

Crystal balls in the hospital Predicting treatment response

Dr. Cecilia Engel Thomas

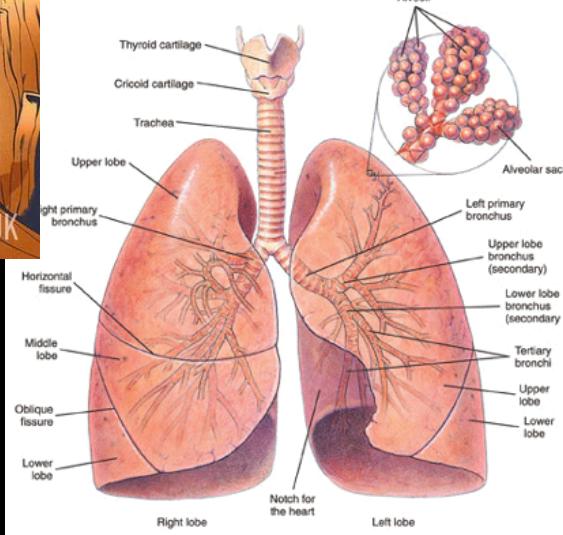
Post doc in Schwenk lab at SciLifeLab and KTH



SciLifeLab



RECREATIONAL DIVE PLANNER™													
DIVING SCIENCE & TECHNOLOGY CORP. SURFACE INTERVAL CREDIT TABLE													
START	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
DEPTH (feet) ►	35	40	50	60	70	80	90	100	110	120	130	140	0:00
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B	19	16	13	11	9	8	7	6	6	5	4	1	0:47 3:48
25	22	17	14	12	10	9	8	7	6	5	5	1	0:00 0:09 0:31 1:19
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33	27	21	17	15	13	11	10	9	8	7	7	1	0:00 0:16 0:17 0:39 1:28
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52	44	33	27	22	19	17	15	14	12	11	10	1	0:06 0:12 0:18 0:25 0:32 0:41 0:50 1:12 2:00
57	48	36	29	24	21	18	16	14	13	12	11	1	0:06 0:11 0:17 0:24 0:31 0:40 0:49 1:11 1:59 5:00
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57	55	41	33	27	23	21	18	16	15	14	13	1	0:04 0:19 0:27 0:34 0:42 0:50 0:59 1:21 2:09 5:10
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99	79	57	44	36	30	27	23	20	17	14	13	1	0:03 0:07 0:11 0:16 0:20 0:25 0:30 0:35 0:41 0:47 0:53 1:00 1:08 1:25 2:35
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27	97	67	52	43	34	27	23	20	17	14	13	1	0:02 0:03 0:07 0:10 0:13 0:17 0:23 0:28 0:34 0:40 0:46 0:52 0:59 1:07 1:15 1:46 2:34 5:35
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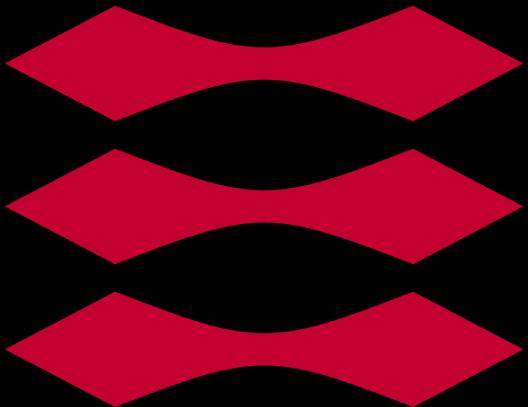


www.medicalnewstoday.com/articles/315901.php



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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



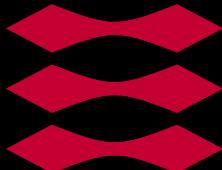
Text mining of
scientific literature



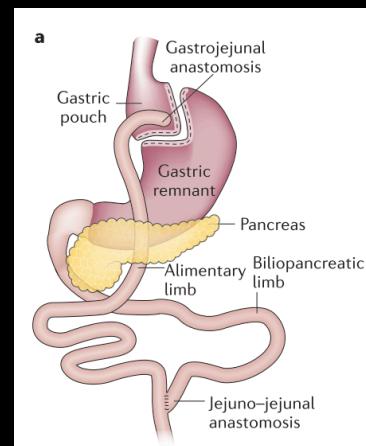
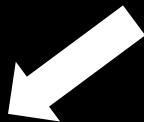
Metagenomics
habitat prediction







UNIVERSITY OF
COPENHAGEN



Crystal balls in the hospital

Predicting treatment response

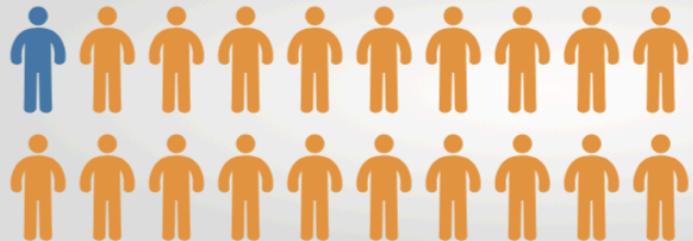


ABILITY (aripiprazole)
Schizophrenia



CRESTOR (rosuvastatin)

