

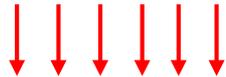
Profiling intense pulsed light-elicited changes in *E. coli* and flour

Chi Chen

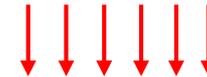
Workshop

September 11, 2020

IPL



E. coli



Food (flour, milk)



DNA damage,
metabolic changes



Chemical changes &
degradation

**Potential
changes**

Metabolomics



**Potential
Consequences**

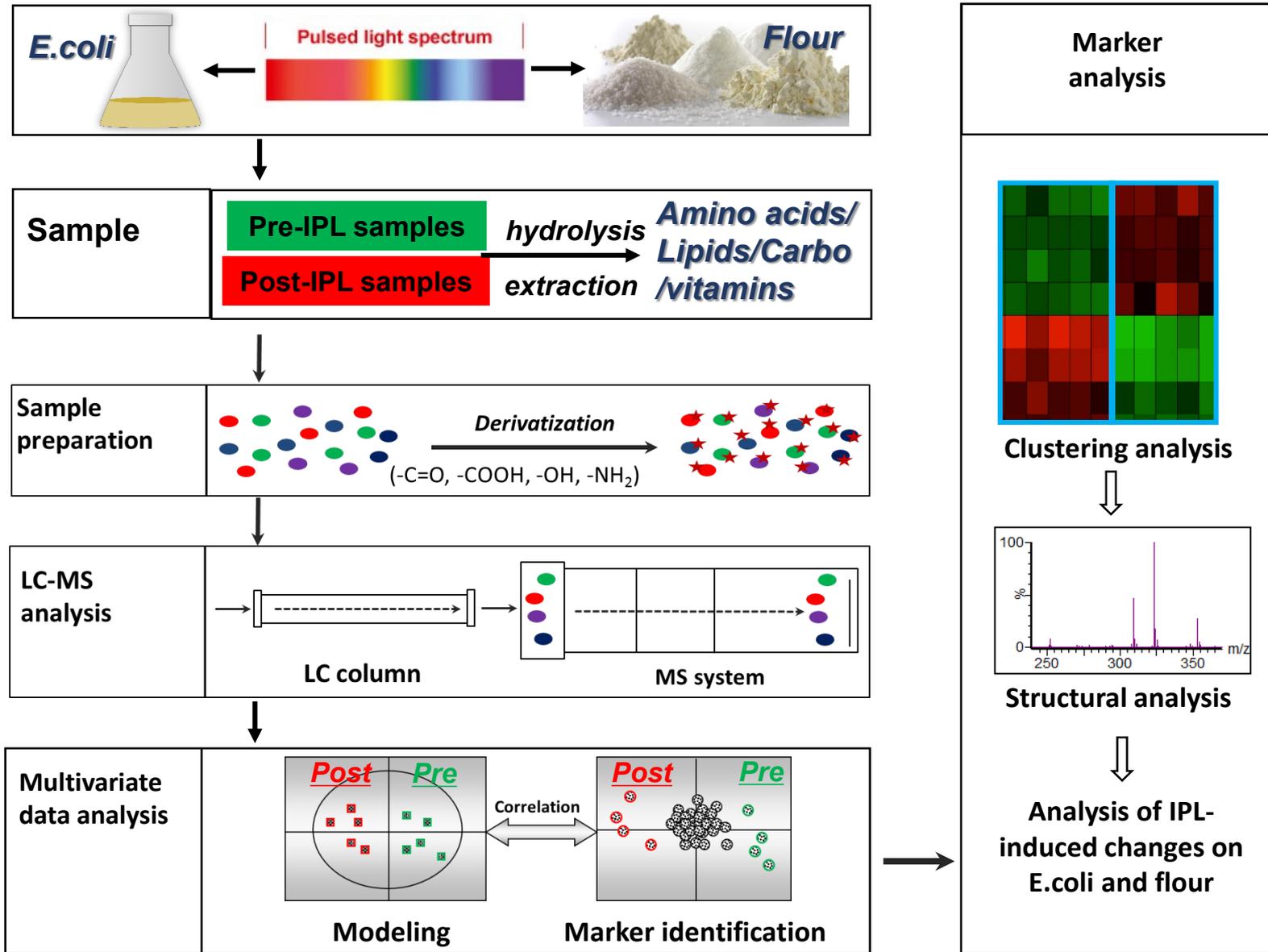
Cell death



Chemometrics

Altered nutritional and
sensory properties

Experiments: chemometrics and metabolomics

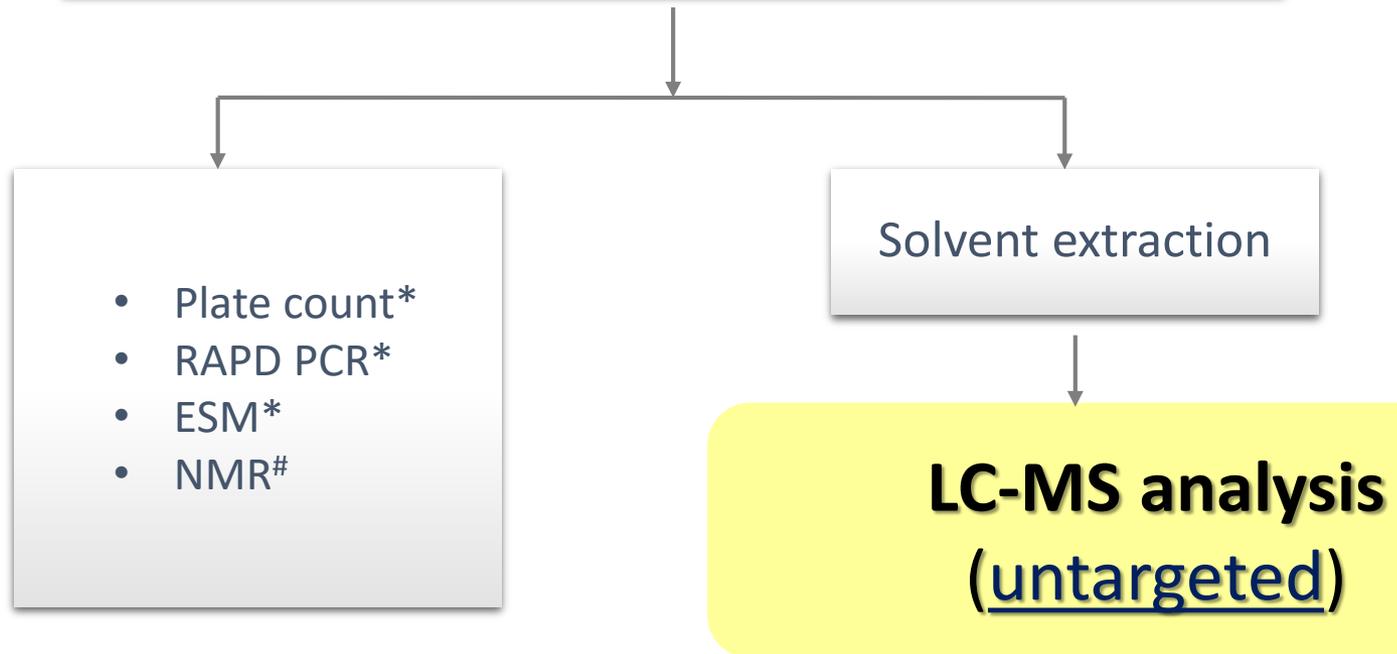


(1) Effects on *E.coli* metabolome



E.Coli Samples

- Overnight *E. coli* culture (in Luria-Bertani broth)
 - IPL-treated *E. coli* culture*#
 - Residence time: 0s (control), 5s, 10s, 15s, 20s
 - Height: 8cm
 - Energy: 5~20J/cm²



