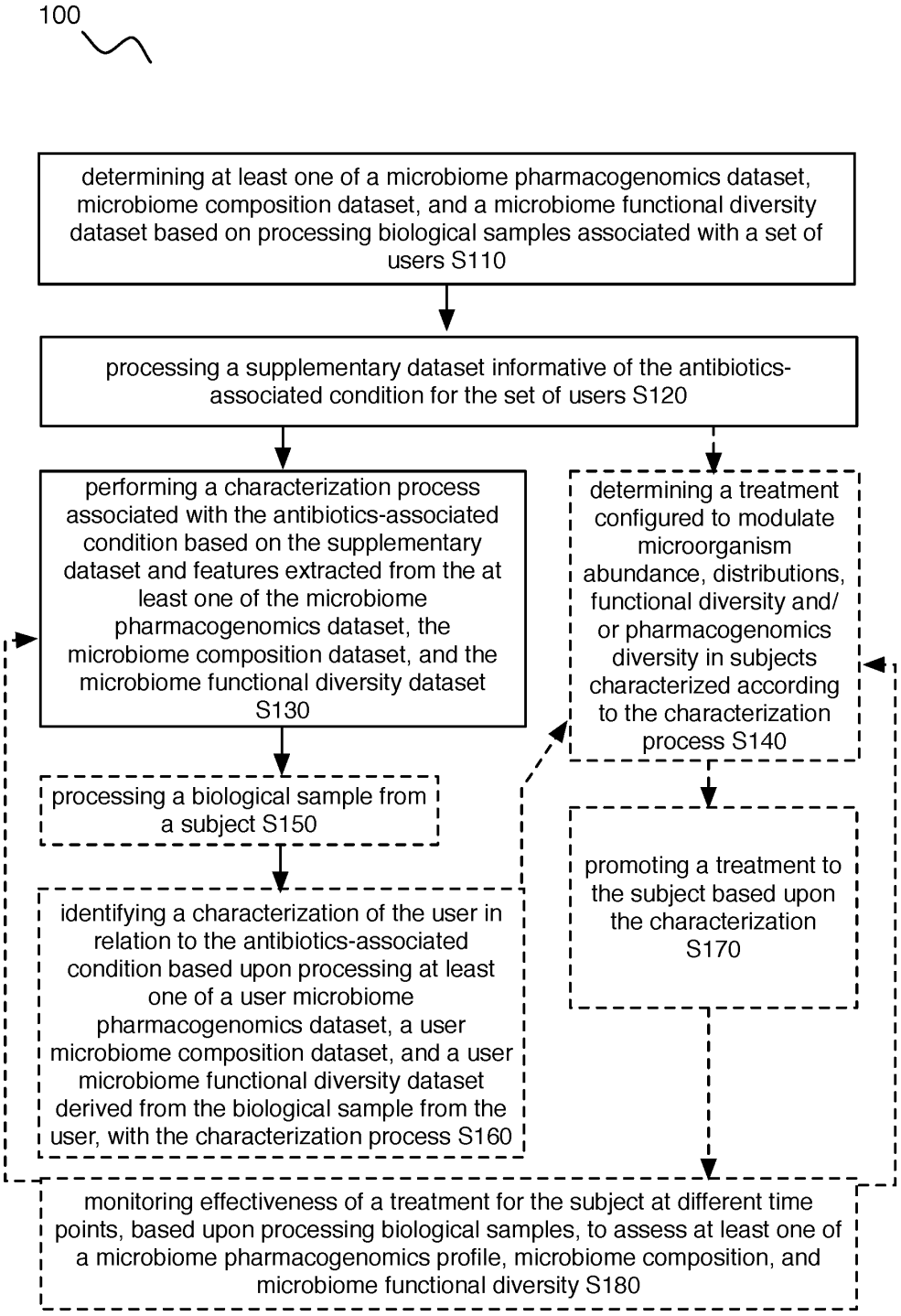

100
determining at least one of a microbiome pharmacogenomics dataset, microbiome composition dataset, and a microbiome functional diversity dataset based on processing biological samples associated with a set of users S110
processing a supplementary dataset informative of the antibiotics-associated condition for the set of users S120
performing a characterization process associated with the antibiotics-associated condition based on the supplementary dataset and features extracted from the at least one of the microbiome pharmacogenomics dataset, the microbiome composition dataset, and the microbiome functional diversity dataset S130
determining a treatment configured to modulate microorganism abundance, distributions, functional diversity and/or pharmacogenomics diversity in subjects characterized according to the characterization process S140
processing a biological sample from a subject S150
promoting a treatment to the subject based upon the characterization S170
identifying a characterization of the user in relation to the antibiotics-associated condition based upon processing at least one of a user microbiome pharmacogenomics dataset, a user microbiome composition dataset, and a user microbiome functional diversity dataset derived from the biological sample from the user, with the characterization process S160
monitoring effectiveness of a treatment for the subject at different time points, based upon processing biological samples, to assess at least one of a microbiome pharmacogenomics profile, microbiome composition, and microbiome functional diversity S180

