

Race, Ethnicity, and Health Disparities

Presented by:

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THE UNIVERSITY of
NORTH CAROLINA
at CHAPEL HILL

**NUTRITION
RESEARCH
INSTITUTE**

EATUNIQUELY

*Celebrating a Decade
of Nutrition Discoveries
2008 – 2018*



Leading research in precision nutrition by understanding how our genes, the bacteria in our gut, and our environment create differences in our metabolism that affect our individual requirements for and responses to nutrients.

Program Insights:

- Factors that are known to contribute to diversity in disease risks
- Differences in disease risks that are related to race and ethnicity
- Modifiable behaviors that reduce risks of developing diseases
- Nutritional interventions that have been shown to diminish disease risks
- Nutritional interventions that have the potential to improve health outcomes



What are Health Disparities & who experiences them?



Many populations in America, whether defined by race, ethnicity, immigrant status, disability, sex, gender, or geography, experience higher rates of certain diseases and more deaths and suffering from them compared with the general population.

Health Disparity Populations

NIH-designated U.S. health disparity populations include Blacks/African Americans, Hispanics/Latinos, American Indians/Alaska Natives, Asian Americans, Native Hawaiians and other Pacific Islanders, socioeconomically disadvantaged populations, underserved rural populations, and sexual and gender minorities.

Factors associated with diversity of disease risks



GENETICS

RACE & ETHNICITY

ENVIRONMENTAL
CONDITIONS / EXPOSURES

IN UTERO EXPOSURE
(MOM'S IMPACTING BABY IN WOMB)

Factors associated with diversity of disease risks

GENETICS

ACCESS

RACE & ETHNICITY

DIET / NUTRITION

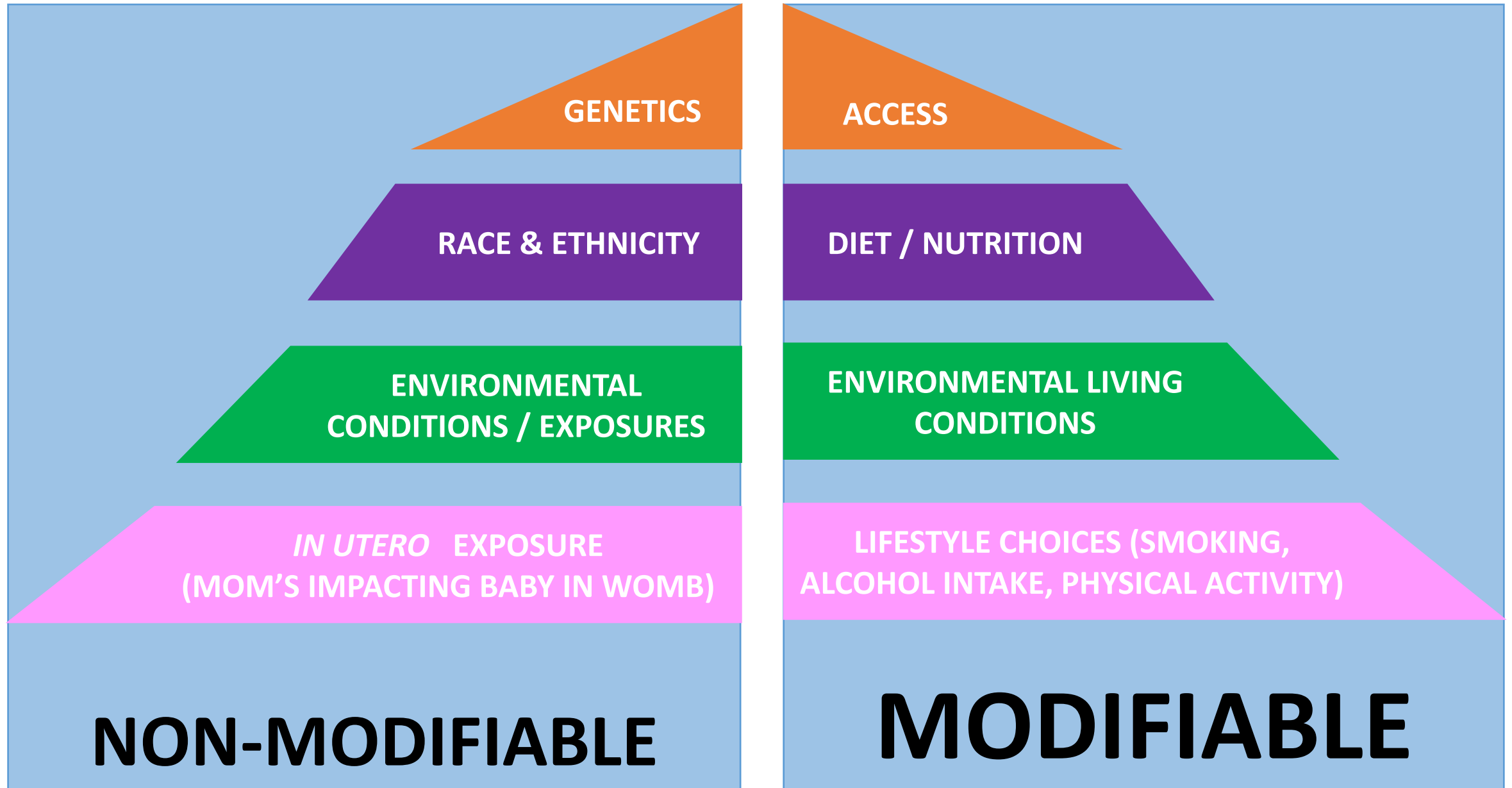
ENVIRONMENTAL
CONDITIONS / EXPOSURES

ENVIRONMENTAL LIVING
CONDITIONS

IN UTERO EXPOSURE
(MOM'S IMPACTING BABY IN WOMB)

LIFESTYLE CHOICES (SMOKING,
ALCOHOL INTAKE, PHYSICAL ACTIVITY)

Factors associated with diversity of disease risks



Race and Ethnicity-associated disease risk factors (*Non-modifiable*)

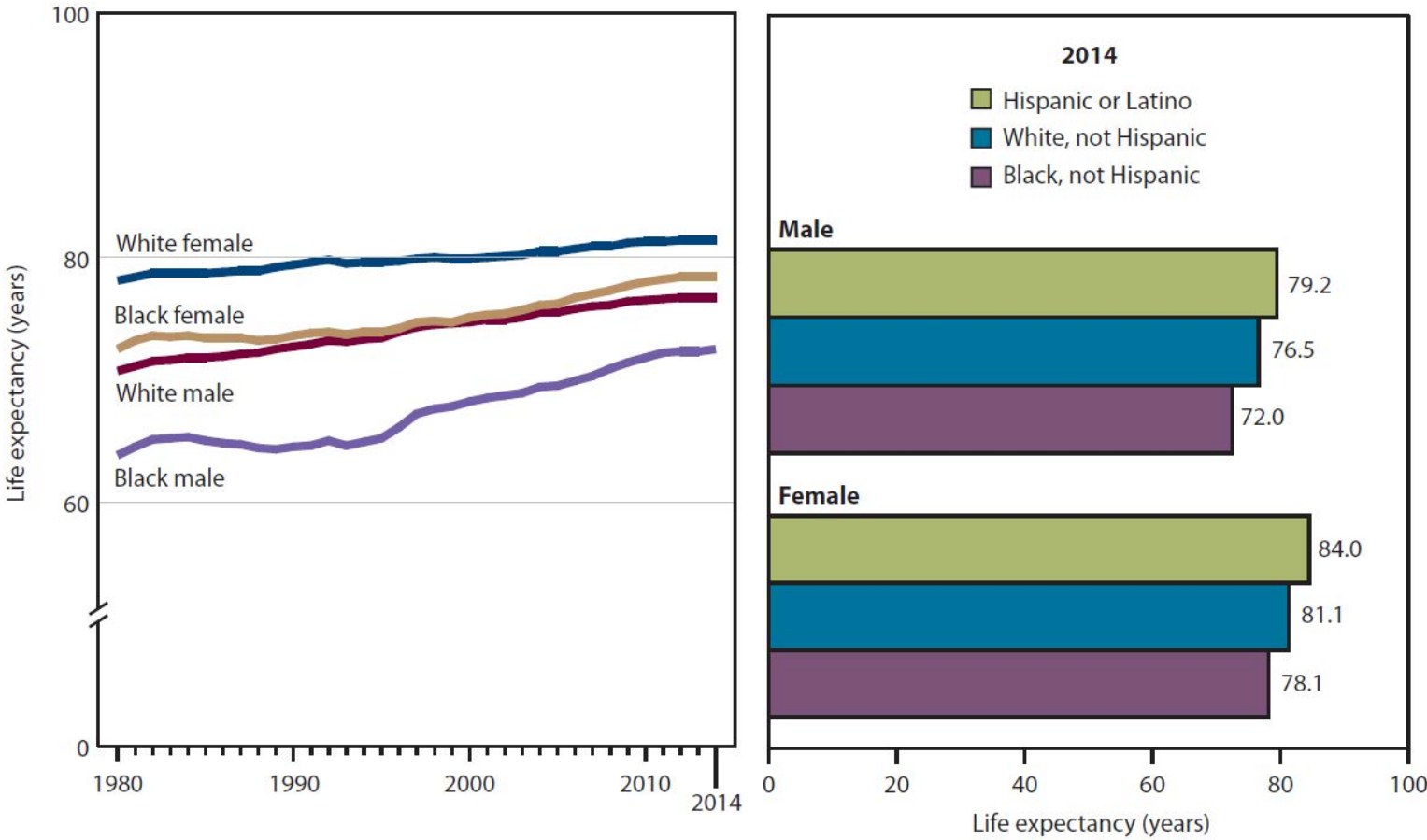


Figure 18. Life expectancy at birth, by sex, race and Hispanic origin: United States, 1980–2014.

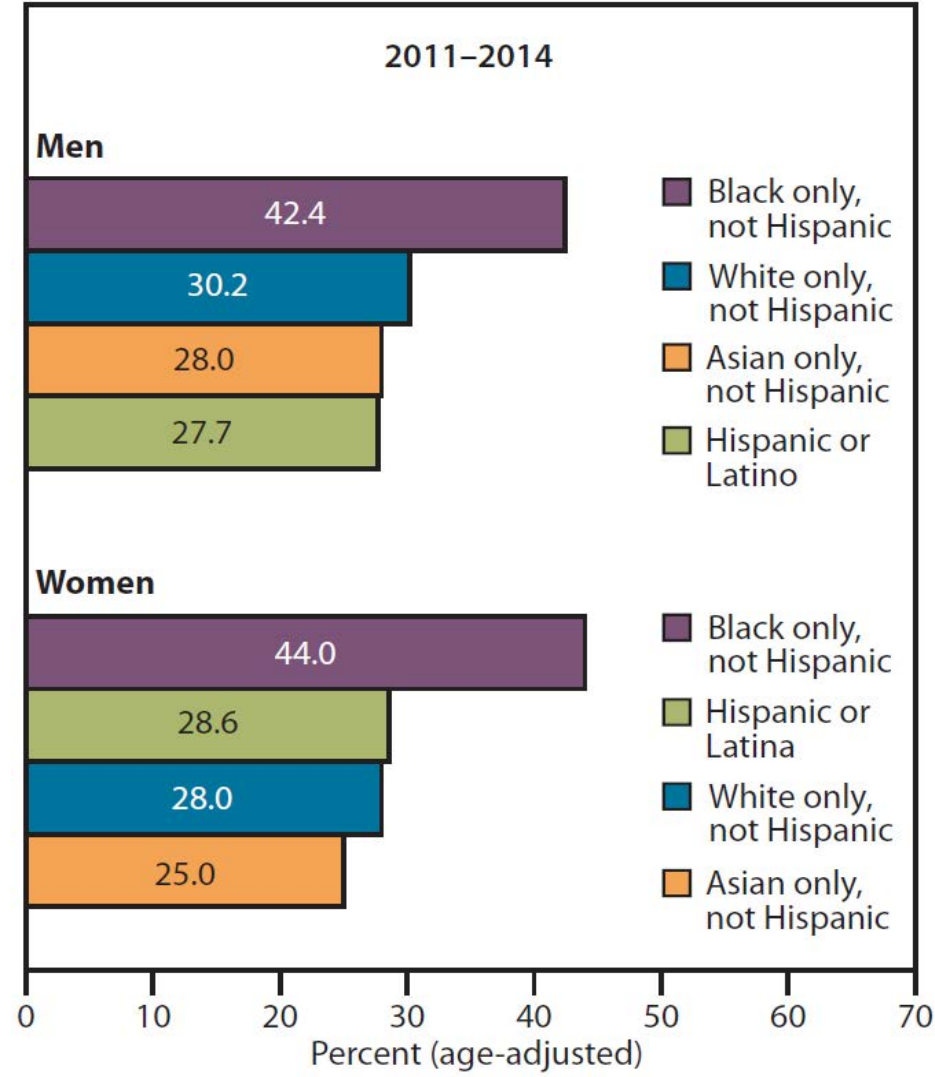


Figure 23. Hypertension among adults aged 20 and over, by sex and race and Hispanic origin: United States, 1999–2000 through 2013-14.

