



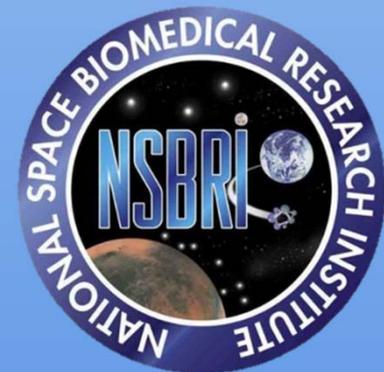
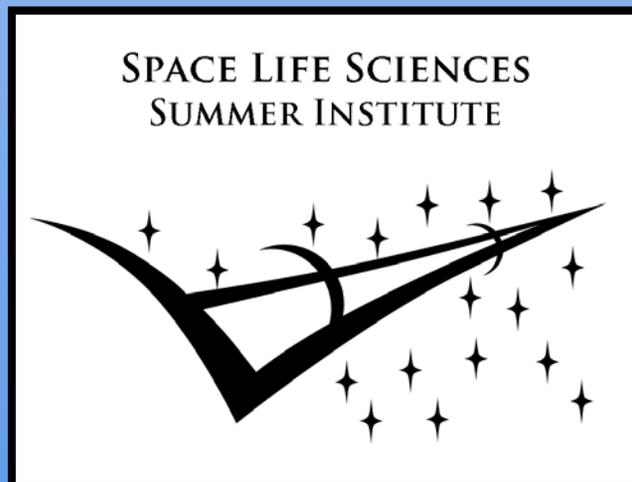
National Space Biomedical Research Institute Apprenticeship Exit Presentation

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Pharmacology Discipline

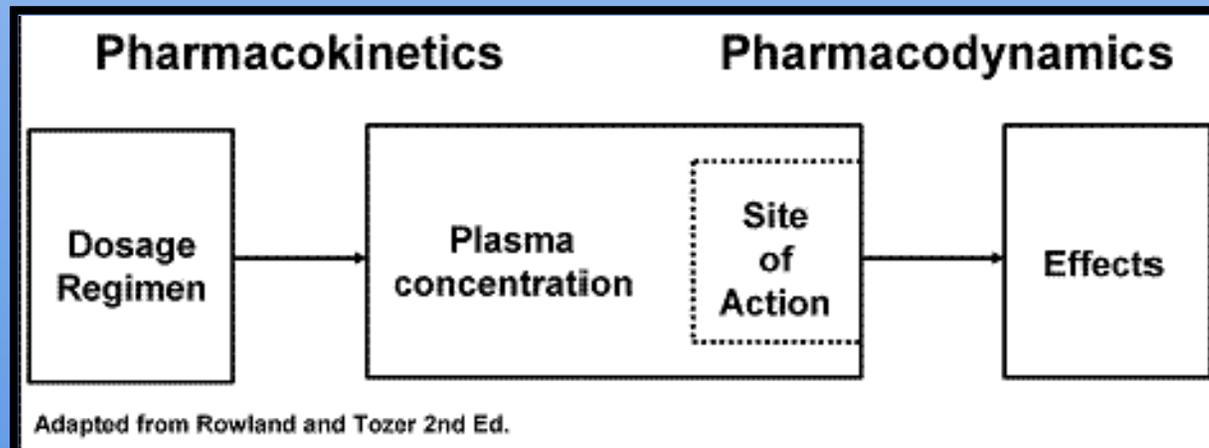






Risk of Clinically Relevant Unpredicted Effects of Medication

- Medication usage
- Medication stability
- Spaceflight and pharmacokinetics
- Spaceflight and pharmacodynamics
- Spaceflight and antimicrobials





Pharmacology Database

- Human Research Program Task
- Contain fundamental information about each medication in the ISS medical kit
- Information collected from terrestrial sources