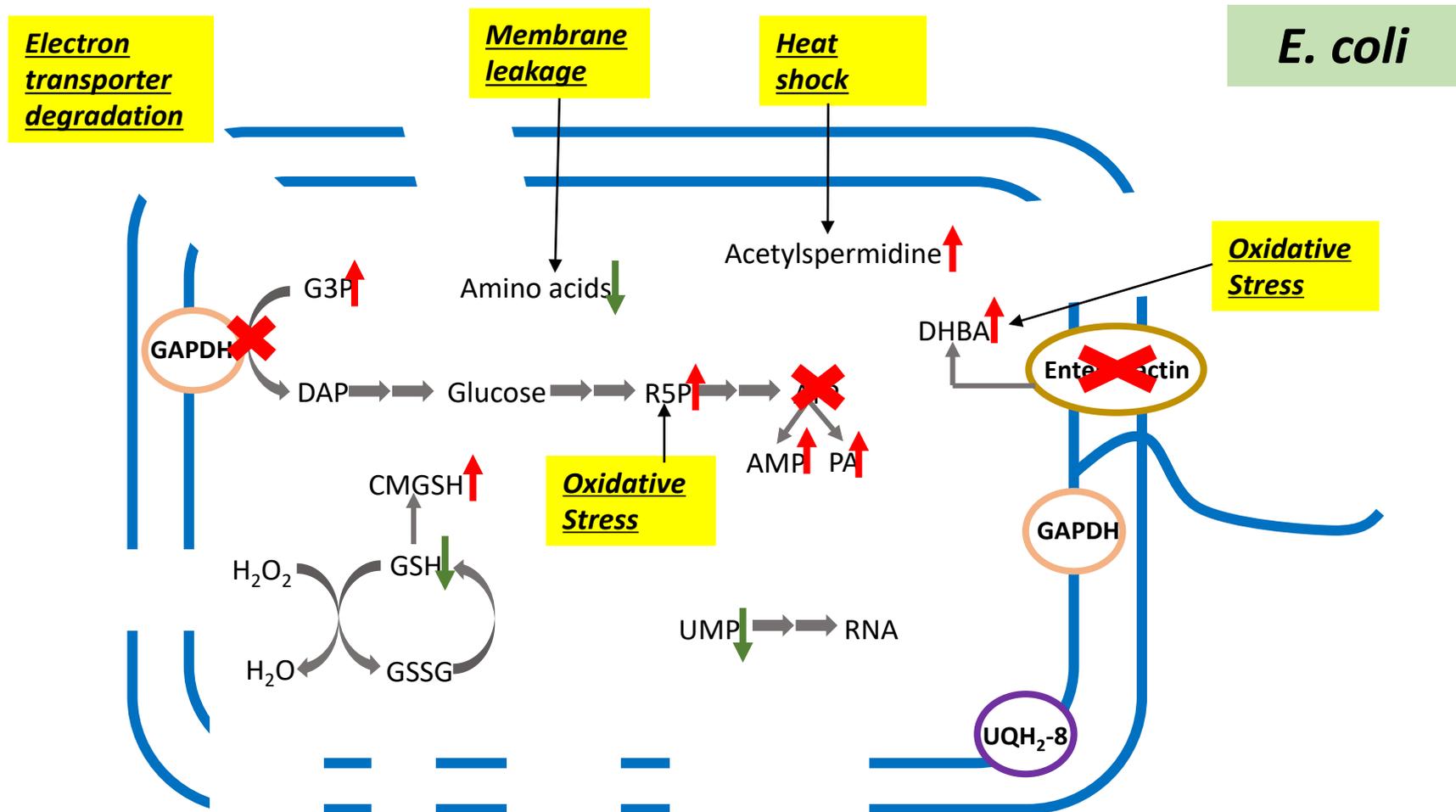
*Baumler lab

#Ruan lab

Summary



- IPL-elicited metabolic changes are dose-dependent



General Mills All Purpose Wheat Flour

- Untreated flour (Control)
 - IPL-treated flour*

--Voltages -- 2.2 and 3kV

--Feeder hopper rates: 4.2 and 8.1kg/hr

- Frequencies of IPL: 1, 3, and 14Hz

Color

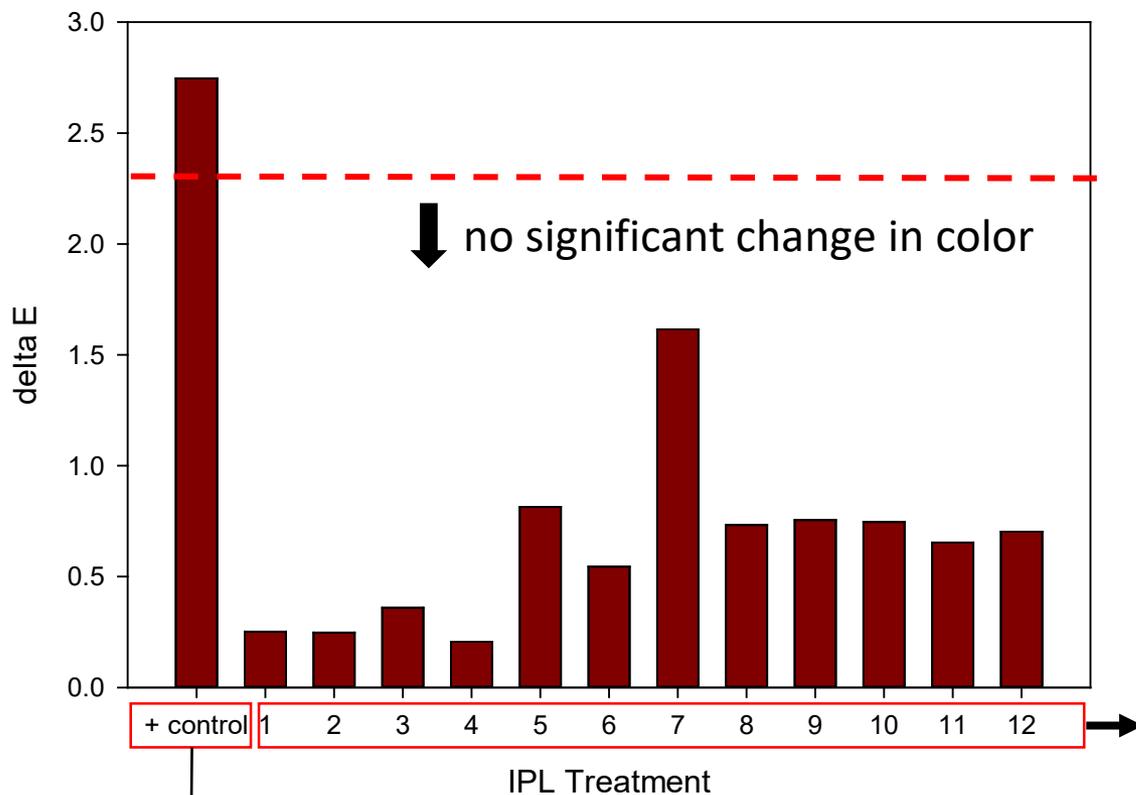
Solvent extraction

LC-MS analysis
(targeted & untargeted)

Effect on food: wheat flour



Color



