

Crystal balls in the hospital

Predicting treatment response

Dr. Cecilia Engel Thomas

Post doc in Schwenk lab at SciLifeLab and KTH



SciLifeLab



This anatomical diagram illustrates the human respiratory system. At the top, the trachea (windpipe) is shown with its characteristic cartilaginous rings. Above it are the thyroid and cricoid cartilages. The trachea branches into the right and left primary bronchi, which enter the right and left lungs respectively. The right lung is divided into three lobes: the upper lobe, middle lobe, and lower lobe, separated by the horizontal and oblique fissures. The left lung is divided into two lobes: the upper lobe and lower lobe, separated by the oblique fissure. A notch for the heart is visible on the medial border of the left lung. An inset in the upper right corner provides a magnified view of the alveoli, which are small, sac-like structures where gas exchange occurs, clustered together in an alveolar sac. Labels on the right side of the diagram include: Alveoli, Alveolar sac, Left primary bronchus, Upper lobe bronchus (secondary), Lower lobe bronchus (secondary), Tertiary bronchi, Upper lobe, and Lower lobe. Labels on the left side include: Thyroid cartilage, Cricoid cartilage, Trachea, Upper lobe, Right primary bronchus, Horizontal fissure, Middle lobe, Oblique fissure, and Lower lobe. A label at the bottom center points to the Notch for the heart.



www.medicalnewstoday.com/articles/315901.php



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DTU



Bachelors in Technical Biomedicine
Masters in Bioinformatics and Systems Biology

Text mining of Electronic
Patient Records



Cancer
prediction



Clustering of
single cell data



Text mining of
scientific literature



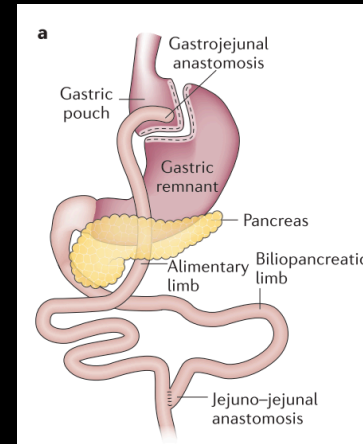
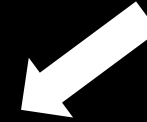
Metagenomics
habitat prediction





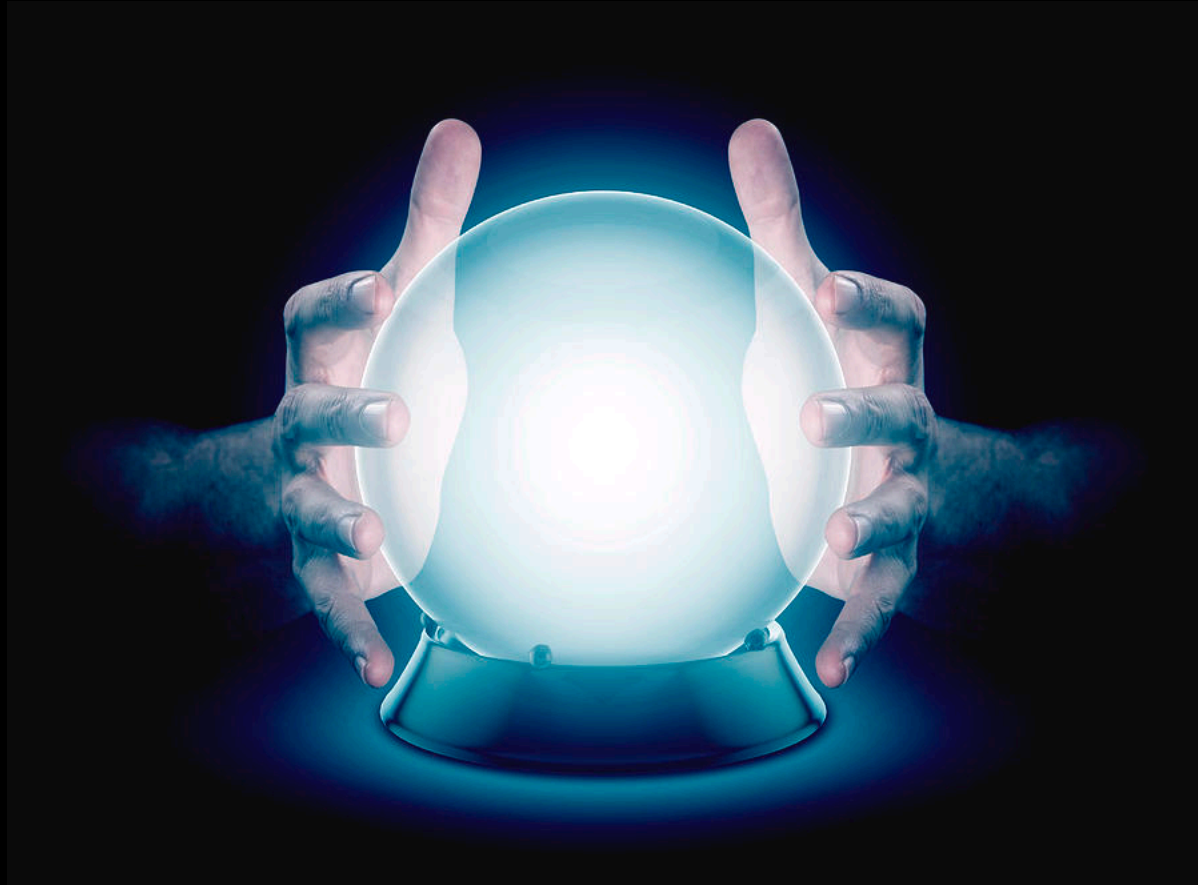


DTU



Crystal balls in the hospital

Predicting treatment response



ABILIFY (aripiprazole)
Schizophrenia





More common

- Body aches or pain
- congestion
- cough
- difficulty with moving
- dry or **sore throat**
- **headache**
- hoarseness
- pain in the joints
- **runny nose**
- tender, swollen glands in the neck
- trouble swallowing
- voice changes