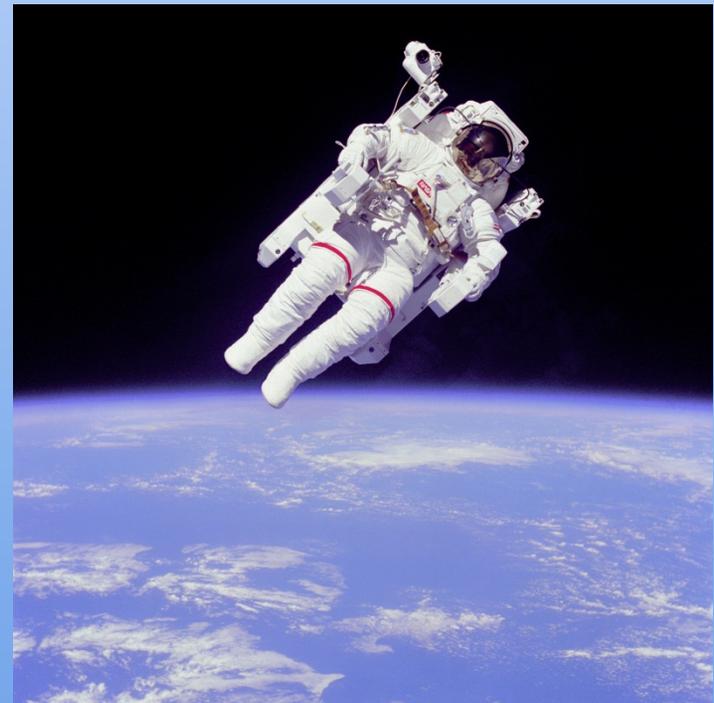
Pharmacology Database

- Permit pharmacology discipline researchers to quickly search for any drug-related information requested by space medicine or other researchers
- Enable predictions of likely side effects or potential barriers to effective treatment
- Reduce the need for redundant medication stability studies



Additional Applications within HRP

- Risk of performance errors due to fatigue resulting from sleep loss, circadian desynchronization, extended wakefulness, and work overload
- How can individual crew members most effectively and safely use sleep and alertness medications prior to and during spaceflight?





Pharmacology Database



2013

Pharmacology Database

Acetaminophen



Dosage Form Used by NASA: Acetaminophen 325 mg

Documented Use By NASA:

- [Cintron NM, Putcha L, Vanderploeg JM. Inflight pharmacokinetics of acetaminophen in saliva. In: Results of the Life Sciences DSOs Conducted Aboard the Space Shuttle 1981-1986. National Aeronautics and Space Administration: 1987:179, edited by M. W. Bungo, T. Bagian, M. A. Bowman, and B. M. Levitan, Space Biomedical Research Institute, Johnson Space Center, 1987, p. 18-23.](#)
- [O'Rangers, Eleanor A., PharmD, Clinical Pharmacology of Spaceflight. Medscape, 01/03/2011](#)
- [Vernikos, J., Drugs in Space. Keynote Speech, 2007 Biennial International Symposium of European Low Gravity Research Association, Florence, Italy, September 5, 2007](#)
- [Vernikos J. Pharmacological approaches. Acta Astronaut. 1995 Feb-Mar;35\(4-5\):281-95](#)

Brand Names: U.S.

Acephen™ [OTC]; APAP 500 [OTC]; Aspirin Free Anacin® Extra Strength [OTC]; Cetafen® Extra [OTC]; Cetafen® [OTC]; Excedrin® Tension Headache [OTC]; Feverall® [OTC]; Little Fevers™ [OTC]; Mapap® Arthritis Pain [OTC]; Mapap® Children's [OTC]; Mapap® Extra Strength [OTC]; Mapap® Infant's [OTC]; Mapap® Junior Rapid Tabs [OTC]; Mapap® [OTC]; Non-Aspirin Pain Reliever [OTC]; Nortemp Children's [OTC]; Ofirmev™; Pain & Fever Children's [OTC]; Pain Eze