Positive control: flour treated with 3-h UV

IPL Factorial Design

Treatment	Frequency	Feeder Rate	Voltage
1	3000	4200	1.0
2	3000	4200	3.0
3	3000	4200	14.0
4	3000	8100	1.0
5	3000	8100	3.0
6	3000	8100	14.0
7	2200	4200	1.0
8	2200	4200	3.0
9	2200	4200	14.0
10	2200	8100	1.0
11	2200	8100	3.0
12	2200	8100	14.0

Effect on food: mesquite flour



Mesquite Flour Samples
Untreated control

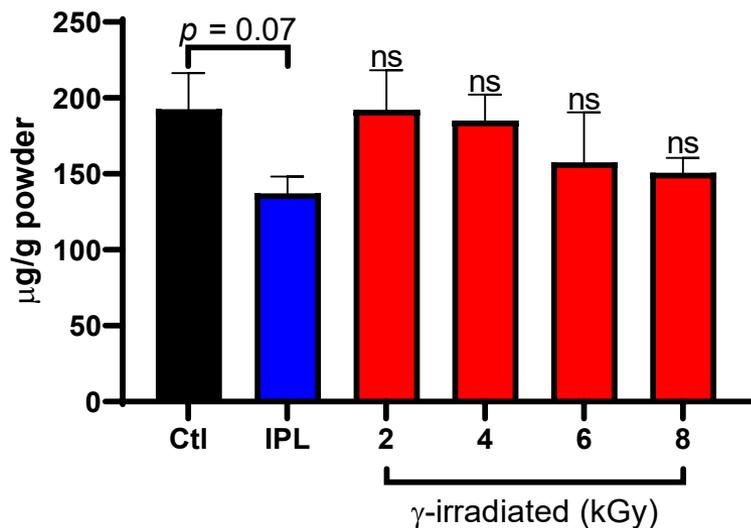
Voltage: 3kv
28 s residence time
1 pulse/sec