Rare

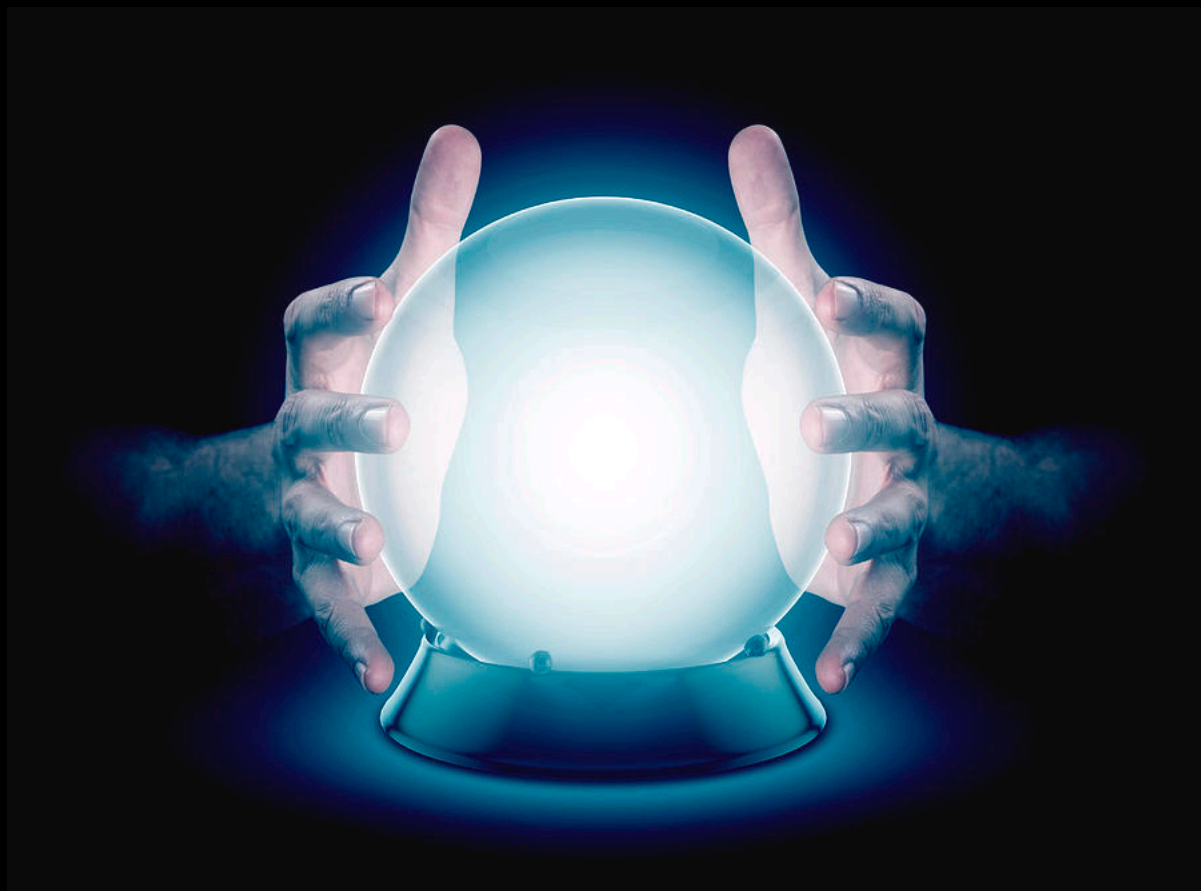
- Dark-colored urine
- fever
- muscle cramps or spasms
- muscle pain, stiffness, tenderness, wasting, or weakness
- unusual tiredness or weakness

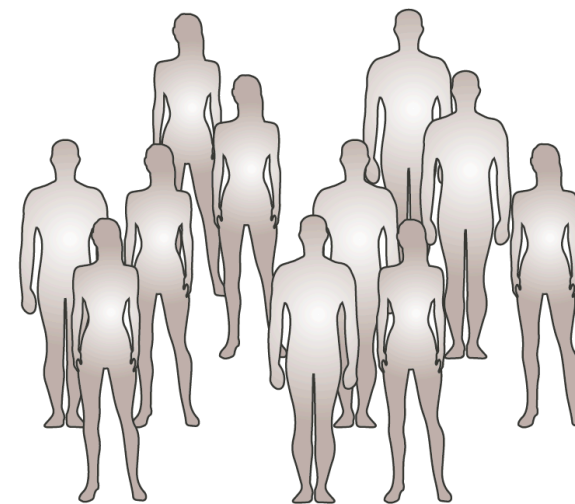
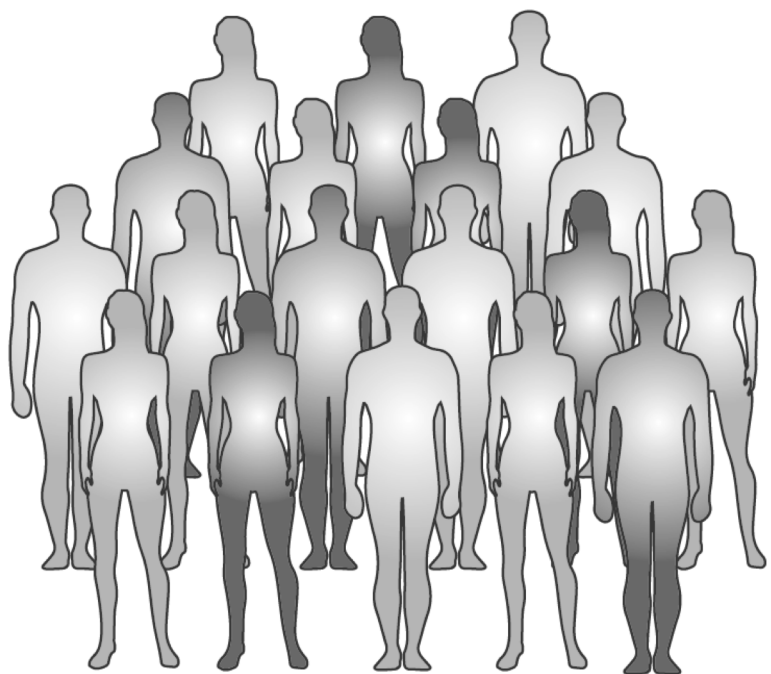
Incidence not known

- Abdominal or stomach pain
- clay-colored stools
- **skin rash**
- unpleasant breath odor
- **vomiting** of blood
- yellow eyes or skin

