THE UNIVERSITY OF WESTERN AUSTRALIA

DENT 3005:Introduction to Pharmacology

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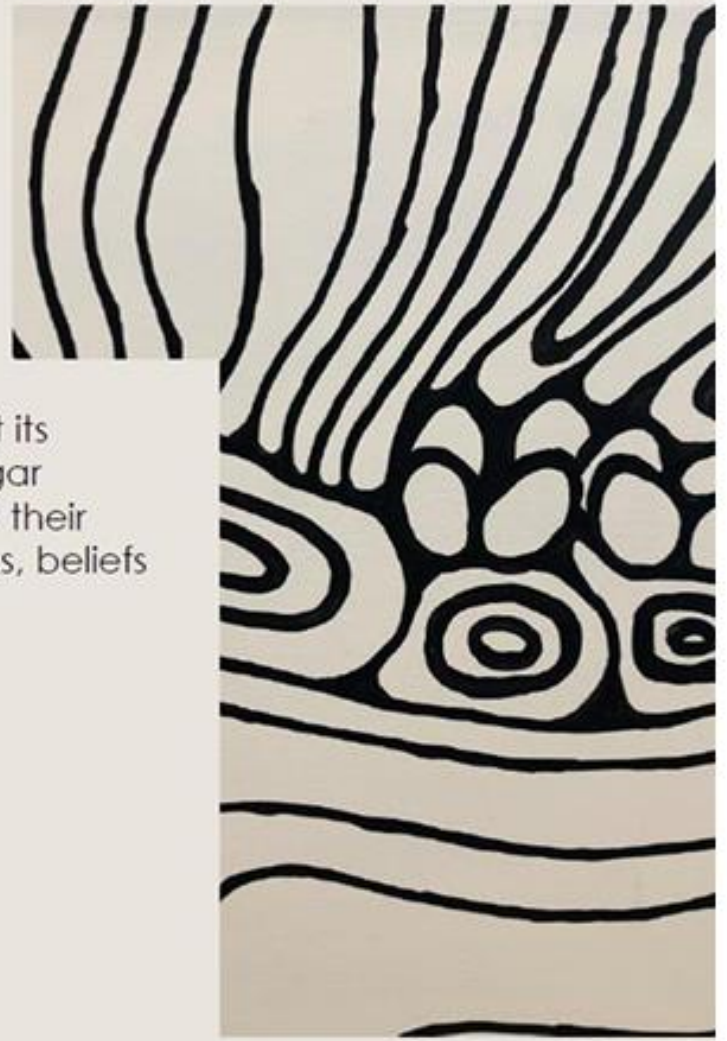
Dr Thuy Linh Truong
thuy.truong@uwa.edu.au

THE UNIVERSITY OF WESTERN AUSTRALIA

Acknowledgement of country

The University of Western Australia acknowledges that its campus is situated on Noongar land, and that Noongar people remain the spiritual and cultural custodians of their land, and continue to practise their values, languages, beliefs and knowledge.



Artist: Dr Richard Barry Walley OAM

Learning Outcomes

Learning objectives

1. Explain the role of complementary medicines in healthcare and dentistry
2. Identify uses, adverse effects, and interactions of key agents (St John's Wort, Valerian, Calcium, Evening Primrose, Ginkgo biloba)
3. Recognize clinically significant interactions
4. Apply this knowledge to safe patient management in dental practice

Term	Definition
Traditional Chinese medicine	- Has been established for over 2000 years - Disease is result of disturbance in natural environment of the body - Purpose is to restore the balance of Yin and Yang
Ayurveda	- Practiced primarily in the Indian subcontinent for 5,000 years
Aromatherapy	- Involves the use of essential oils to promote health and well-being
Homeopathic medicine	- A belief that “like cures like” - Involves dilutions of active compounds
Naturopathic medicine	- Practitioners work with natural healing forces within the body - Goal of helping the body heal from disease and attain better health
Qi gong	- A component of traditional Chinese medicine
Reiki	- A Japanese word representing universal life energy
Osteopathic medicine	- Conventional medicine - Emphasizes diseases arising in the musculoskeletal system - Underlying belief that all of the body’s systems work together, and disturbances in one system may affect function elsewhere in the body

