

# **Patient Care - a Collaboration that Requires Information Standards**

**Thomas M Jones, MD**  
Chief Medical Officer, Tolven  
[tom.jones@tolvenhealth.com](mailto:tom.jones@tolvenhealth.com)

# Topics

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- Describing people in clinical terms
- Using clinical language to share information
- Helping computers understand words
- Representing patients electronically
- Care pathways
- Employing intelligent agents
- Using standards to create virtual patients
- Facilitating interaction between virtual patients and standard care pathways

# Who is Marshall Smith ?

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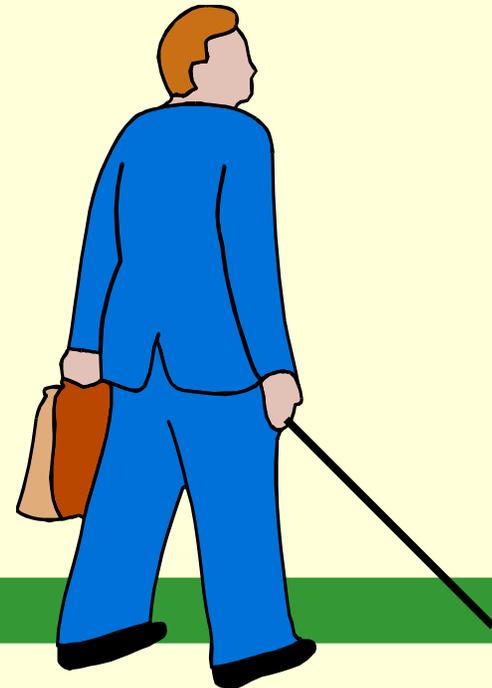
- A valid EHR does not begin until the patient has been correctly identified.
- Within the EHR, the patient must be accurately described in order for the EHR to be useful for the entire clinical team.
- In order to advance the EHR beyond the state of “clever archive”, the patient must be electronically modeled for “forward-looking” activities.



# Who is Marshall Smith ?

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- Mr. Smith began losing his vision 12 years ago due to idiopathic retinal degeneration. He is now legally blind. Despite his visual loss, he has been able to continue his career as a successful insurance broker.



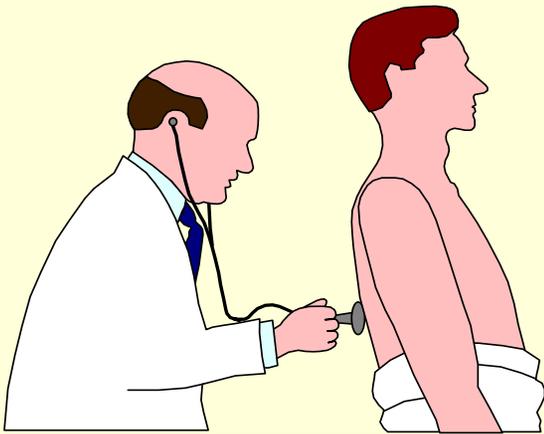


- Mr. Smith had been active in sports as a young man. He continued to compete in marathons and other road races well into his forties. It is thought that the stress of his athletic activities contributed to the development of osteoarthritis of his right hip. He had to give up running over 15 years ago because of increasing hip pain. Now he has constant pain regardless of his activity.

# Who is Marshall Smith ?

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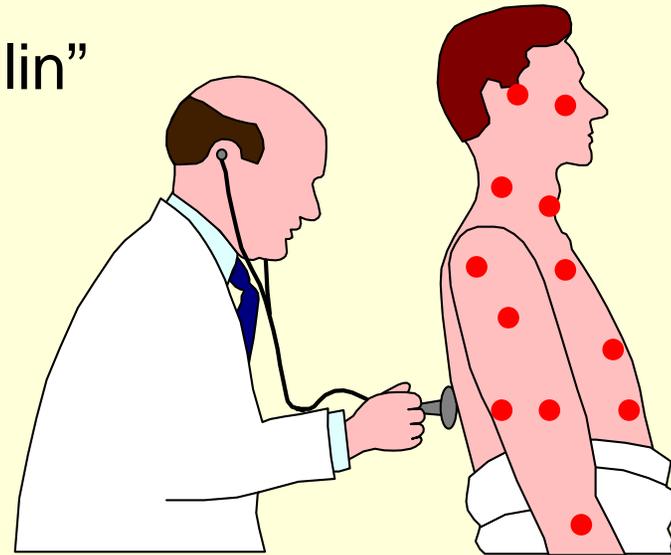
- Mr. Smith is a 62 y.o. man with severe degenerative osteoarthritis of the right hip. His activity has been severely limited because of pain and instability. Because of failure to respond adequately to management with medications, Mr. Smith has been admitted to hospital for total hip replacement.



Mr. Smith is also a patient.

# Marshall Smith, the Patient

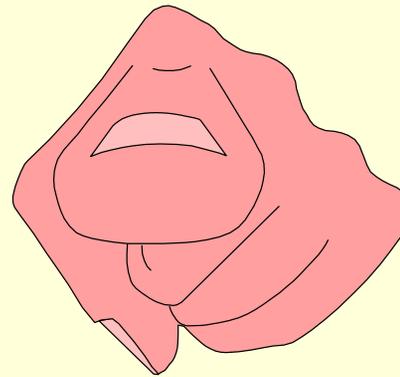
- For his picture as a patient, blindness and the need for a total hip replacement are critical “brush stroke” descriptors. Other critical descriptors include his age and sex. In addition, since Mr. Smith is a man who has had an allergic reaction to penicillin, “allergy to penicillin” becomes another critical descriptor.



# Describing Patients

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- For medical care, clinicians create a patient picture which is painted with descriptors of the patient's most important medical problems, attributes and issues. The medical view of the person is thus a meaningful, necessary, operational model.



# ***Describing Patients***

- Clinical pictures are communicated from one clinician to another using a highly evolved short hand language which focuses on and emphasizes clinical problems and clinical attributes.

These “medical descriptors” carry enormous significance for patient care.

They also become essential pieces of information for clinical decisions and clinical rules.



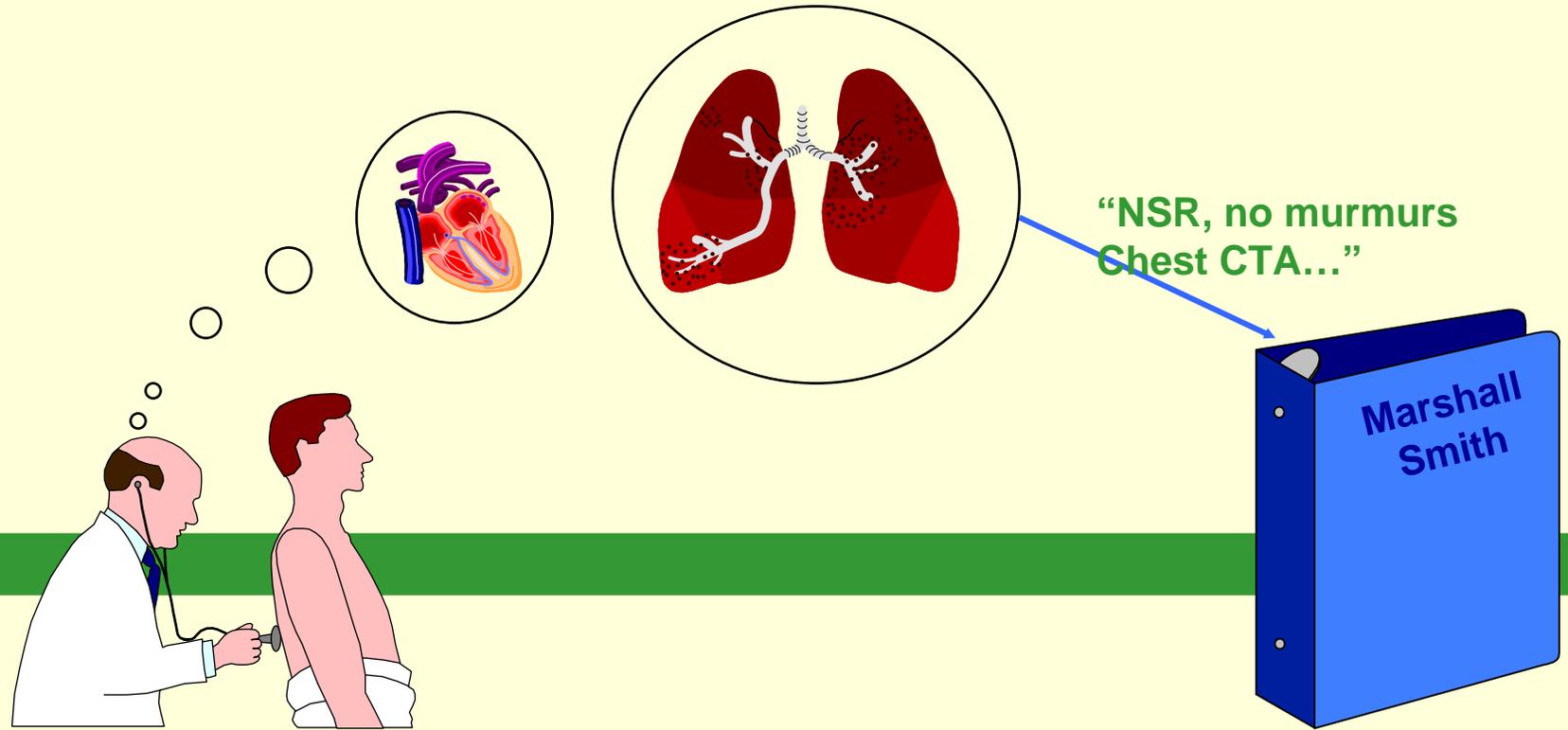
# Describing Patients

- Each important medical descriptor conveys dimensions of meaning along with implicit and explicit medical knowledge. For instance, the term “cardiac arrest” creates an instant, complex image of clinical activity.