IPL treatment

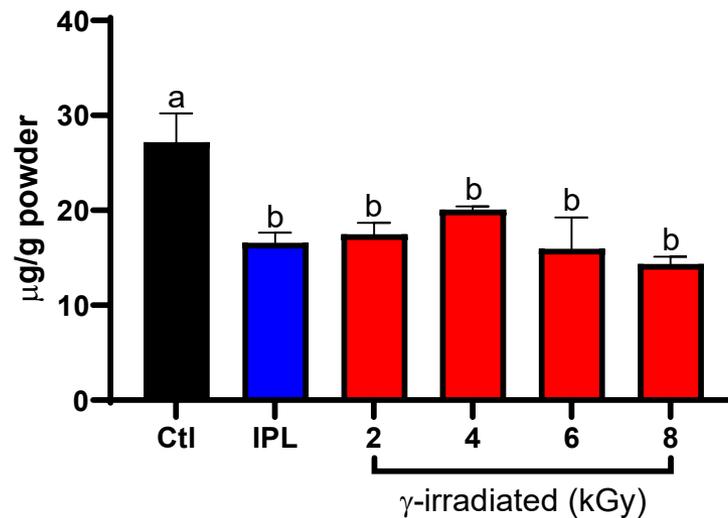
γ -Irradiation

^{137}Cs -- 2, 4, 6,
& 8 kGy

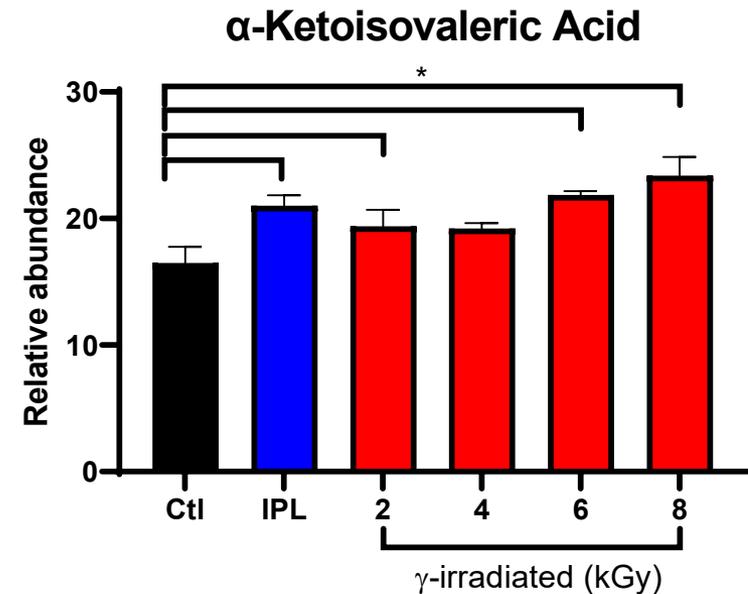
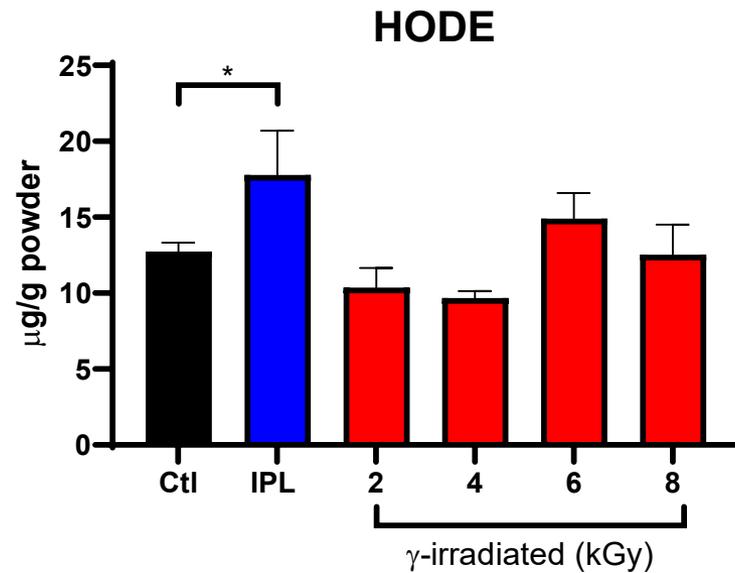
Acetic Acid



