

# The Physics of Flying Feces

Jim Gauthier, CIC, MLT  
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The Physics of Flying Feces

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Jim Gauthier, MLT, CIC

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Objectives

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- Discuss the unwanted presence of feces in our healthcare settings
- Discuss possible issues with this presence
  - Patient colonization
  - Disease transmission
- Look at possible solutions to this spread

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Feces\*

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- fe·ces fi siz/ [**fee**-seez]
- -noun (used with a plural verb )
  - 1. Waste matter discharged from the intestines through the anus; excrement.
  - 2. Also, especially British, faeces.
    - Origin 1425-75; late middle English from Latin faecēs - grounds, dregs, sediment

\*[www.dictionary.com](http://www.dictionary.com)  
○ Dictionary.com unabridged V1.0.1

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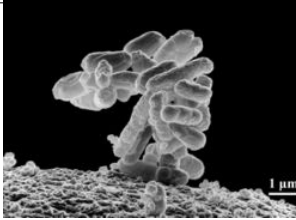
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## Some Stuff You Don't Really Want to Know!

- The average person passes 100 – 250 gm of feces per day
- Defecation may occur from once every two or three days to several times per day



Wikipedia.org

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## More Stuff!

- 70-75% of what we pass per rectum is water
- 30% of solid remaining is bacteria ( $1 \times 10^{12}$  per gram, dry weight)



(Kelly 1994, [www.heptune.com/poop.html](http://www.heptune.com/poop.html))

[www.my.opera.com](http://www.my.opera.com)

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## What Do We Do With It?

- Toilets
  - Evidence back to 26<sup>th</sup> century BC, Indus Valley Civilization
  - Flush toilet in every house
  - Attached to a sewage system



[www.arthistory.upenn.edu](http://www.arthistory.upenn.edu)

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## What Do We Do With It?

- 15<sup>th</sup> Century BC Minoan (Crete)
- Evidence of flushing toilets



[www.wikipedia.org](http://www.wikipedia.org)

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## What Do We Do With It?

- Roman Empire
- With the fall of the Roman Empire, this technology was lost



Ancient Rome - [www.wikipedia.com](http://www.wikipedia.com)

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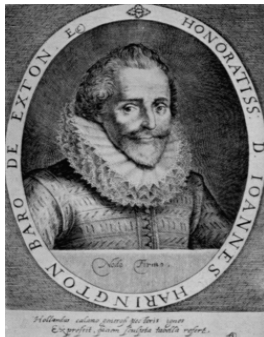
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## What Do We Do With It?

- Sir John Harington
- Credited in 1596 with our basic design today
  - Flush valve
  - Wash down design



[www.wikipedia.com](http://www.wikipedia.com)

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## Modern Waste Disposal



- Modifications through the 1700's
- Albert GIBLIN obtained a patent in 1819 for the "Silent Valveless Water Waste Preventer"

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## Toilet Trivia

- Thomas Crapper did not "invent" the toilet
- Phrase "crap" was in use long before Tom came along!



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## So, What is the Problem?



[www.apple.com/trailers](http://www.apple.com/trailers)

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## Handling of Feces

- Patients have a few choices
  - Use the toilet in the room
    - May be shared
  - Use a commode
    - Kept at bedside
    - May be shared
  - Use Bedpan
    - Kept in a variety of places
    - Not always single use



[www.medical-solution.net](http://www.medical-solution.net)

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## Handling of Feces



[www.dri-line.com](http://www.dri-line.com)

- Choices
  - Use Incontinent products
    - Briefs
  - Use bed
    - May have an absorbent pad under them
    - Vented, unconscious ICU patients

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## Sluice Rooms

[www.stanbridge.co.uk/care/planning.html](http://www.stanbridge.co.uk/care/planning.html)

- "Sluice"
  - either a slop hopper or a utensil washer/disinfector.
  - The slop hopper is a cross between a sink and a conventional toilet.
  - It functions in a similar way to a cistern type toilet and it is not an ideal way of dealing with human waste disposal.
  - It should be considered only as a back up to the automatic equipment.