# Describing Patients

- As clinicians speak with and examine patients, they distill a stream of conceptual information into these “medical descriptors” which are incorporated in the medical record.



# *Caring for Mr. Smith*

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- One of Mr. Smith's medical problems (need for total hip replacement), has received an unusual amount of clinical attention. It is a procedure which has had, in the past, a wide range of costs. Careful study of patients undergoing this procedure has led to the development of guidelines for management of these patients.



## Brief Summary

**TITLE:**  
Total hip replacement.

**SOURCE(S):**  
AAO-HNS Consensus Statement 1994 Sep 12;12(5):1-31

**ADAPTATION:**  
Not applicable: The guideline was not adapted from another source.

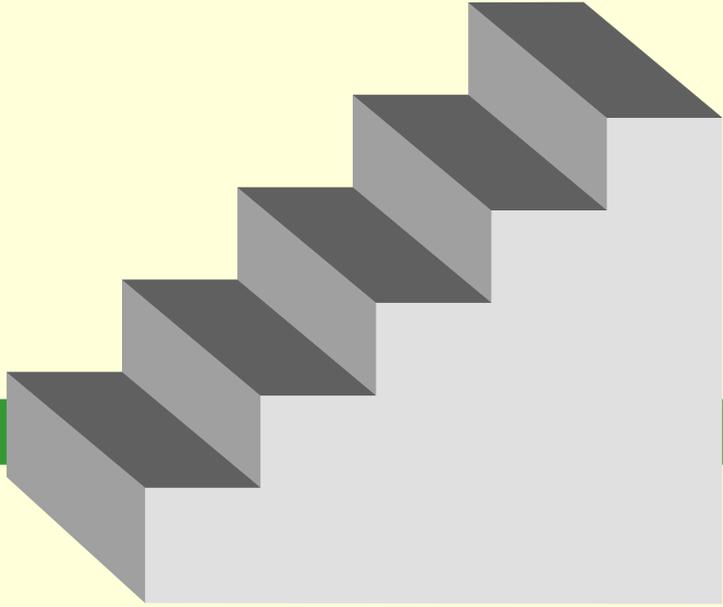
**RELEASE DATE:**  
1994 Sep

### MAJOR RECOMMENDATIONS:

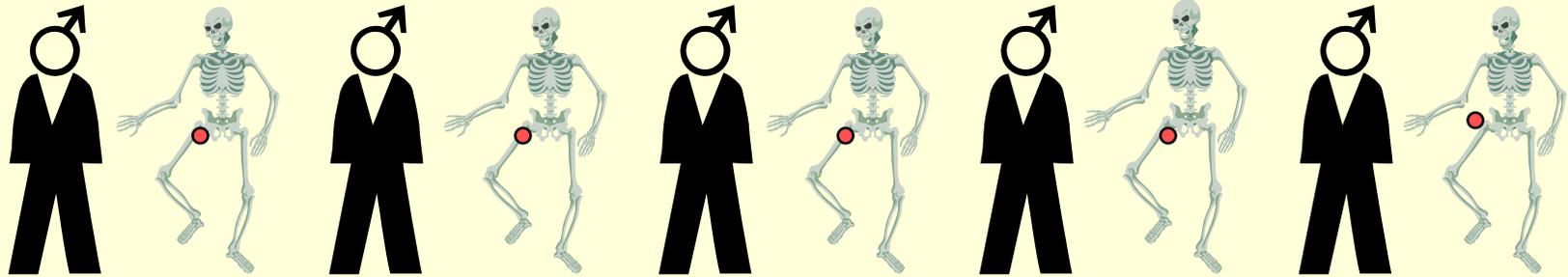
- **Hip replacement** (HR) is an option for nearly all patients with diseases of the **hip** that cause chronic discomfort and significant functional impairment.
- In the aggregate, total **hip replacement** (THR) is a highly successful treatment for pain and disability. Most patients have an excellent prognosis for long-term improvement in symptoms and physical function.
- Perioperative complications such as infection and deep venous thrombosis have been significantly reduced because of use of prophylactic antibiotics and anticoagulants and early mobilization.
- The predominant mode of long-term prosthetic failure appears to be related to generation of particulate matter, which in turn causes an inflammatory reaction and subsequent bone resorption around the prosthesis.
- Revision of THR is indicated when mechanical failure occurs. The surgery is technically more difficult and the long-term prognosis is generally not as good as for primary THR. The optimal surgical techniques for THR revision vary considerably depending on the conditions encountered. Continued periodic followup is necessary to identify early evidence of impending failure so as to permit remedial actions before a catastrophic event.
- Improved methods for evaluating existing technology should be developed and implemented, especially with respect to patient-defined outcomes.
- Future research should focus on refining indications for surgery; defining reasons for differences in procedure rates by age, race, gender, and geographic region; developing surgical techniques, materials, and designs that will be clearly superior to current practices; understanding the inflammatory response to particulate material and how to modify it; determining optimal short- and long-term rehabilitation strategies; and elucidating risk factors that may lead to

# What is a Protocol (pathway)?

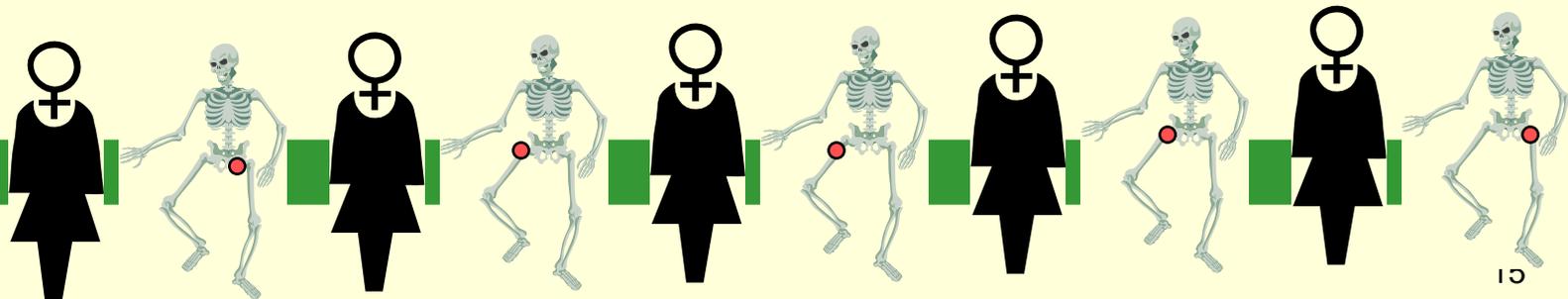
- A protocol is an organized, stepwise series of interventions and evaluations designed to turn guidelines into efficient and effective movement of a patient along a path of recovery. At each step, criteria for success have been determined. Comparing the patient at each step with those criteria can both prevent variances and detect those variances which may explain differences in outcomes.



# Identifying Pathway Patients



- Men and women who have needed total hip replacement surgery are considered to be in the same pathway group regardless of whether the right hip or the left hip was involved. Guidelines for all of these patients have been incorporated into a Care Pathway.



# Describing Pathway Patients

- Pathway patients are defined by a limited set of descriptors. While the same cluster of descriptors is common to all patients in a study group, understanding that “sameness” is possible only if identical, standard terms are used.

~~All senior citizens elderly folks old, but not too old~~  
~~men and women 60-and -over-but-under-80~~  
 males and females where  $59 < \text{age} < 80\text{y}$

# Patients Eligible for the Pathway

- Patients who are eligible for this pathway will have many other descriptors which distinguish them from one another while sharing hip pain and appropriate age range.