High cholesterol



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

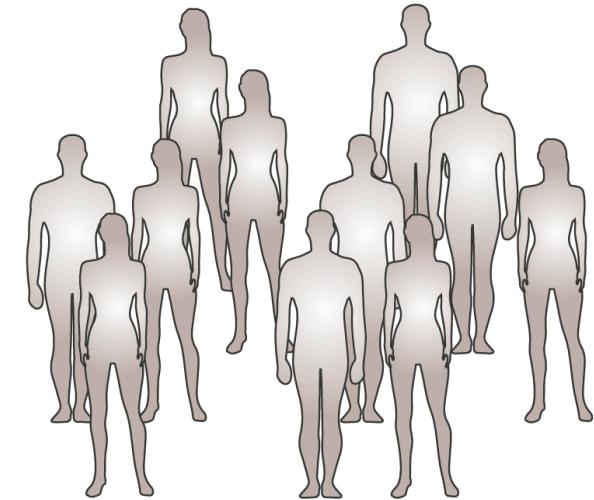
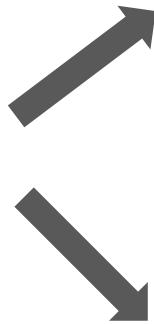
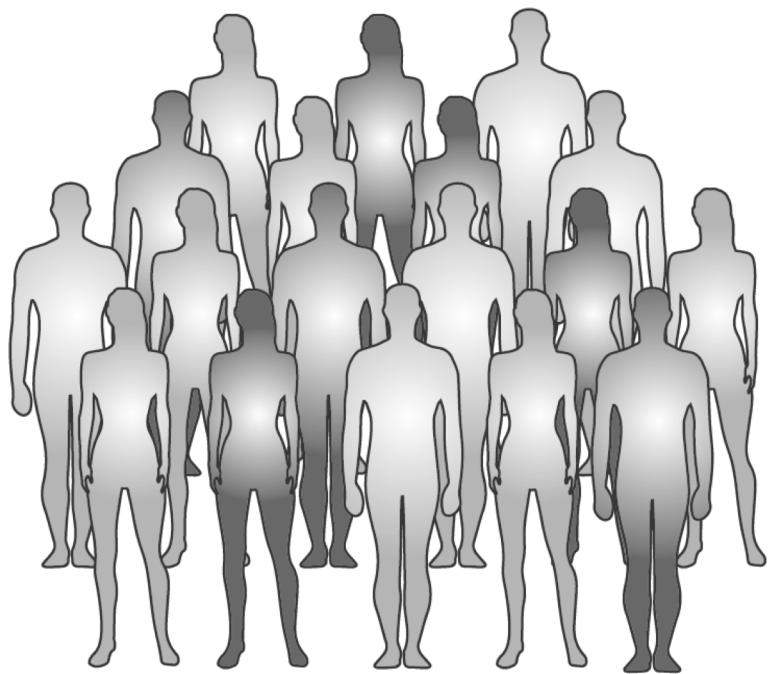
Incidence not known