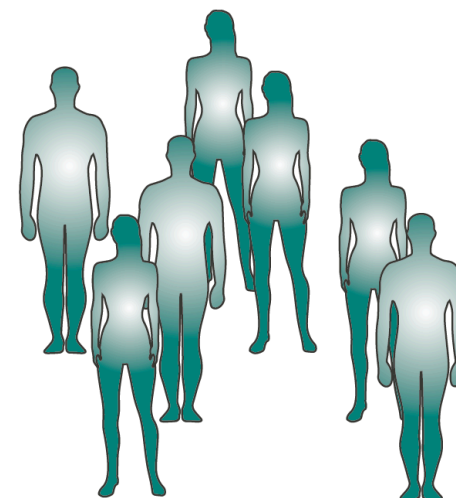
Less common

- Accidental injury
- accumulation of pus, swollen, red, or tender area of infection near a tooth
- acid or sour stomach
- arm, back, or jaw pain
- **belching**
- bladder pain
- bloated or full feeling
- bloody or cloudy urine
- blurred vision
- burning feeling in the chest or stomach
- burning, crawling, itching, **numbness**, prickling, "pins and needles", or tingling feelings
- chest pain or discomfort
- chest tightness or heaviness
- chills
- **constipation**
- **depression**
- **diarrhea**
- difficult or labored breathing
- difficult, burning, or painful urination
- discouragement
- **dizziness**
- dry mouth
- excess air or gas in the stomach or intestines
- excessive muscle tone
- fast, irregular, pounding, or racing heartbeat or pulse
- fear
- feeling faint
- feeling of constant movement of self or surroundings
- feeling of warmth or heat
- feeling sad or empty
- flushed, **dry skin**
- flushing or redness of the skin especially on the face and neck
- fruit-like breath odor
- general feeling of discomfort or illness
- **heartburn**
- increased hunger
- increased thirst
- increased urination
- irritability
- itching skin
- lack of appetite
- lack or loss of strength
- lightheadedness
- loss of appetite
- loss of consciousness
- loss of interest or pleasure
- muscle tension or tightness
- **nausea**
- **neck pain**
- nerve pain
- nervousness
- pain or swelling in the arms or legs without any injury
- pain or tenderness around the eyes and cheekbones
- pain, swelling, or redness in the joints
- pale skin
- passing gas
- pounding in the ears
- sensation of spinning
- shivering
- **slow heartbeat**
- sneezing
- stomach pain, discomfort, tenderness, or upset
- stuffy nose
- sweating
- swelling of the hands, ankles, feet, or lower legs
- trouble concentrating
- trouble sleeping
- **unexplained weight loss**
- unusual bleeding or bruising
- vomiting





Non-responder



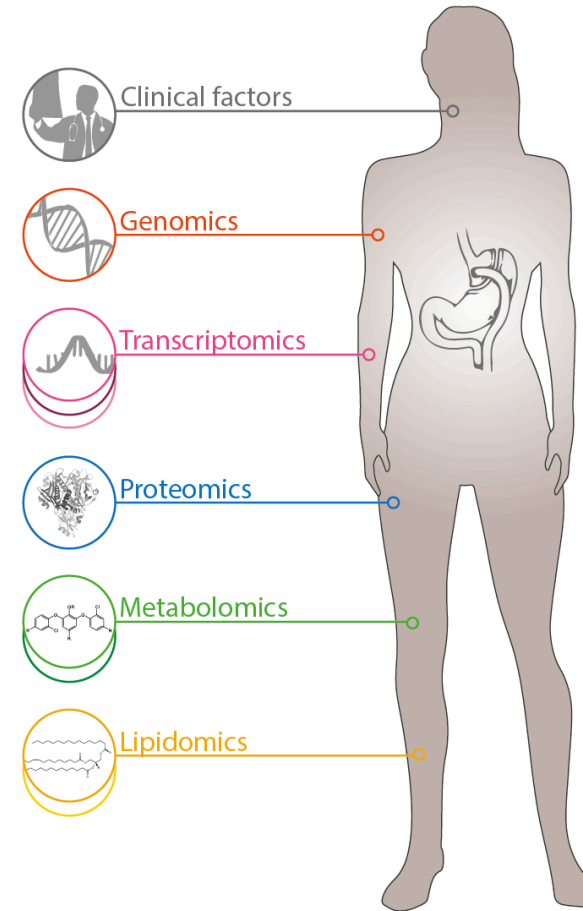
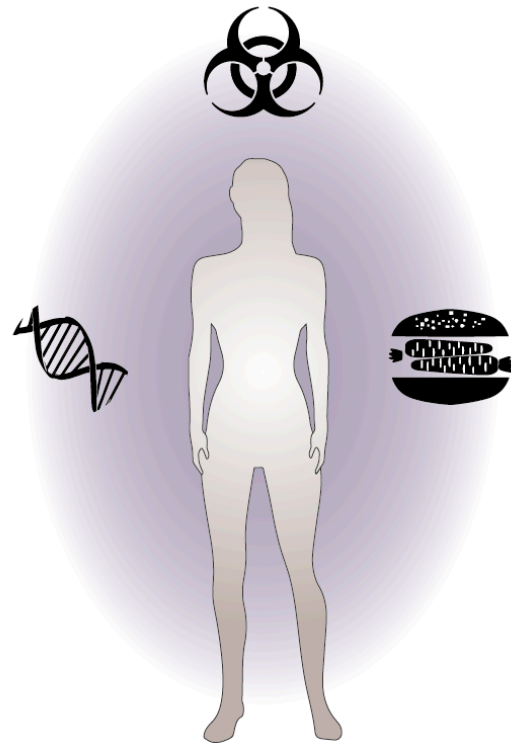
Responder