Age: 65



Age: 68



Age: 77



Age: 69



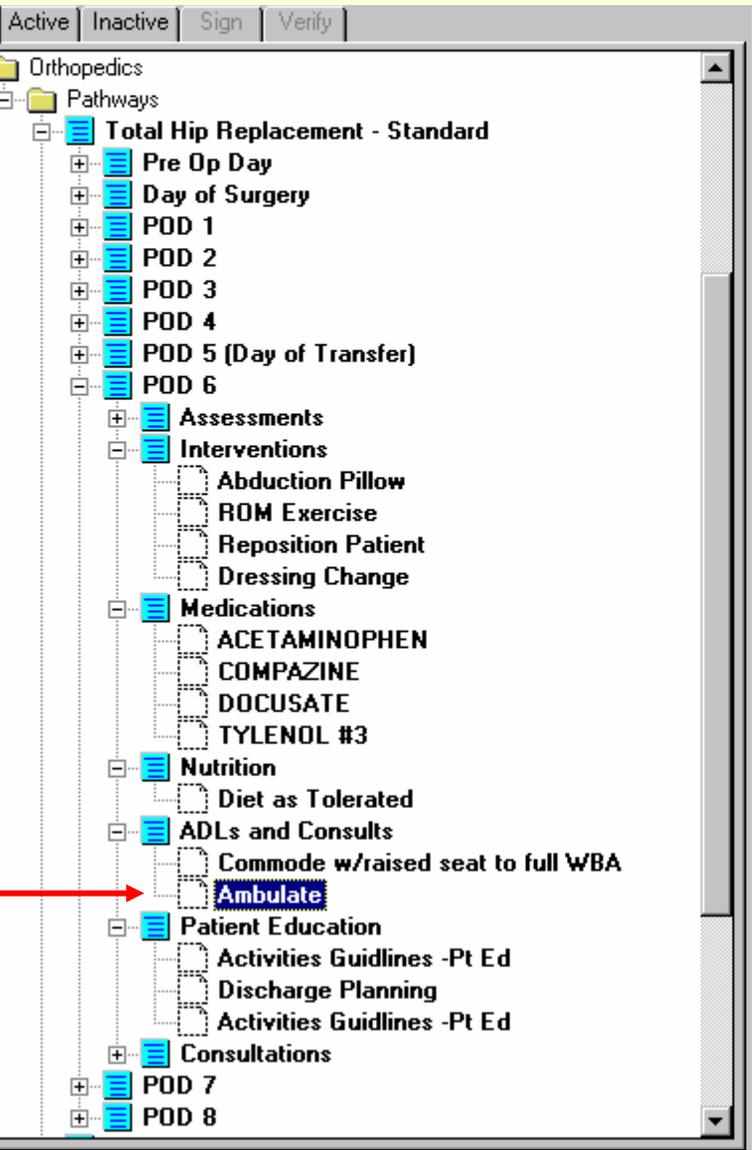
Age: 73



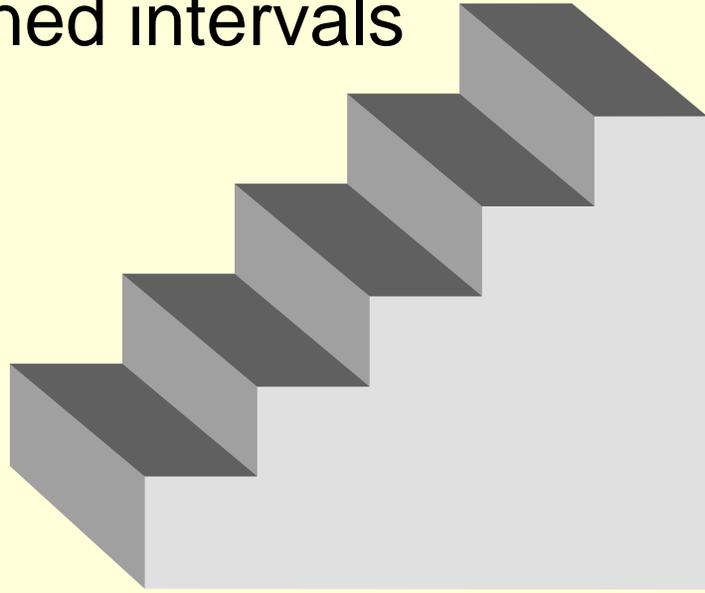
Age: 62

Mr. Smith has at least one such descriptor - his blindness.

# Representing a Pathway



One can represent a pathway as a series of orders for work that members of the patient's care team should perform at planned intervals



# Detecting Variances

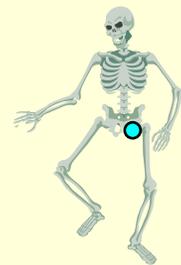
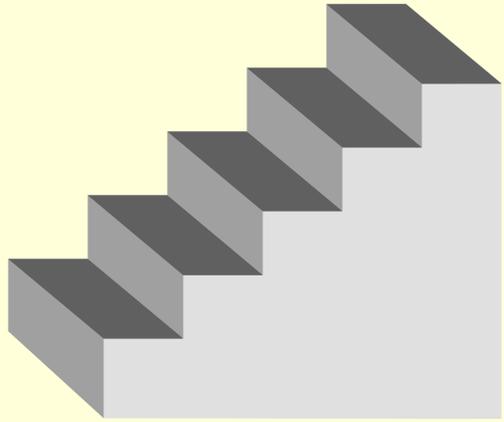
- On pathways like the “Total Hip Replacement” Pathway, failure to achieve successful outcomes such as timely discharge can arise from relatively mundane issues.

“For example: At one facility, variance analysis revealed that 60 per cent of all patients were not being ambulated when scheduled.”



# Preventable Variances

- Because ambulating is so critical to success in the “Total Hip Replacement” Pathway, blindness would be a predictable reason for falling off the pathway.



Pre-emptive support for a blind patient might well prevent an unnecessary variance.



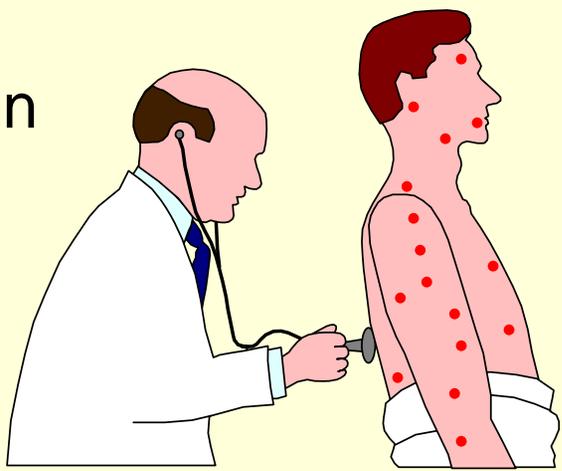
# *Transforming Descriptors*

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- When transforming descriptors, information becomes more abstract and less ambiguous.
- The end state abstraction is a virtual representation of an important piece of clinical information.
- It is this final abstraction of the clinical descriptive data which should populate the clinical information infrastructure.

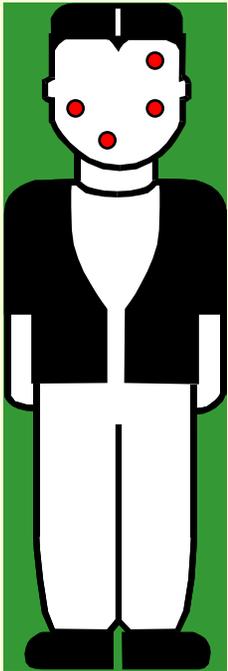
# Describing Mr. Smith

- When Mr. Smith reported his penicillin reaction to his doctor, his doctor could enter the fact of Mr. Smith's penicillin allergy in his electronic medical record. It is an important descriptor of Mr. Smith as far as his medical care is concerned and has its own "short hand" way of being entered on Mr. Smith's allergy list where it is maintained as part of a quick medical summary of Mr. Smith.



# Representing Mr. Smith

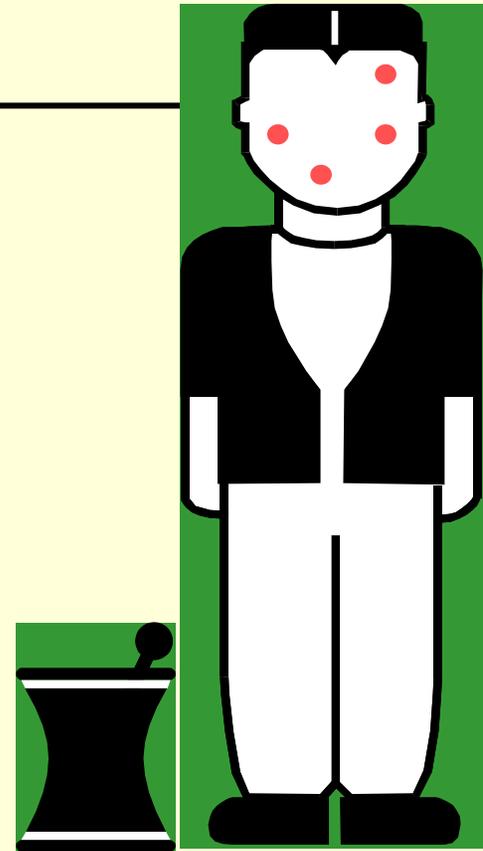
- In the EHR, the rudimentary “electronic Mr. Smith” should be enhanced by combining the identifier for Mr. Smith with a standard way of describing his drug allergy.
- This version of the electronic Mr. Smith can be used to protect the real Mr. Smith from having additional, perhaps more serious, allergic reactions to antibiotics in an allergic class related to penicillin – such as cefazolin.



