Voluntary exercise modulates the gut microbiota and improves skin inflammation in a mouse model

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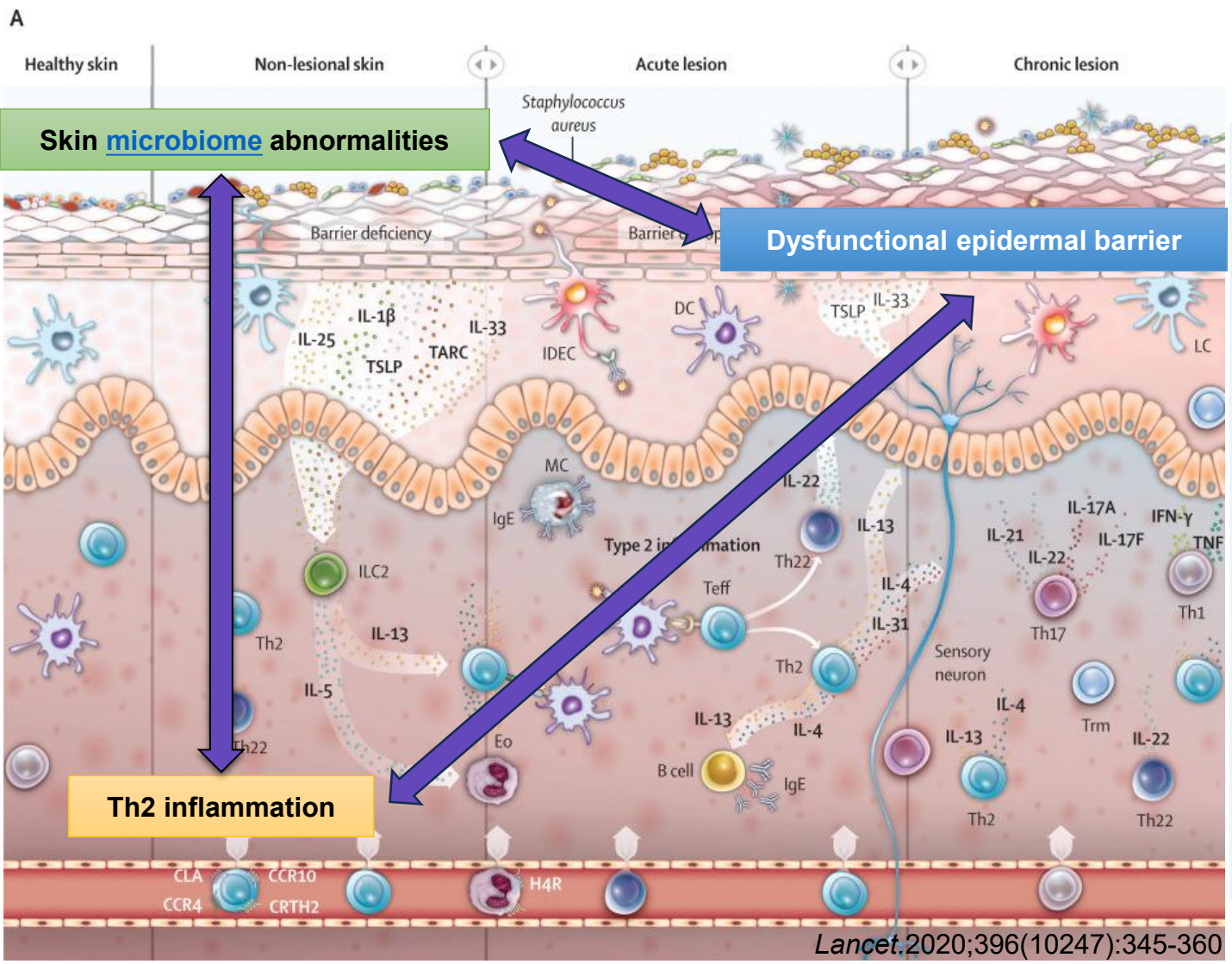
COI Disclosure