FIGURE 1A

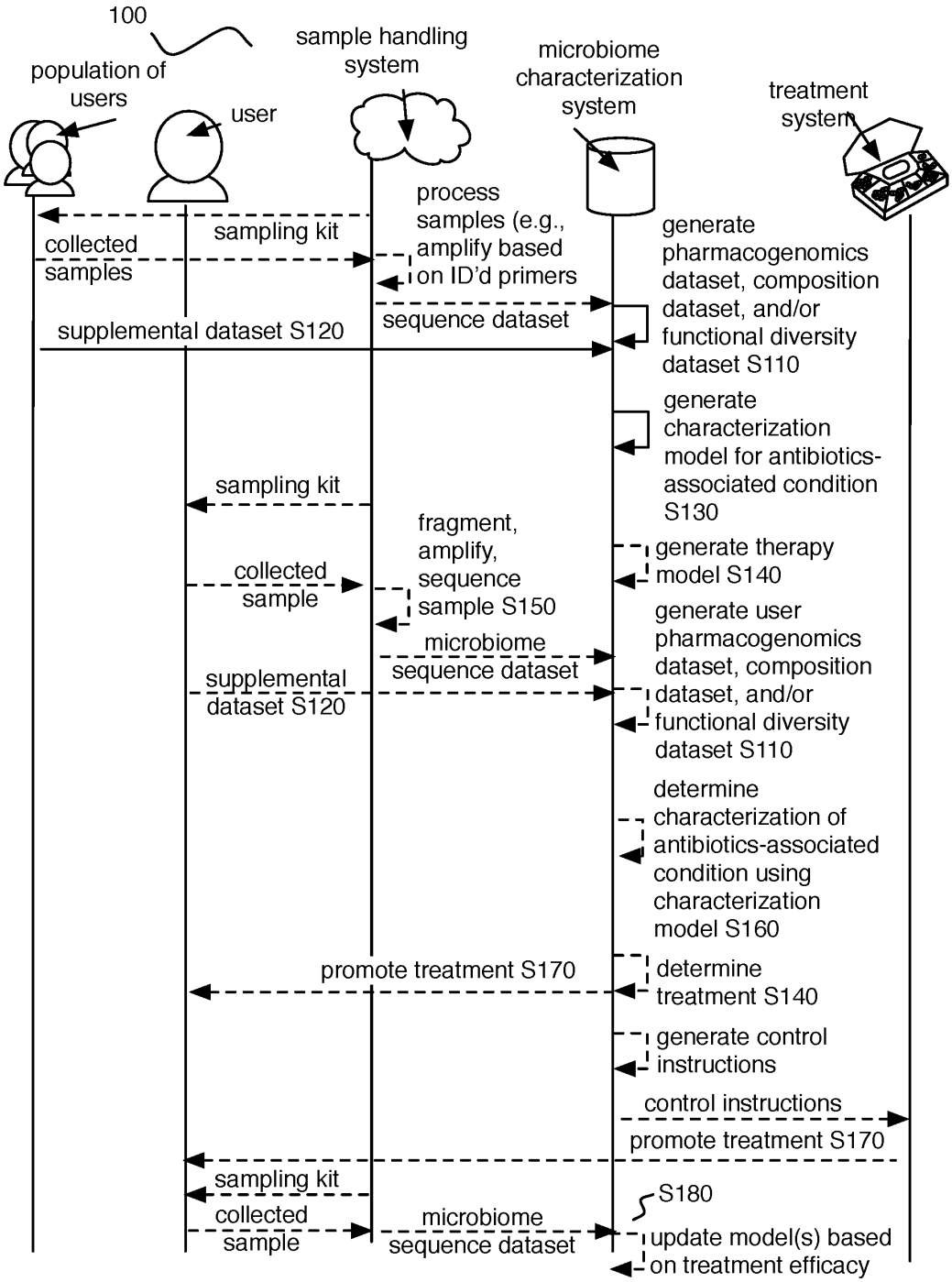

100
population of users
user
sample handling system
microbiome characterization system
treatment system
sampling kit
collected samples
process samples (e.g., amplify based on ID'd primers
sequence dataset
generate pharmacogenomics dataset, composition dataset, and/or functional diversity dataset S110
supplemental dataset S120
generate characterization model for antibiotics-associated condition S130
sampling kit
fragment, amplify, sequence sample S150
collected sample
generate therapy model S140
generate user pharmacogenomics dataset, composition dataset, and/or functional diversity dataset S110
microbiome sequence dataset
supplemental dataset S120
determine characterization of antibiotics-associated condition using characterization model S160
promote treatment S170
determine treatment S140
generate control instructions
control instructions
promote treatment S170
sampling kit
S180
collected sample
microbiome sequence dataset
update model(s) based on treatment efficacy

FIGURE 1B

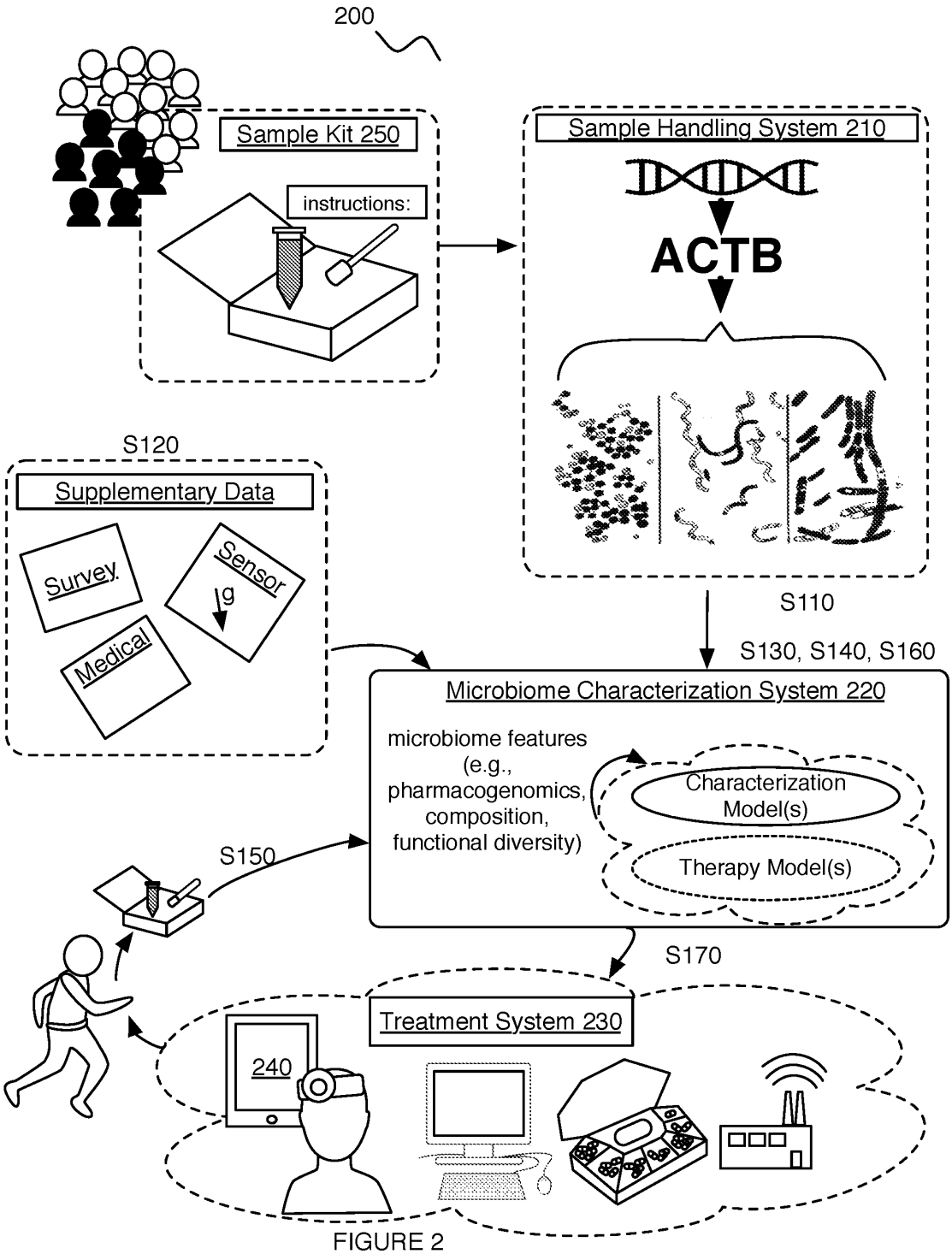

200
Sample Kit 250
instructions:
Sample Handling System 210
ACTB
S120
Supplementary Data
Survey
Sensor
g
Medical
S110
S130, S140, S160
Microbiome Characterization System 220
microbiome features
(e.g.,
pharmacogenomics,
composition,
functional diversity)
Characterization
Model(s)
Therapy Model(s)
S150
S170
Treatment System 230
240