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

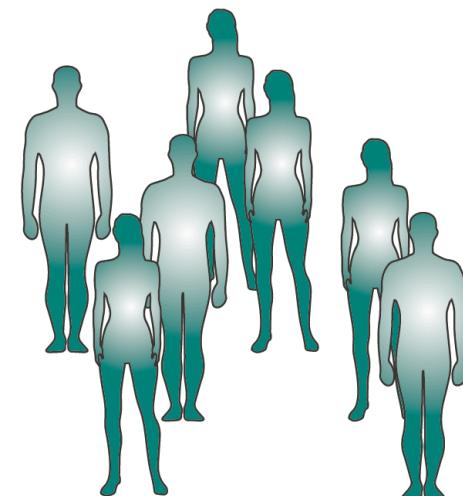
Less common

- 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



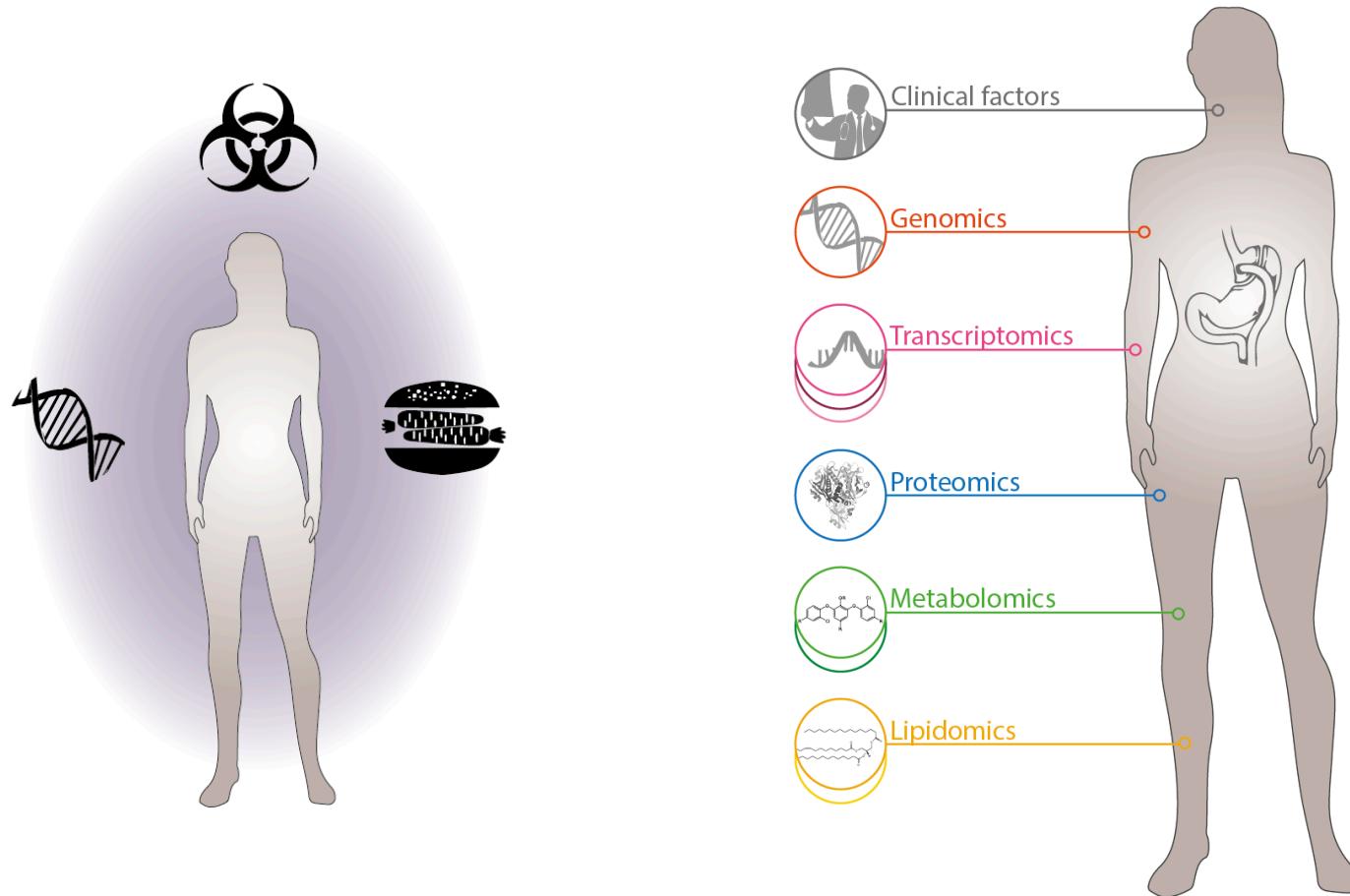
Responder

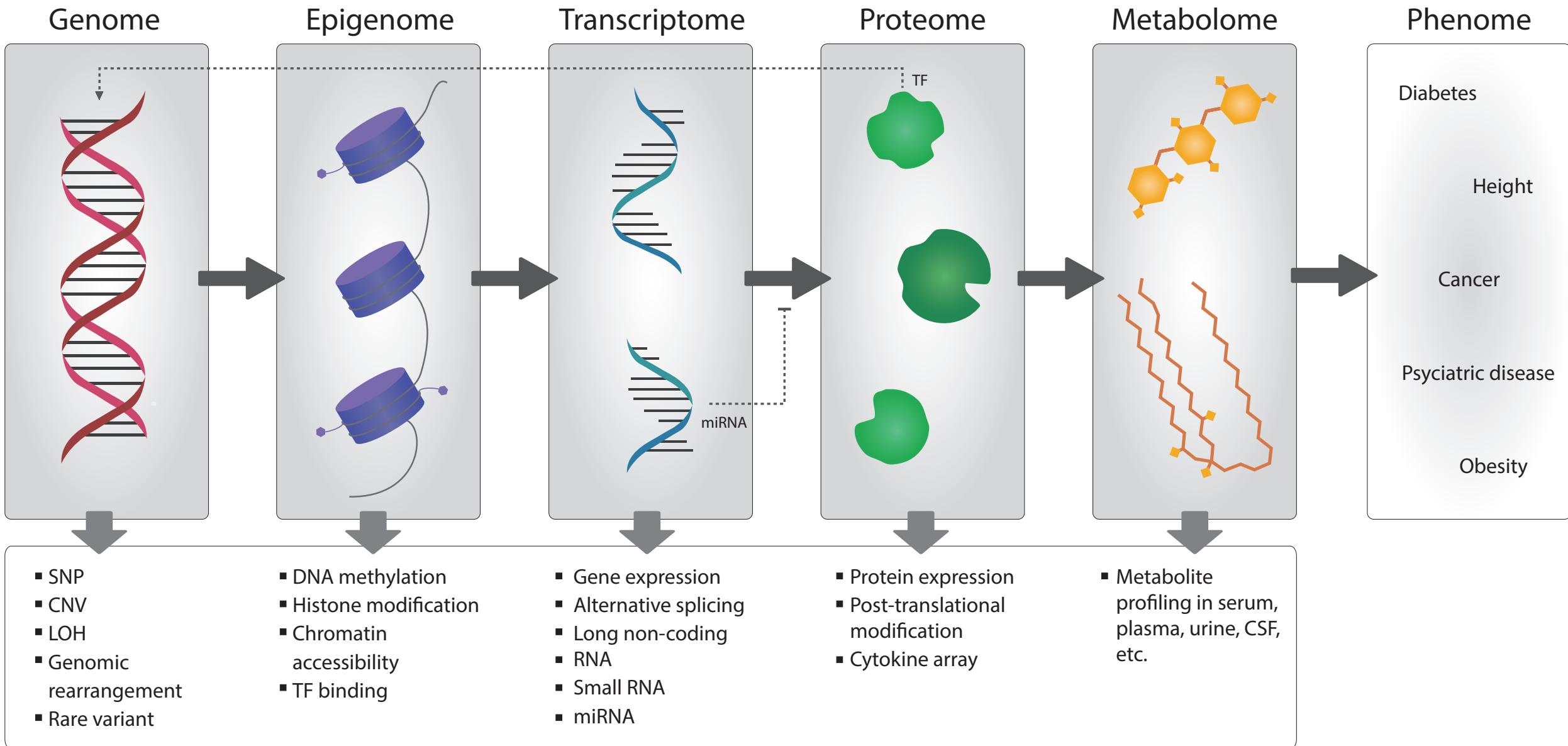
How to make a “crystal ball”