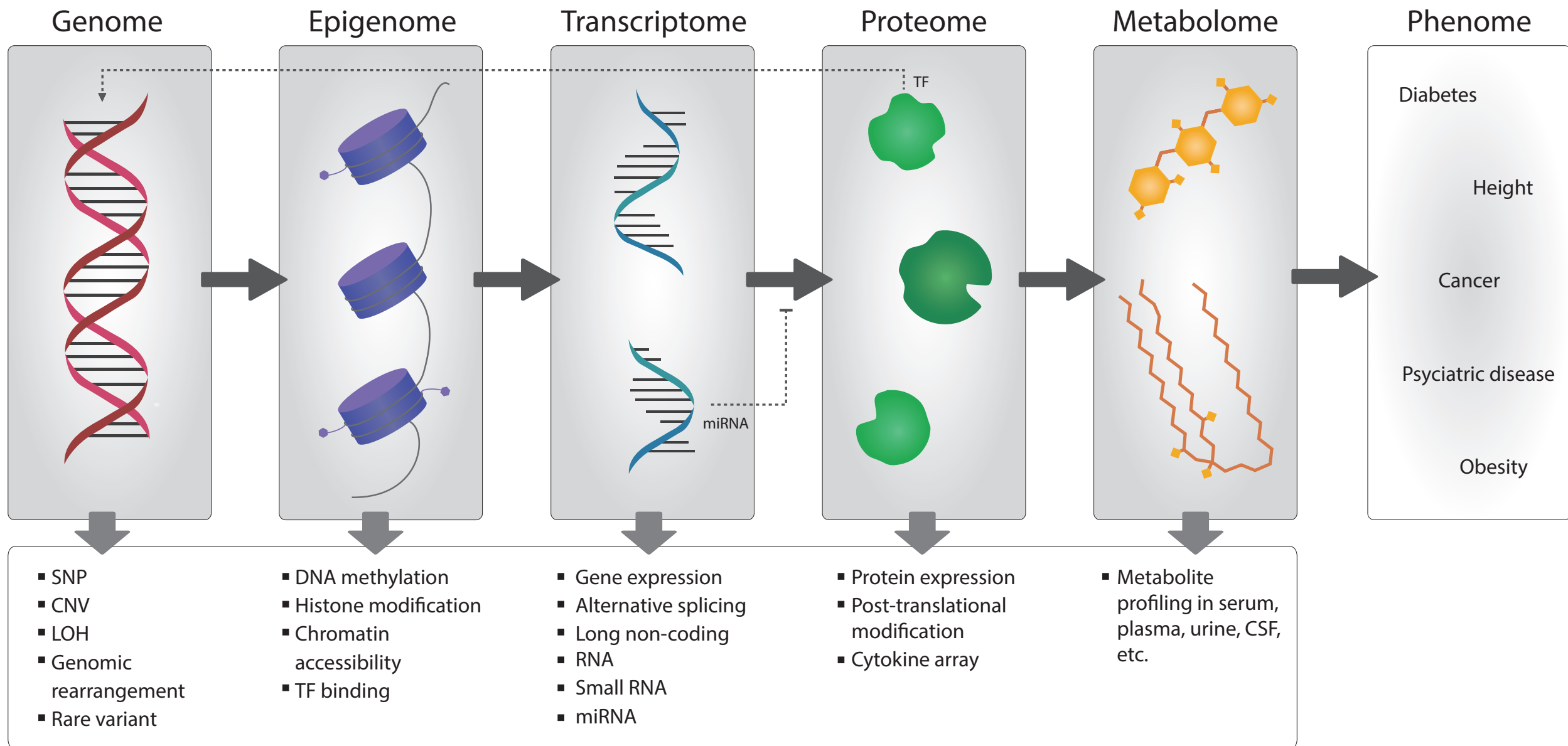
How to make a “crystal ball”

Step 1: Collect information/data on the patients

Step 2: Come up with a good way to combine that data and make predictions

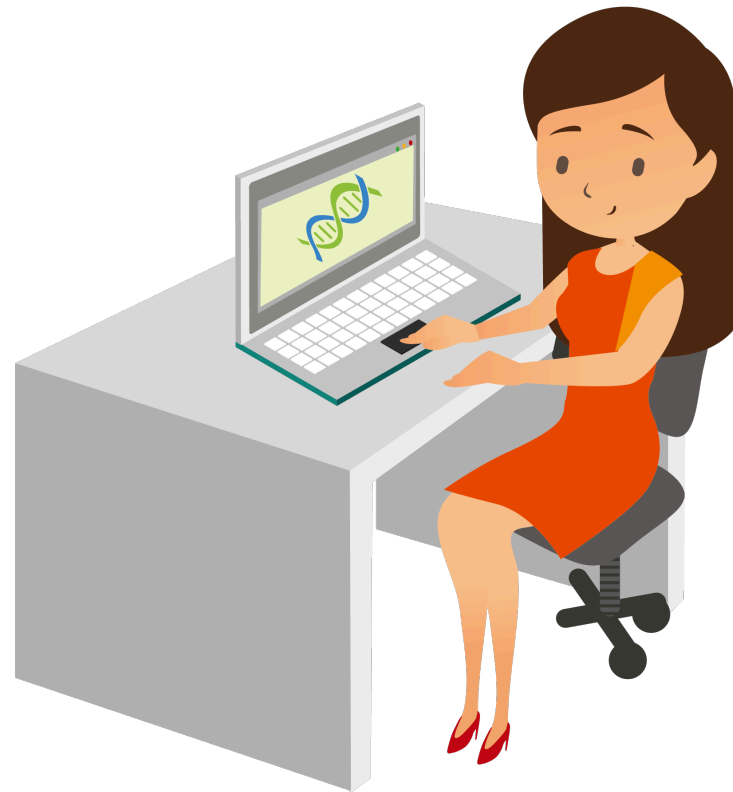
Step 1: Collect information/data on the patients





Molecular readouts

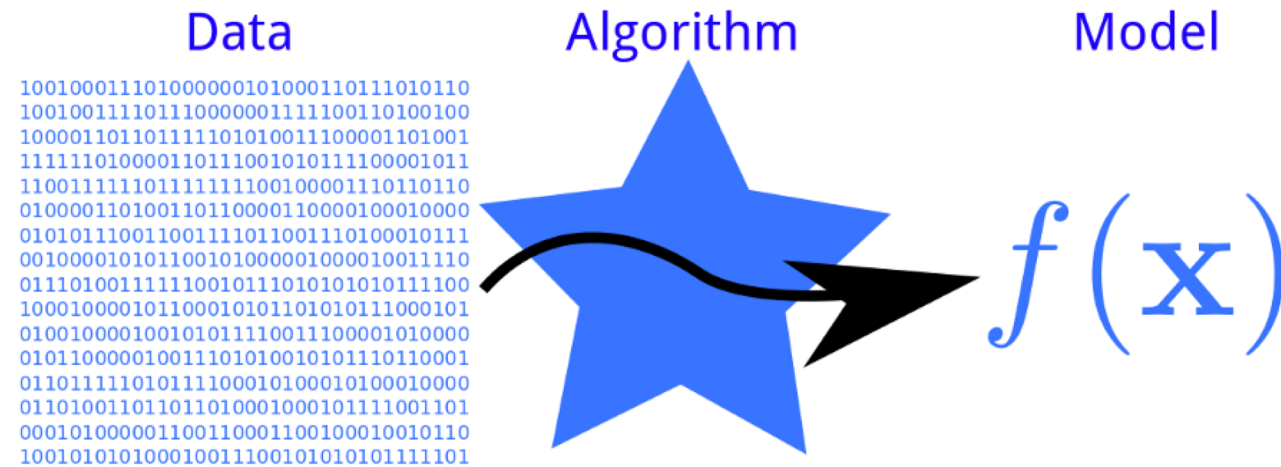
Step 2: Come up with a good way to combine that data and make predictions