Race and Ethnicity-associated disease risk factors (*Non-modifiable*)

- Mutations in the HEXA gene cause **Tay-Sachs** disease.
- *HEXA* helps make part of an enzyme called β -hexosaminidase A, located in lysosomes, which break down toxic substances and act as recycling centers.
- Specifically helps break down a fatty substance called GM2 ganglioside. <https://ghr.nlm.nih.gov/condition/tay-sachs-disease>

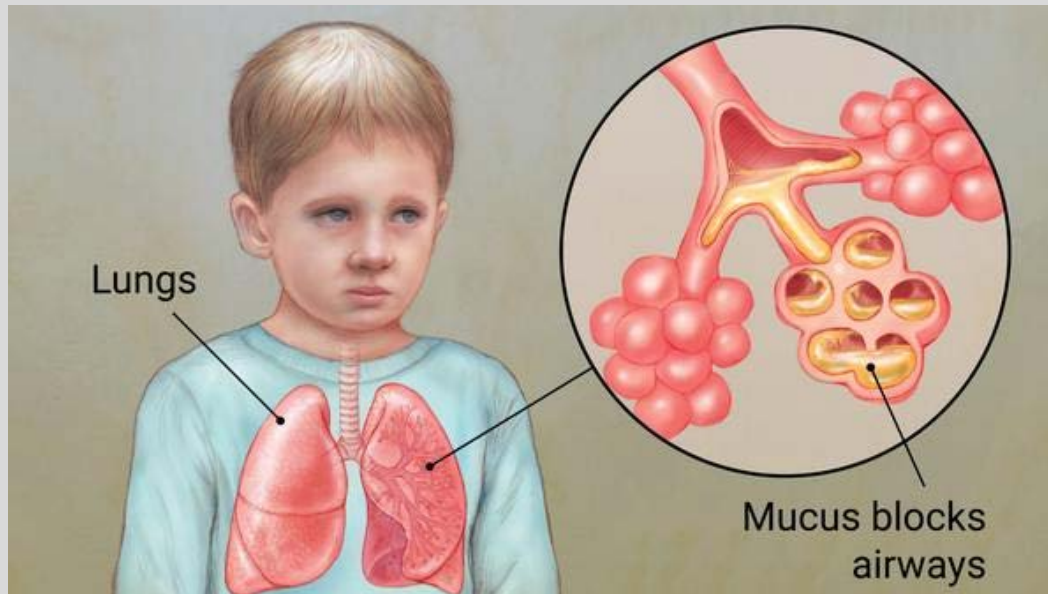
Ashkenazi Jews

**French-Canadian communities
(Quebec)**

**Old Order Amish community
(Pennsylvania)**

**Cajun population
(Louisiana)**

Cystic Fibrosis



North
European

Africans
Asians

Mutation in cystic
fibrosis transmembrane
conductance regulator
(CFTR) gene.

<https://www.cff.org/What-is-CF/About-Cystic-Fibrosis/>

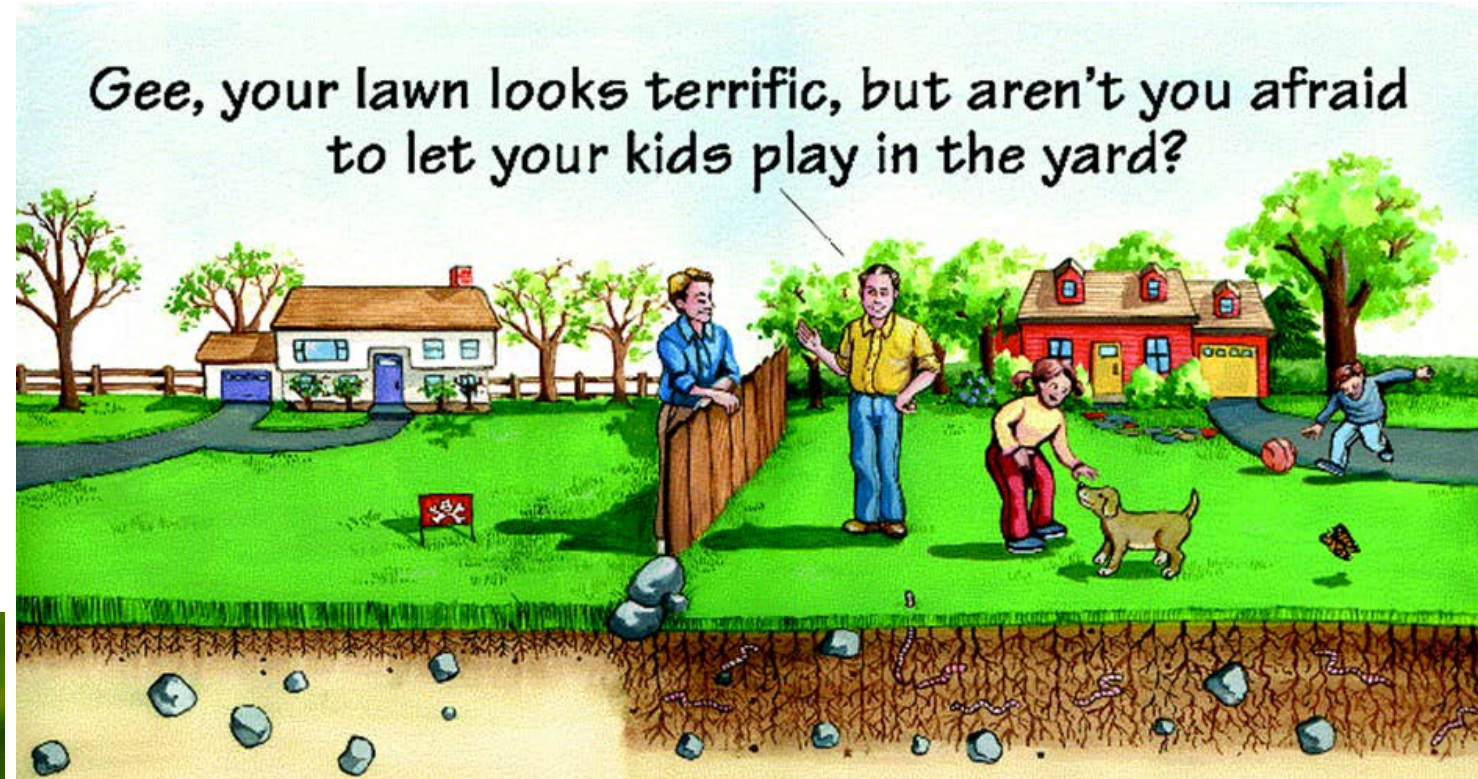
Environmental Exposure-associated disease risk factors (*Non-modifiable*)

- Lower socioeconomic position has been more consistently associated with greater harm from air pollution.
- Low socioeconomic status consistently increased the risk of **premature death** from fine particle pollution among 13.2 million Medicare recipients studied in the largest examination of particle pollution-related mortality nationwide.

Zeger SL, et al. Environ Health Perspect. 2008; 116: 1614-1619.



Environmental Living Condition-contributing disease risk factors (Modifiable)



Diversity in Access-associated disease risk factors (Modifiable)



ACCESS

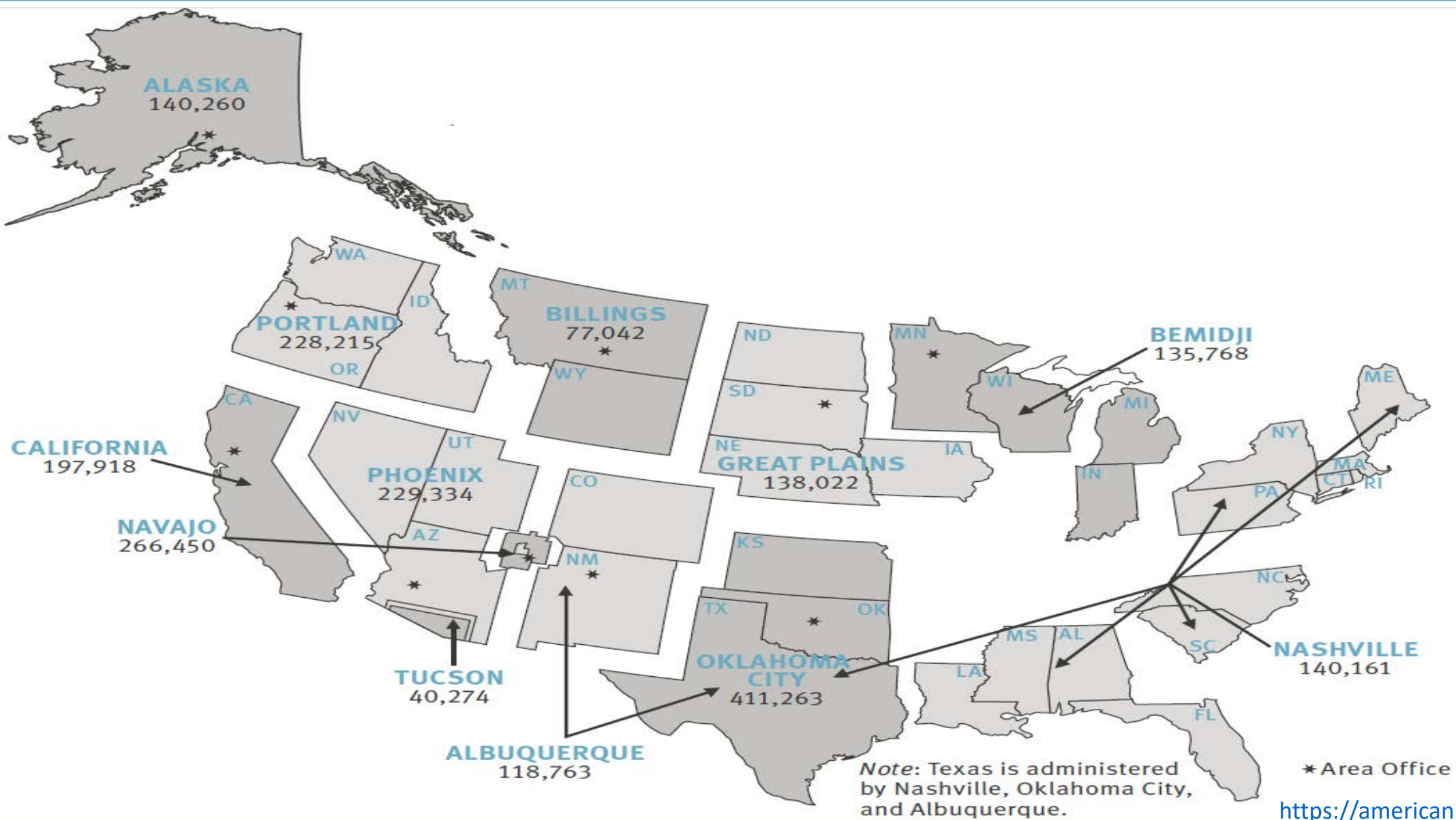
Access-associated disease risk factors cont. (Modifiable???)