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

Adapted from Ritchie *et al.*, 2015

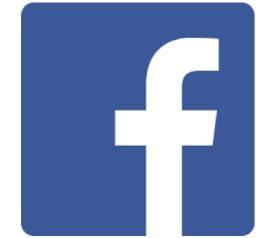
Step 2: Come up with a good way to combine that data and make predictions



Machine learning

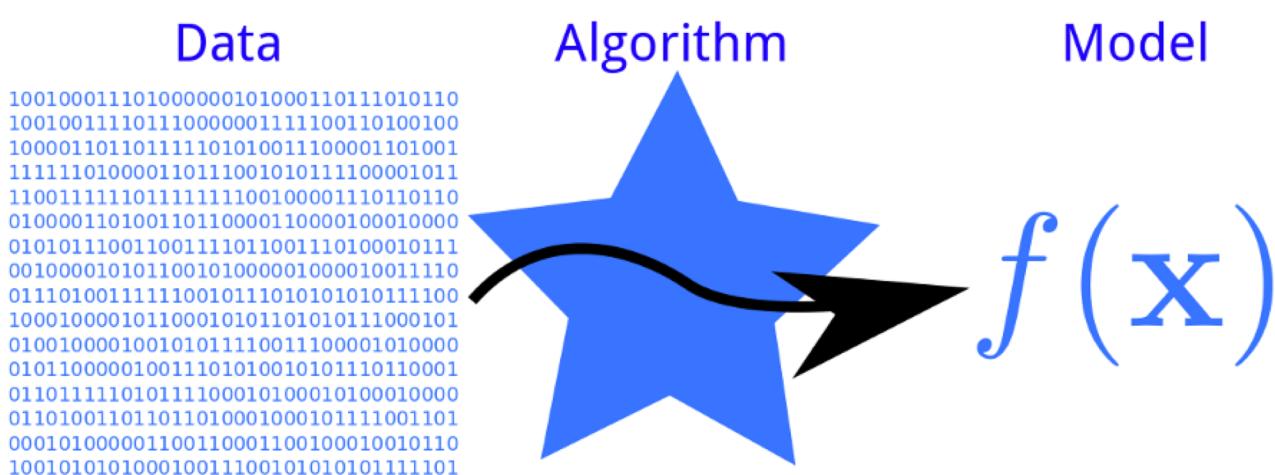


Google



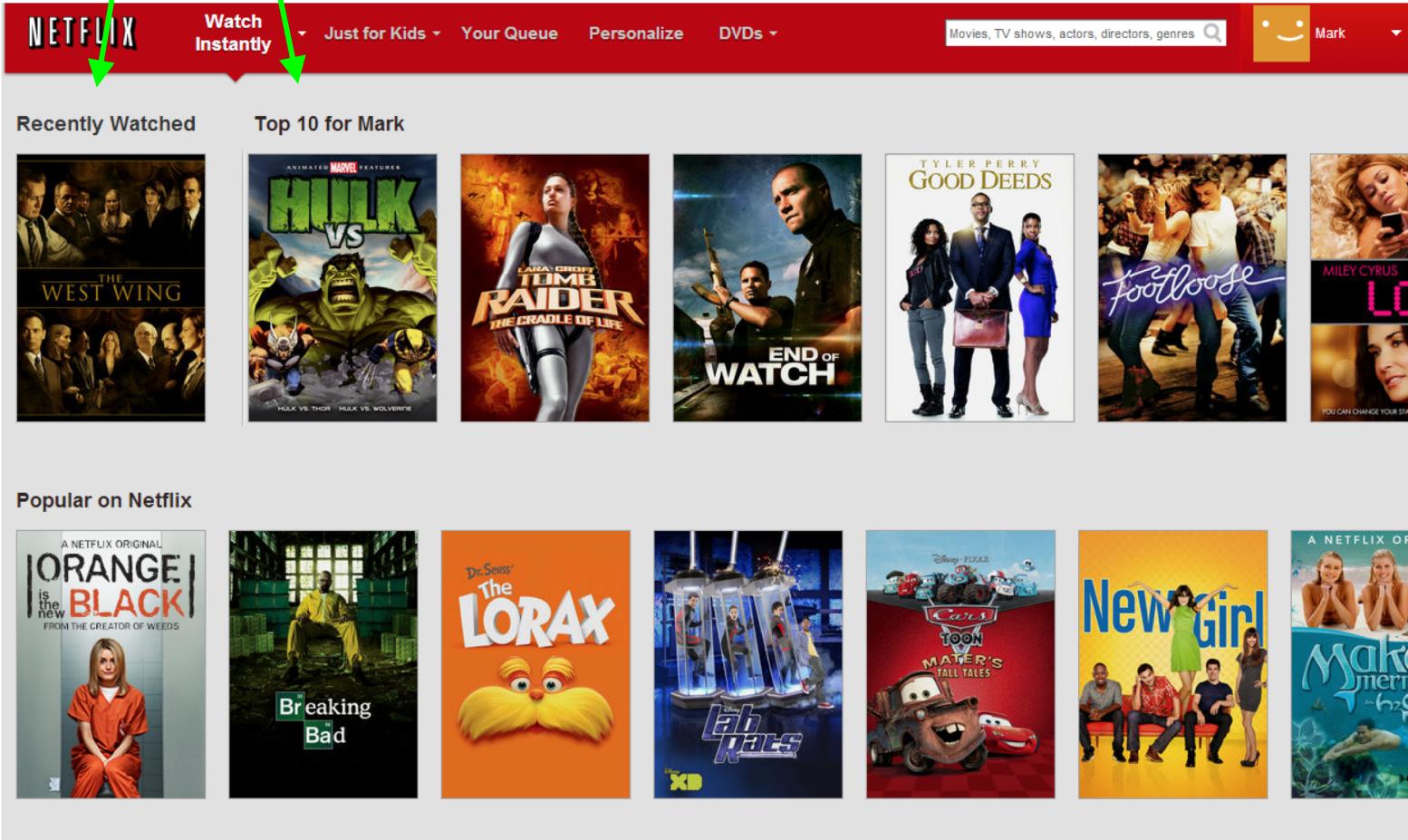
amazon

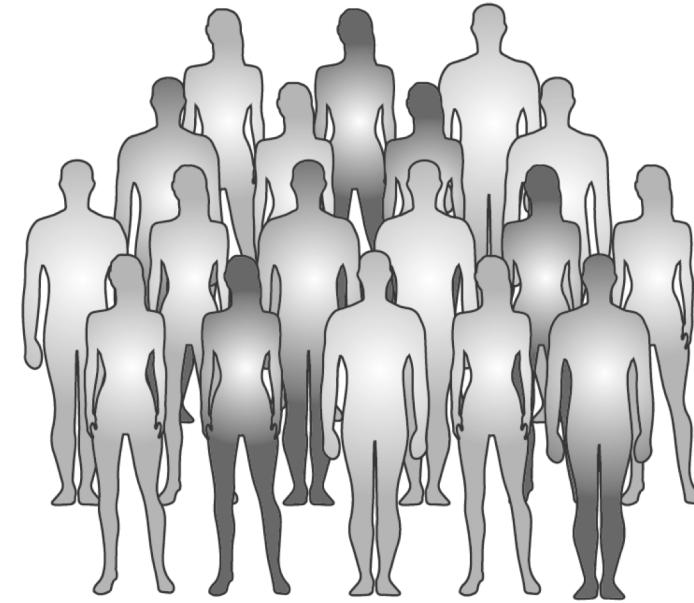
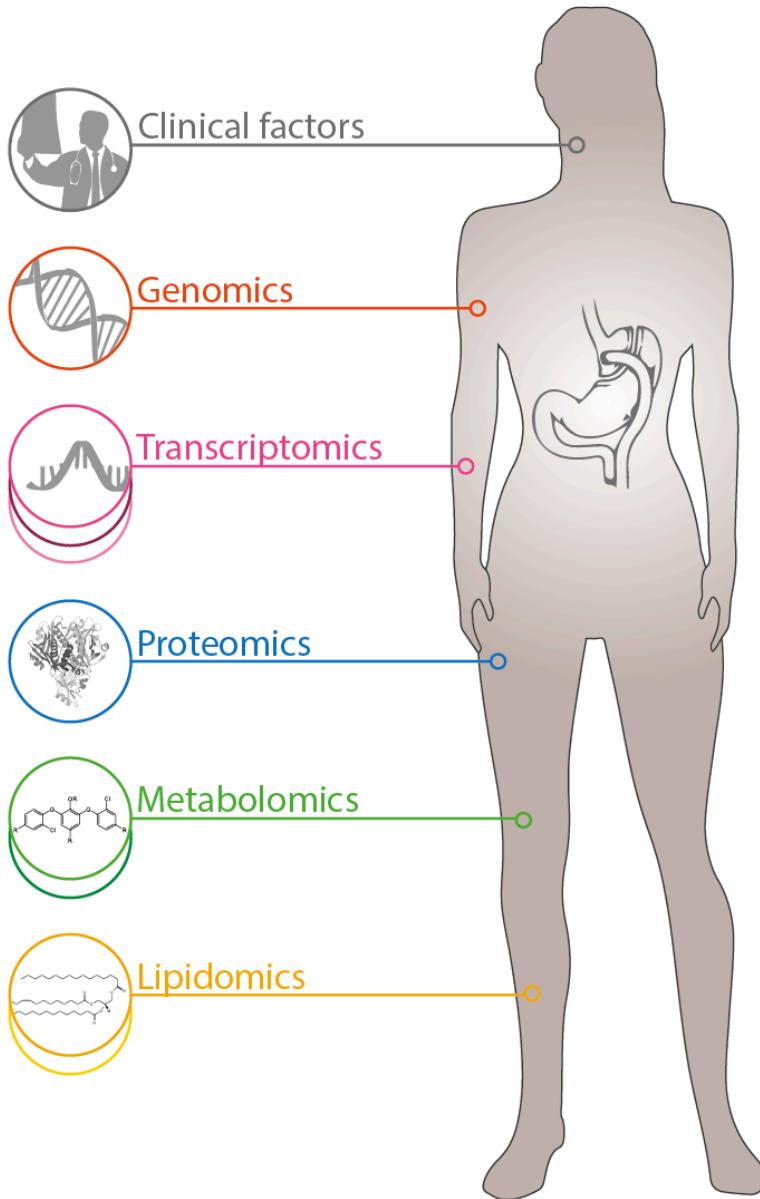
Machine learning