MRSHLSMTH034/76  
 ICD 10/Y 40.0

# Representing Mr. Smith

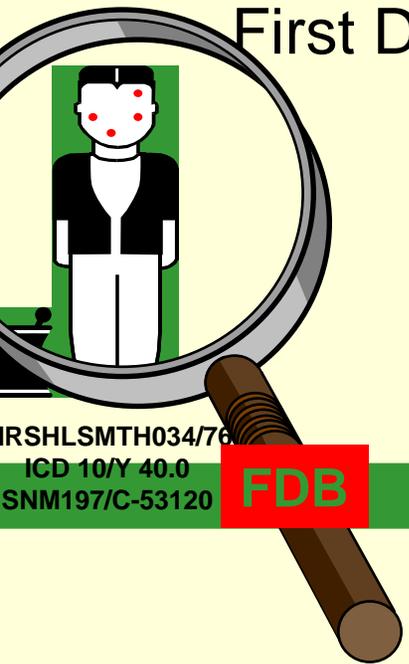
- When an order for cefazolin is placed for Mr. Smith in a medication management application, that cefazolin order should be added to the patient object; the electronic Mr. Smith is enhanced.



**MRSHLSMTH034/76**  
**ICD 10/Y 40.0**  
**SNM197/C-53120**

# Protecting Mr. Smith

- The electronic patient object acts as an efficient way for knowledge from FDB to be applied so that an alert is generated. The clinician placing the cefazolin order can then retract it before Mr. Smith can experience the allergic reaction predicted by interaction between the virtual Mr. Smith and the First Data Bank knowledge base.



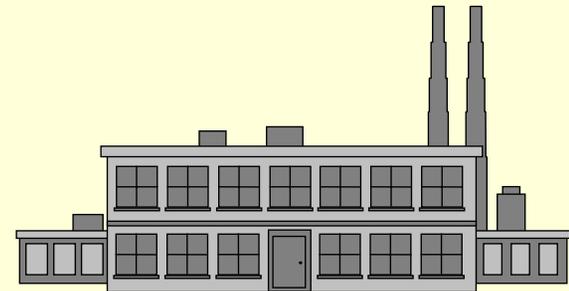
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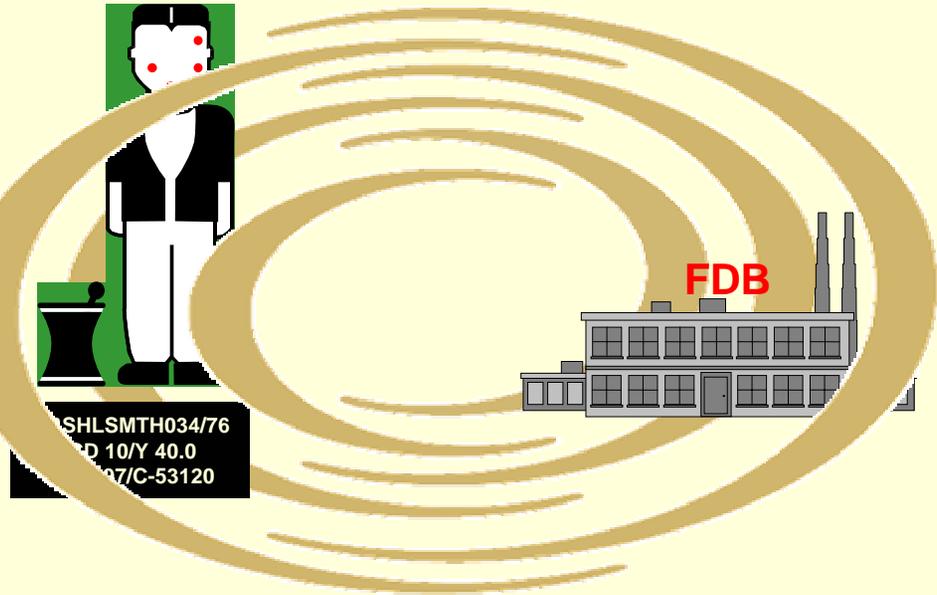
# Authoring “Rules”

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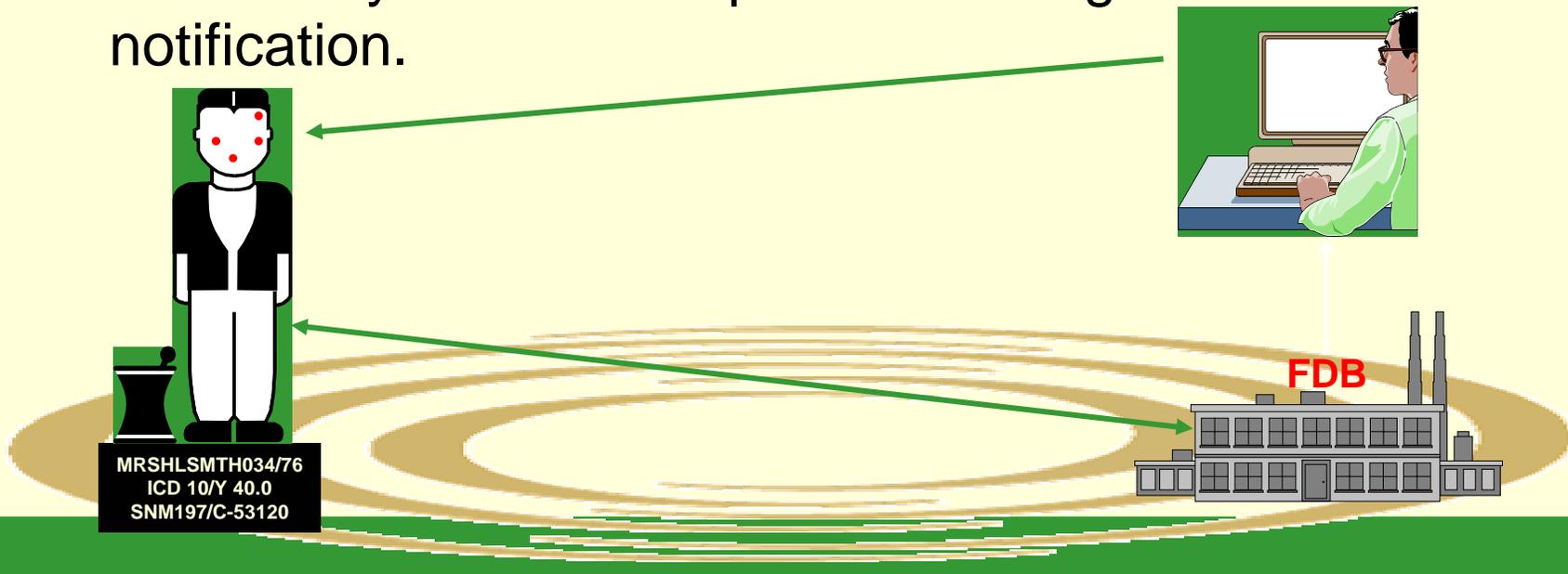
- Groups of clinicians can act as “knowledge factories” creating “rules engines” for representing clinical rules.
- First Data Bank, an example of a commercial knowledge factory, can supply rules for such topical areas as drug allergy alerts and drug-drug interactions.



- In the electronic application world, the electronic patient can be created from carefully transformed descriptors.
- Standard knowledge about medications can be electronically represented as well.

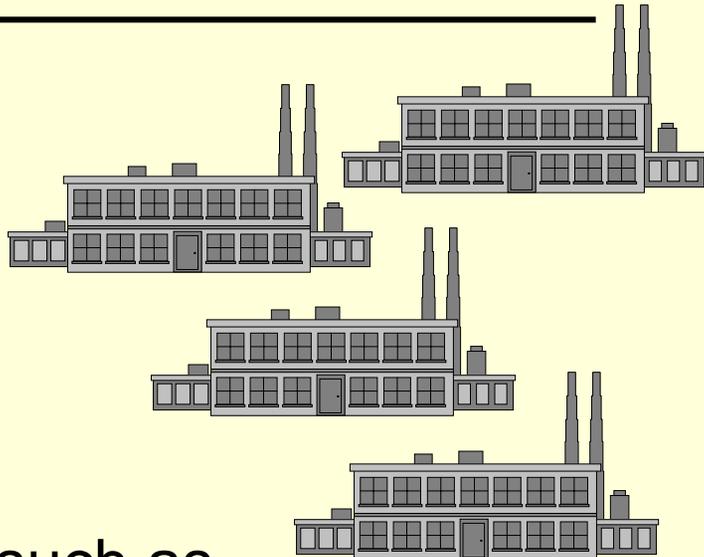


- In order to make electronic objects more “visible” in this world, the application used by clinicians to describe the patient must use the same identifiers as the FDB knowledge base. This synchrony of vocabulary facilitates rapid rules recognition and notification.