Characteristic	Severe headache or migraine ¹			Low back pain ¹			Neck pain ¹		
	1997	2010	2014	1997	2010	2014	1997	2010	2014
Race ^{2,4}									
White only.	15.9	16.7	15.6	28.7	29.1	28.7	15.1	16.0	15.3
Black or African American only	16.7	18.2	15.1	26.9	27.2	28.4	13.3	13.3	12.1
American Indian or Alaska Native only.	18.9	18.8	19.2	33.3	33.6	28.9	16.2	16.9	16.9
Asian only.	11.7	10.1	10.1	21.0	19.1	17.6	9.2	9.6	9.4
Native Hawaiian or Other Pacific Islander only	---	*	*	---	*	*	---	*	*
2 or more races.	---	21.5	21.3	---	35.6	35.2	---	22.0	21.4
Hispanic origin and race ^{2,4}									
Hispanic or Latino	15.5	16.2	14.9	26.4	27.4	26.9	13.9	15.1	15.0
Mexican.	14.6	15.7	14.7	25.2	26.5	26.5	12.9	14.7	14.8
Not Hispanic or Latino	15.9	16.8	15.5	28.4	28.7	28.4	14.9	15.5	14.8
White only	16.1	17.0	16.1	29.1	29.7	29.4	15.4	16.3	15.7
Black or African American only.	16.8	18.4	15.1	26.9	27.1	28.0	13.3	13.3	11.8
Education ^{5,6}									
25 years and over:									
No high school diploma or GED.	19.2	18.2	16.8	33.6	34.5	34.5	16.5	18.9	17.5
High school diploma or GED	16.0	17.4	15.6	30.2	31.9	32.3	15.5	16.8	15.5
Some college or more.	13.8	15.1	14.3	26.9	28.0	26.9	14.6	15.8	15.1

Table 41. Severe headache or migraine, low back pain, and neck pain among adults aged 18 and over, by selected characteristics: United States (1997–2014).

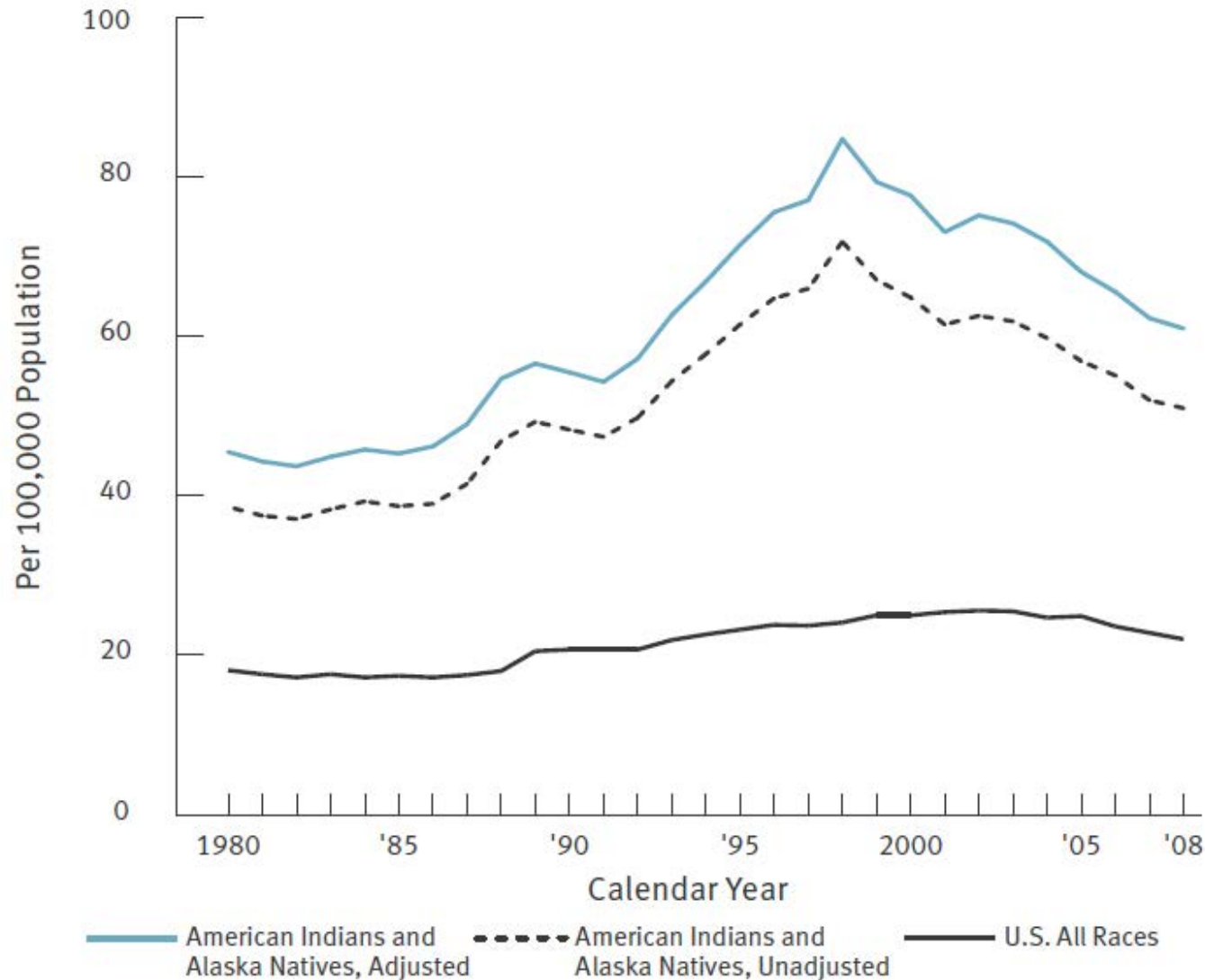
Race and Ethnicity-associated disease risk factors (*Non-modifiable*)

Indian Health Service – Service Population by Area, Calendar Year 2014



Race and Ethnicity-associated disease risk factors (Non-modifiable)