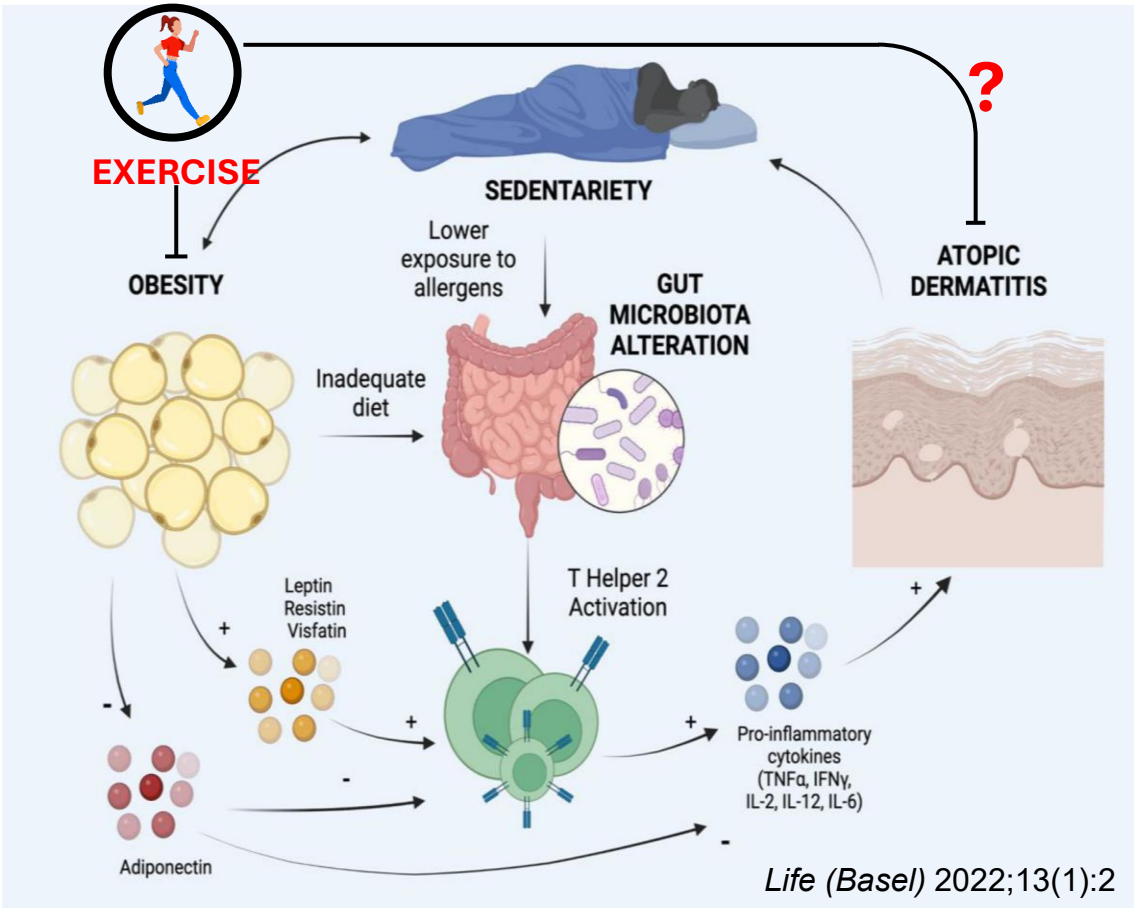
Wanchen Zhao, et al.

The authors have no financial conflicts of interest to disclose concerning the presentation.

What is atopic dermatitis (AD)



Lancet.2020;396(10247):345-360



Life (Basel) 2022;13(1):2

AD is associated with less physical activity

Atopic Dermatitis Is Associated with Less Physical Activity in US Adults

Jonathan I. Silverberg[1 2 3], Jing Song[4], Daniel Pinto[5 6], Sherry H. Yu[7], Abigail L. Gilbert[8], Dorothy D. Dunlop[2 4 6], Rowland W. Chang[4 5 6]

Table 1. Association of atopic dermatitis with physical activity as measured by daytime actigraphy in adults