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

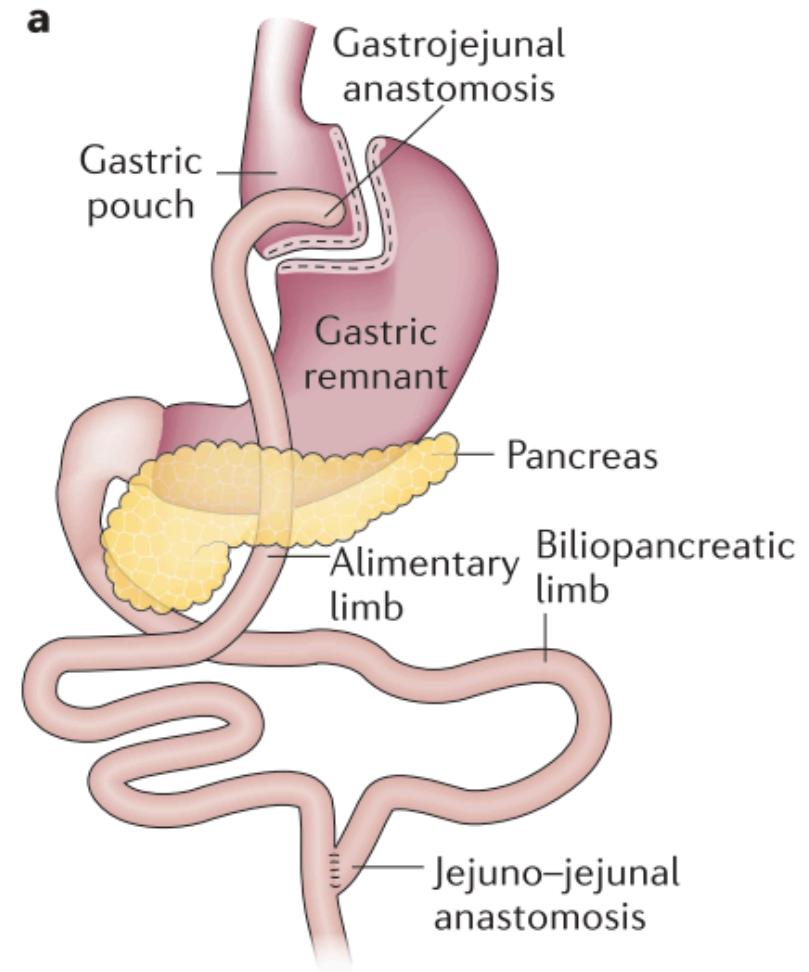


Lifestyle change



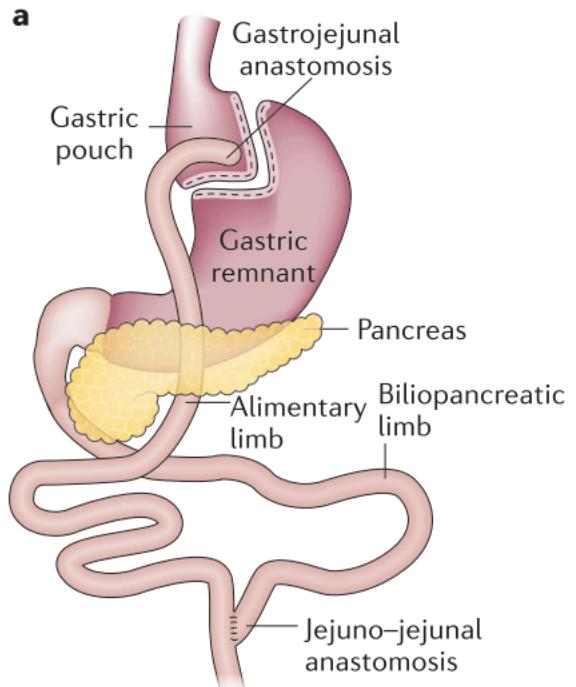
Medication

Nguyen & Varela 2016

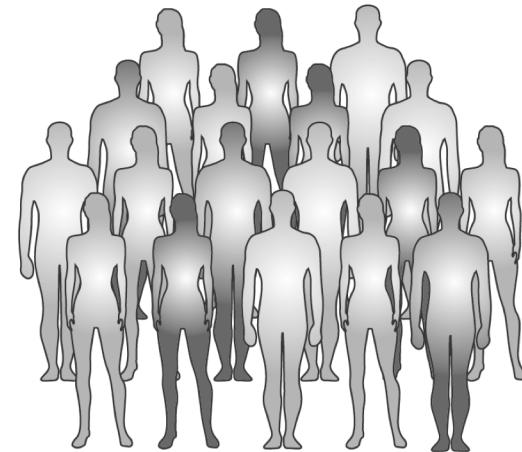