FIGURE 2

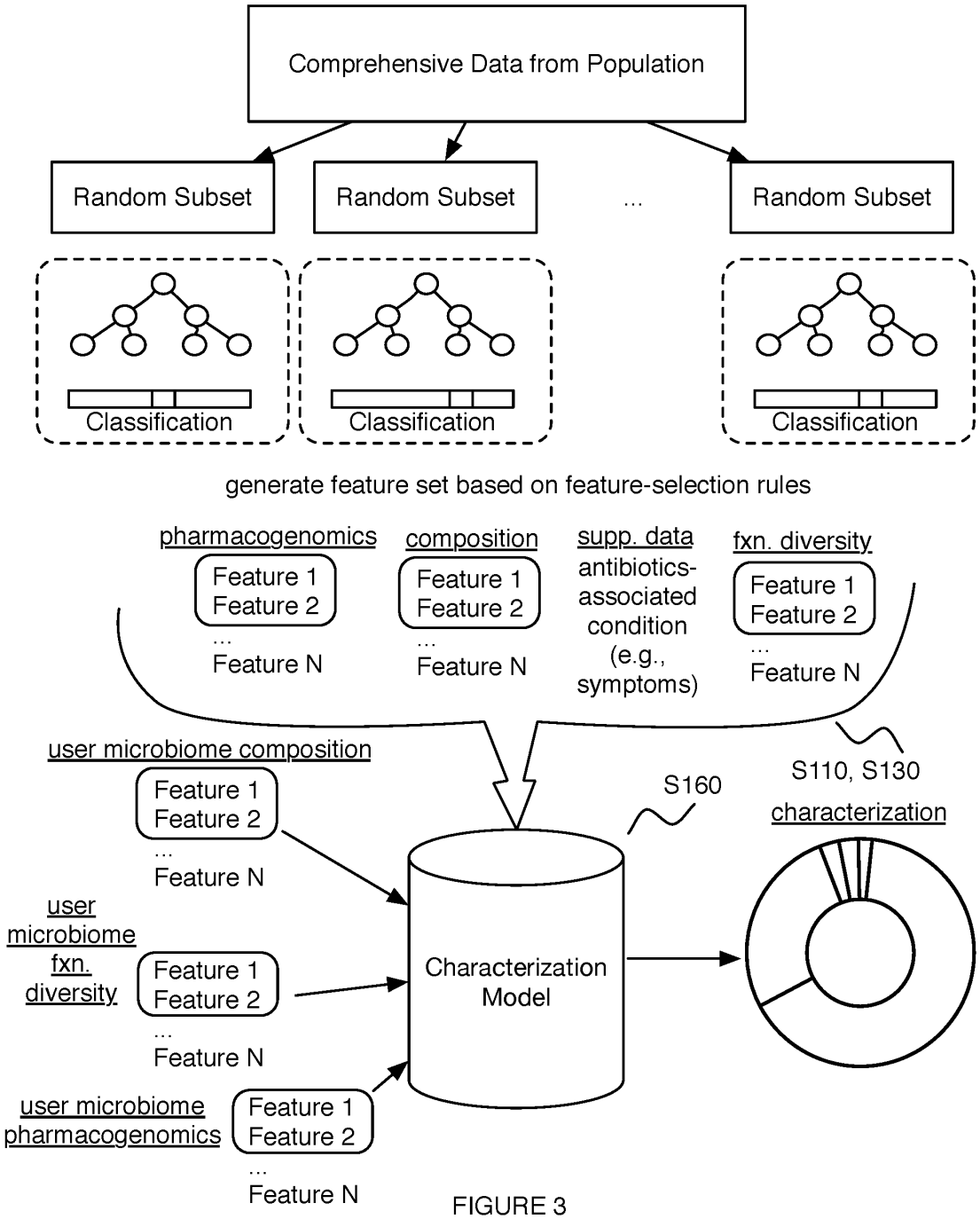

Comprehensive Data from Population
Random Subset
Random Subset
...
Random Subset
Classification
Classification
Classification
generate feature set based on feature-selection rules
pharmacogenomics
Feature 1
Feature 2
...
Feature N
composition
Feature 1
Feature 2
...
Feature N
supp. data
antibiotics-associated condition (e.g., symptoms)
fxn. diversity
Feature 1
Feature 2
...
Feature N
user microbiome composition
Feature 1
Feature 2
...
Feature N
S110, S130
S160
characterization
user microbiome fxn. diversity
Feature 1
Feature 2
...
Feature N
Characterization Model
user microbiome pharmacogenomics
Feature 1
Feature 2
...
Feature N

