasticity

Mechanisms of Recovery (Brain changes)

1. Recovery from “Brain Shock”
2. Sprouting
3. Rewiring (relearning)

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Hope: Neuroplasticity

Mechanism 1: Recovery from “Brain Shock”

- After injury, some neurons lose inputs
 - The are ok but can’t activate
 - Not enough inputs
 - Brain area goes “off-line”
- With time and use, remaining inputs gain strength
 - And so shut-down neurons get active again
 - Brain areas comes back “on-line”

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Hope: Neuroplasticity

Mechanism 2: Sprouting

= Reconnecting “De-friended” cells

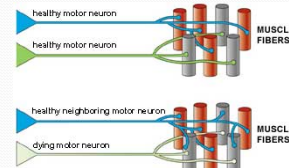
- After injury, some neurons ok, but inputs (friends) are lost
 - Receiving neurons get “lonely”
 - Brain area goes off-line

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Hope: Neuroplasticity

Mechanism 2: Sprouting

- Inputs to neuron’s neighbours “sprout” to de-friended cells
 - And restore inputs to “lonely” cells
 - Like friends of remaining friends



- Brain area comes back online (may be a bit confused)

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Hope: Neuroplasticity

Mechanism 3: Rewiring (relearning)

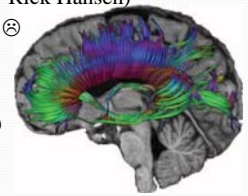
- All learning rewires brain connections
- Sometimes damaged area is lost entirely
- Need to learn to do tasks using another area of brain
 - Called “Behavioural compensation”
 - = Work-arounds
 - E.g., Memory books, Post-it notes
- Basis of a most therapy (Best we have so far)
 - Using what’s left.

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Hope: Research

Long-term

- Cellular mechanisms of recovery
 - Neurogenesis – new neurons ☺ (E.g., UVic)
 - Axon regrowth ☺ (e.g., iCord – Rick Hansen)
 - Spinal cord and 10 years away. ☹
- Brain Imaging
 - Better MRI scans
 - Imaging of axon function ☺
 - Dr. Joschko will say more



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Hope: Research

Long-term (minor)

- Spatial navigation (me at UVic)
 - Navigation in virtual reality
 - Have found what TBI survivors can and can’t do
 - Future: How TBI survivors might navigate better
 - Future: How to train survivors to navigate better

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Hope: Research

Long-term (me at UVic)

- Spatial navigation and EEG
 - EEG during navigation in virtual reality
 - New method of analysing EEG
 - Shows what areas of the brain are active
 - And activating each other.
 - Future: What might be missing in TBI survivors

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Hope: Research

Medium term

- Better measurement of outcome (and rehab)
 - 3 new measurement tools ☺
 - We have developed one that listens to survivors ☺
 - Takes valuable rehab time ☺
- Better Rehab methods
 - Usually by practitioners – trying very hard ☺
 - Slow spread of information ☺

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Hope: Research

Medium term

- Community-based research
 - Growing in popularity
 - University researchers working on questions community wants answered
 - UVic-United Way

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Hope: Research

Medium term

- Community-based research: Coping Skills and Well-being
 - At VBIS, PG's Coping Skills program
 - UVic (me +)
 - Program: Weekly for 3 weeks, group, peers
 - Assessment: Pre and Post
 - Everyday functioning, satisfaction
 - Affect, Well-being, Coping
 - Study in progress

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Hope: Research

Medium term (Just an idea right now)

- Wii Fit and Rehab.
- Wii Fit being used by PT's in NeuroRehab (VGH)
 - Used for 2 years
 - Improvements in physical problems
 - Enjoyed by patients
- Plan is to research effectiveness
 - And measure cognitive recovery as well.

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Hope: You

Right now

- Use it or lose it? Be active:
 - Mind and Body
 - Exercise and Fun
- Purpose in Life
 - Working towards goals
- "Happiness comes from between"
 - Family and friends
- Church?

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Hope: You

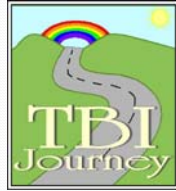
Right now

- Resources
 - Internet
 - My website
 - Google and YouTube
- Books
 - For survivors and family
 - Links to Amazon.ca on my website
- CV Head Injury Society

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On the Road: You are not alone

- Each survivor's brain injury is unique
 - But survivors face similar problems
- Many problems have known causes
 - Though no "cures" yet.
 - Only work-arounds
- Your life can have meaning.
- People care and can help
- It's a tough road, but you are not alone.



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Research Partners

- Michael Joschko – Functional Outcome Profile (ICBC)
- Ann Mariscak – TBI/ABI Incidence (BCBIA)
- Sharon Livingstone – TBI and Spatial Navigation (NSERC)
- Philip Zeman – TBI and EEG (CANASSIST)
- Coping Skills
 - VBIS – Leidi Fortner (United Way)
 - UVic – Fred Grouzet, Stacey Ross

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