Propionic Acid



Effect on food: mesquite flour



Potential side effects of IPL treatment

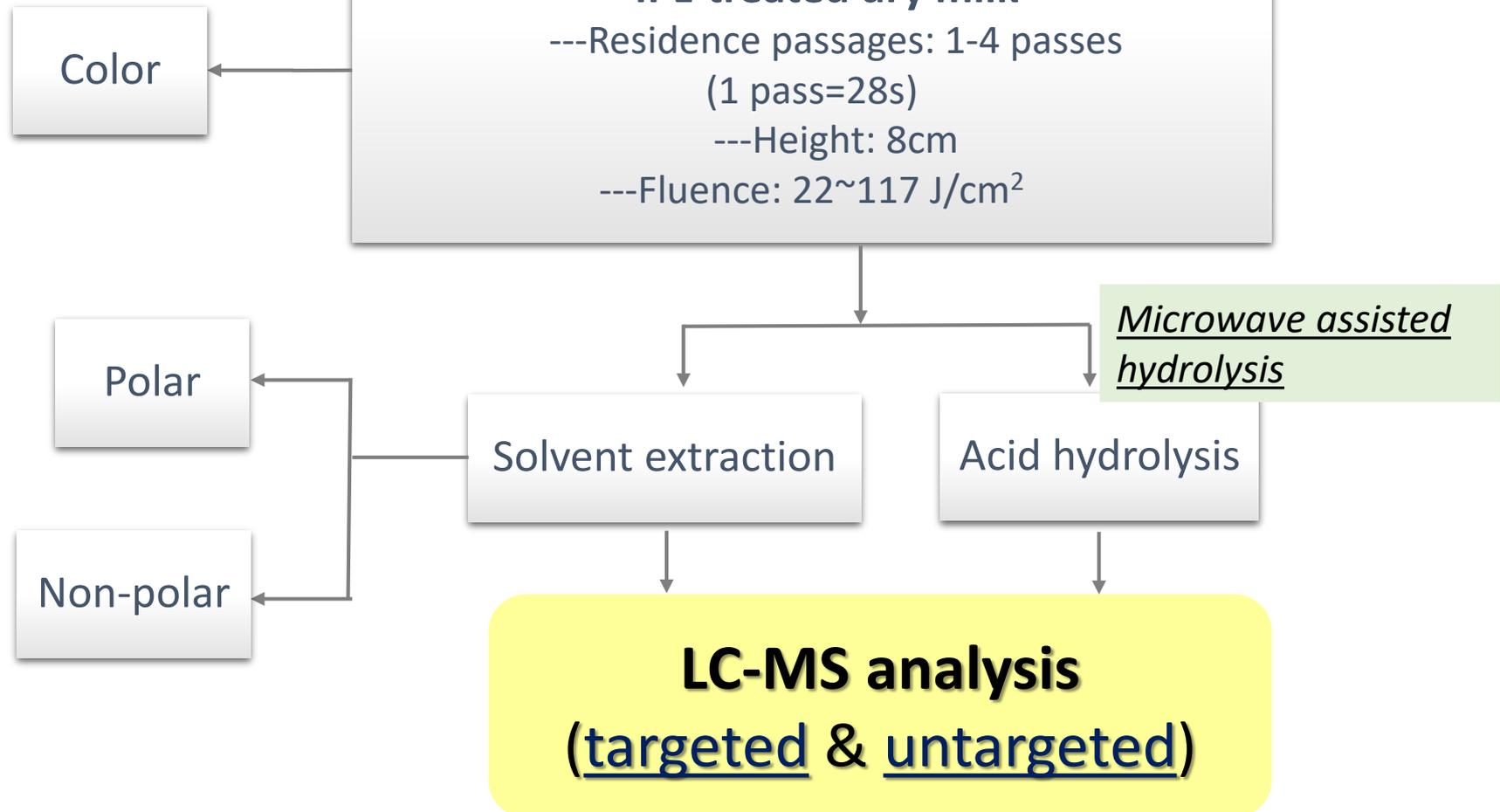
- Lipid oxidation: oxidation of PUFA
- Amino acid deamination

Effect on food: Non-fat dry milk