FIGURE 3

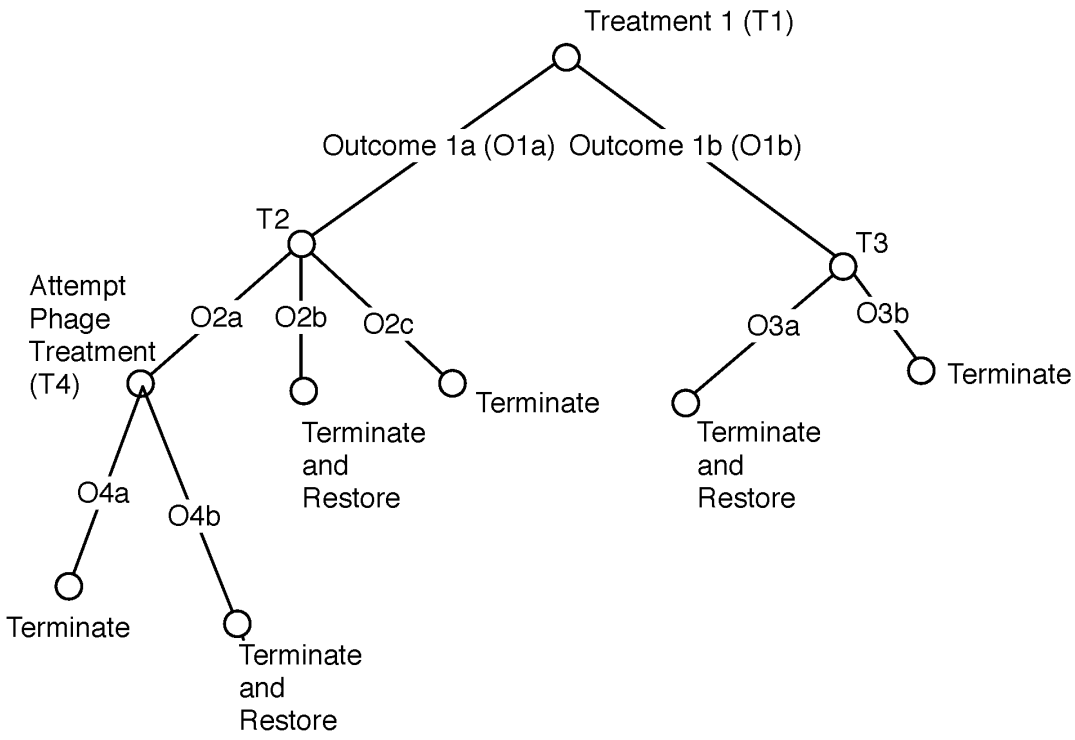

Treatment 1 (T1)
Outcome 1a (O1a)
Outcome 1b (O1b)
T2
T3
Attempt Phage Treatment (T4)
O2a
O2b
O2c
O3a
O3b
Terminate
Terminate and Restore
Terminate
Terminate and Restore
O4a
O4b
Terminate
Terminate and Restore

FIGURE 4

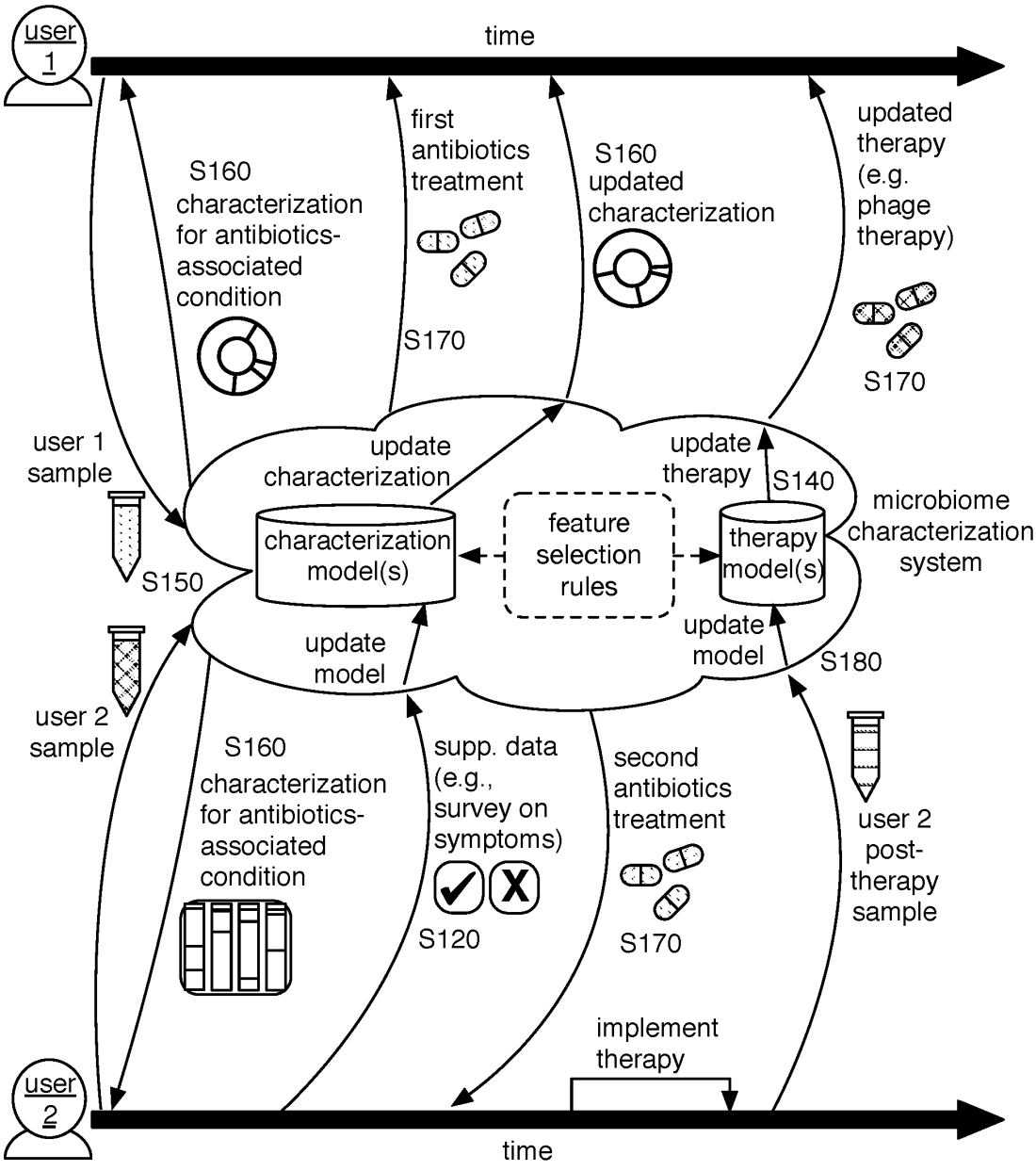

user 1
time
first antibiotics treatment
S160 characterization for antibiotics-associated condition
S170
S160 updated characterization
updated therapy (e.g. phage therapy)
S170
user 1 sample
update characterization
update therapy
S140
microbiome characterization system
characterization model(s)
feature selection rules
therapy model(s)
S150
update model
update model
S180
user 2 sample
S160 characterization for antibiotics-associated condition
supp. data (e.g., survey on symptoms)
S120
second antibiotics treatment
S170
user 2 post-therapy sample
implement therapy
user 2
time