Machine learning

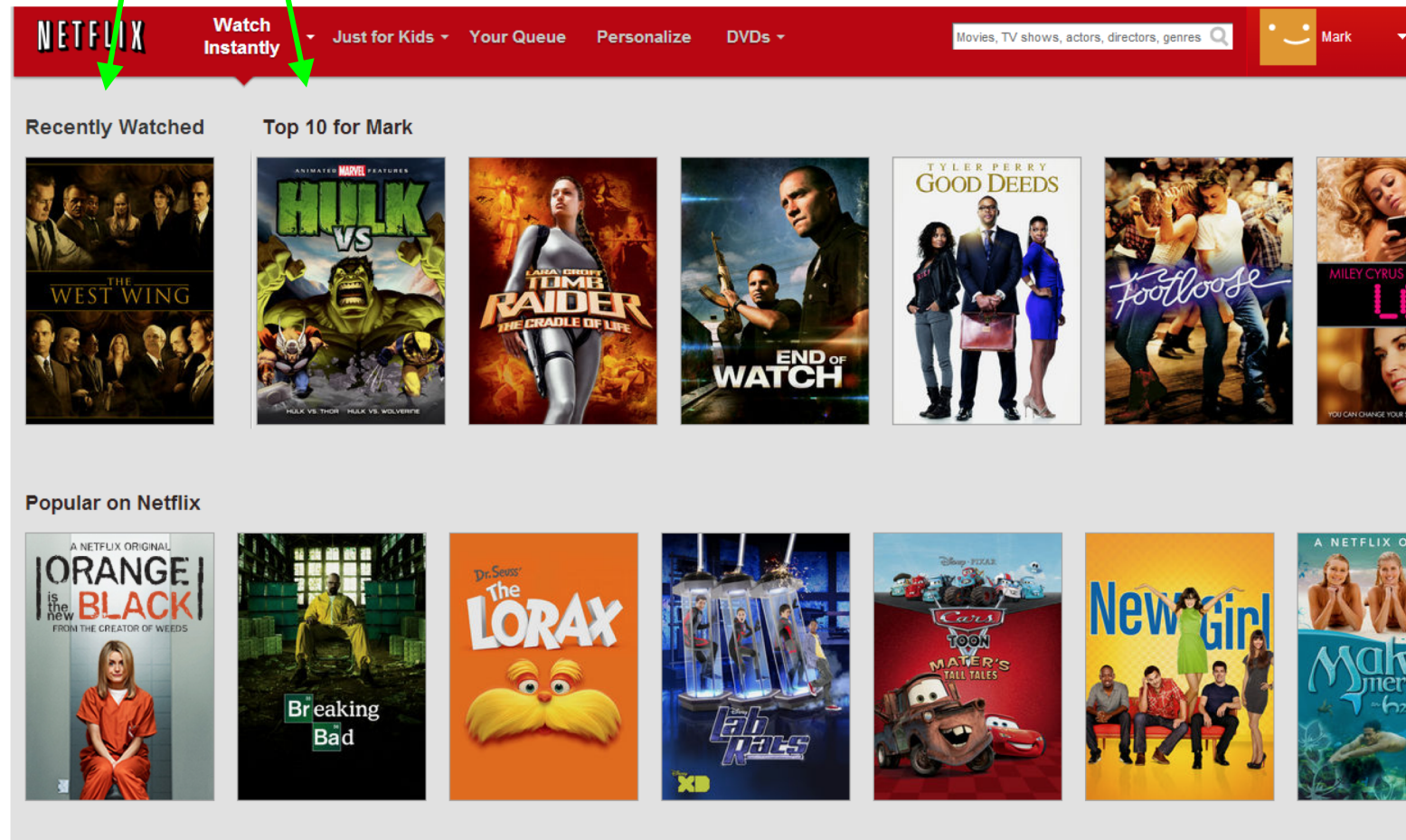


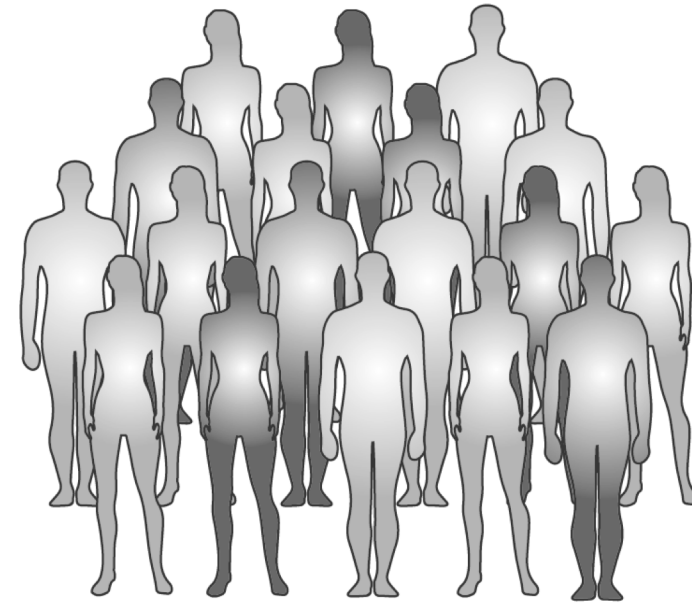
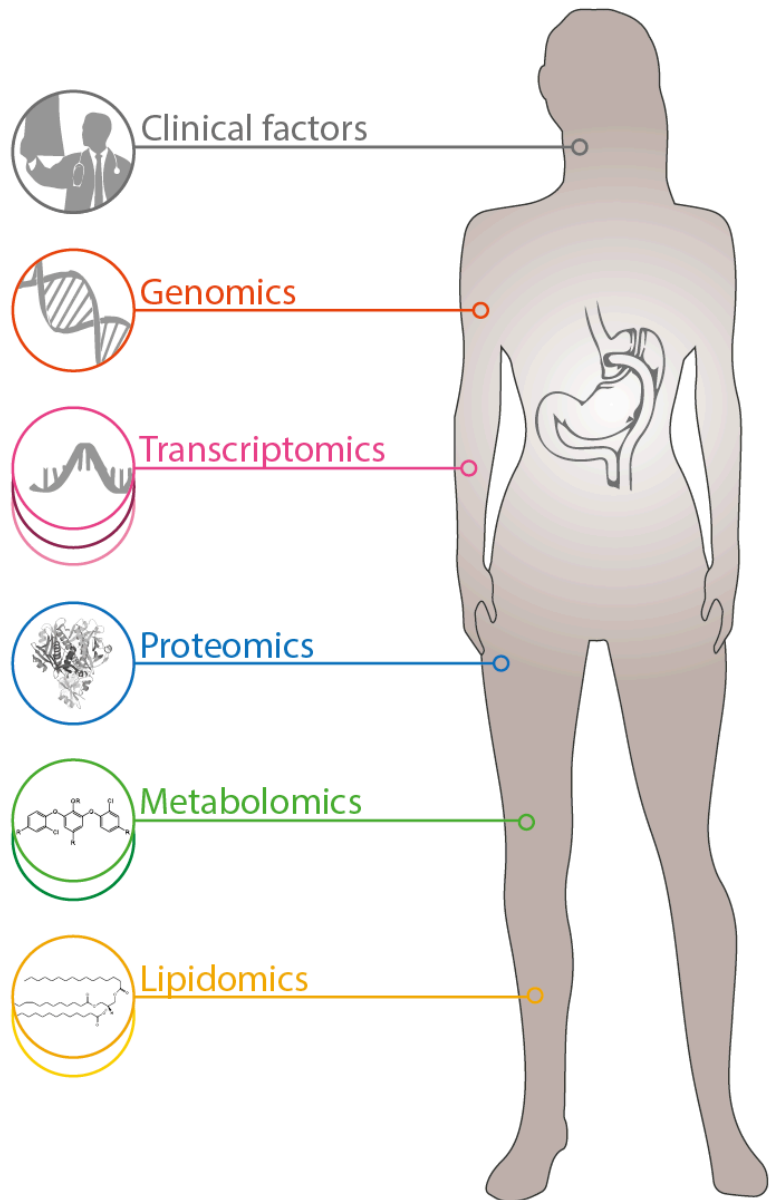
Machine learning