# Deploying Rules Efficiently

- As rules engines become more numerous and increasingly sophisticated, applications must rely more on



“intelligent agents”

for activities such as

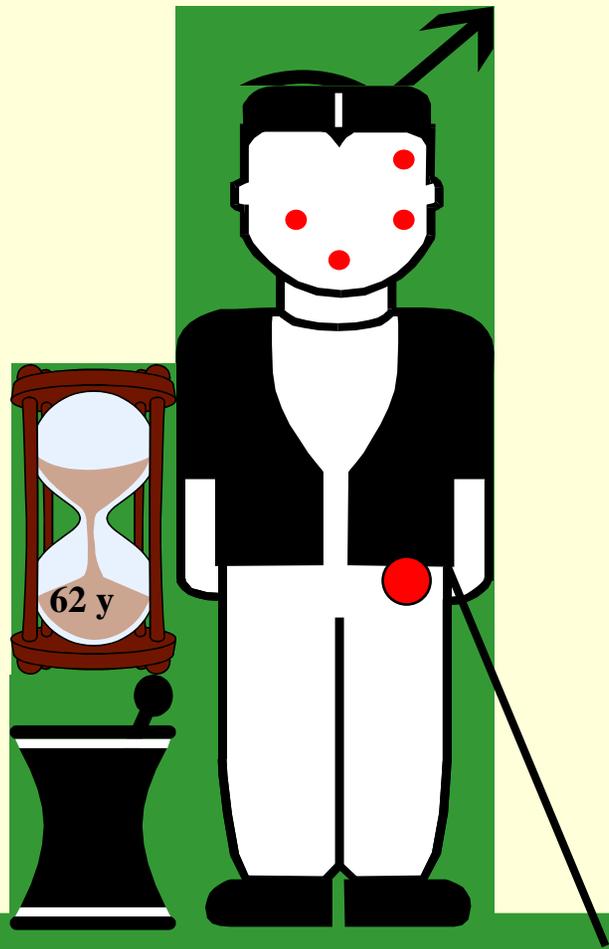


event detection

and notification

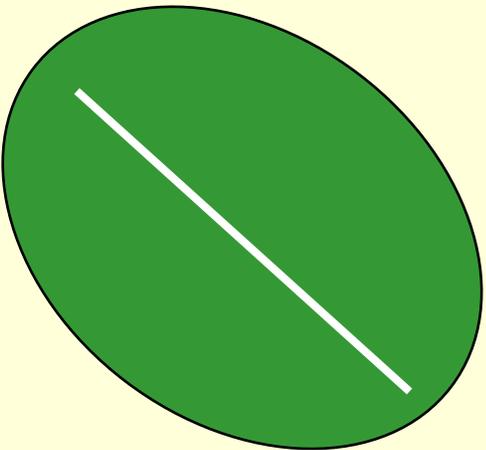
# *Describing Mr. Smith*

If we continued to combine descriptors for Mr Smith without regard for vocabulary standards, the electronic Mr. Smith which would evolve is likely to be less easy to use for rules-based applications which rely on rapid identification of important clinical data.



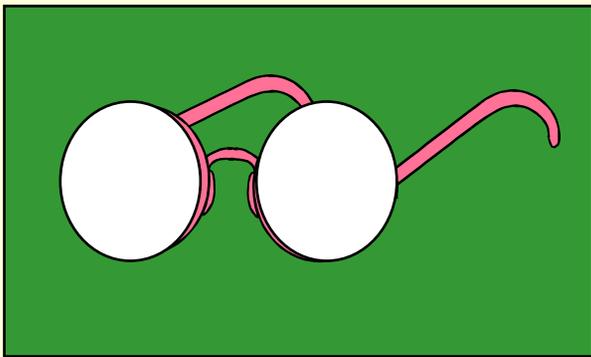
# Recognizing Descriptors

- Representing the same concept in different words may not be a problem for clinicians;



Blindness

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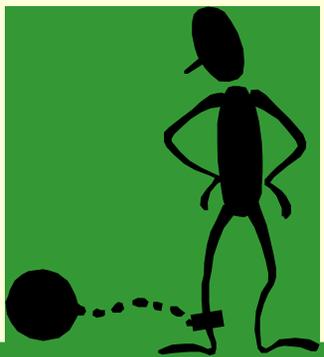
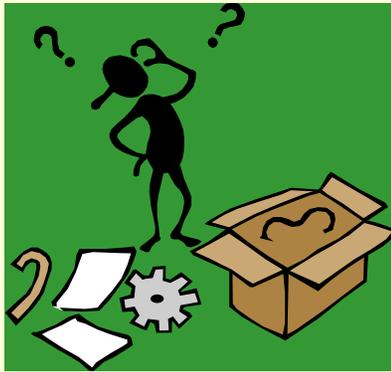


Cannot See

however, it is a huge problem for computers.

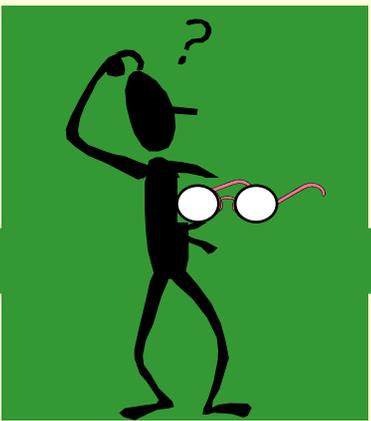
# Recognizing Descriptors

- Without the ability to immediately recognize the needed patient descriptors, intelligent agents are frustratingly handicapped and cannot effectively complete their jobs.



# Recognizing Descriptors

- In this instance, an intelligent agent cannot recognize Mr. Smith's blindness because differing representations for blindness were used by the clinician authoring the rule and the clinician caring for Mr. Smith.



# Recognizing Descriptors

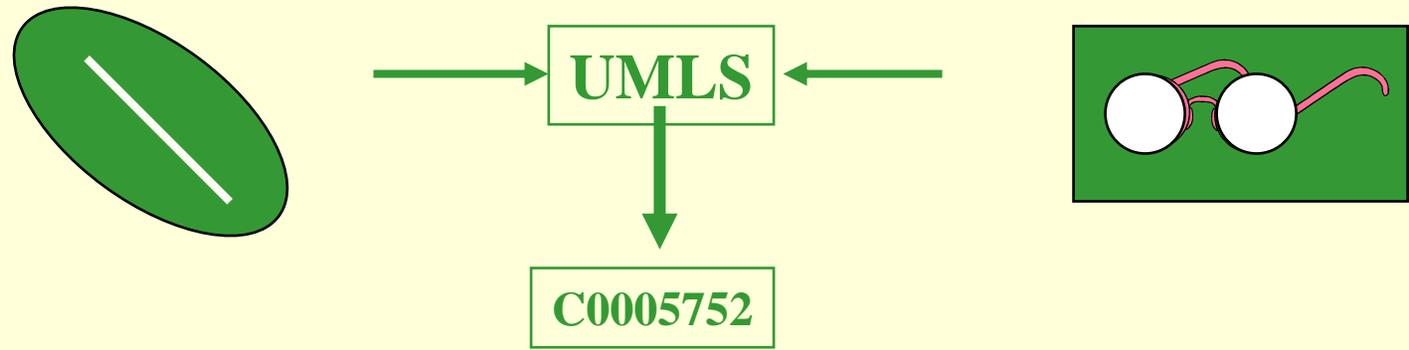
- Since computerized applications cannot be expected to automatically make the cognitive link between different representations of the same concept,



- Developers must be sure to map all representations of the same concept to a unique, universally recognizable concept identifier.

# Standardizing Descriptors

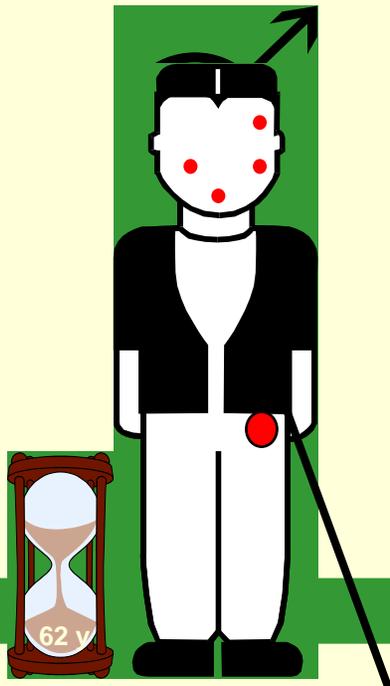
- In the infrastructure, an Enterprise Terminology Service can represent a standard concept based mapping for all such identifiers.



- For instance, the Unified Medical Language System (developed with tools by Apelon) is an ambitious warehouse for concept identifiers and the medical knowledge which they represent.