FIGURE 5

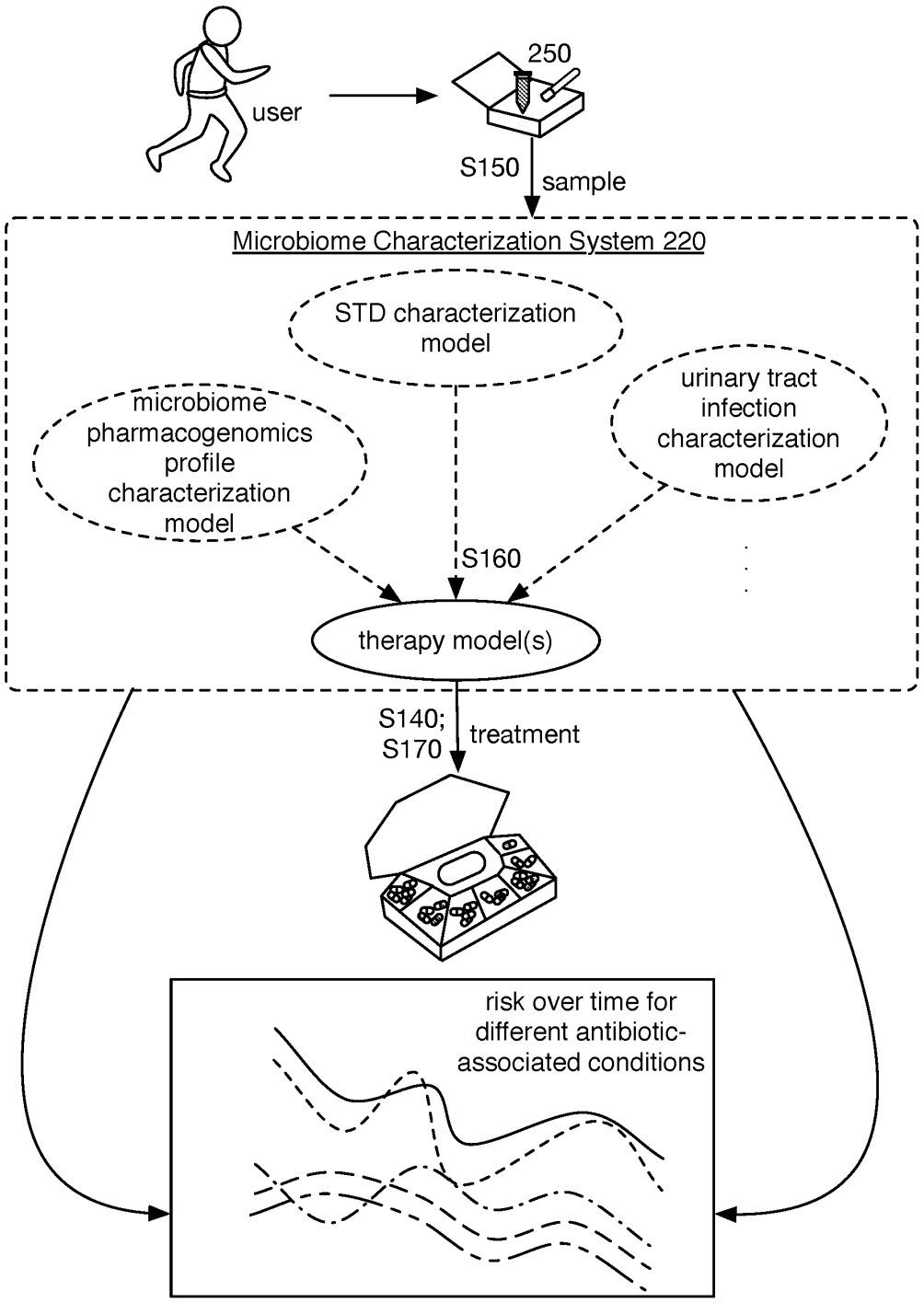

user
250
S150
sample
Microbiome Characterization System 220
STD characterization model
microbiome pharmacogenomics profile characterization model
urinary tract infection characterization model
S160
therapy model(s)
S140; S170
treatment
risk over time for different antibiotic-associated conditions

FIGURE 6

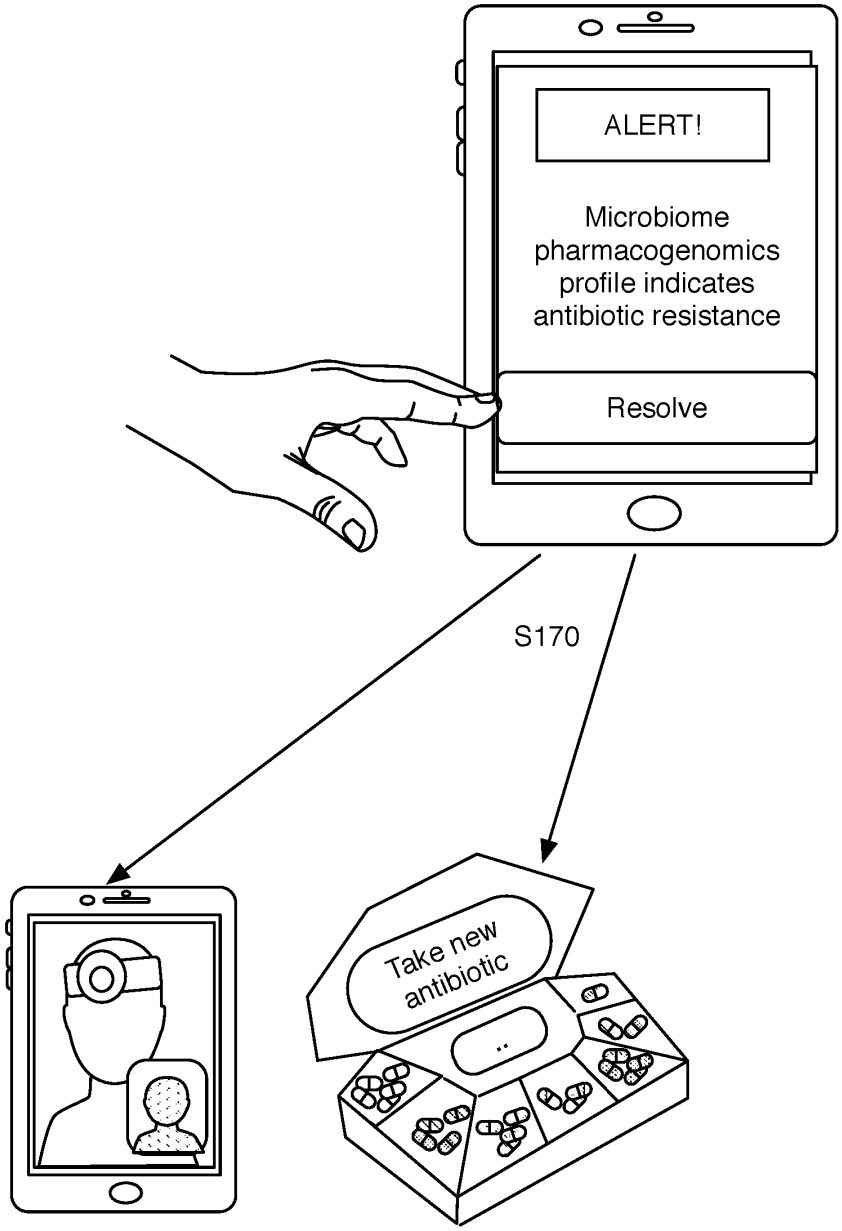
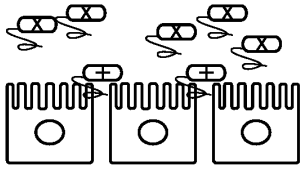
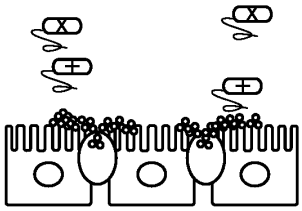