	Atopic dermatitis					
	No (n = 3,061)	Yes (n = 189)				
Variable	Mean (95% CI)	Mean (95% CI)	Crude beta (95% CI)	*P*	Adjusted beta (95% CI)	*P*
Average daily activity (count)[1]	261275 (254825.6–267725.3)	239245 (222411.3–256079.4)	**−19562 (−35498 to −3627.32)**	**0.02**	**−15994 (−30536 to −1452.74)**	**0.03**
Average sedentary time (min)	489.7 (485.0–494.4)	510.6 (494.8–526.4)	15.83 (−1.83 to 33.50)	0.08	12.74 (−4.30 to 29.79)	0.13
Average light activity (min)	344.4 (338.5–350.3)	329.6 (311.9–347.2)	−14.19 (−31.41 to 3.04)	0.10	−7.91 (−27.39 to 6.35)	0.20
Average moderate-vigorous activity (min)	21.2 (20.0–22.4)	17.9 (15.5–20.4)	**−2.68 (−5.42 to −0.06)**	**0.04**	**−2.12 (−3.92 to −0.33)**	**0.02**

Survey linear regression models were constructed with minutes of average daily activity, sedentary time, light activity, and moderate-vigorous activity as measured by actigraphy being the dependent (outcome) continuous variables and history of atopic dermatitis (binary) as the independent (explanatory) variable. Multivariate models included age (continuous), gender (binary), race/ethnicity (white vs. other), birthplace in the United States (binary), highest level of education in the household (less than high school vs. high school or greater), type of home (house vs. other), body mass index (<18, 18–24, 25–29, ≥30), and daily wear time of the actigraph (continuous) as covariates. Domain analysis was performed to yield appropriate estimates of variance. Crude and adjusted beta and 95% confidence intervals (95% CI) were determined.

Boldface indicates significant value.

[1]Average daily activity is the average total daily accelerometer count.

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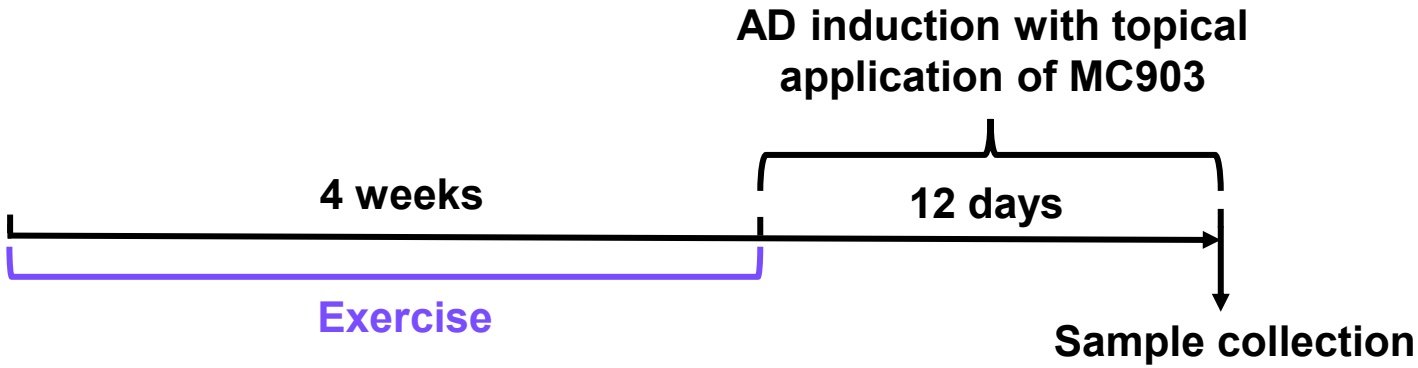
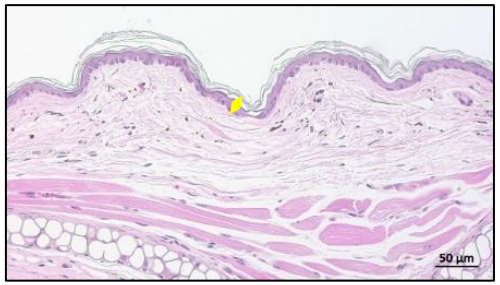
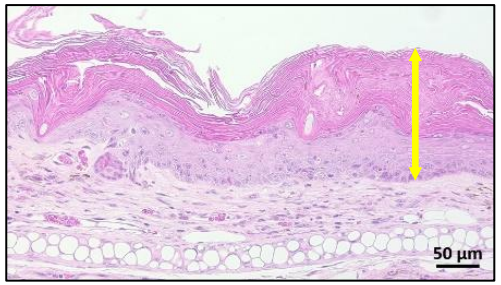
Induction of AD in exercised mice