Input: Movies Mark has watched

Output: Movies Mark will like





Who will respond to therapy?

Input: Omics data

Output: Response to therapy

Which patients with type 2 diabetes
should get which treatment?

Prevalence

415 million in 2013

642 million by 2040

Complex disease with
unknown cause

Defined by dysregulation
of sugar metabolism

Type 2 diabetes

Higher risk with
overweight, smoking,
sedentary lifestyle,
unhealthy eating habits,
and genetics

Can lead to blindness,
dementia, need for
dialysis...

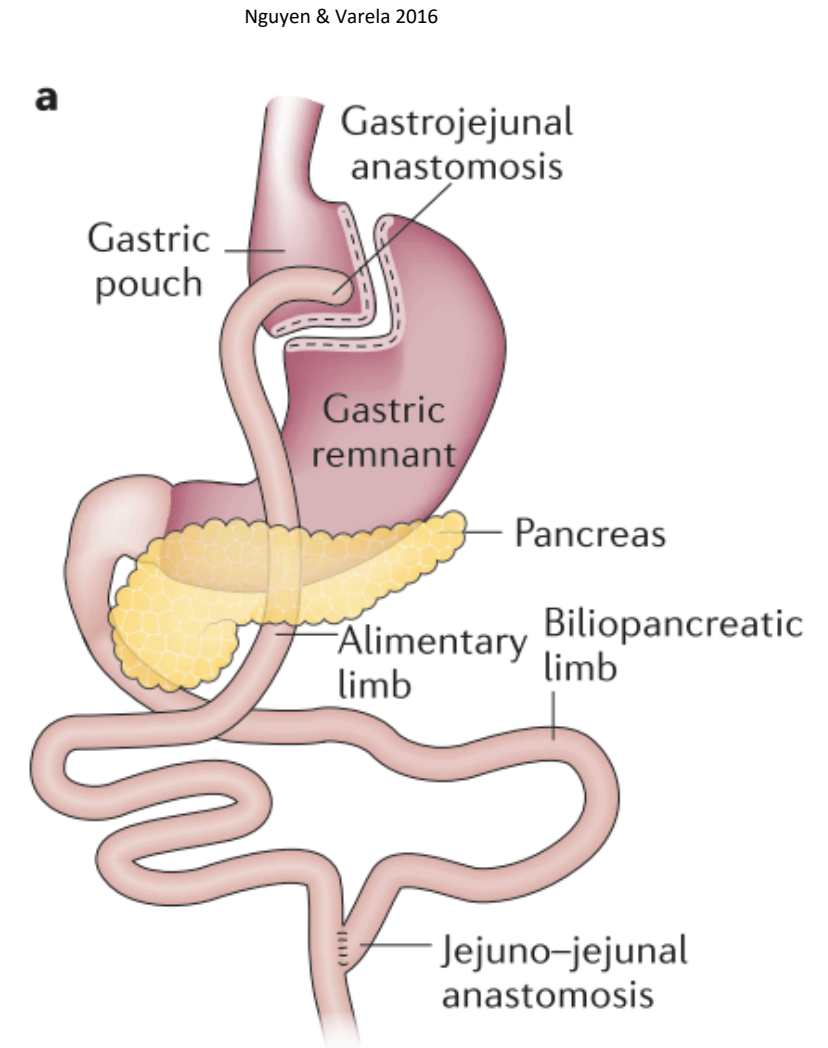
Leading cause of non-
traumatic amputations