# Enhancing the Electronic Patient

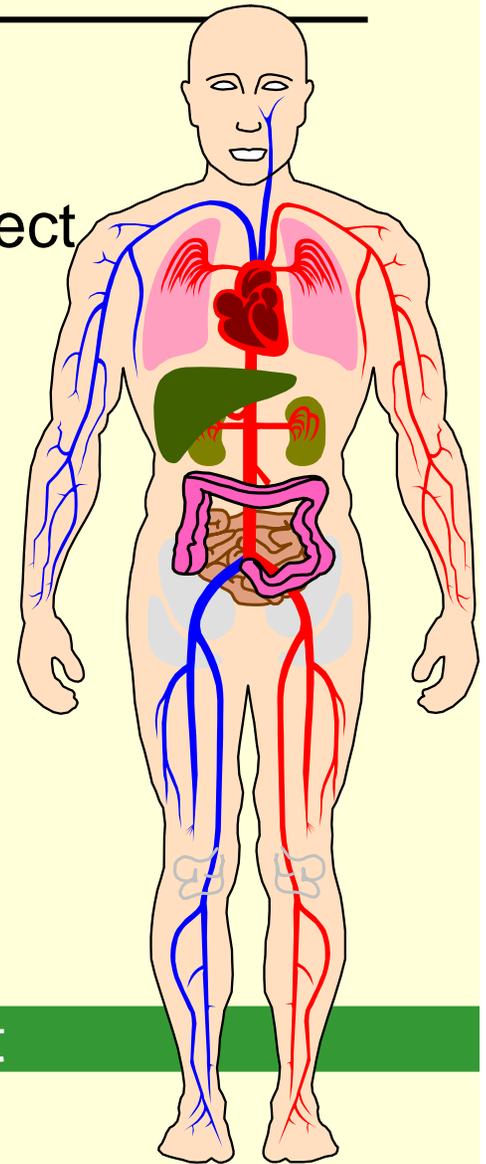
- When standard descriptors as unique identifiers are available to the patient object the electronic patient



is transformed

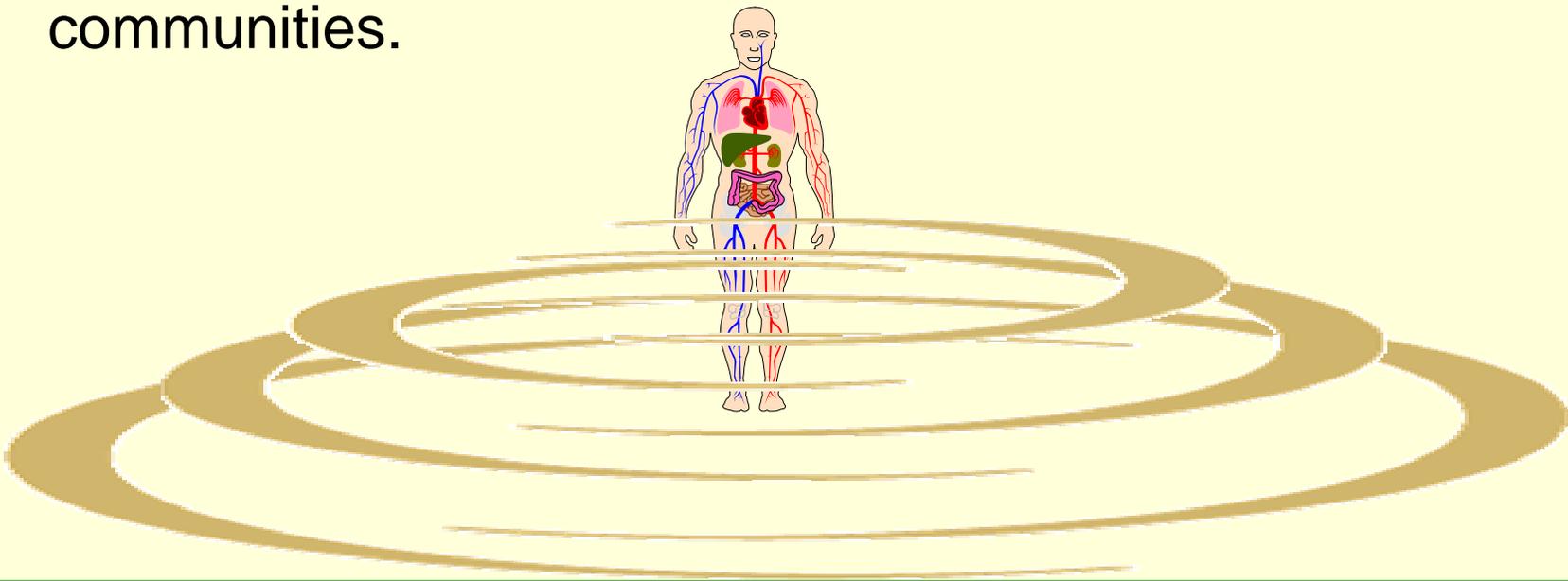


into the virtual patient



# Constructing a Virtual Environment

- Clinical users should be able to create virtual patients in a standards-based environment constructed by development teams working with members of the clinical care, clinical research, and biomedical informatics communities.



# Constructing a Virtual Environment

- A standard information model across all applications will be key to making all clinically important aspects of the virtual patient visible to all appropriate intelligent agents.



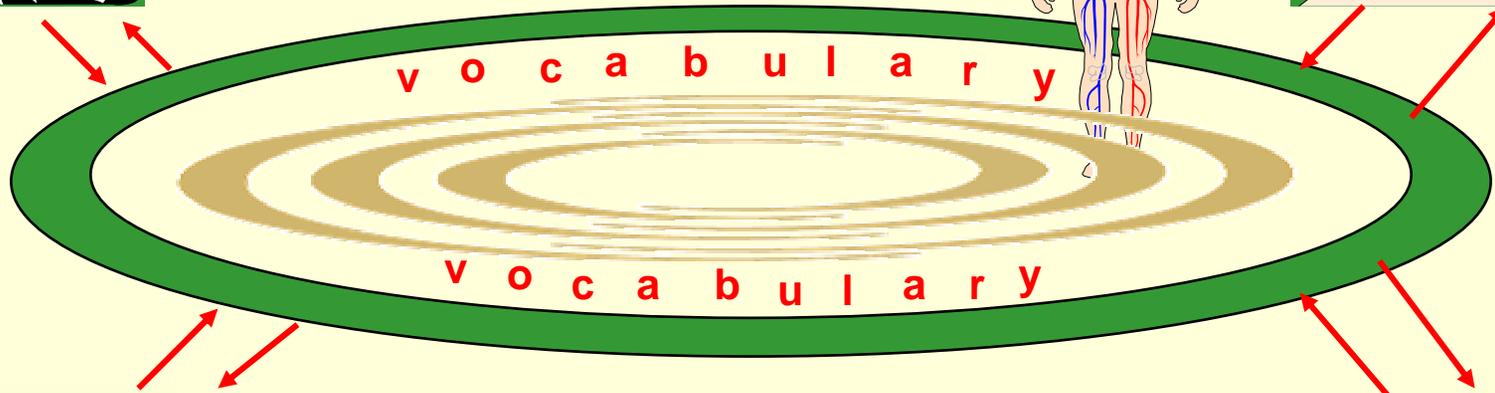
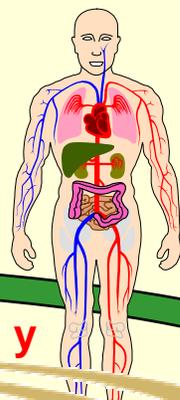
# Building the Virtual Patient

Vocabulary standards will allow all authorized participants to shape the virtual patient.