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### Rim Flushing Sink



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### Hoppers

- Plenty of good evidence that there is dispersal of bacteria around these sinks  
(Moorefield 1998, Frederick 1997)
- Household studies showed aerosol can persist hours after a flush (Gerba 1975)



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### Bed Pan Washing

- Pipe or wand on back of toilet
- Still in general use
- Huge risk of splashing
- Only rinses pan, no disinfection



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**Hospital Pathogens**

- Vancomycin Resistant Enterococci
  - VRE
  - Can cause urinary tract infections, wound infections
  - Colonizes 98% of patients
  - Reasonably hardy in the environment
    - 5 – 7 days no problem
  - Susceptible to hospital-grade disinfectants

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**Hospital Pathogens**

- Clostridium difficile
  - CD associated diarrhea
  - Contains a spore
    - Hardy environmental survivor
    - Resistant to most hospital-grade disinfectants
  - Vegetative bacteria sporulate when under stress
    - Drying, antibiotics, temperature changes
    - Easy to kill with hospital-grade disinfectants (vegetative cells)

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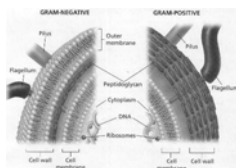
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**Other Fecal Fellows**

- Gram negative bacteria
  - E. coli
  - Klebsiella pneumonia
  - Enterobacter species
  - Citrobacter species
  - Proteus species
  - Providencia species
  - Serratia species



[usa.k12.ar.us/massena/bacteria\\_notes\\_h1.htm](http://usa.k12.ar.us/massena/bacteria_notes_h1.htm)

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## Other Poop Pathogens

- Salmonella species
- Shigella species
- Yersinia species
- E. coli O157:H7
- Campylobacter species
- Aeromonas / Vibrio species
- Hepatitis A

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## Hardy Little Guys!

- Enterococcus, Staphylococcus, *Streptococcus pyogenes* – Months on dry surfaces
- *E. coli*, *Serratia marcescens*, Klebsiella, Shigella – months
- CDAD – months
- Enteric viruses – rotavirus, HAV, polio – approx 2 months

(Kramer et al (on line))

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## What Are We Seeing?

- Outbreak of Hepatitis A
- 11 of 154 healthcare workers contracted illness from 2 burn patients (father and infant)
- All had contact with source infant, 8/11 had contact with father
  - Poor hand hygiene
  - Eating on wards

(Doebbeling 1993)

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## What Are We Seeing?

- Transmission of VRE
- After routine cleaning, 2 of 10 rooms still had detectable VRE
  - Light switch, toilet flusher, telephone, bathroom faucet
- I can see nurse enter room with gloves and gown on
  - Turn on dirty light switch, and offer care!

(Martinez 2003)

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## What Are We Seeing?

- Patient and environmental contamination in Rehabilitation facility
  - 15% of surfaces sampled had VRE, usually related to patient colonization

(Trick 2002)

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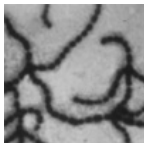
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## What Are We Seeing?



- Structured physical exam of VRE positive patients
  - auscultation of heart and lungs
  - palpation of back, abdomen, and lower extremities
- Bugs were present!

(Zachary 2001)

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## Patient Examination

- 67% of the time VRE could be found
  - Gowns 37%
  - Gloves 63%
  - Stethoscopes 31%
  - All 3 were contaminated in 24% of cases
- Iliostomy or colostomy were linked
- Alcohol wipe removed VRE

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## Is it Just the Patients?

- NO
  - Transfer to healthcare workers and their families
    - I will talk about cleaning!
- (Baran 2002)



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## Is it Just Incontinent Patients?

- 14 cVRE, continent – Mock exam rooms
- Chair cultures positive
  - 36% outpatient, 58% hemodialysis
- Couch Cultures positive
  - 48% outpatient, 42% radiology, 45% hemodialysis

(Grabsch 2006)

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## Environment

- Gowns positive
  - 20% outpatient consultation, 4% radiology, 30% hemodialysis sessions
- Infection control measures should focus on
  - effective HCW and patient hand hygiene
  - chair and couch cleaning

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## How Might This Be Possible

- Contamination of patient's clothing?
- Poor patient hand hygiene?