Lifestyle change

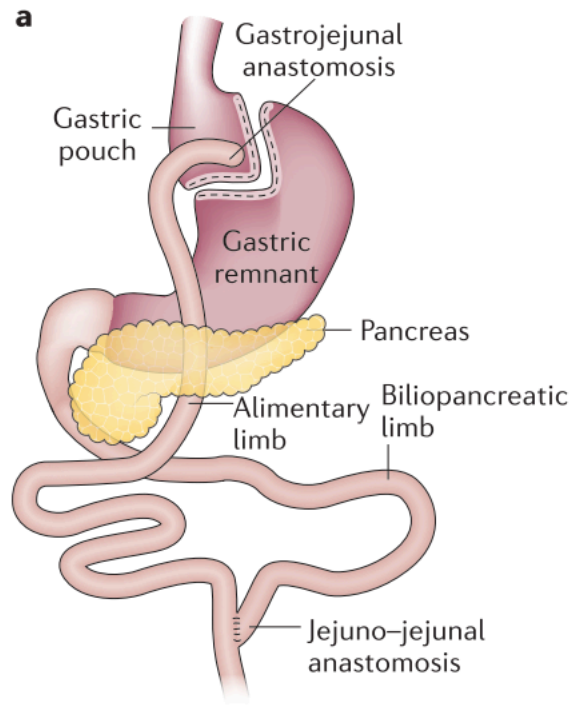


Medication

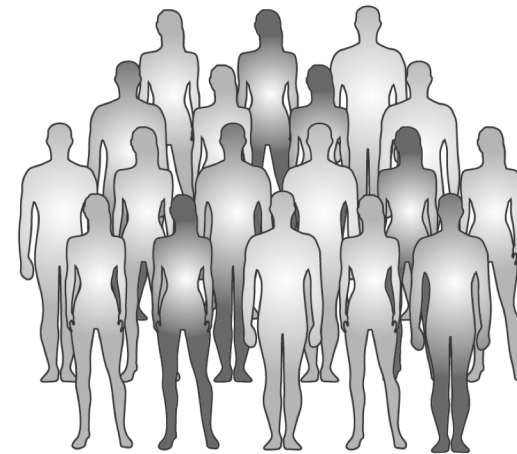
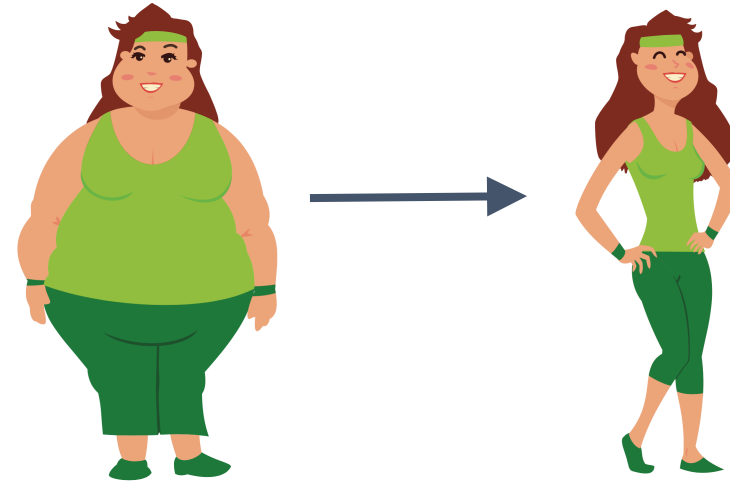


Bariatric surgery

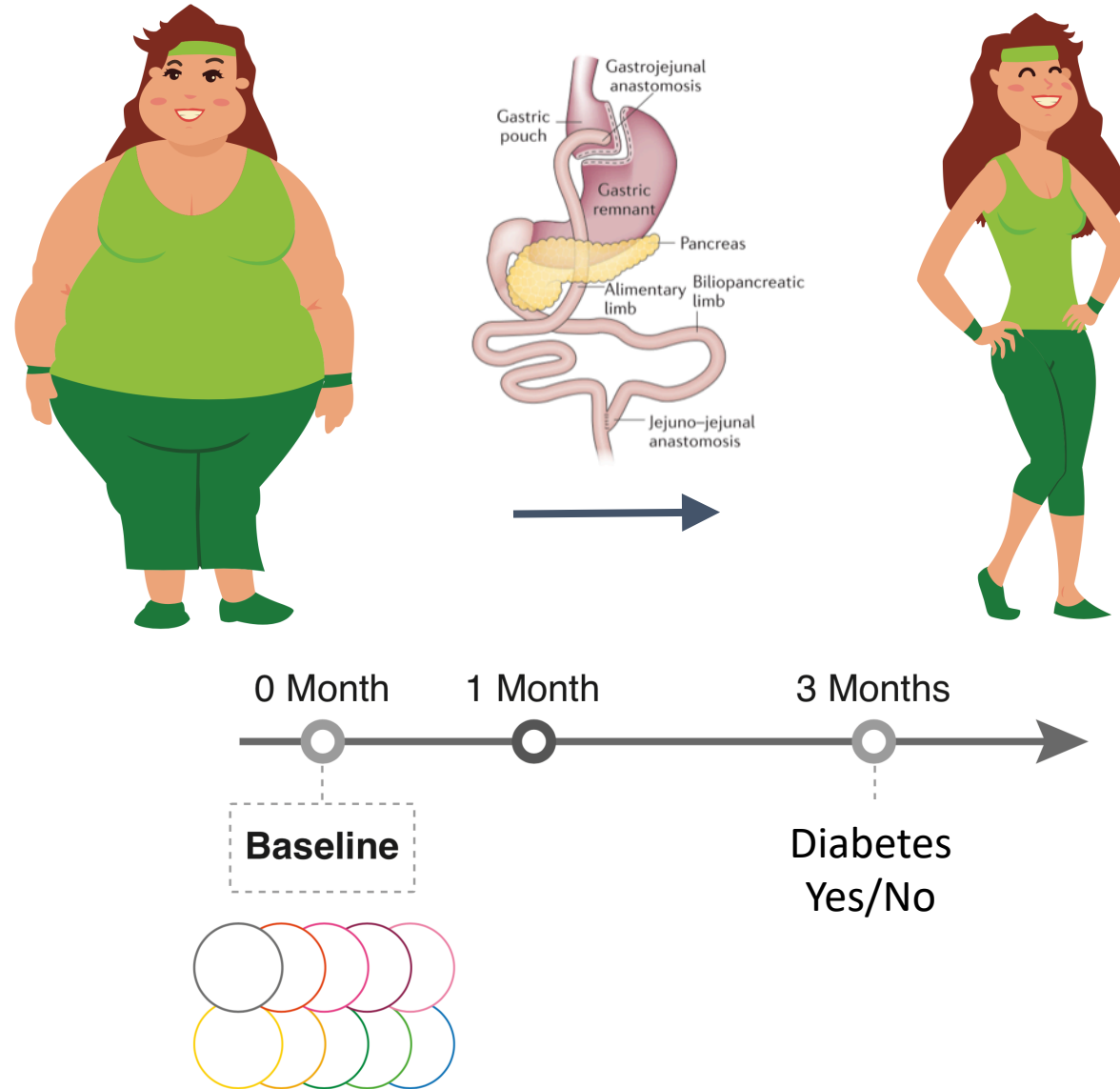
For whom can bariatric surgery be
a treatment for type 2 diabetes?