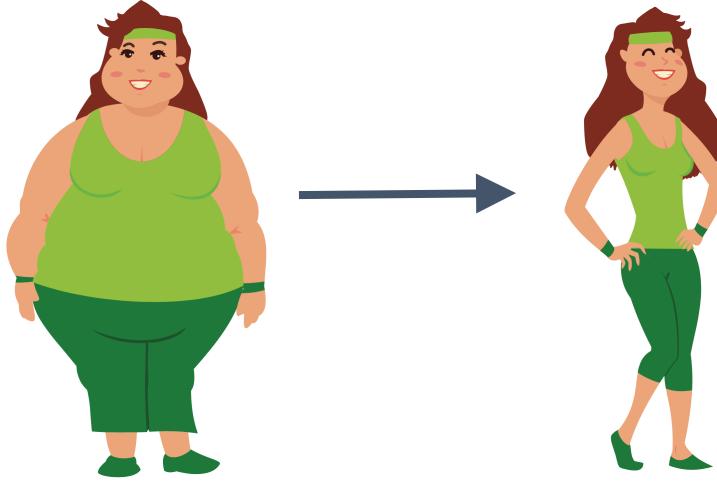


Bariatric surgery

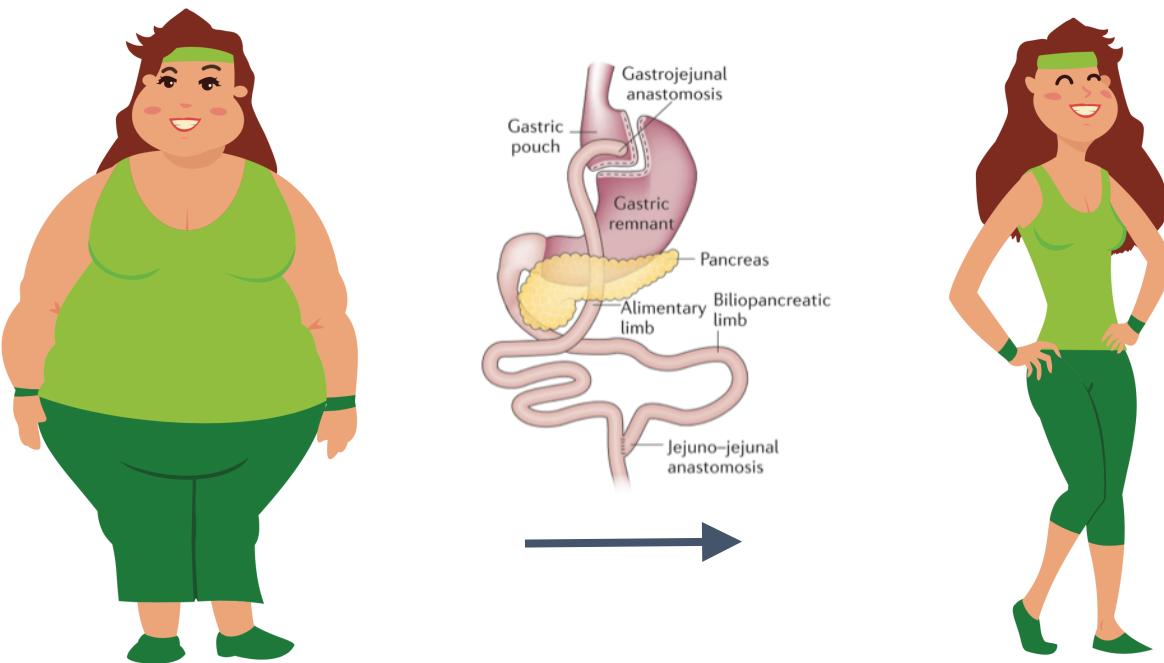
For whom can bariatric surgery be
a treatment for type 2 diabetes?



Nguyen & Varela 2016



Who will respond to therapy?