Complementary medicines

- Herbal products have pharmacological effects – benefits, side effects, allergies, drug interactions
- Professional guidance essential for safe use and correct dosing
- Regulation in Australia – Therapeutic Goods Administration (TGA) & Office of Complementary Medicines ensure safety, quality, efficacy
- Regulation in NZ – Ministerial Advisory Committee on Complementary & Alternative Health advises government
- Challenges
  - Misconception: “Natural” = safe (e.g. strychnine is natural but toxic)
  - Variable active ingredient levels due to climate & growth conditions
  - Risk of contamination (e.g. heavy metals)

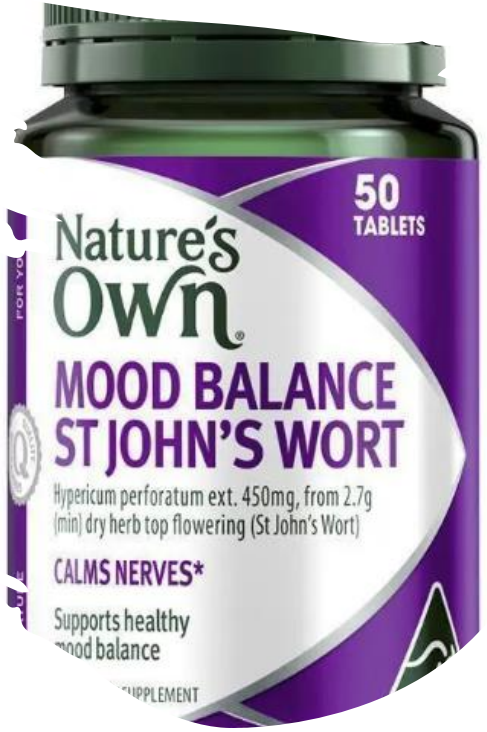
St John's Wort

- Active compound: *Hypericin* – standardised in commercial preparations
- Primary use: antidepressant for mild–moderate depression
  - Not effective in severe depression
- **Pharmacology**
  - MOA: Inhibits reuptake of serotonin, noradrenaline, dopamine, GABA, glutamate
  - Avoid with other antidepressants – risk of serotonin excess
  - Weak MAOI activity (mainly in vitro)
- **Serious interactions**
  - Serotonergic drugs: SSRIs, venlafaxine, buspirone, tramadol, triptans, pethidine, dexamphetamine, illicit stimulants
  - Drugs metabolised by CYP3A4, CYP2C9, CYP2C19
  - May enhance CNS depressant effects of sedatives & alcohol
  - Can alter blood levels of some medicines

ST JOHN'S WORT (DENTAL DRUG INTERACTIONS)		
Medication	**Interaction Severity**	**Potential Effect**
Azithromycin	Major	Possible photosensitivity reactions
Benzodiazepines	Major	Reduced effectiveness
Clarithromycin	Major	Reduced anti-infective effectiveness
Clindamycin	Major	Reduced anti-infective effectiveness
Codeine	Major	Increased sleep time and analgesia
Dexamethasone	Major	Reduced effectiveness
Diphenhydramine	Major	Possible photosensitivity reactions
Doxycycline	Major	Reduced anti-infective effectiveness Possible photosensitivity reactions
Erythromycin	Major	Reduced anti-infective effectiveness
Hydrocodone	Major	Increased sleep time and analgesia
Ibuprofen	Major	Possible photosensitivity reactions
Oxycodone	Major	Increased sleep time and analgesia
Prednisone	Major	Reduced effectiveness
Tetracycline	Major	Reduced anti-infective effectiveness
Zolpidem	Major	Reduced effectiveness

St John's – clinical considerations

- Risk when combined with other serotonergic agents
- **Symptoms**
  - Mental: agitation, confusion
  - Motor: tremor, hyperreflexia, poor coordination
  - Temperature: fever, sweating, shivering
  - GI: diarrhoea
- **Management:** discontinue contributing drugs, seek urgent medical review



Valerian (*Valeriana officinalis*)

