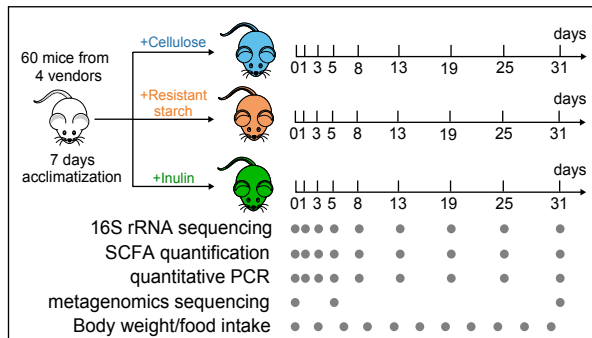
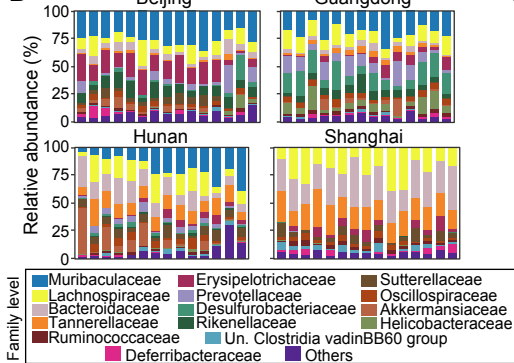


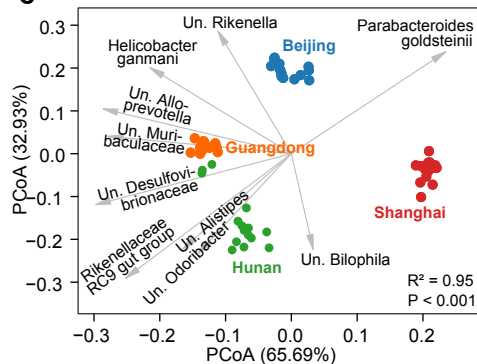
# A Dynamic microbiome and metabolomics data



# B



# C



# D

## Systems data modeling and analysis

### Ecological network inference

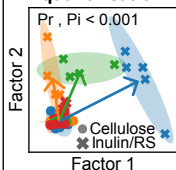
$$\frac{d \log(x_i(t))}{dt} = \alpha_i + \sum_j \beta_{i,j} x_j(t) + \epsilon_i u_i(t)$$

$\epsilon_i$ : response coefficient

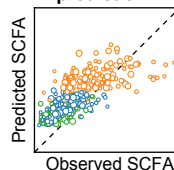
positive responder

negative responder

### Individualized response quantification



### Microbial metabolome prediction



### SCFA producer inference