ALERT!
Microbiome pharmacogenomics profile indicates antibiotic resistance
Resolve
S170
Take new antibiotic

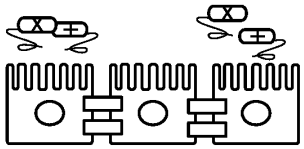
FIGURE 7



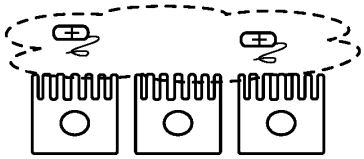
block pathogen entry



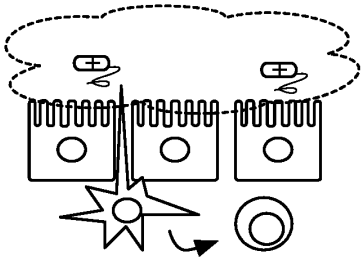
form mucous barrier



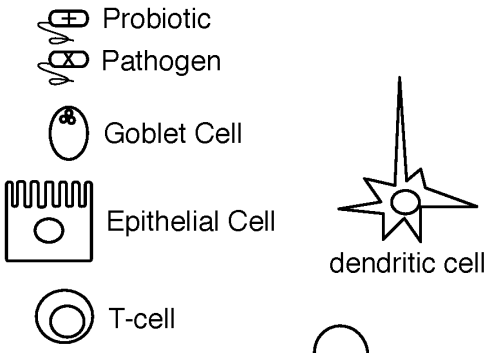
enhance apical tight junctions



produce antimicrobial factors



stimulate anti-inflammatory cytokines



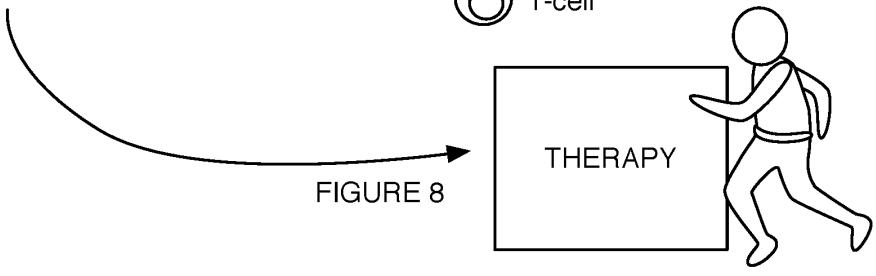


FIGURE 8

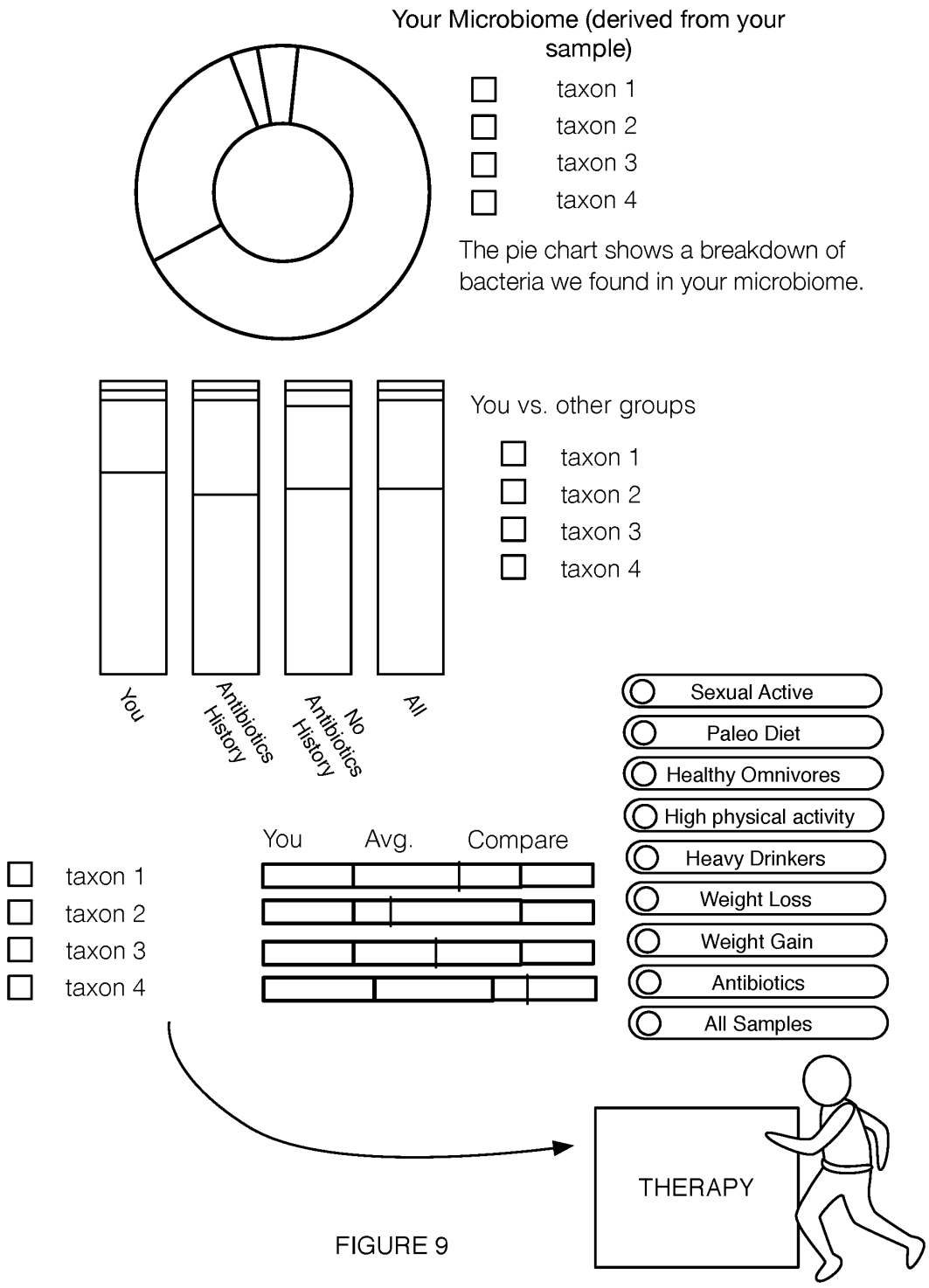

Your Microbiome (derived from your sample)
taxon 1
taxon 2
taxon 3
taxon 4
The pie chart shows a breakdown of bacteria we found in your microbiome.
You vs. other groups
taxon 1
taxon 2
taxon 3
taxon 4
You
Antibiotics History
No Antibiotics History
All
Sexual Active
Paleo Diet
Healthy Omnivores
High physical activity
Heavy Drinkers
Weight Loss
Weight Gain
Antibiotics
All Samples
You
Avg.
Compare
taxon 1
taxon 2
taxon 3
taxon 4
THERAPY