Pharmacology Database

 Pharmacology Database		Compiled by Ashley Kappenman NASA Johnson Space Center 7/11/2013 All information attributable to Lexi-Drugs, unless otherwise cited		
Medication Name	Brand Name: US	Pharmacologic Category	Dosing: Adult	
Acetaminophen 325 mg (Tylenol)	Acephen™ [OTC]; APAP 500 [OTC]; Aspirin Free Anacin® Extra Strength [OTC]; Cetafen® Extra [OTC]; Cetafen® [OTC]; Excedrin® Tension Headache [OTC]; Feverall® [OTC]; Little Fevers™ [OTC]; Mapap® Arthritis Pain [OTC]; Mapap® Children's [OTC]; Mapap® Extra Strength [OTC]; Mapap® Infant's [OTC]; Mapap® Junior Rapid Tabs [OTC]; Mapap® [OTC]; Non-Aspirin Pain Reliever [OTC]; Nortemp Children's [OTC]; Ofirmev™; Pain & Fever Children's [OTC]; Pain Eze [OTC]; Q-Pap Children's [OTC]; Q-Pap Extra Strength [OTC]; Q-Pap Infant's [OTC]; Q-Pap [OTC]; RapiMed® Children's [OTC]; RapiMed® Junior [OTC]; Silapap Children's [OTC]; Silapap Infant's [OTC]; Triaminic™ Children's Fever Reducer Pain Reliever [OTC]; Tylenol® 8 Hour [OTC]; Tylenol® Arthritis Pain Extended Relief [OTC]; Tylenol® Children's Meltaways [OTC]; Tylenol® Children's [OTC]; Tylenol® Extra Strength [OTC]; Tylenol®	Analgesic	Pain or fever: Oral: Note: OTC dosing recommendations may vary by product and/or manufacturer. Regular release: 325-650 mg every 4-6 hours or 1000 mg 3-4 times daily (maximum: 4 g daily) Extended release: 1300 mg every 8 hours (maximum: 3.9 g daily) Rectal: 325-650 mg every 4-6 hours or 1000 mg 3-4 times daily (maximum: 4 g daily) I.V.: < 50 kg: 15 mg/kg every 6 hours or 12.5 mg/kg every 4 hours; maximum single dose: 750 mg/dose; maximum daily dose: 75 mg/kg/day (≤3.75 g daily) ≥50 kg: 650 mg every 4 hours or 1000 mg every 6 hours; maximum single dose: 1000 mg/dose; maximum daily dose: 4 g daily	Oral (Aronoff, 2007): Children: Clor <10 mL/minute: Administer every 8 hours Intermittent hemodialysis or peritoneal dialysis CRRT: No adjustments necessary. Adults: Clor 10-50 mL/minute: Administer every 6 hours Clor <10 mL/minute: Administer every 8 hours Intermittent hemodialysis or peritoneal dialysis CRRT: Administer every 8 hours. I.V.: Clor ≤30 mL/minute: Use with caution; co
Acetazolamide 250 mg (Diamox)	Diamox Sequels	Anticonvulsant, Miscellaneous; Carbonic Anhydrase Inhibitor; Diuretic, Carbonic Anhydrase Inhibitor; Ophthalmic Agent, Antiglaucoma	Note: IM administration is not recommended because of pain secondary to the alkaline pH. Altitude illness: Oral: Manufacturer's labeling: 500-1000 mg/day in divided doses every 8-12 hours (immediate release tablets) or divided every 12-24 hours (extended release capsules). These doses are associated with more frequent and/or increased side effects. Alternative dosing has been recommended: Prevention: 125 mg twice daily; beginning either the day before (preferred) or on the day of ascent; may be discontinued after staying at the same elevation for 2-3 days or if descent initiated (Basnyat, 2006; Luks, 2010). Note: In situations of rapid ascent (such as rescue or military operations), 1000 mg/day is recommended by the manufacturer. The Wilderness Medical Society recommends consideration of using dexamethasone in addition to acetazolamide in these situations (Luks, 2010). Treatment: 250 mg twice daily. Note: With high altitude cerebral edema, dexamethasone is the primary treatment; however, acetazolamide may be used adjunctively with the same treatment dose (Luks, 2010). Edema: Oral, I.V.: 250-375 mg once daily Epilepsy: Oral: 8-30 mg/kg/day in divided doses. A lower dosing range of 4-16 mg/kg/day in 1-4 divided doses has also been recommended; maximum dose: 30 mg/kg/day or 1 g/day (Oles, 1983; Reiss, 1996). Note: Minimal additional benefit with doses > 16 mg/kg/day. Extended release capsule is not recommended for treatment of epilepsy. Glaucoma: Oral, I.V.: Chronic simple (open-angle): 250 mg 1-4 times/day or 500 mg extended release capsule twice daily Secondary angle (closed-angle) glaucoma: 250-500 mg maintenance; 25-250 mg every 4 hours (250 mg every 12 hours has been effective in short-term	Note: Use is contraindicated in marked renal Clor 10-50 mL/minute: Administer every 12 hours Clor <10 mL/minute: Avoid use. Hemodialysis: Moderately dialyzable (20% to 30%) Peritoneal dialysis: Supplemental dose is not



HESI-NASA Project MoSAIC



The Health and Environmental Sciences Institute (HESI)

- A nonprofit institution whose mission is to engage scientists from academia, government, and industry to identify and resolve global health and environmental issues

NASA Human Health and Performance Center



- A global convener of government, industry, academic, and non-profit organizations that support the advancement of human health and performance innovations for space flight, commercial aviation, and challenging environments on Earth

Project MoSAIC - Medicines Stability And Innovation Collaboration

Proparacaine

- Topical ocular anesthetic drop
- Used for:
 - Glaucoma testing
 - Foreign object removal
 - Treatment of eye injury
- Storage requires refrigeration





HESI-NASA Project MoSAIC Relevance

If successful, this project will remove the requirement of cold temperatures during transport and storage for this compound

This will impact

- Clinics, medics and other caregivers
- Drug companies
- NASA



Evaluating Sex Differences in Sleep and Alertness Medication Side Effects

- Sleep problems are a frequent indication for medication use in spaceflight
- Recent FDA updates to Ambien dosing guidelines are sex-specific
- Potential pharmacologic differences between sexes should be evaluated





Summer Intern Collaboration





Thank You

□ Dr. Virginia Wotring

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