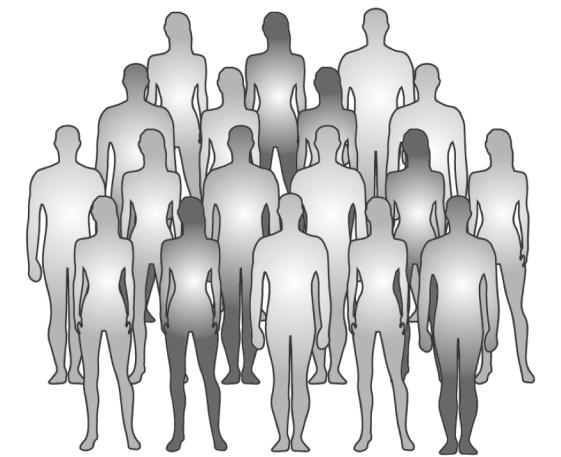
0 Month 1 Month 3 Months

A horizontal timeline with three grey circles labeled "0 Month", "1 Month", and "3 Months". A black arrow points from left to right between the first two circles, and another black arrow points from the second circle to the third.

Baseline

Diabetes
Yes/No

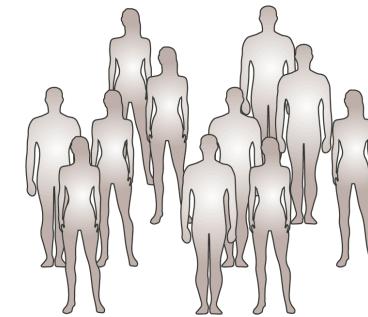




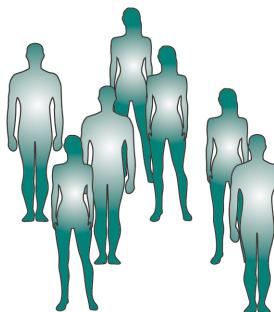
Who will respond to therapy?



Prediction
algorithm



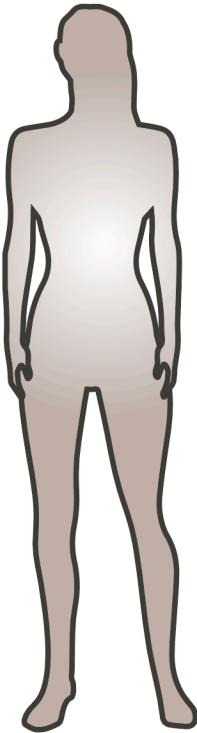
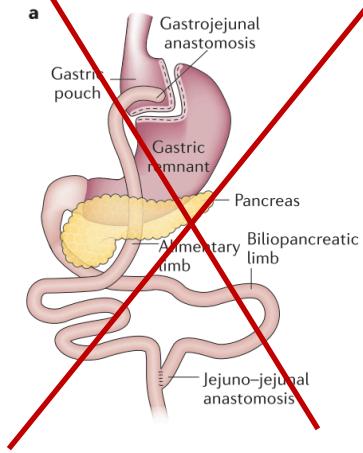
Still diabetic/non-responder



Not diabetic/responder

Input: Information about the patient

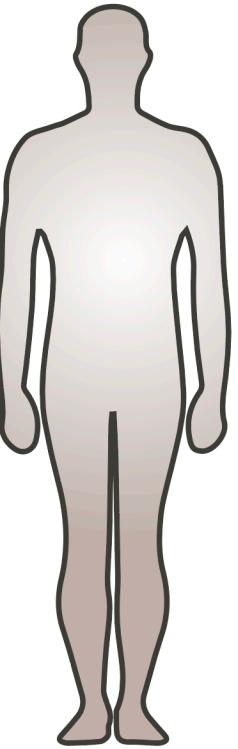
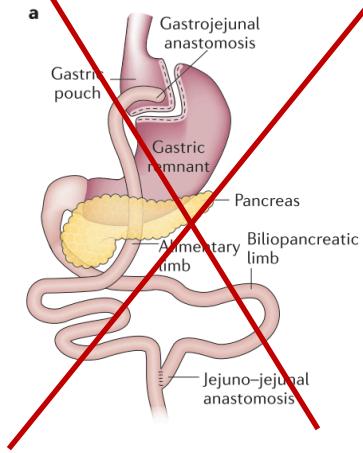
Output: Response to therapy



Prediction
algorithm



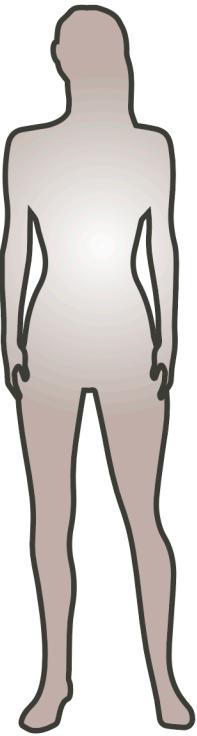
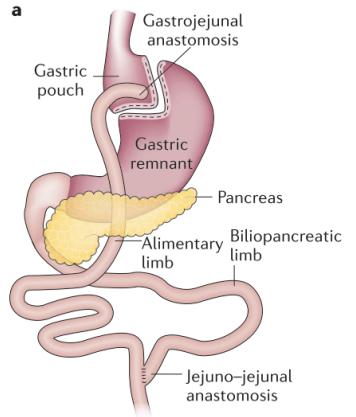
Still diabetic/non-responder



Prediction
algorithm



Still diabetic/non-responder



Prediction
algorithm



Not diabetic/responder