4.44 Age-Adjusted Diabetes Mellitus Death Rates

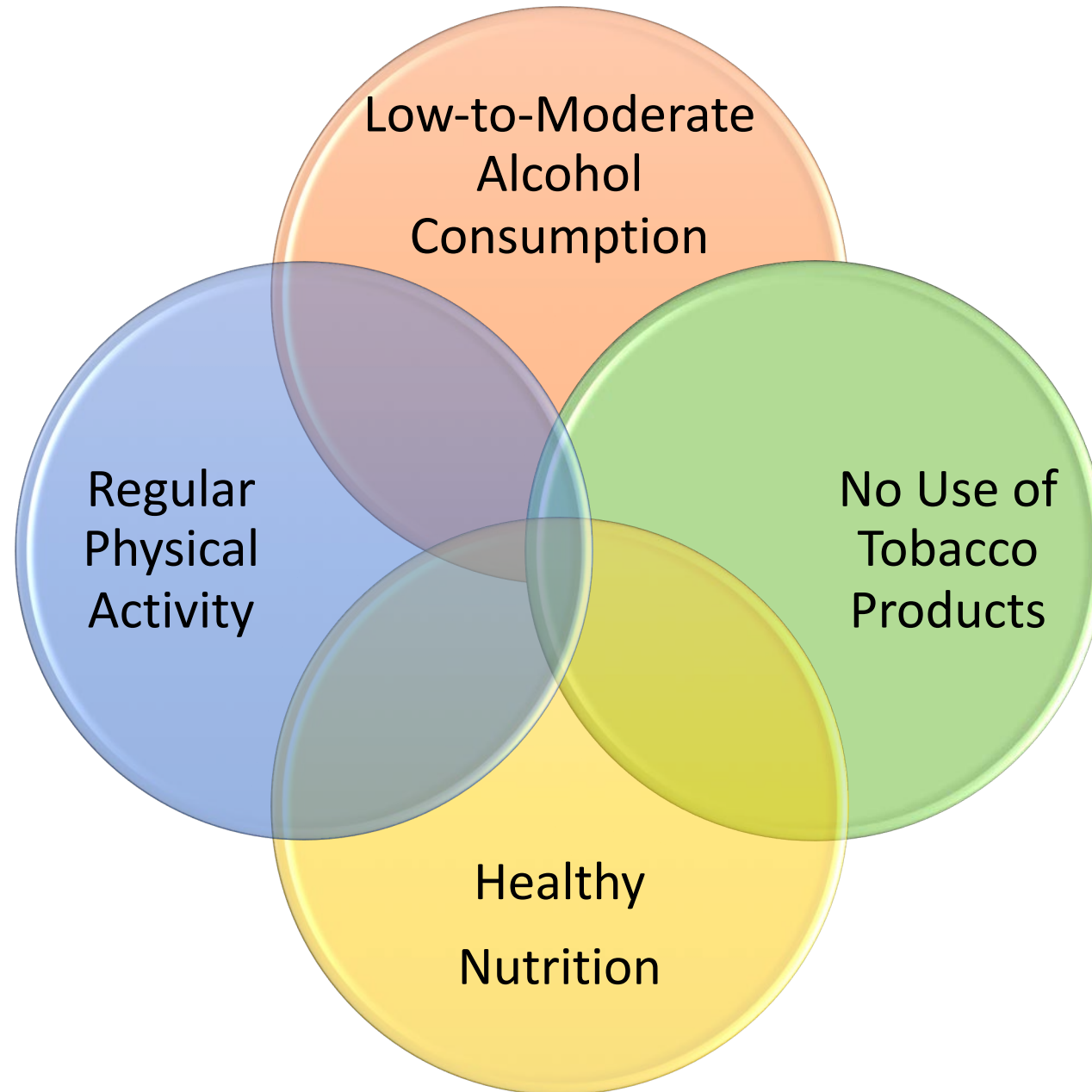


(1)Physical Inactivity

(2)Over-nutrition

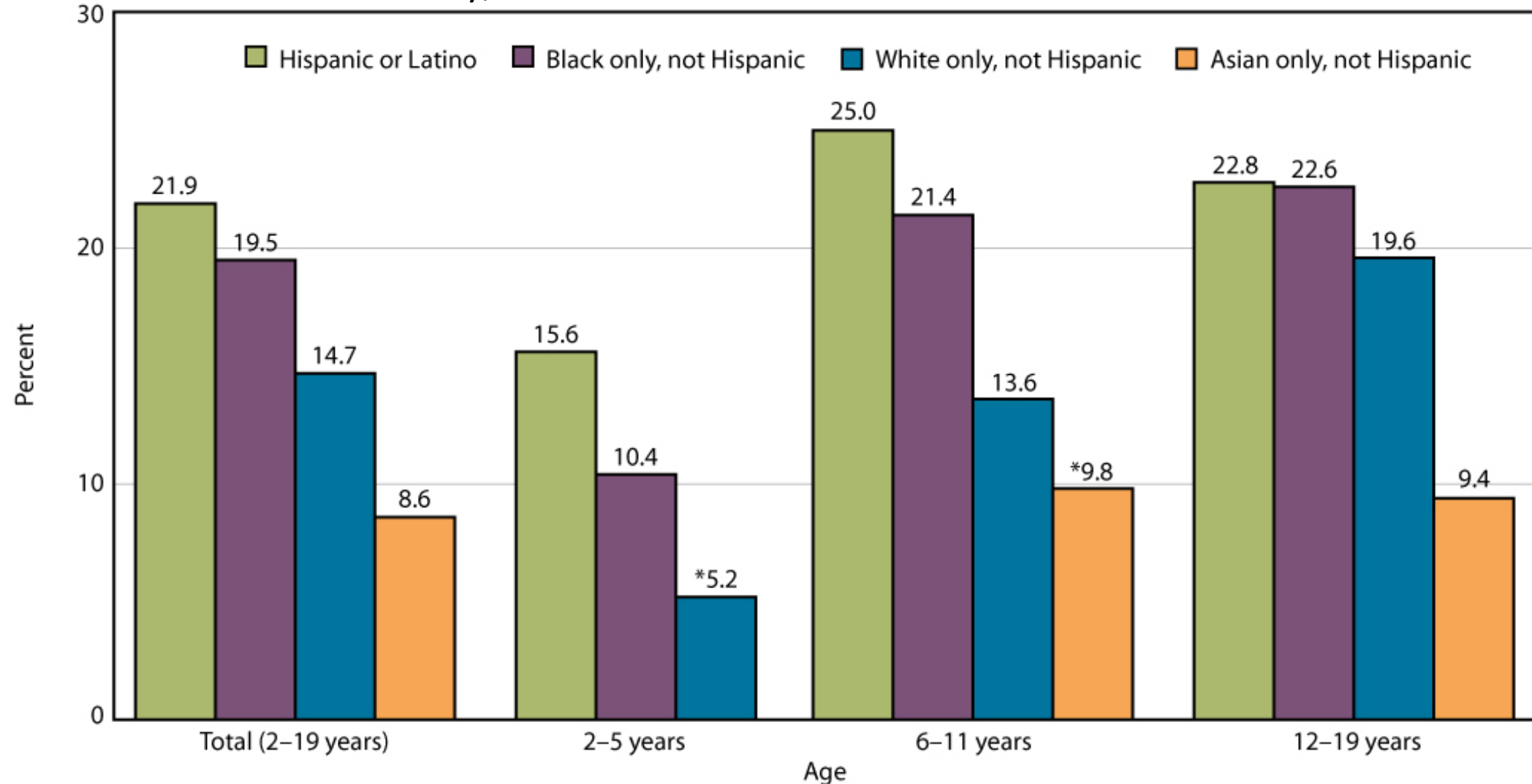
(3)Chronic Stress

Lifestyle Choice-associated disease risk factors (Modifiable)



Nutrition – A key modifier to diminish diversity-associated disease risk factors

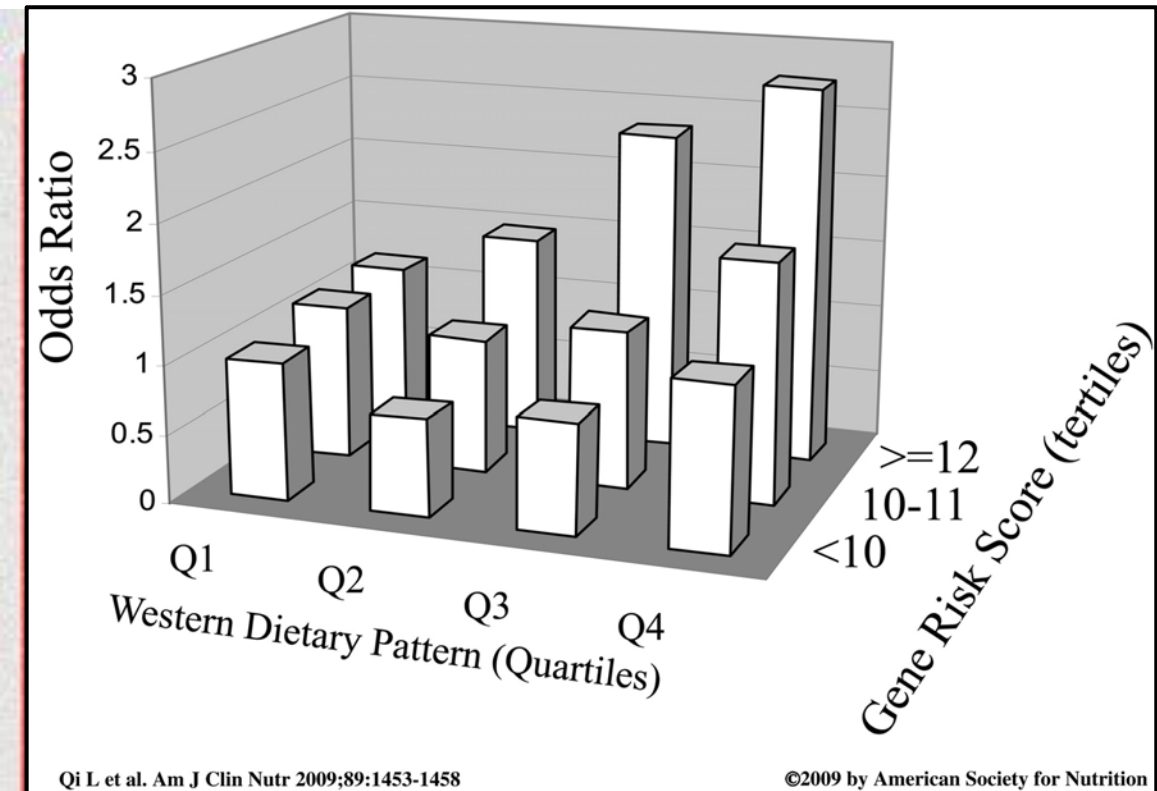
Children with obesity, 2011–2014



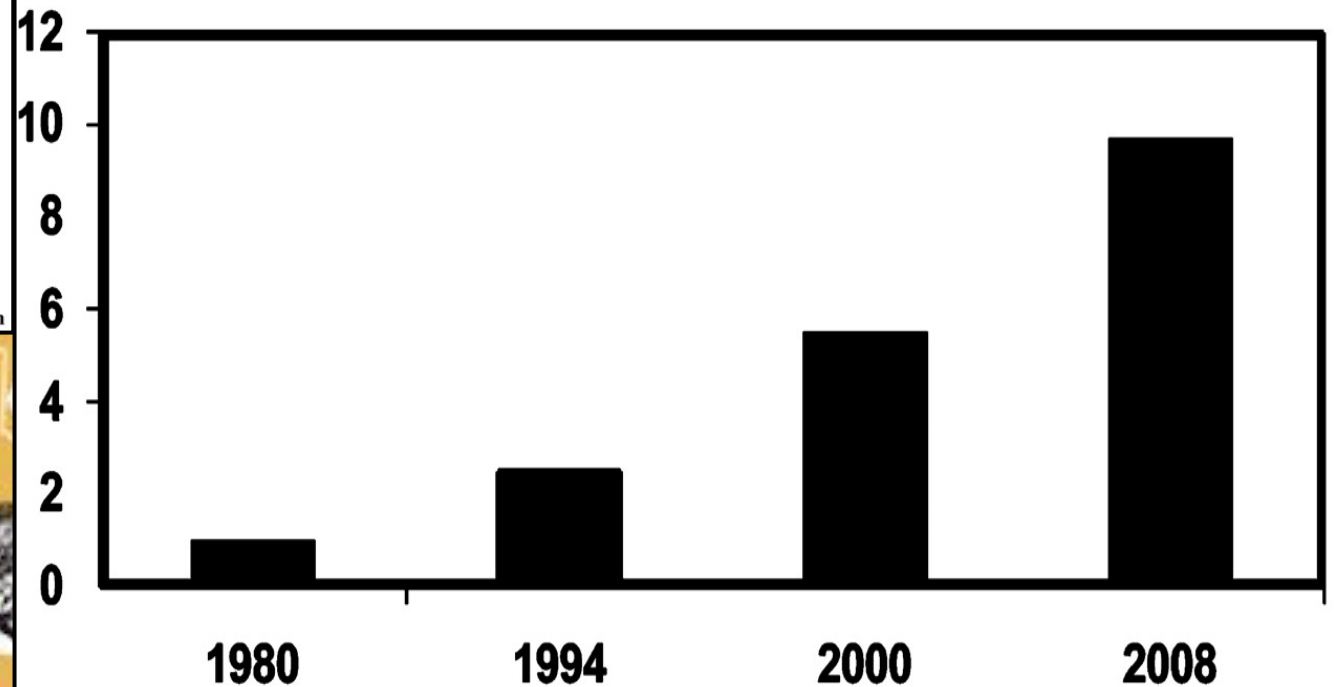
NOTE: Obesity is defined as a body mass index at or above the sex- and age-specific 95th percentile of the CDC growth charts.

SOURCE: CDC/NCHS, *Health, United States, 2015*, Figure 22. Data from the National Health and Nutrition Examination Survey (NHANES).

Impact of migration on Chinese to the US & Western Diet abroad



Escalating Diabetes Epidemic in China

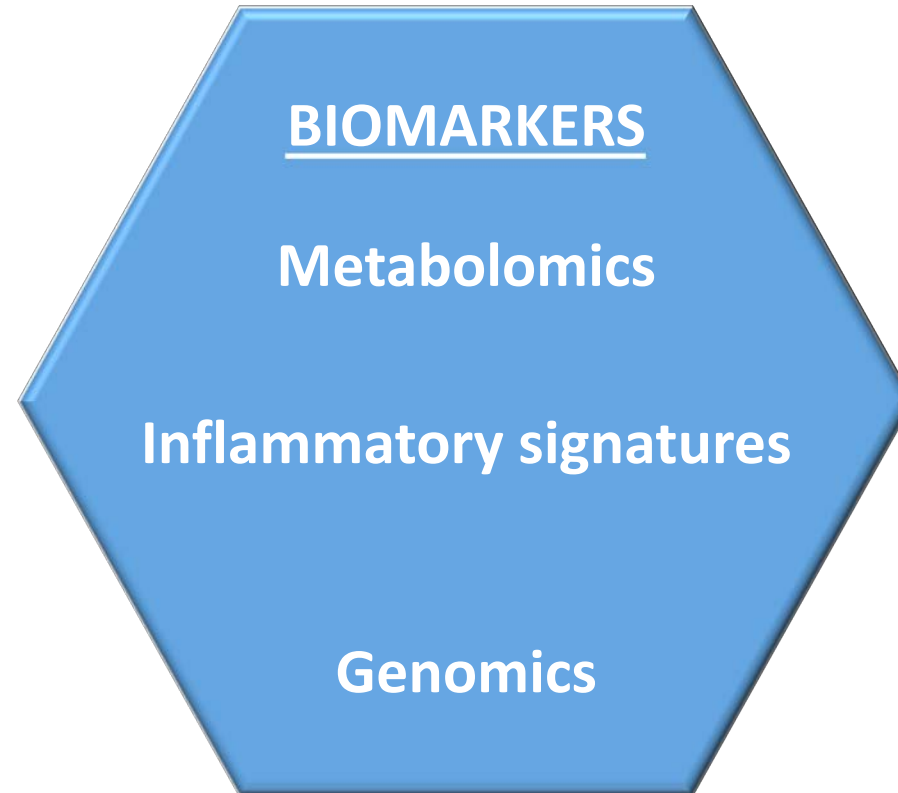


Pan et al. Diabetes Care 1994; Gu et al. Diabetologia 2003; Yang et al. NEJM 2010





Metabolic dysfunction & health disparities in cancer research:



Metabolic dysfunction & health disparities in cancer research:

BIOMARKERS

Metabolomics

Inflammatory
signatures

Genomics

**Metabolic profiles
in cancer-adjacent
normal breast tissues**

Melissa Troester



UNC
GILLINGS SCHOOL OF
GLOBAL PUBLIC HEALTH



**Yasmin
Kanaan**



**Characterizing commonalities
and differences between the
breast and prostate cancer
metabotypes in
African Americans**

**Clinically distinct
breast cancer cell lines
have metabolically
different responses to
Taxol treatment**



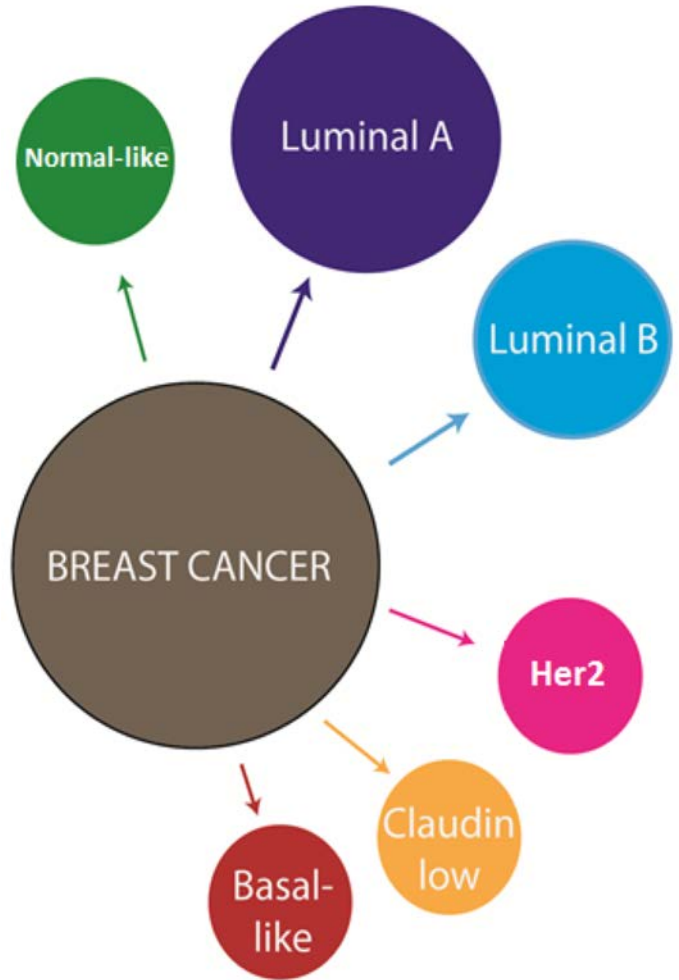
ERCMRC Internal



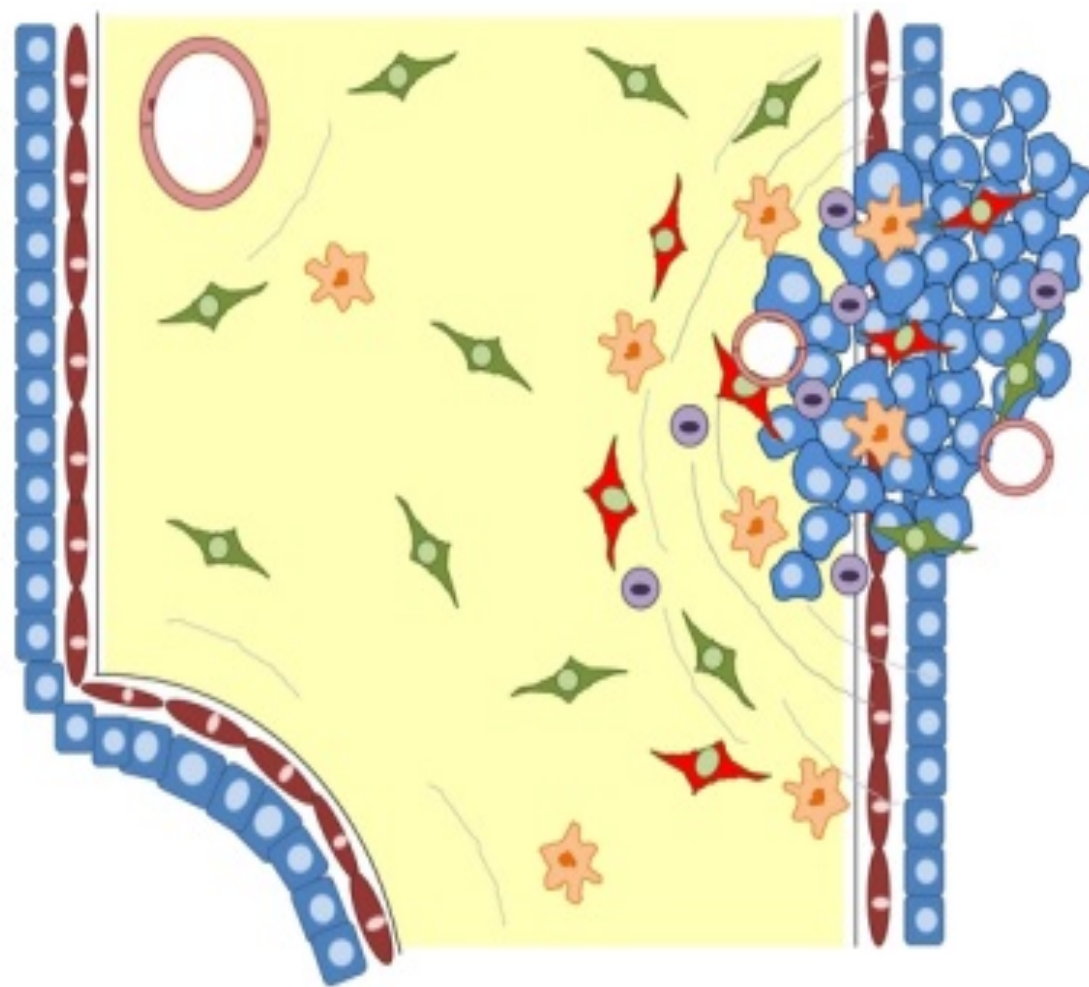
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Metabolic profiles in normal breast tissues adjacent to breast tumors

Breast Cancer is a multi-faceted disease



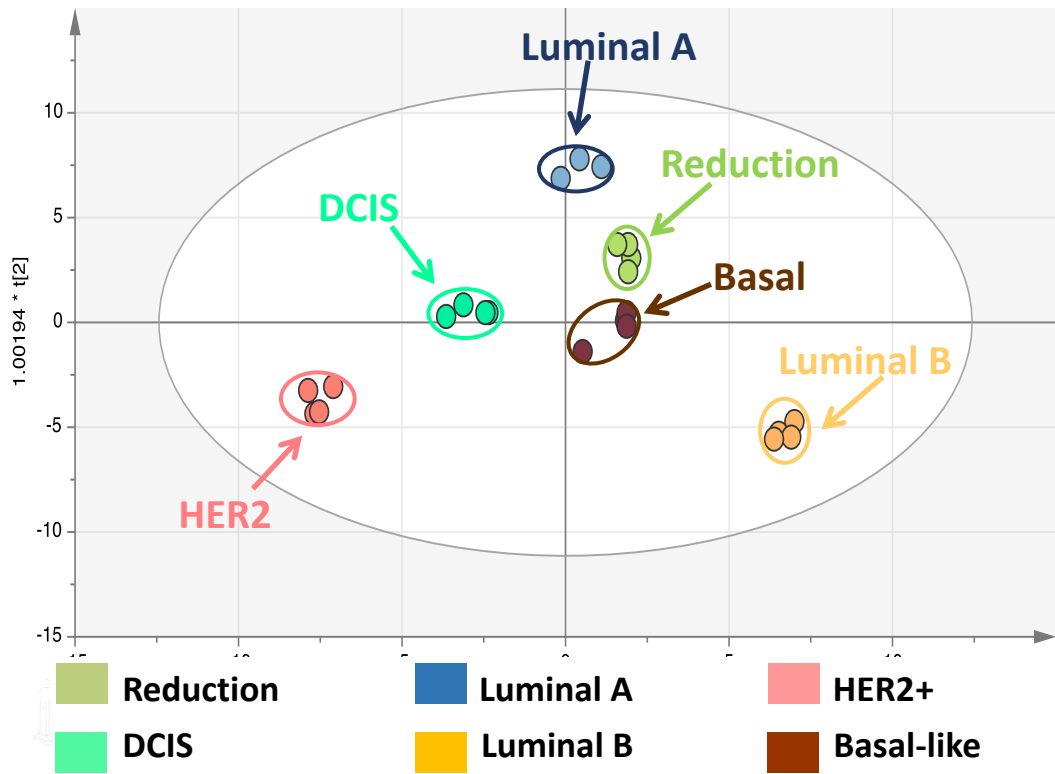
- Cancer cells
- Normal epithelium
- Normal myoepithelium
- Macrophages
- Fibroblast
- Myofibroblast
- ECM
- Mesenchymal stem cells
- Stroma
- Blood vessels



Tumor and adjacent tissue microenvironment

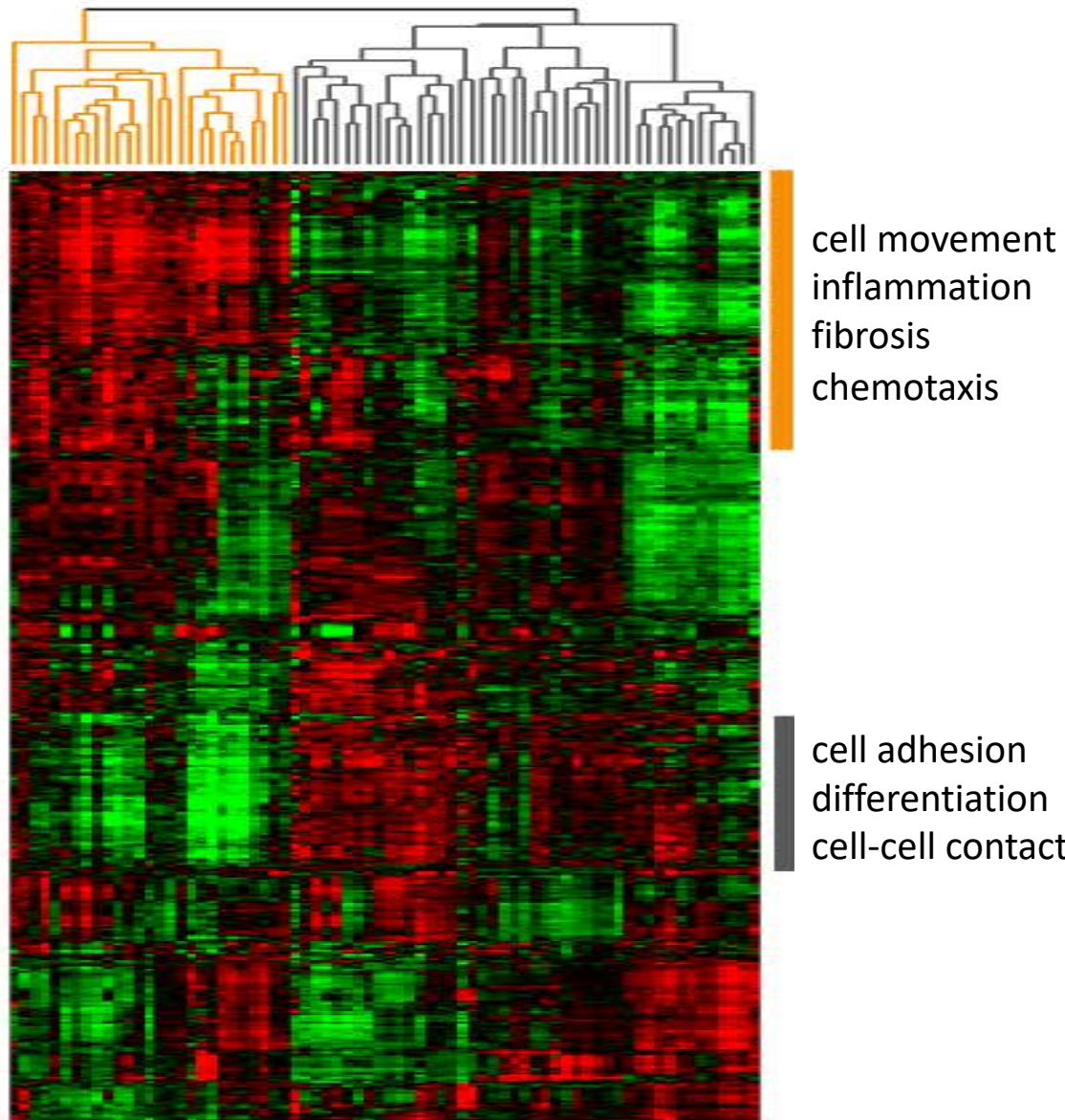
Correlated metabolomic, genomic, and histologic phenotypes in histologically normal breast tissue.