- Strong odour due to ***valeric acid*** – attractive to cats, used as bait for feral cat control
- *Officinalis* = cultivated historically in monasteries for medicine & flavouring (e.g., root beer)
- **Pharmacology**
  - Roots used for sedative effect in insomnia
  - Some evidence: ↓ time to fall asleep, ↑ sleep quality, minimal "hangover" effect
  - Evidence mixed in recent studies
  - Generally safe for short-term use
- Active compounds: ***valepotriates***
  - May ↑ serotonergic activity (serotonin-like structure)
  - Possible action via GABA receptor complex (benzodiazepine-like)
- **Interactions & ADR**
  - Prolongs barbiturate effects – avoid with thiopentone & barbiturates (e.g., epilepsy treatment)
  - Adverse effects: headache, restlessness, occasional palpitations (rare)

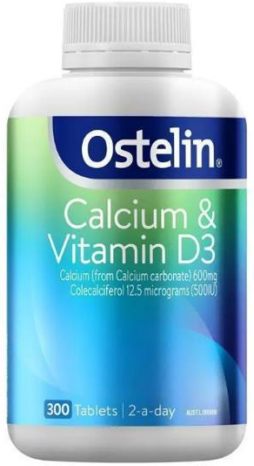
VALERIAN (DENTAL DRUGS INTERACTIONS)		
Concomitant Drug	**Interaction Severity**	**Potential Effect**
Benzodiazepines	Major	Excess sedation
Codeine	Major	Excess sedation
Diphenhydramine	Major	Excess sedation
Hydrocodone	Major	Excess sedation
Oxycodone	Major	Excess sedation
Zaleplon	Major	Excess sedation
Zolpidem	Major	Excess sedation

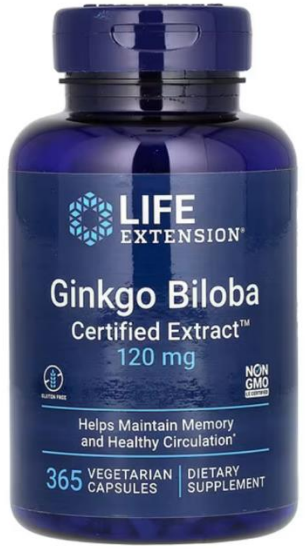
Valerian – clinical considerations

- Take at night to avoid daytime sedation
- Avoid caffeine, nicotine, high-sugar/fat foods in the evening (reduce sleep disturbance)
- Avoid in hepatic dysfunction – risk of increased hepatotoxicity with high doses
- Avoid in pregnancy – insufficient safety data; potential altered absorption during gestation

Other

SUBSTANCE + DRUG	INTERACTION SEVERITY	POTENTIAL EFFECT
Calcium + Doxycycline	Moderate	Reduced anti-infective effectiveness
Calcium + Tetracycline	Moderate	Reduced anti-infective effectiveness
Evening Primrose + Aspirin	Moderate	Enhanced bleeding
Evening Primrose + Ibuprofen	Moderate	Enhanced bleeding
Ginkgo biloba + Aspirin	Major	Enhanced bleeding
Ginkgo biloba + Ibuprofen	Major	Enhanced bleeding