Standard clinical laboratory results

Genomics, proteomics



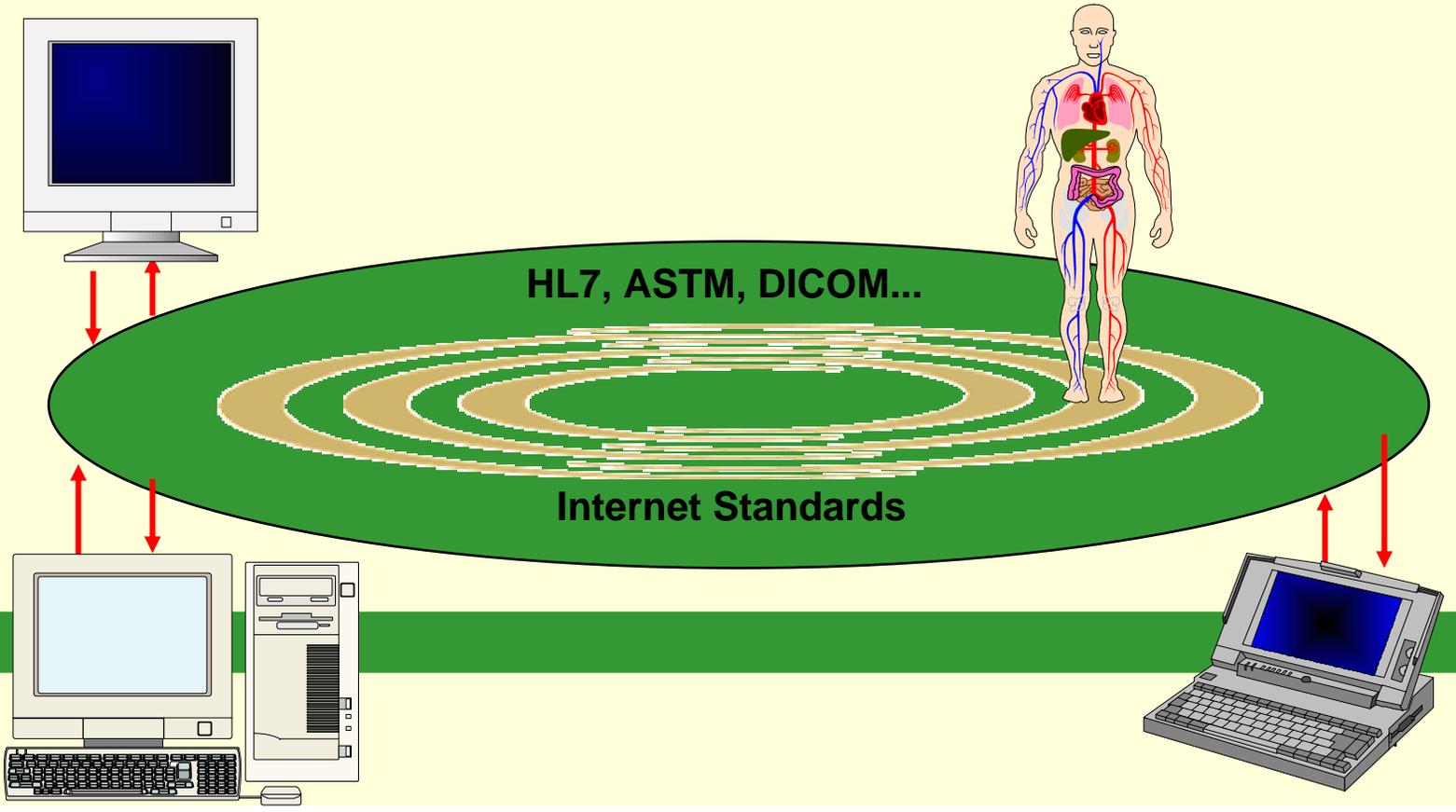
Clinician orders and observations

Patient input



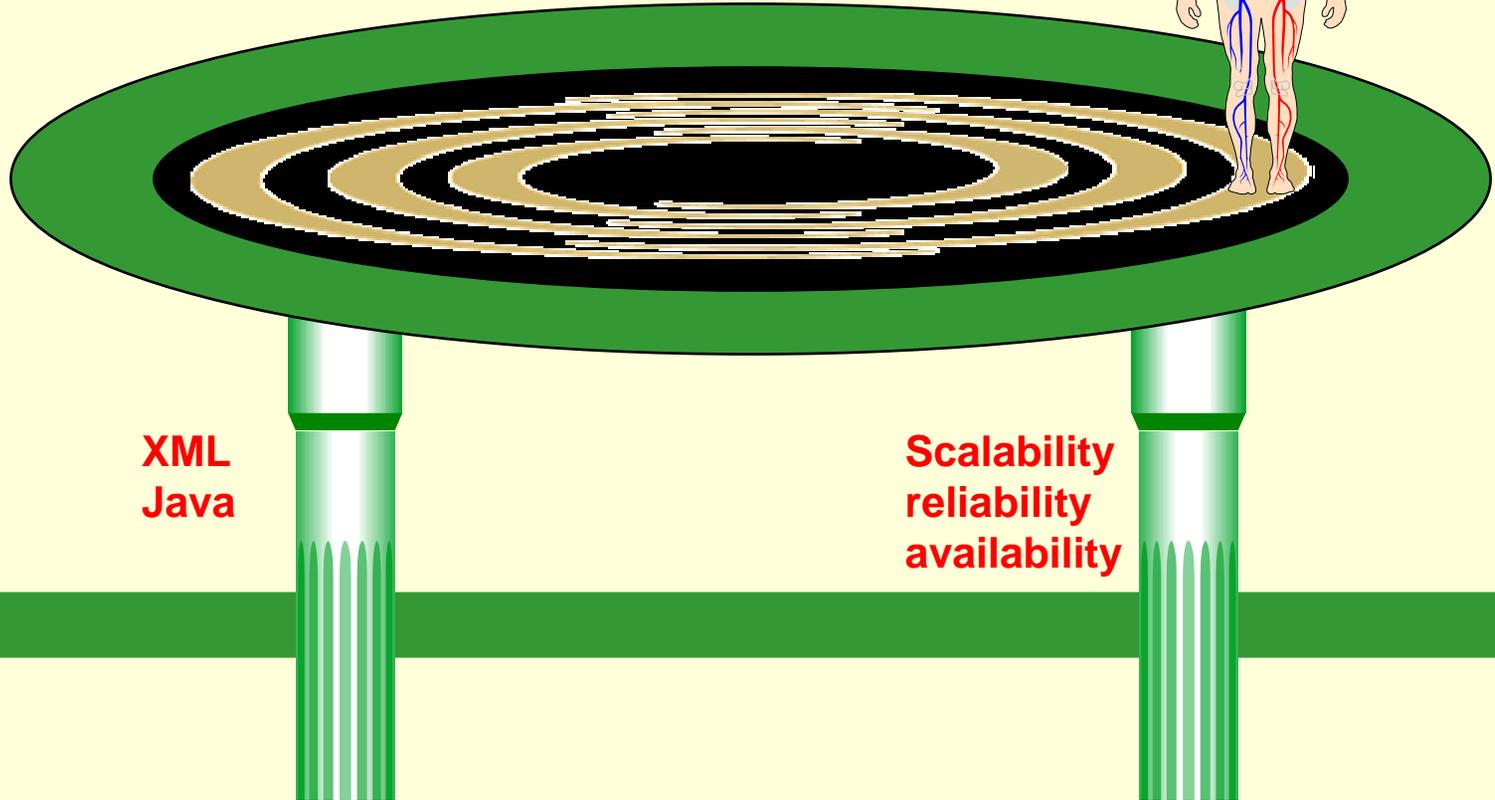
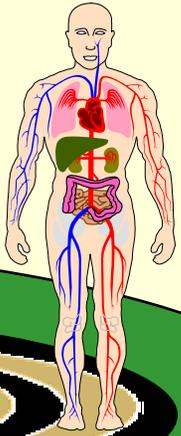
# Constructing a Virtual Health Space

- Standards for messaging and networking allow clinical applications to communicate rapidly with one another.

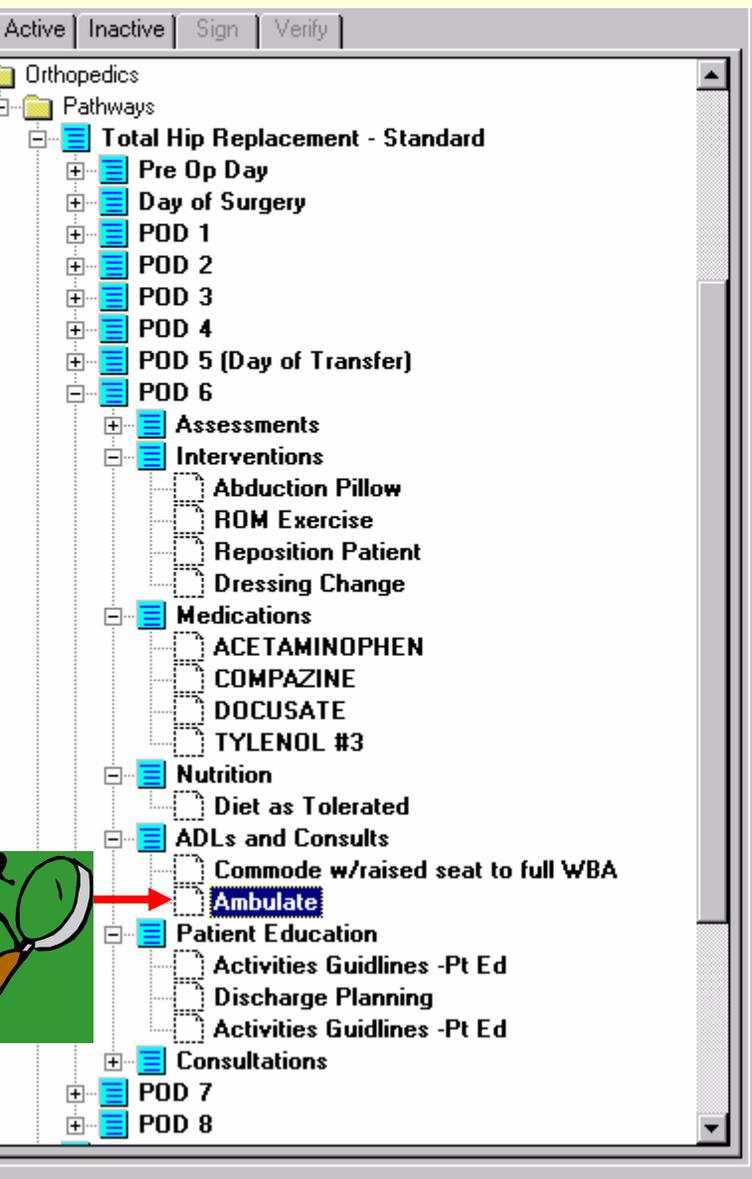


# Constructing a Virtual Health Space

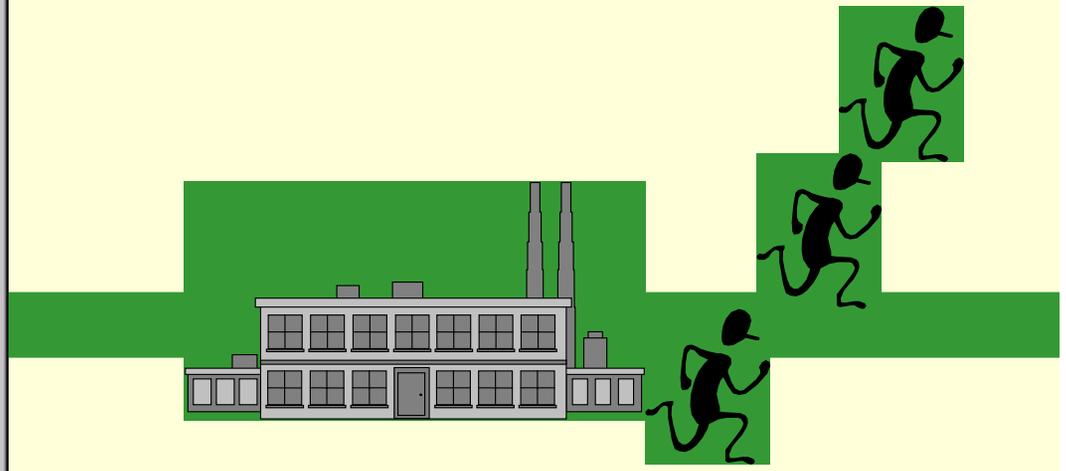
- Common technology architecture and industry communication standards are required.