X. Sun, D. Stewart, R. Sandhu, et al. (2018), *PLOS One*.



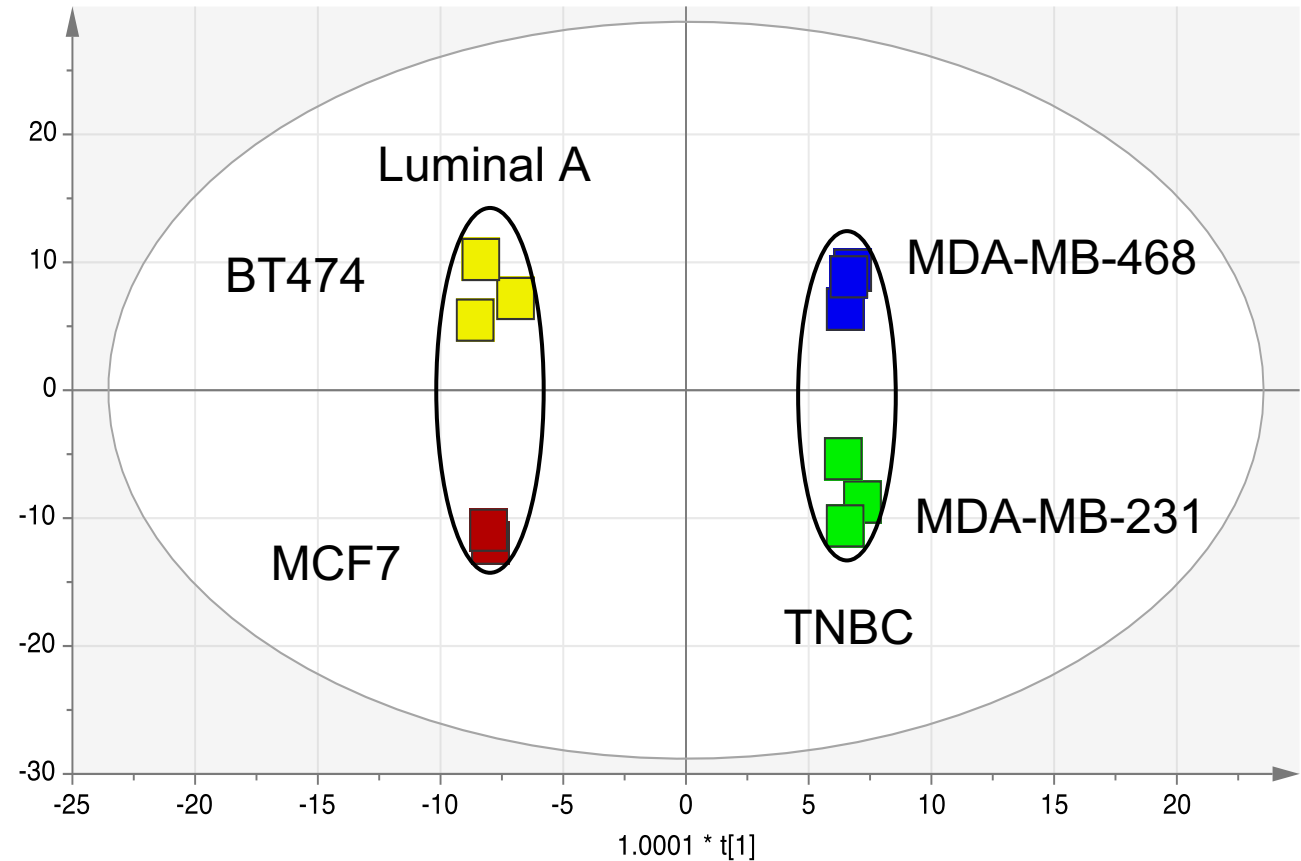
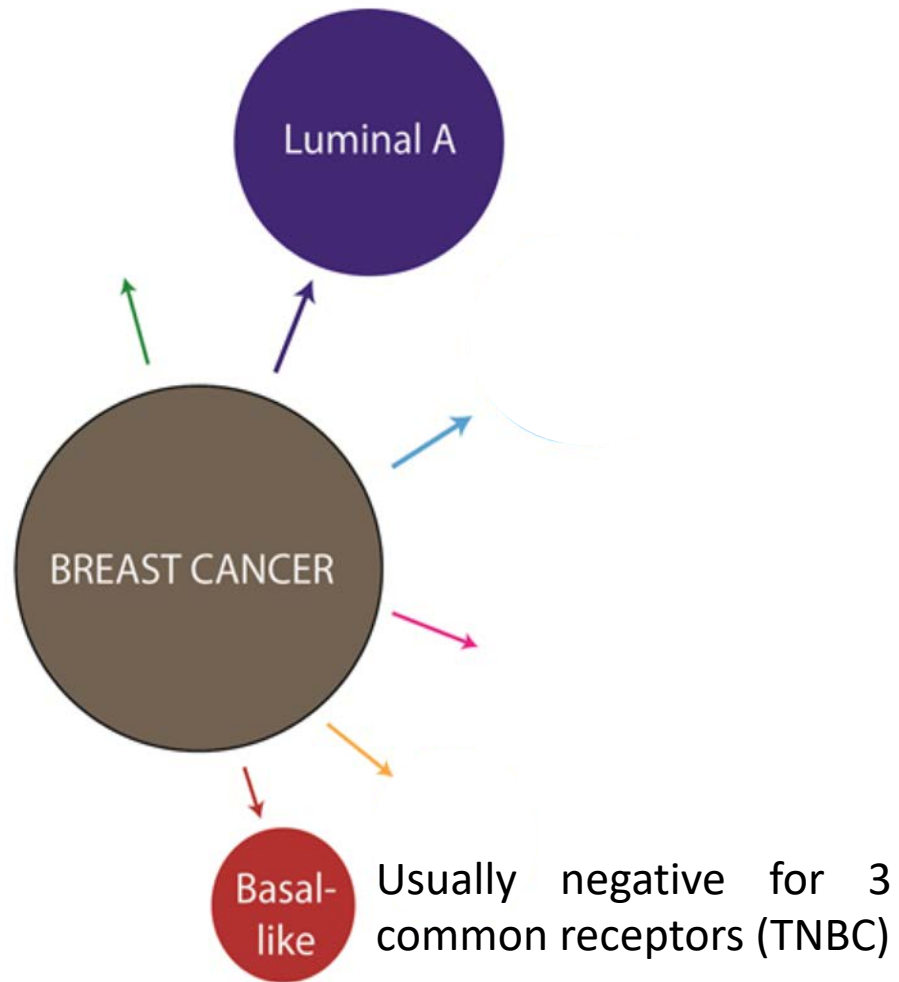
Metabolic differences exist in certain normal-adjacent breast tissues

Normal tissues express different gene signatures

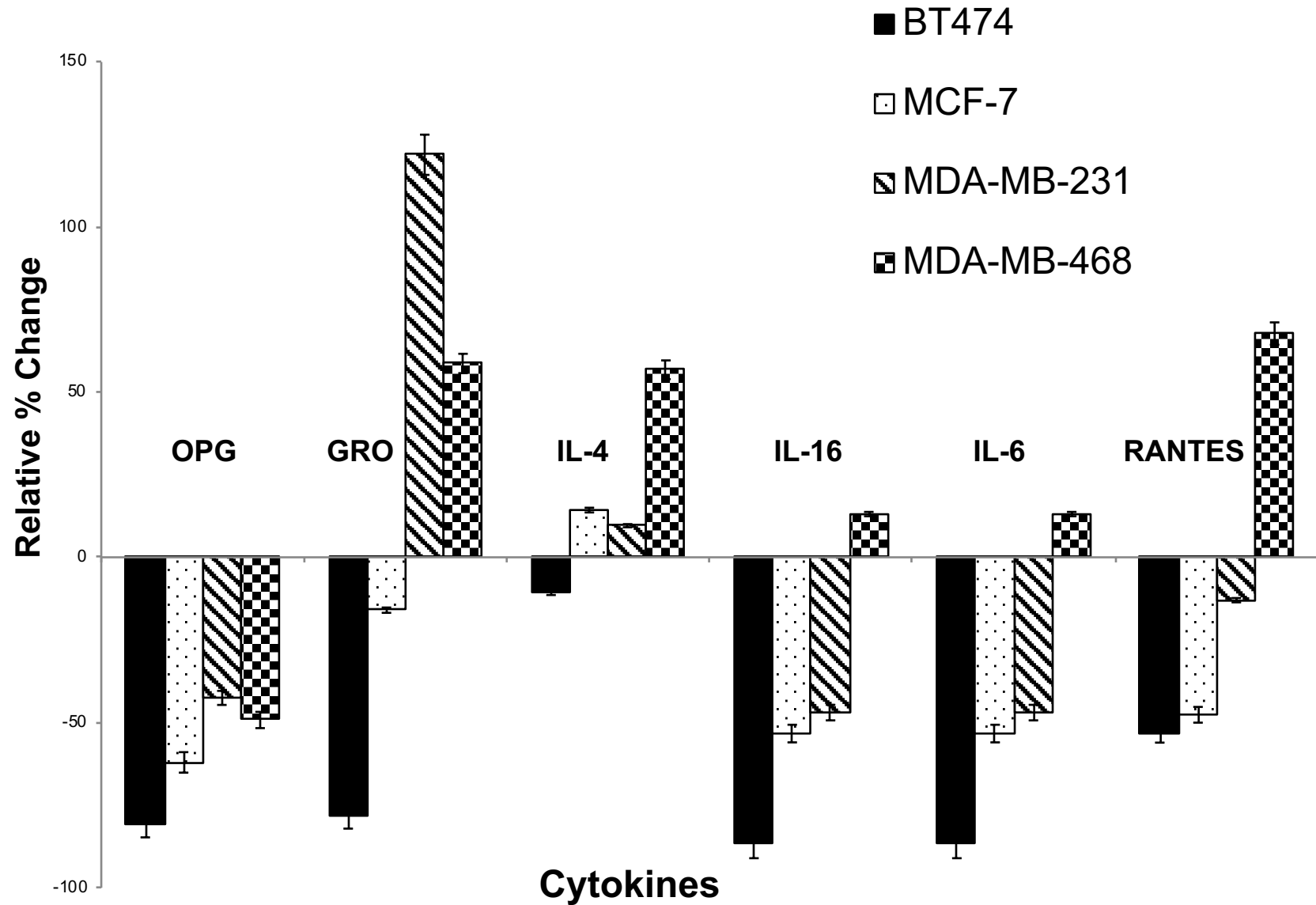
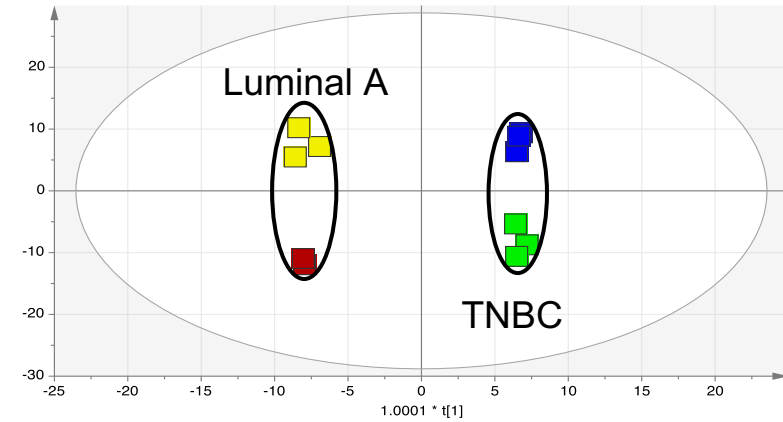