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Special populations

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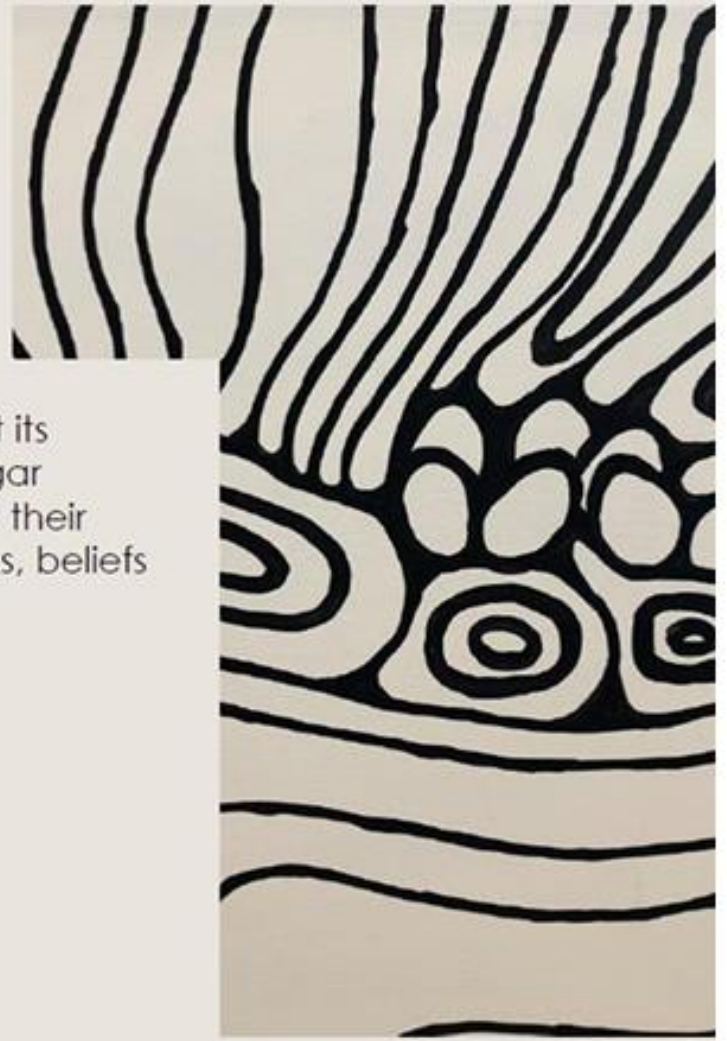

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Learning Outcomes

Learning objectives

1. Explain how pregnancy, ageing, and childhood affect pharmacokinetics
2. Recognise key pharmacotherapy considerations in special populations
3. Identify risks of interactions and adverse effects
4. Apply safe prescribing and dosing principles
5. Integrate pharmacology into dental treatment planning

Special populations

- **Considerations for**
  - Dental care must be adapted for different patient groups with unique needs
  - Today's focus: pregnancy, elderly, and children
- **Pregnant patients**
  - Balance maternal oral health with foetal safety
  - Timing of treatment is critical
  - Careful selection of medications and radiographs
- **Elderly patients**
  - Complex medical histories and comorbidities
  - Polypharmacy → increased risk of drug interactions
  - Age-related changes in oral tissues and reduced healing capacity
- **Children**
  - Require modified communication and behaviour management
  - Strong focus on prevention and early intervention
  - Growth and development influence treatment planning

Pregnancy: absorption & drug action

- Hormonal changes alter GI function
- Slower peristalsis & gastric emptying → drug absorption affected
- Erratic gastric acid secretion → impacts acidic drug absorption
- Effects vary between individuals → unpredictable outcomes
- Important to be aware of possible pharmacokinetic changes

Pregnancy: distribution

- Plasma volume expands in pregnancy
- May dilute drug concentration at receptor sites
- Little direct evidence of major altered drug effects
- Possible lower drug levels → reduced effect

Drug safety in pregnancy

- Timing of exposure → key to foetal effects
- Limited safety data (excluded from trials, few large studies)
- Risk–benefit balance must be assessed individually
- Australian pregnancy drug categories: no longer used
- Use evidence-based resources & drug info services for support

Australian pregnancy categories

- Not hierarchical
- Category B (B1, B2, B3): animal data
- B ≠ safer than C
- Category D not always contraindicated (e.g. anticonvulsants)
- System = general guide, not patient-specific advice
- **Limitations**
  - Implies safety ranking
  - No info on stage of foetal development
  - Not always updated with new data
- Moving away from category use