Non-Fat Dry Milk Samples

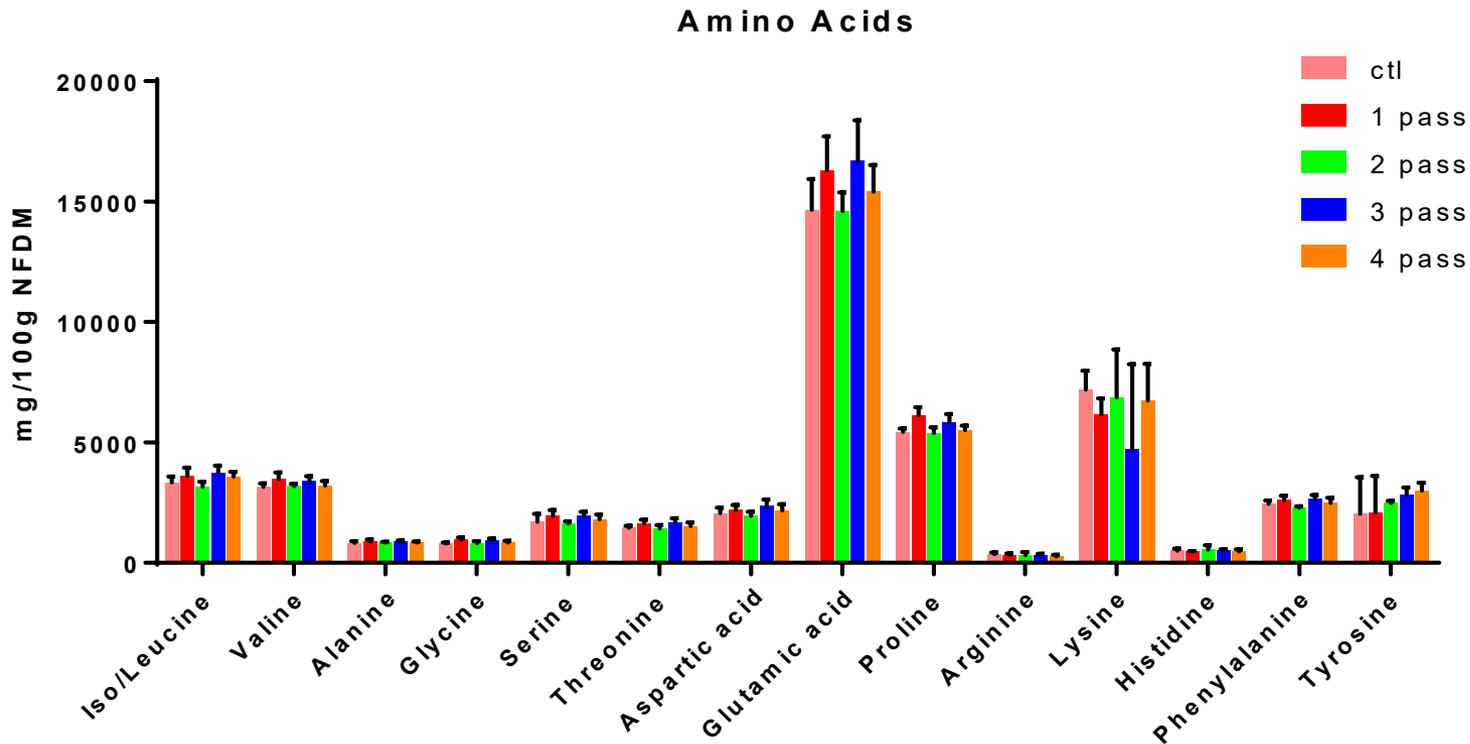
- **Untreated dry milk (Control)**
 - **IPL-treated dry milk***
 - Residence passages: 1-4 passes
(1 pass=28s)
 - Height: 8cm
 - Fluence: 22~117 J/cm²