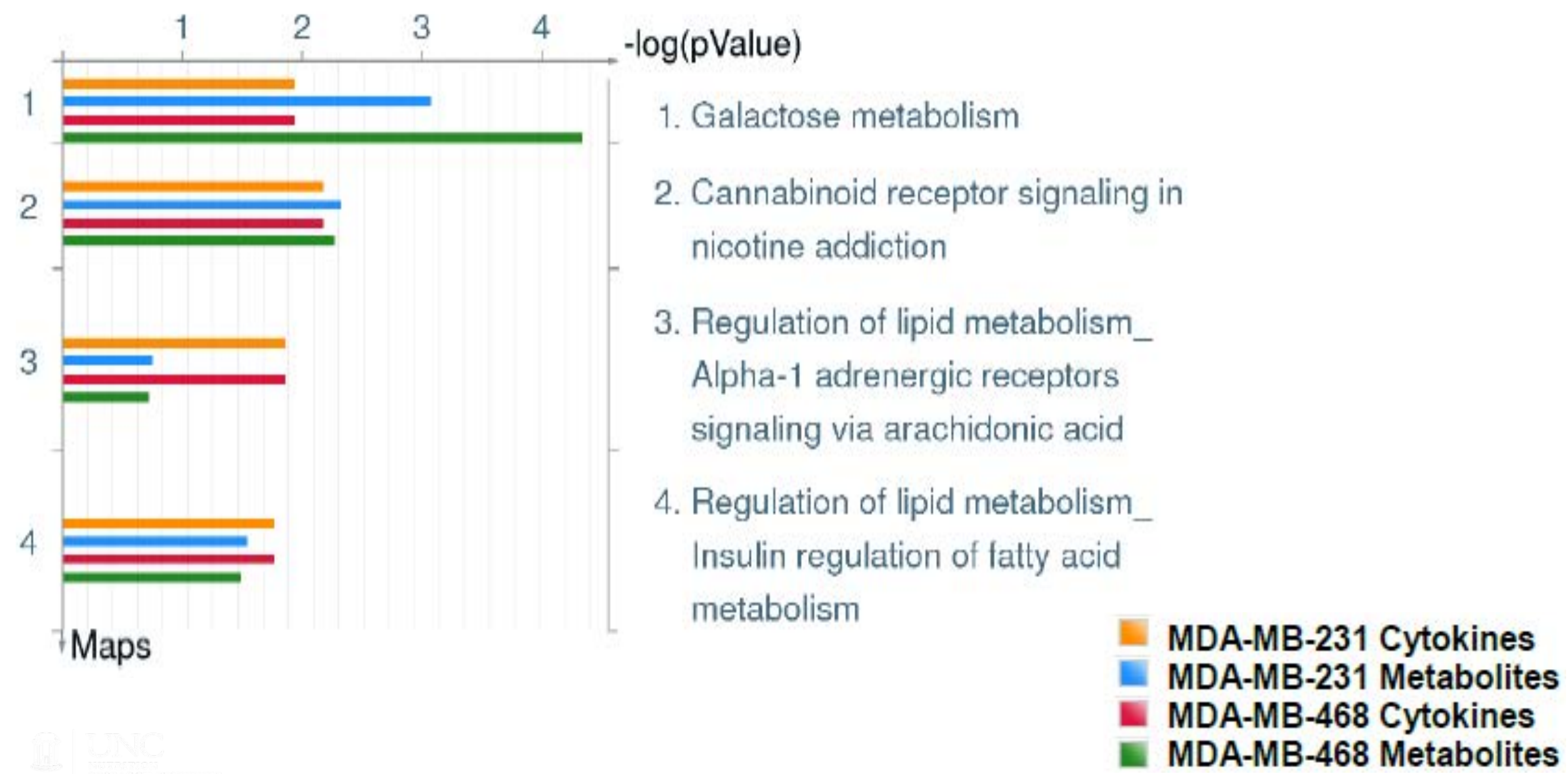
Roman-Perez et al., *Breast Cancer Res.* 2012 14:R51.

Metabolic differences in clinically different breast cancer cell treatment response

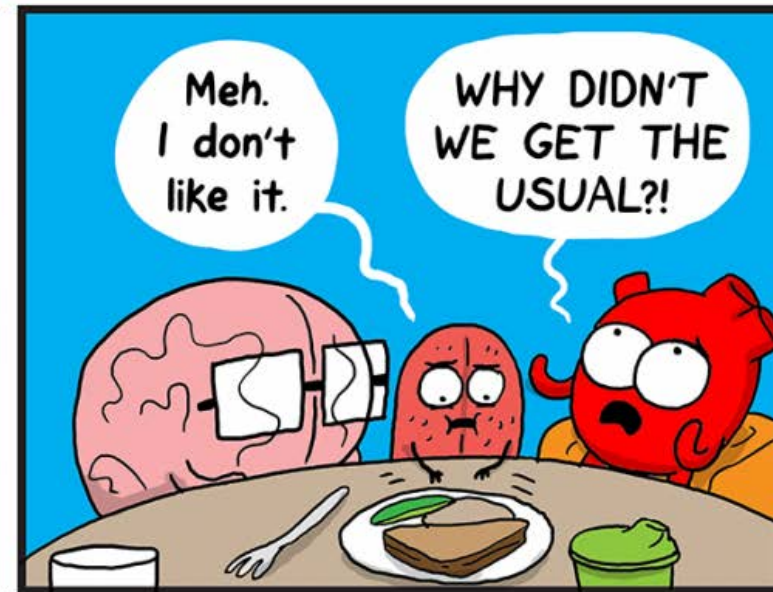
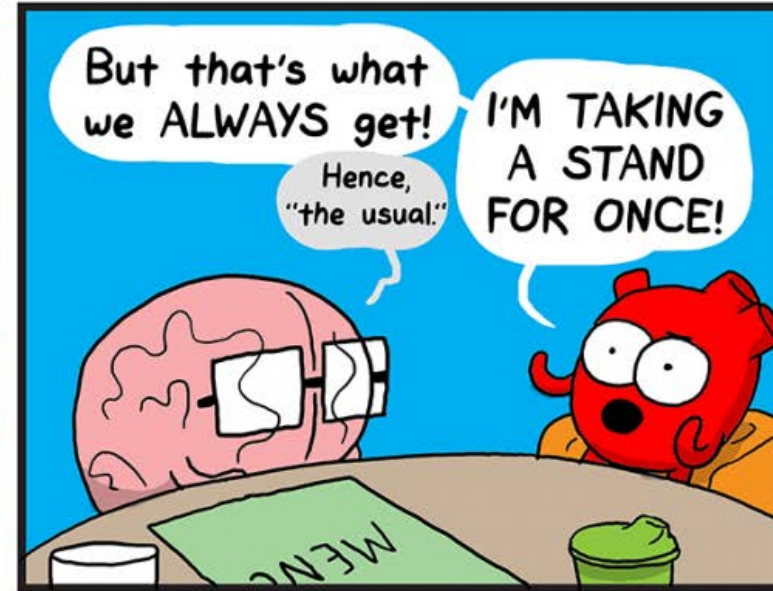
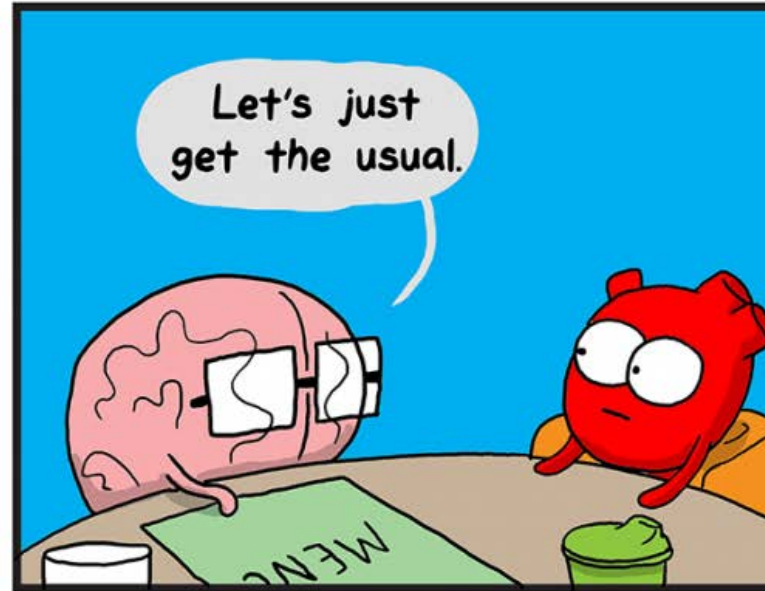


Inflammatory markers also distinguishable across clinically distinct breast cancer cell lines





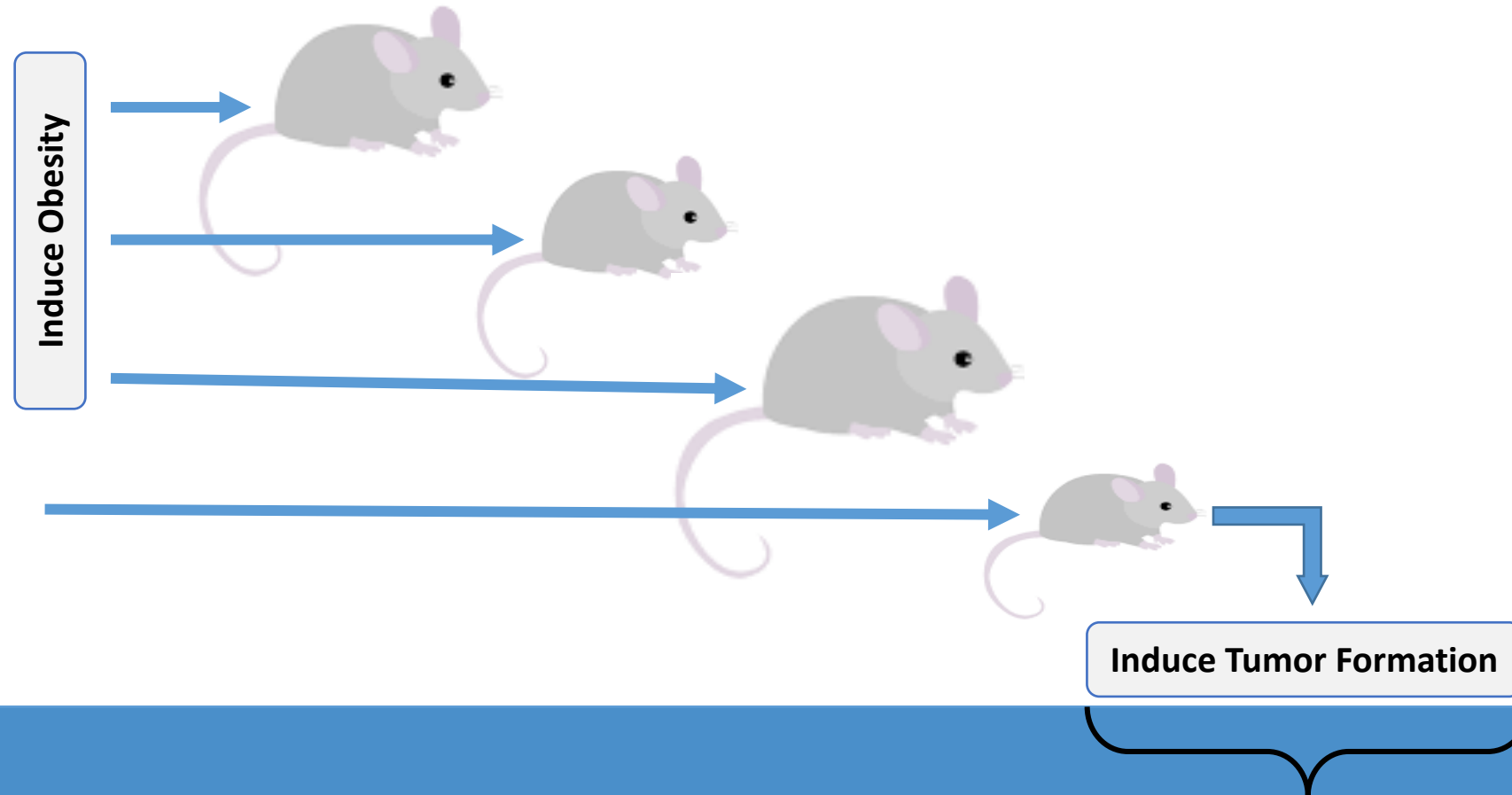
What Can We Do???