Australian pregnancy categories

Category	Definition
A	Drugs which have been taken by a large number of pregnant women and women of childbearing age without any proven increase in the frequency of malformations or other direct or indirect harmful effects on the foetus having been observed
B1	Drugs which have been taken by only a limited number of pregnant women and women of childbearing age, without an increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus having been observed. Studies in animals have not shown evidence of an increased occurrence of foetal damage
B2	Drugs which have been taken by only a limited number of pregnant women and women of childbearing age, without an increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus having been observed. Studies in animals are inadequate or may be lacking, but available data show no evidence of an increased occurrence of foetal damage
B3	Drugs which have been taken by only a limited number of pregnant women and women of childbearing age, without an increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus having been observed. Studies in animals have shown evidence of an increased occurrence of foetal damage, the significance of which is considered uncertain in humans
C	Drugs which, owing to their pharmacological effects, have caused or may be suspected of causing, harmful effects on the human foetus or neonate without causing malformations. These effects may be reversible. Accompanying texts should be consulted for further details
D	Drugs which have caused, are suspected to have caused or may be expected to cause, an increased incidence of human foetal malformations or irreversible damage. These drugs may also have adverse pharmacological effects. Accompanying texts should be consulted for further details
X	Drugs which have such a high risk of causing permanent damage to the foetus that they should not be used in pregnancy or when there is a possibility of pregnancy

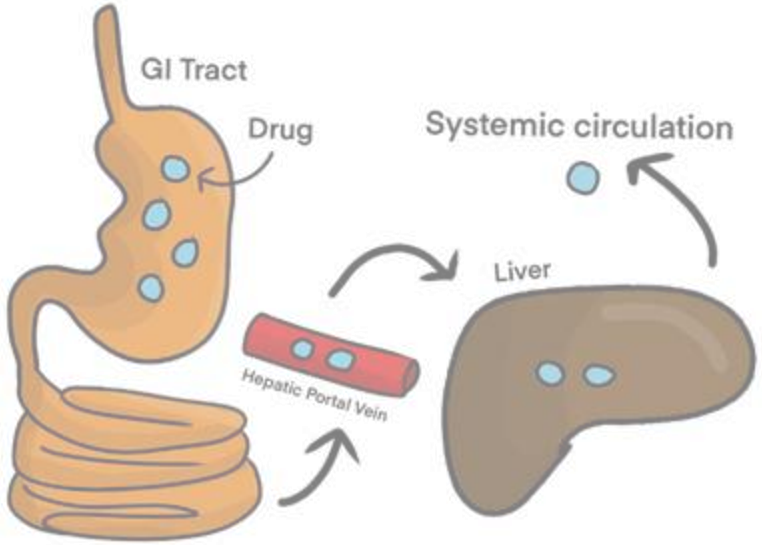
Please don't try to remember this, no longer recommended as part of standard practice

Age and pharmacokinetics

- Drug handling changes across lifespan
- Children: developing organs → variable responses
- Elderly: age-related decline in organ function
- Both groups → higher risk of adverse effects

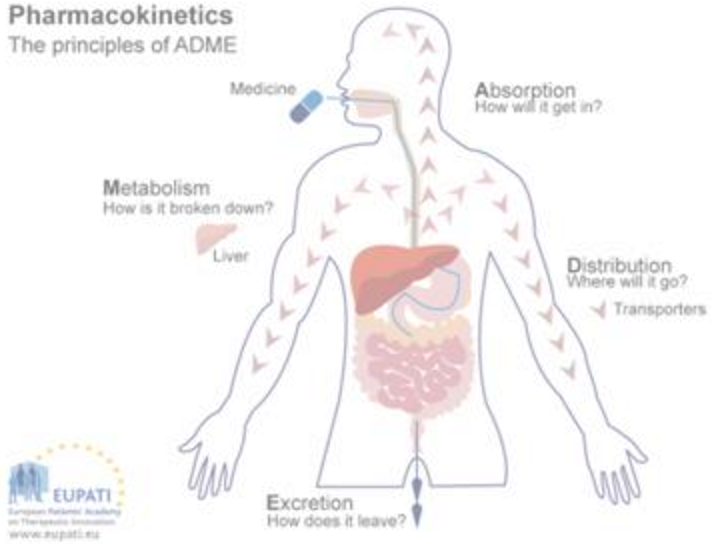
Absorption

- Slower peristalsis & gastric emptying at both extremes
- Infants: low bile & erratic gastric acid → altered absorption
- Example: penicillin absorbed better in infants
- Elderly: reduced perfusion & muscle mass → slower absorption
- Infants: thinner skin → ↑ topical absorption risks