Effects on NFDM - Hydrolysis



- IPL does not alter total or single amino acid concentration of NFDM

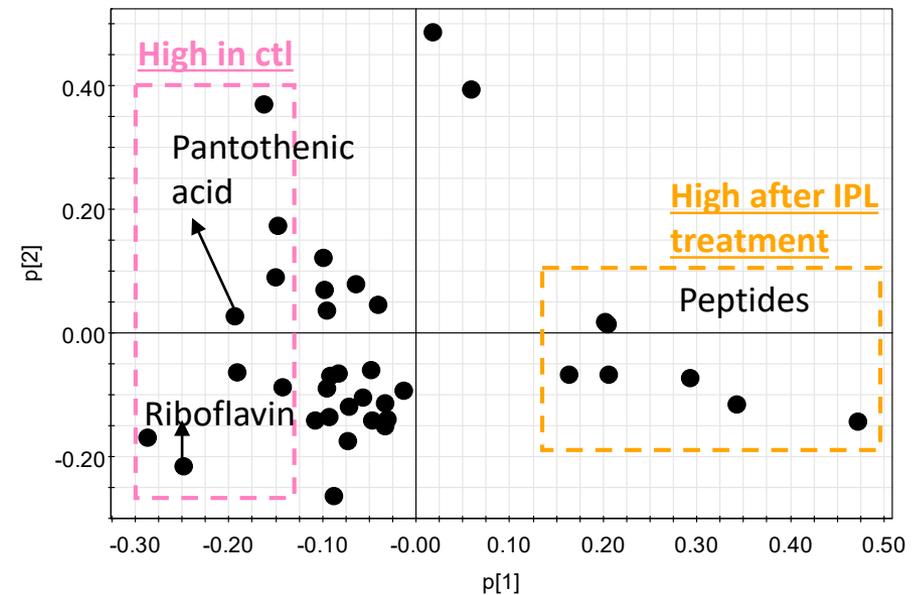
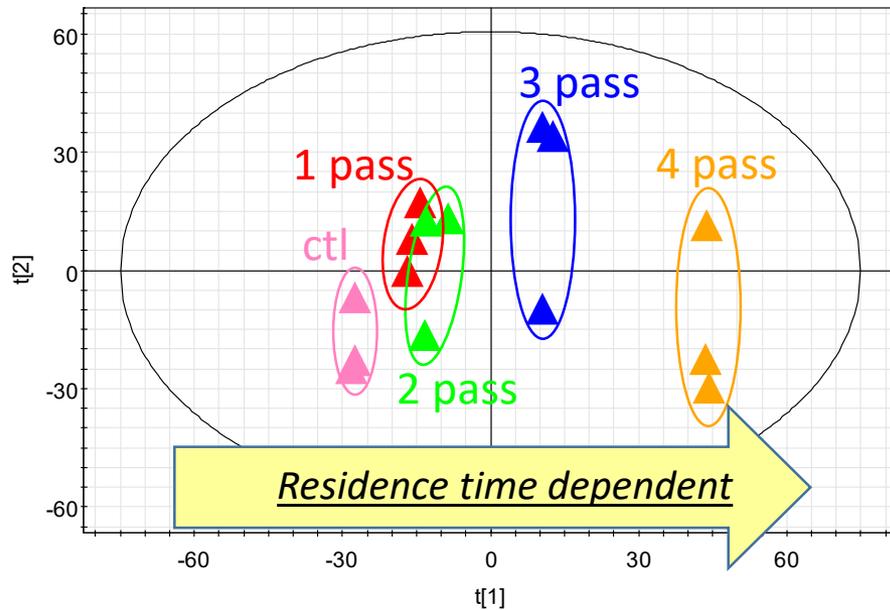