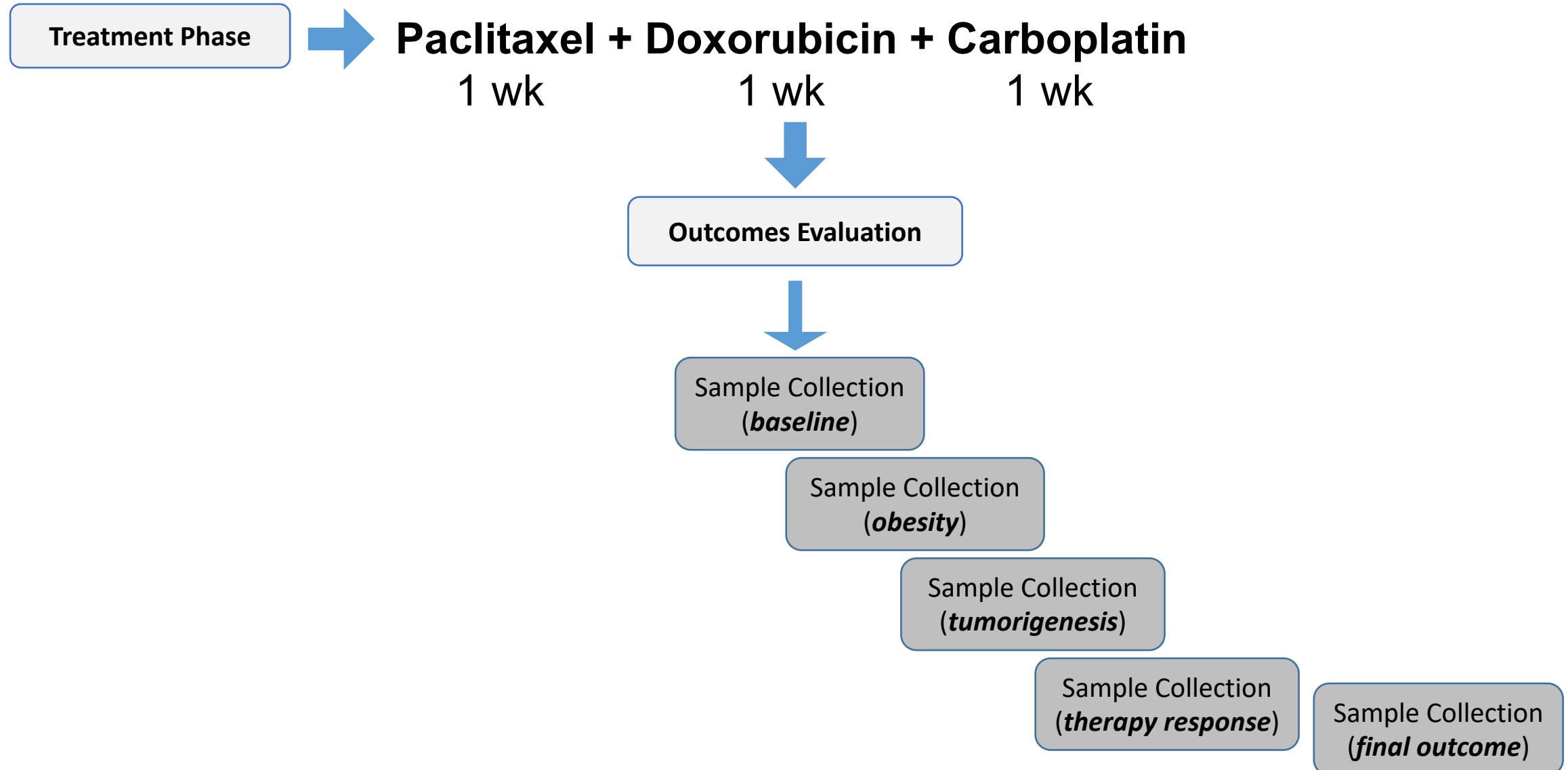
Higher Dietary Carbohydrates Detrimentally Impact Obesity-Associated Breast Cancer Chemoresistance:

Hypothesis: diets higher in simple carbohydrates contribute to chemoresistance phenotypes in obesity-driven breast cancer more than diets high in fat, but high-carbohydrate and high-fat diets are most detrimental.

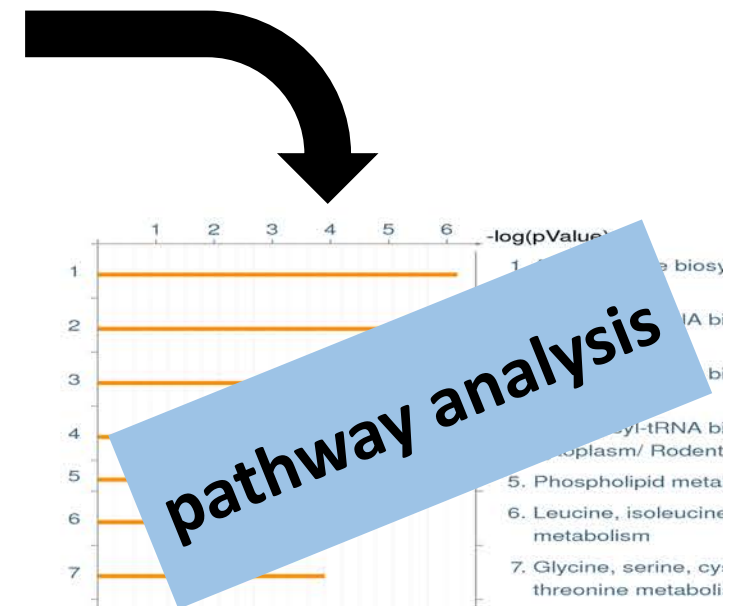
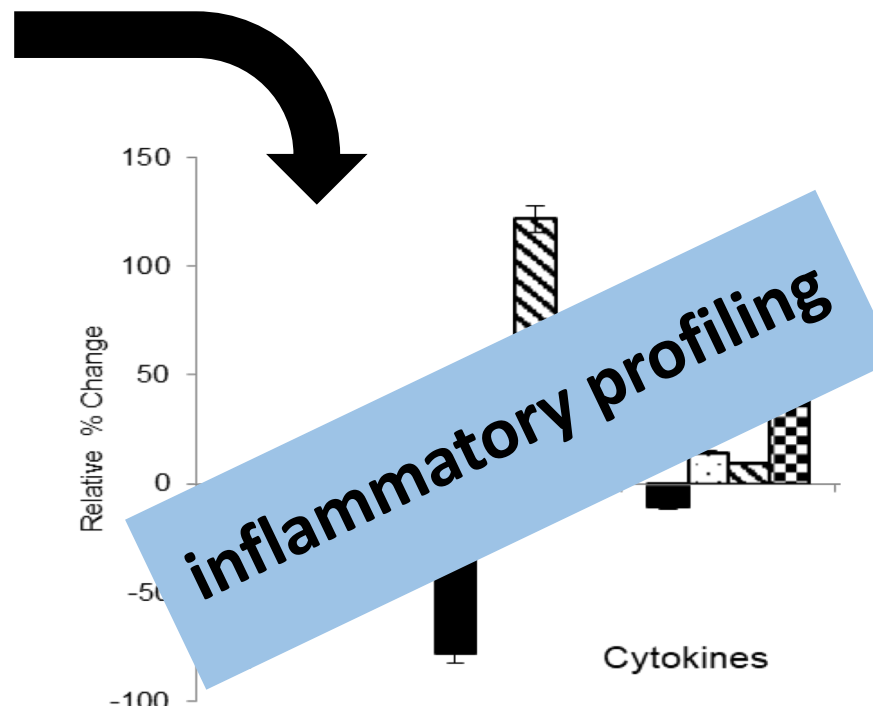
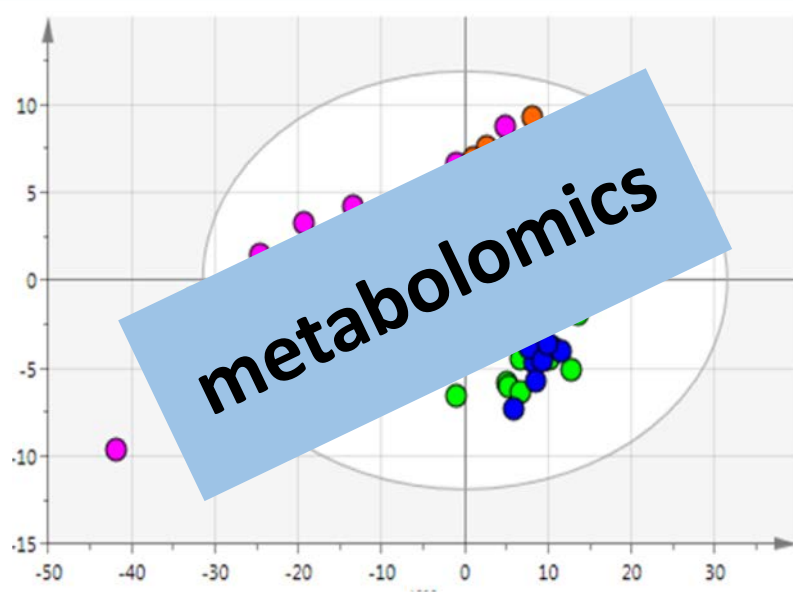
Diet Groups
A. High Carb
B. High Fat
C. High Carb & Fat
D. Control Diet



Establish impact of different macronutrients on obesity-induced breast cancer Chemoresistance



Identify nutritionally-associated, obesity-dependent metabolic and inflammatory markers and mechanisms



Who do the significantly modifiable markers work for best?

Which ones are significantly modifiable?



Dr. Steven Zeisel

Choline as an essential nutrient



- We all need choline.
- Men and post-menopausal women need to get choline through their diet.
- Genetics dictate that some pre-menopausal also have to eat choline to get enough.
- Low choline increases birth defects.



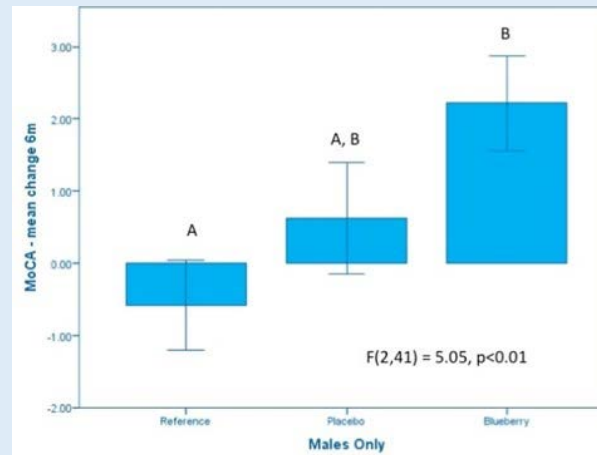
Dr. Carol Cheatham

Nutrition for memory and attention abilities

B.E.R.R.Y. Study (Blueberries: Exciting Research Relevant to You)



- Only worked in men. (6 mth study)



- Anthocyanins = an active chemical slows memory loss.



Dr. Stephen Hursting

Diet-gene interaction for cancer prevention

Leptin's Role in Cancer Susceptibility

- Increase in the hormone leptin associated with tumor growth in genetically obese mice.
- Obese people usually have higher leptin & are resistant to its signals.
- Leptin-associated targets may reduce breast cancer susceptibility.





**Your diet is a bank account.
Good food choices are good
investments.**

Bethenny Frankel



**For
Good
Health**