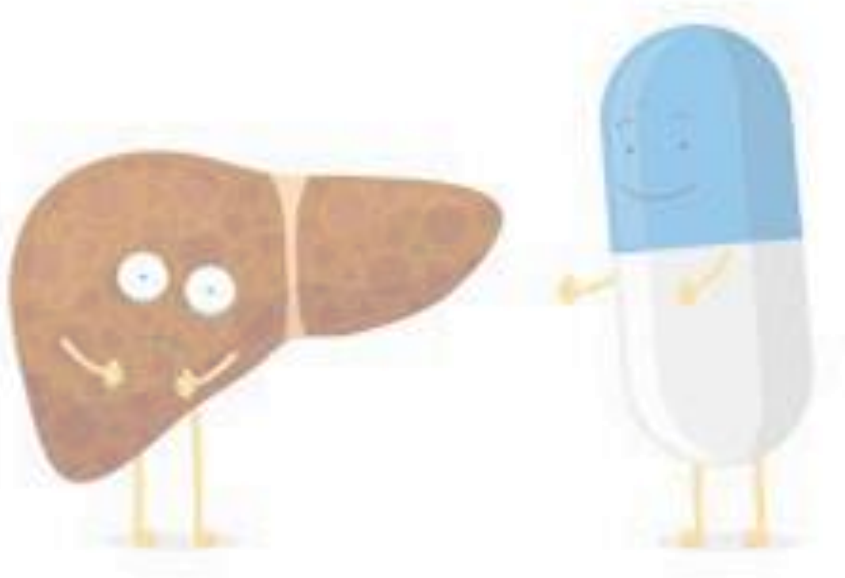
Distribution

- Lower plasma proteins → ↑ free drug levels in infants & elderly
- Neonates: risk of toxicity from high protein-bound drugs
- Kernicterus risk → bilirubin displacement
- Body composition changes with age
  - Infants: more body water, less fat
  - Elderly: less water, more fat



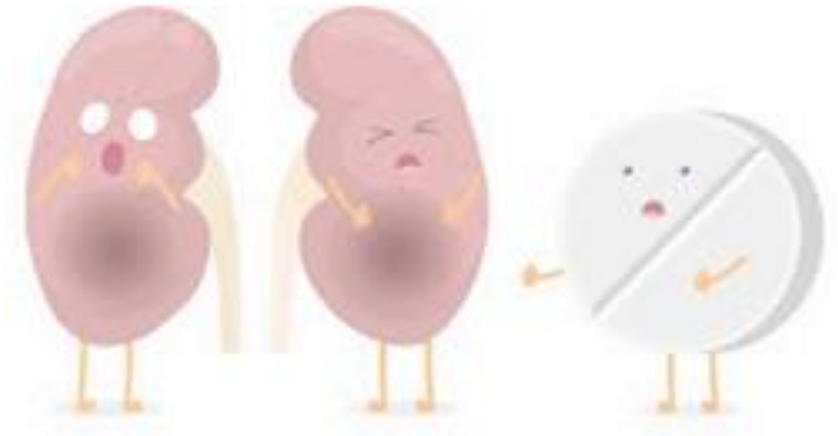
Metabolism

- Infants: immature liver enzymes → slower clearance
- Some drugs can induce enzyme activity (e.g. anti-seizure meds)
- Children 1–9 yrs: ↑ metabolism → higher clearance
- Elderly: reduced microsomal enzyme activity → slower metabolism



Excretion

- Neonates: immature kidneys → slower drug clearance
- Dosing intervals need adjusting
- Elderly: declining renal function with age
- Risk of drug accumulation & toxicity



Paediatric: dosage considerations

- Children ≠ small adults
- Dose not simply scaled by weight
- Organ maturity matters
- Best practice: dose by body surface area
- Some drugs require specialised paediatric dosing guidelines

Geriatric: clinical considerations

- Multiple comorbidities & polypharmacy
- Risk of drug interactions & adverse effects
- Falls & fractures linked to some drugs
- Non-adherence common
  - Cognitive decline
  - Social isolation
  - Financial/transport issues

Special populations: key takeaways

- Pregnancy: absorption & distribution altered, but variable
- Paediatrics: immature systems → careful dosing, ↑ risk of toxicity
- Elderly: declining organ function & polypharmacy → higher risk
- Safe care = understanding pharmacokinetics across lifespan

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