FIGURE 9

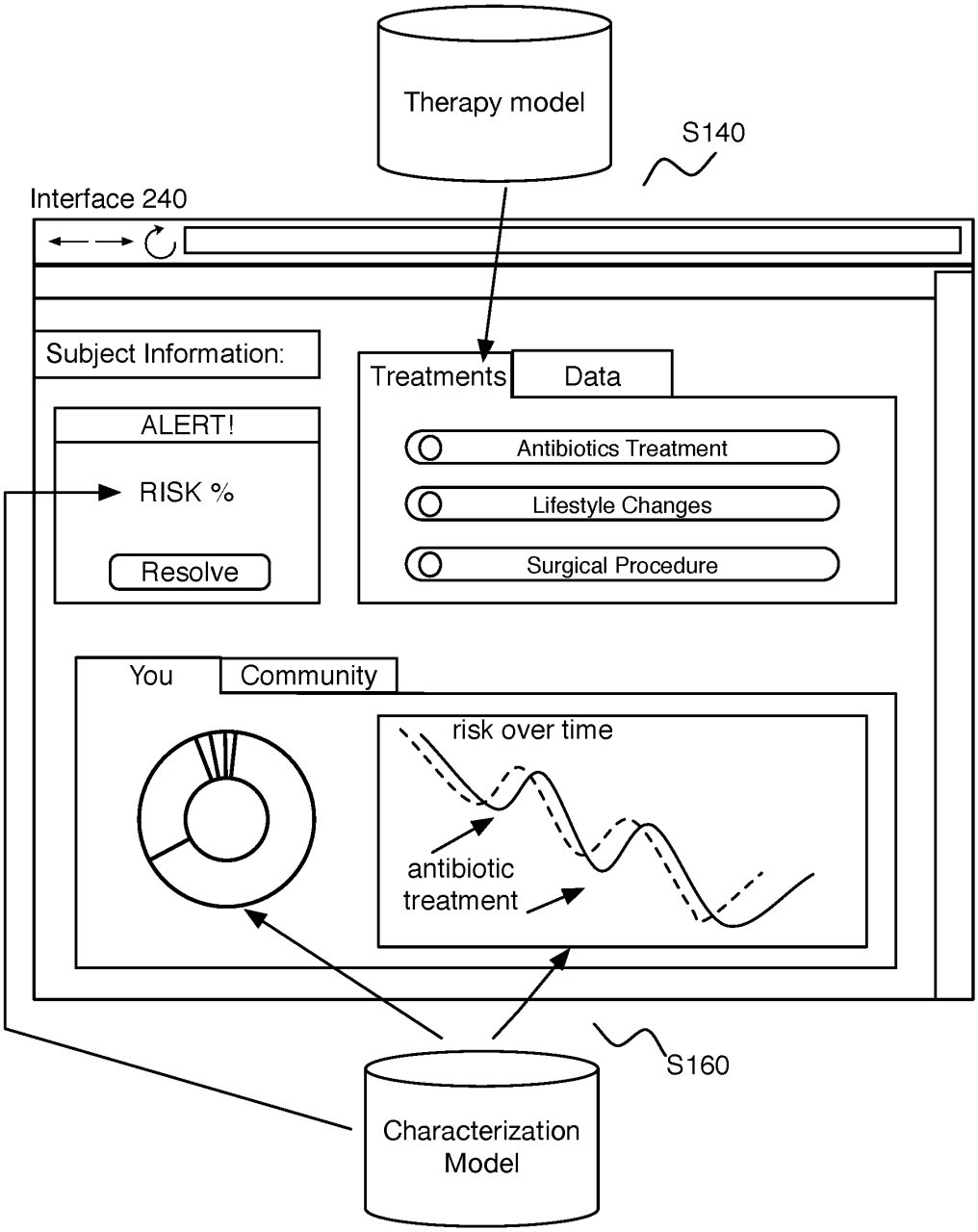

Therapy model
S140
Interface 240
Subject Information:
ALERT!
RISK %
Resolve
Treatments
Data
Antibiotics Treatment
Lifestyle Changes
Surgical Procedure
You
Community
risk over time
antibiotic
treatment
S160
Characterization
Model