# Pathways and Rules

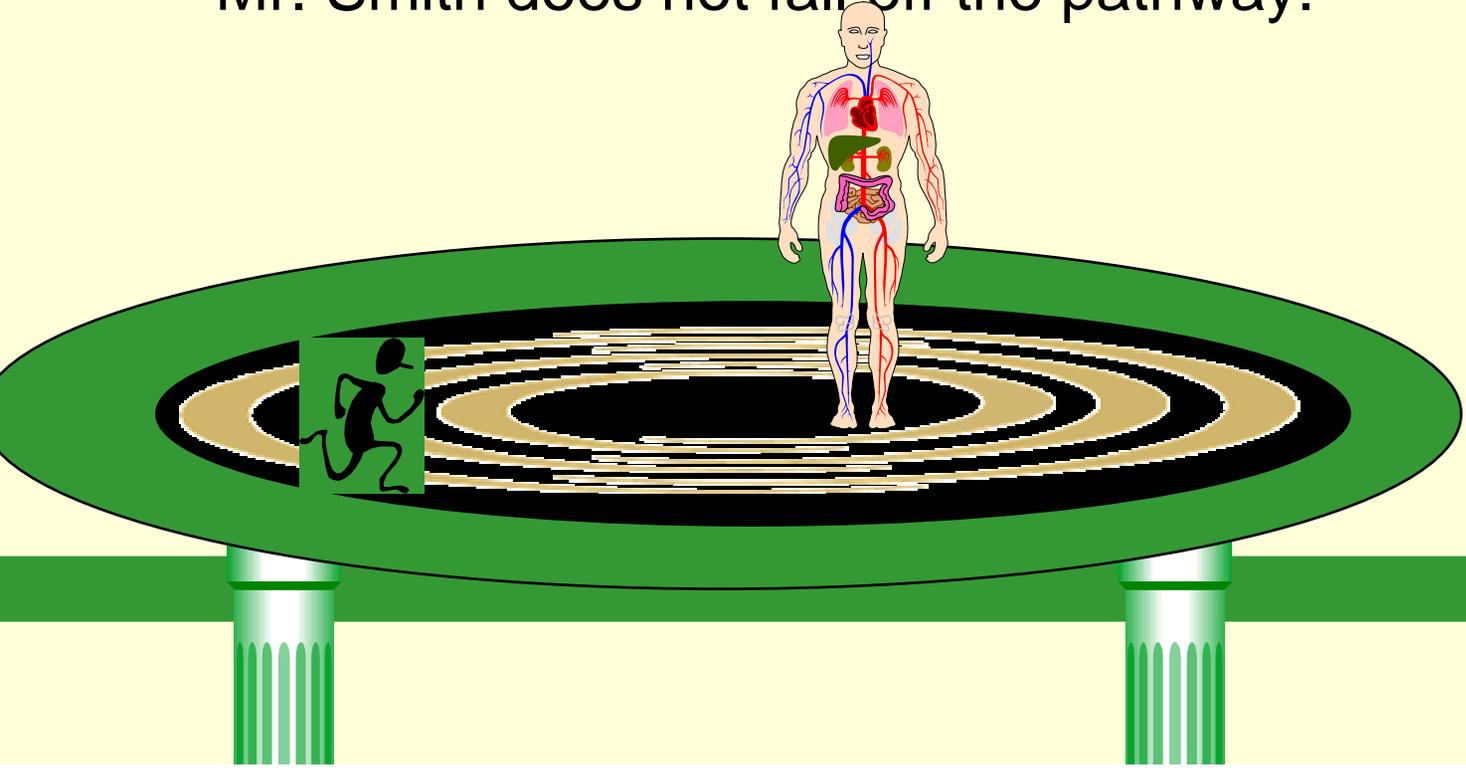


Clinicians will be able to author rules so that intelligent agents can check each order in a complex pathway for interactions with the clinical descriptors on any patient on the pathway.



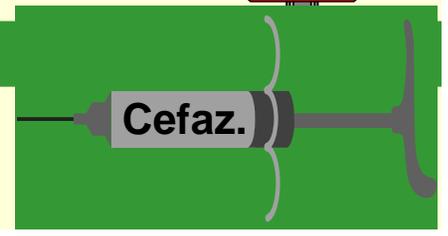
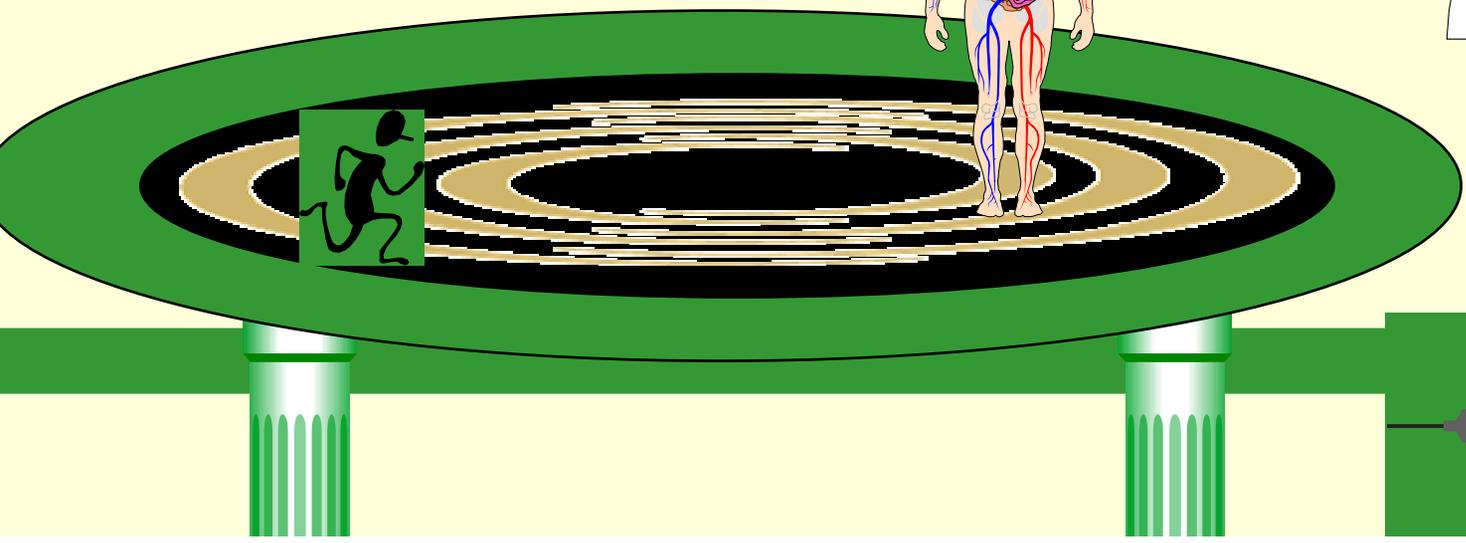
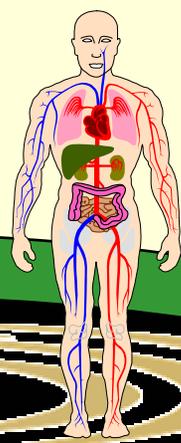
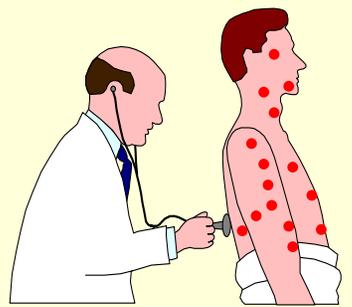
# Pathways in the Virtual Health Space

- Then, an intelligent agent will quickly match Mr. Smith's blindness with the total hip pathway "ambulate" order and notify his care team to add assistance so that Mr. Smith does not fall off the pathway.



# Pathways and the Virtual Patient

- An intelligent agent can detect both the cephalosporin order in the total hip replacement pathway and Mr. Smith's penicillin allergy and prevent an allergic reaction in Mr. Smith.



# Using the Virtual Patient

- By assuring standards for identification, description, and representation of patients in a Virtual Electronic World, we are creating a model environment for proactive patient care in which protection of real people can be enhanced by virtual patients.