- After hydrolysis, untargeted LC-MS analysis revealed no significant changes in NFDM in a PCA model

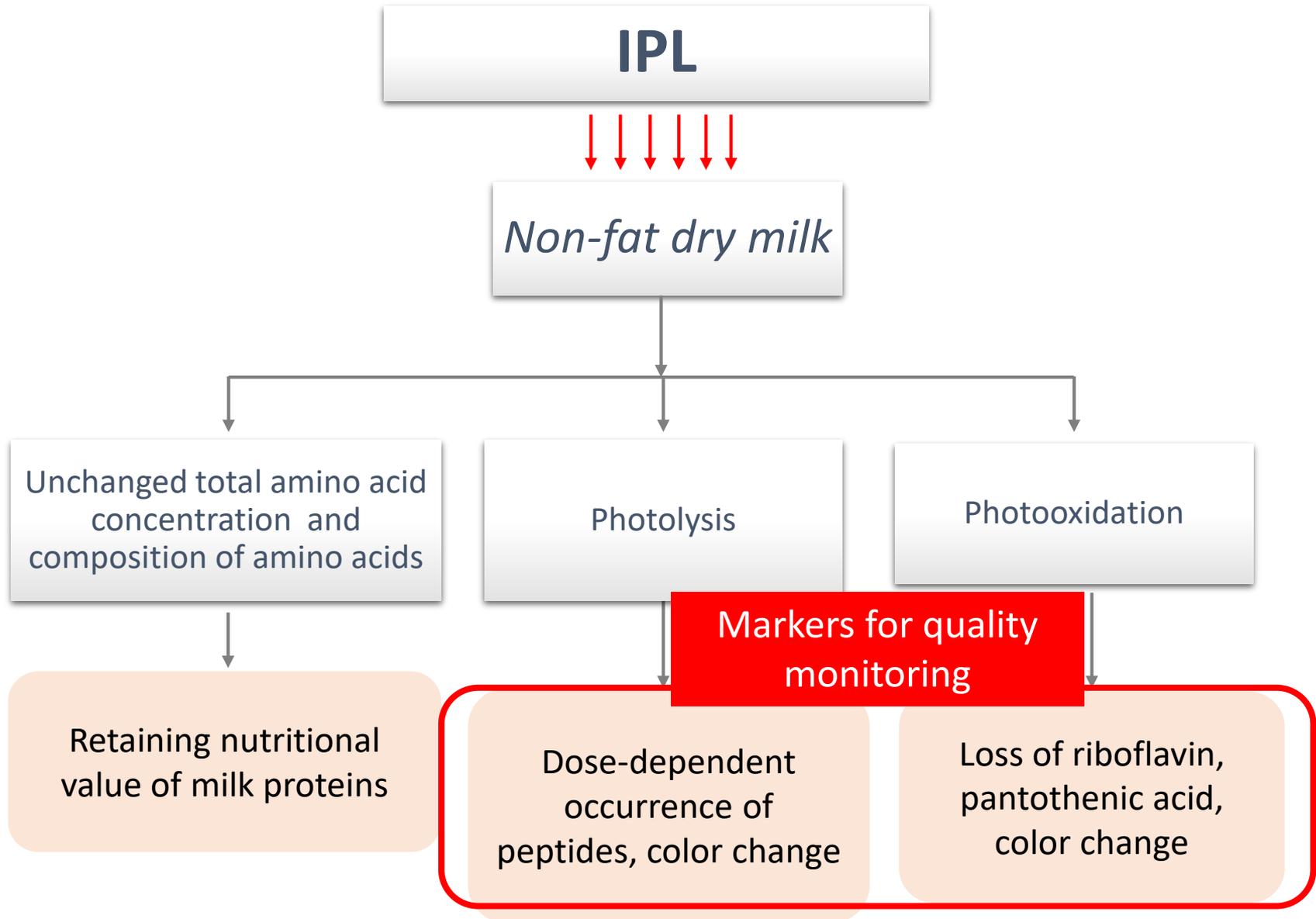
Effects on NFDM – Solvent extraction



- Polar fraction of the NFDM has most significant separation across treatments



Effects on NFDM



Acknowledgement



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