FIGURE 10

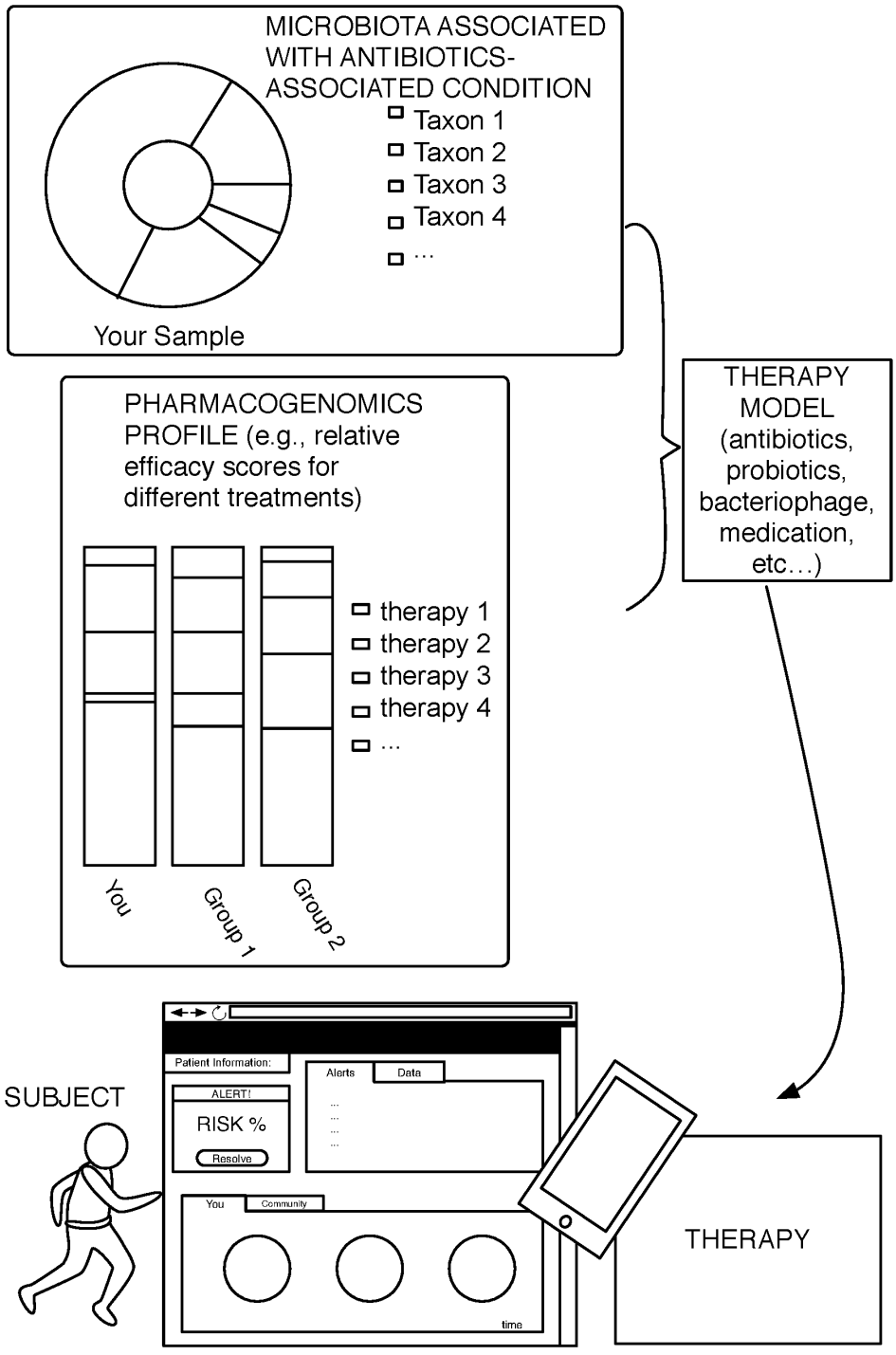

MICROBIOTA ASSOCIATED WITH ANTIBIOTICS-ASSOCIATED CONDITION
Taxon 1
Taxon 2
Taxon 3
Taxon 4
…
Your Sample
PHARMACOGENOMICS PROFILE (e.g., relative efficacy scores for different treatments)
therapy 1
therapy 2
therapy 3
therapy 4
…
You
Group 1
Group 2
THERAPY MODEL (antibiotics, probiotics, bacteriophage, medication, etc…)
SUBJECT
Patient Information:
ALERT!
RISK %
Resolve
Alerts
Data
You
Community
time
THERAPY

FIGURE 11

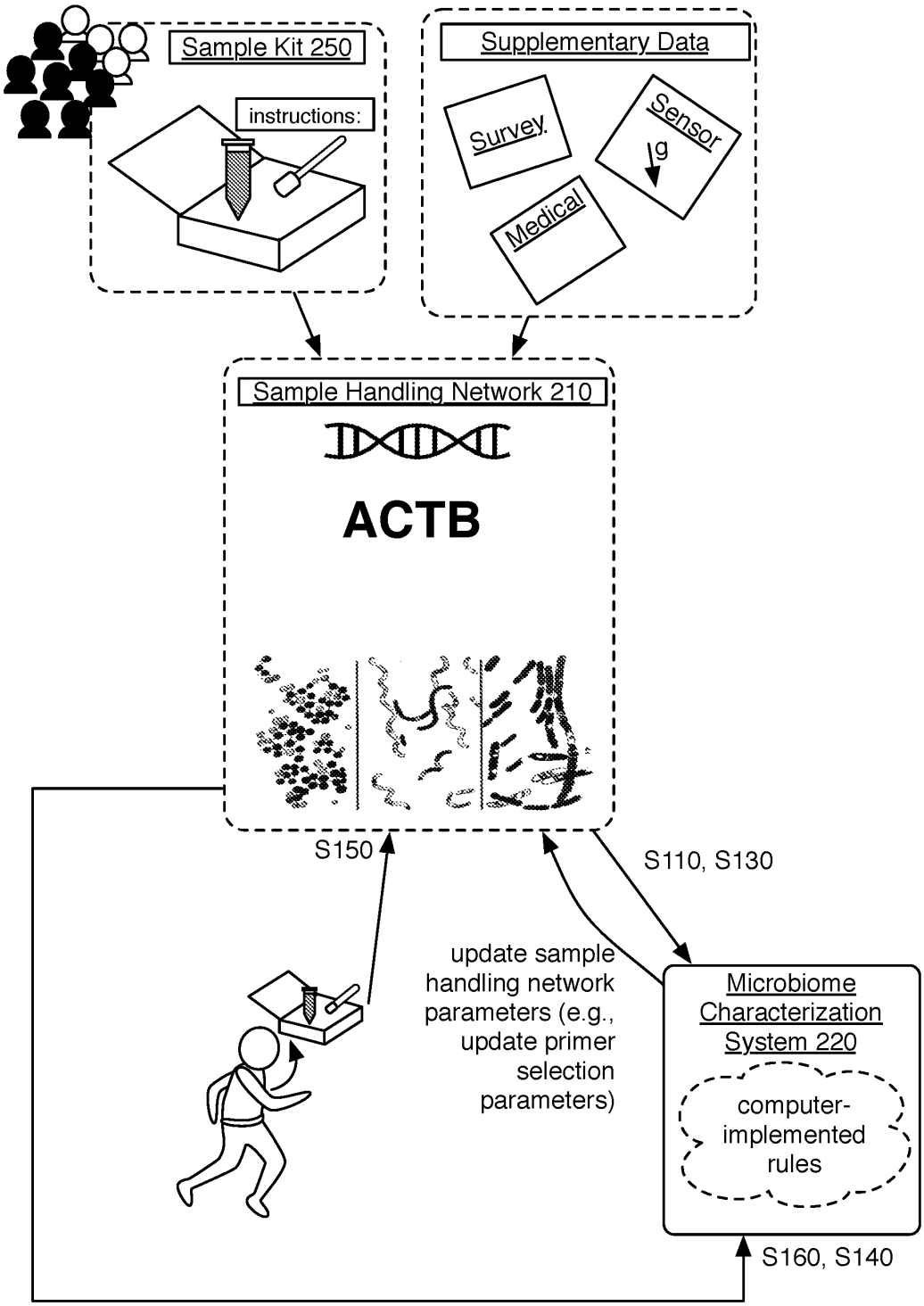

Sample Kit 250
instructions:
Supplementary Data
Survey
Sensor
Medical
Sample Handling Network 210
ACTB
S150
S110, S130
update sample handling network parameters (e.g., update primer selection parameters)
Microbiome Characterization System 220
computer-implemented rules
S160, S140

FIGURE 12