

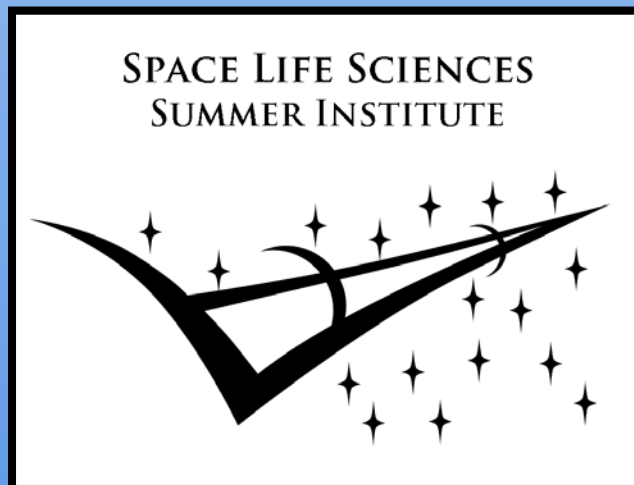
National Space Biomedical Research Institute Apprenticeship Exit Presentation

Ashley Kappenman

The University of Iowa College of Pharmacy

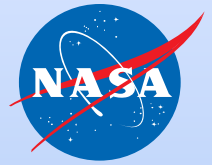
Dr. Virginia Wotring

Pharmacology Discipline



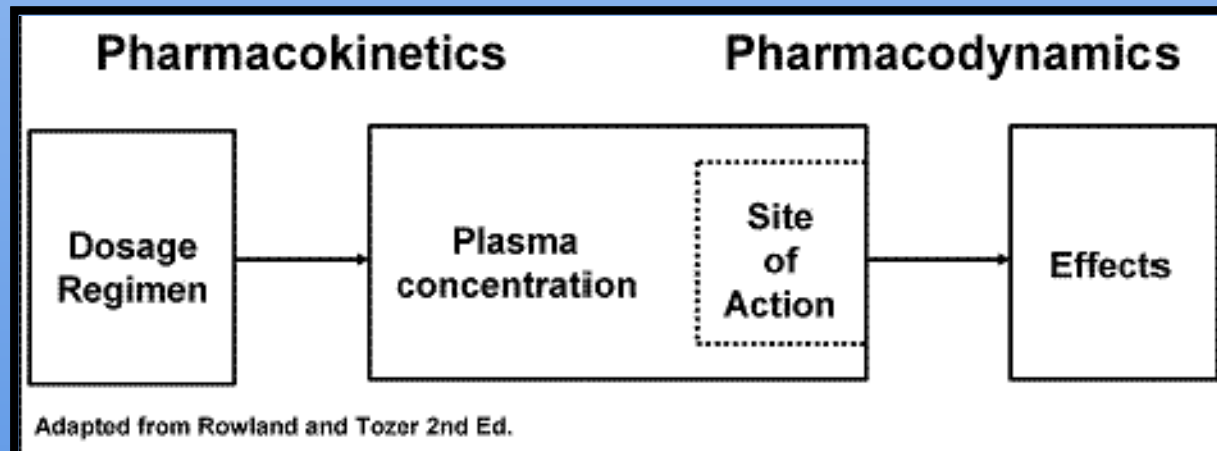
SPACE LIFE SCIENCES
SUMMER INSTITUTE





Risk of Clinically Relevant Unpredicted Effects of Medication

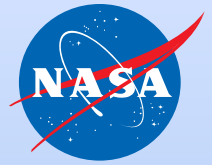
- Medication usage
- Medication stability
- Spaceflight and pharmacokinetics
- Spaceflight and pharmacodynamics
- Spaceflight and antimicrobials



Pharmacology Database

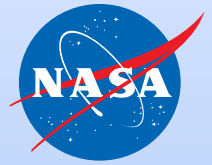
- Human Research Program Task
- Contain fundamental information about each medication in the ISS medical kit
- Information collected from terrestrial sources





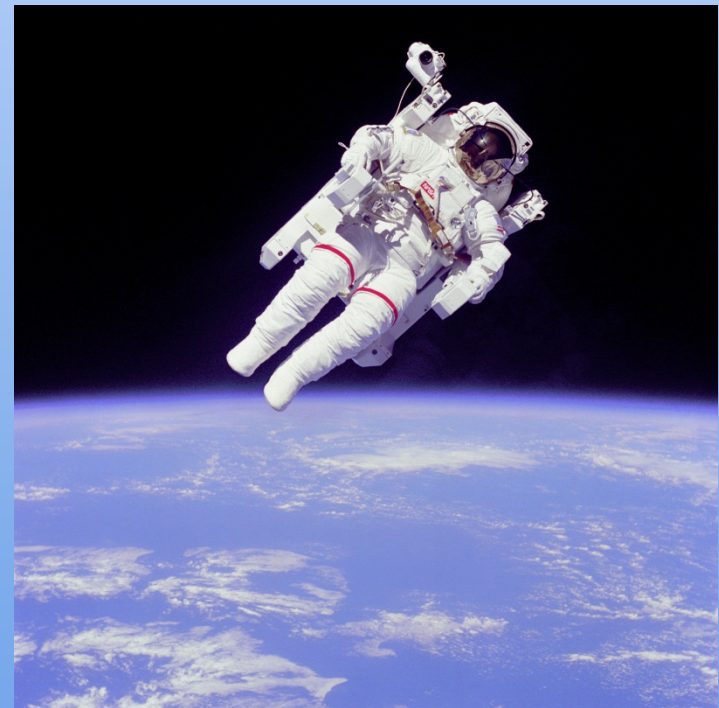
Pharmacology Database

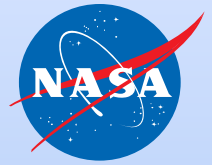
- Permit pharmacology discipline researchers to quickly search for any drug-related information requested by space medicine or other researchers
- Enable predictions of likely side effects or potential barriers to effective treatment
- Reduce the need for redundant medication stability studies



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

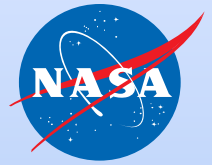
Documented Use By NASA:

[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](#)

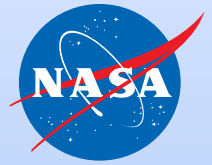
Brand Names: U.S.

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



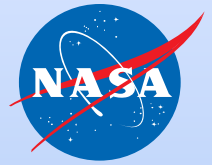
- A global convener of government, industry, academic, and non-profit organizations that support the advancement of human health and performance innovations for space flight, commercial aviation, and challenging environments on Earth

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

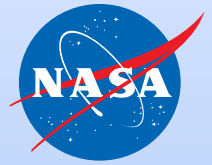
- Clinics, medics and other caregivers
- Drug companies
- NASA



Evaluating Sex Differences in Sleep and Alertness Medication Side Effects

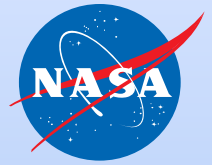
- Sleep problems are a frequent indication for medication use in spaceflight
- Recent FDA updates to Ambien dosing guidelines are sex-specific
- Potential pharmacologic differences between sexes should be evaluated





Summer Intern Collaboration





Thank You

□ Dr. Virginia Wotring

□ Kami Faust

□ Camille Crady

□ Dr. Tina Bayuse

□ Vernie Daniels

□ Andrew Hood

□ Dr. Lauren Merkle

□ Jacqueline Reeves

□ Judith Hayes

□ Dr. Ron McNeel

□ Dr. Amanda Hackler

|||||
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