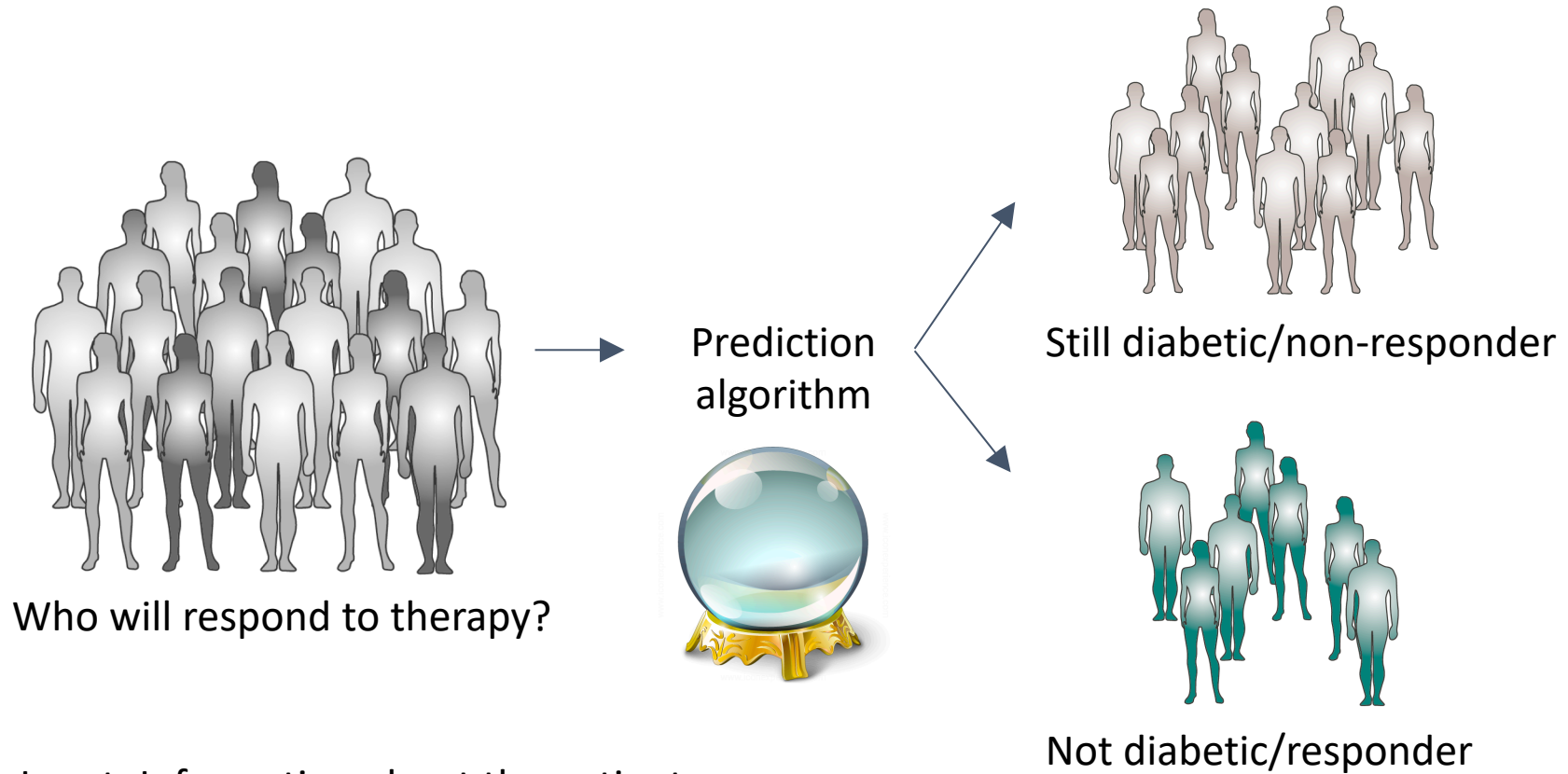


Nguyen & Varela 2016



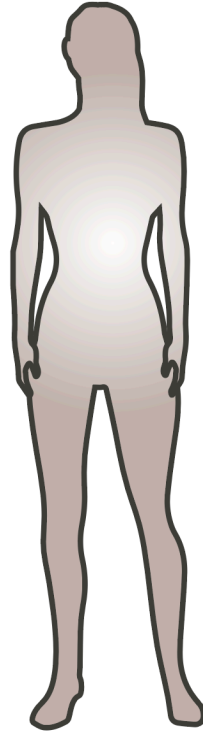
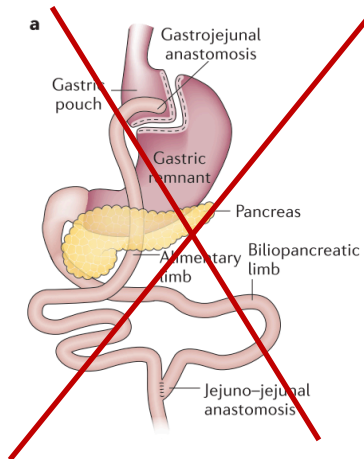
Who will respond to therapy?





Input: Information about the patient

Output: Response to therapy

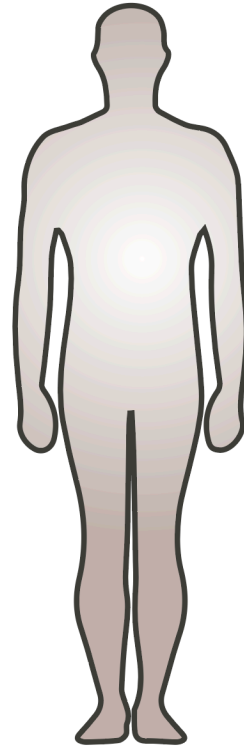
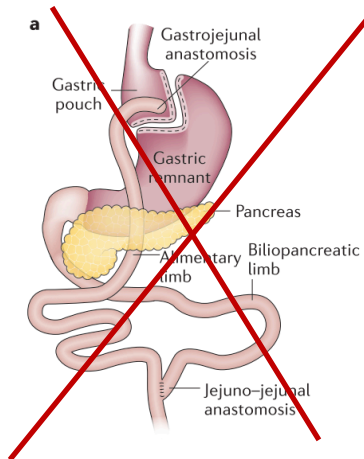


Prediction
algorithm



Still diabetic/non-responder

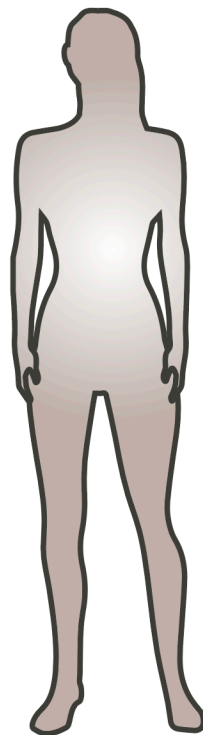
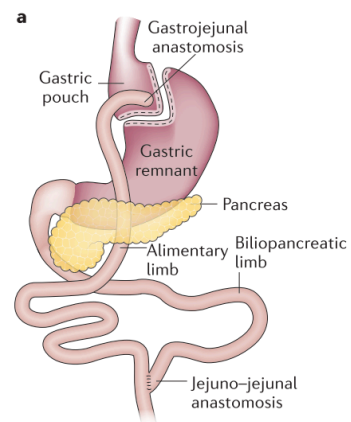




Prediction
algorithm



Still diabetic/non-responder



Prediction
algorithm



Not diabetic/responder