Do2learn.org

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## Where Else do We Find Them

- Garcia, 2005 AJIC, Good review concerning healthcare pneumonia
  - Gastric Colonization
  - Upper Respiratory Tract is colonized
    - Fibronectin helps streptococci to adhere
    - Drying or inflammation will decrease this
    - Reduces streptococci binding sites and allows for overgrowth of gram negative bacilli

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**There's More!**

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- In one ICU, 60% of all patients colonized after 5 days and 85% by tenth day
  - Gram negative microorganisms predominated during this period
- Vented patients
  - Heavily colonized by gram negative
  - Can occur in a little as 24 hours after intubation

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**What Were We Seeing?**

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- Clostridium difficile
  - Fekety 1980
    - Hands and fecally contaminated items
    - Low infective dose in hamsters in presence of antibiotics
    - Over 1000 cfu orally did not colonize nor infect unchallenged hamsters
    - Looked at relationship with Lactobacilli and other gut flora

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**What Were We Seeing?**

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- Important nosocomial pathogen for the 1990s
  - "increased vigilance against this organism be considered in most hospitals." (Zaleznik 1991)
- Deep cleaning
  - "...breaking the cycle of faecal-oral spread."
  - Included deep cleaning (emptying ward) (Cartmill 1994)

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**What Are We Seeing?**

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- Floor Contamination
  - Especially washrooms, sluice rooms
  - Moved by feet hypothesized
  - High rate of colonization in Geriatrics  
(McCoubrey 2003)

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**Let's Be Politically Incorrect!**

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- These patients have been exposed to feces – not colonized!
  - Main source of gram negative bacilli anywhere!
- I still feel most nosocomial cases of VRE and CDAD indicates that:
  - the patient has ingested feces!  
(Cartmill 1994)

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**Cleaning and Disinfecting**

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- We need to clean better
  - Microfibre
  - Single Dip Methods
  - Remove dirt, organisms, spores
- We need to clean effectively
  - Well trained
  - Check the work (glo-germ / glitterbug concept)  
(Dettenkofer 2004, Carling 2006, Buntrock 2005)

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**Cleaning and Disinfecting**

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- Disinfecting is not as important as effective cleaning  
(Dettenkofer 2004)
- Housekeeping has been cut too far in many institutions
  - Or lowest bidder!
  - Florence Nightingale recognized that cleaning was vital in 1850's  
(Dancer 1999)

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**The Soiling of the Environment**

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- How do we change incontinent patient's briefs?
- How do we change beds?
  - Number of glove changes?
- How do we handle bed pans?
  - Bedpan with red paint all over it...
- Commode Chairs?

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**The Environment**

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- I do recognize that we live in a buggy world
  - I only want clean equipment
  - I only want clean hands
  - I only want to limit the movement of those who soil my environment!

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## Suggestions

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- Any new hospital construction or renovation
  - Single rooms
  - Thermal flusher/disinfector
  - Macerators
- Incontinent Rooms
- Multi-use washrooms
  - For continent and incontinent

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## Suggestions

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- Staff and visitor hands
- Patient hands
- Further look at the food link
  - Speculated in 1991 (Zaleznik 1991)
  - Investigated for Gram neg in 1971 (Shooter 1971)
  - CD found in sausages, ground beef, veal, turkey (<http://www.cbc.ca/cp/health/061015/x101520.html>)

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## In Summing Up

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- I have a problem
  - Fecal fascination
- I really do not think it is right to feed feces to patients
  - Okay, pretty harsh, but...
- We need to handle excrement better than our great-great-great grandparents did!

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## Questions?



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## The Next Few Teleclasses

**November 16** *Exploration and Advantages of New Test Methods for Tuberculosis*

... with Dr. Michael Gardham, University of Toronto

**November 21** *Catheter Associated Urinary Tract Infections*

... with Lauren Tew of Bard Ltd., UK

**November 30** *Preventing Surgical Site Infections*

with Bonnie Barnard, St. Peter's Hospital, Montana

**December 7** *Preventing Central Line Associated Infections*

... with Robert Garcia, Brookdale University Medical Center

For the full teleclass schedule – [www.webbertraining.com](http://www.webbertraining.com)  
For registration information [www.webbertraining.com/howtoc8.php](http://www.webbertraining.com/howtoc8.php)

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