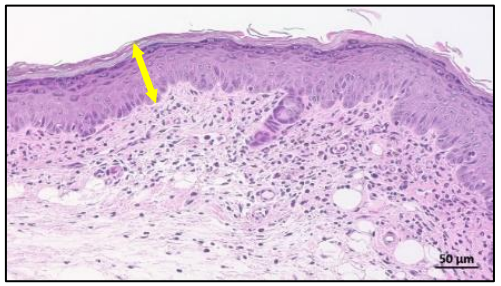
Voluntary running exercise may improve AD



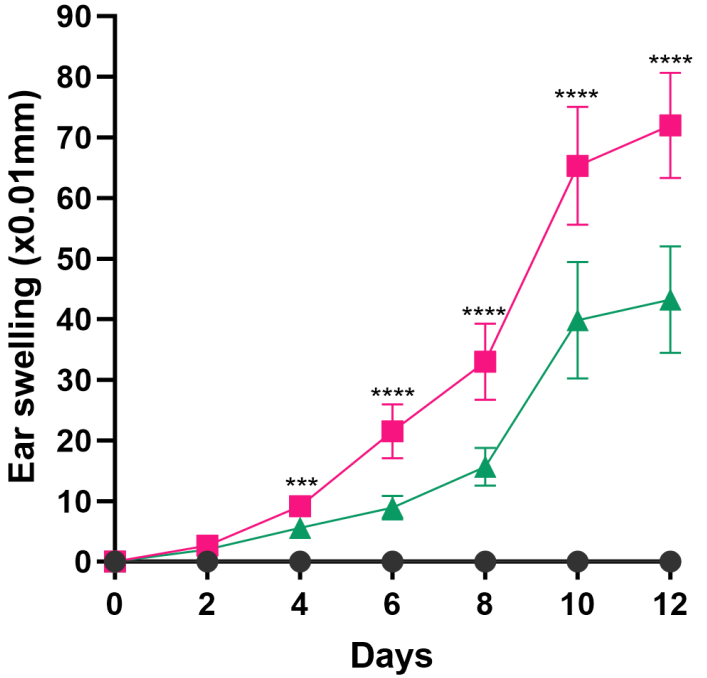
Sedentary + ethanol

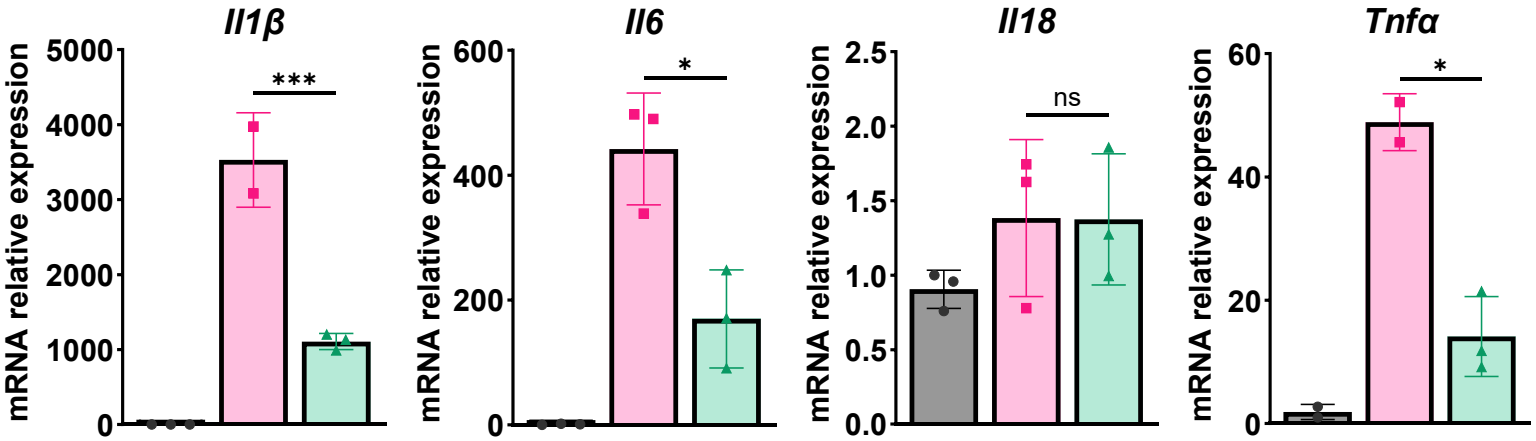


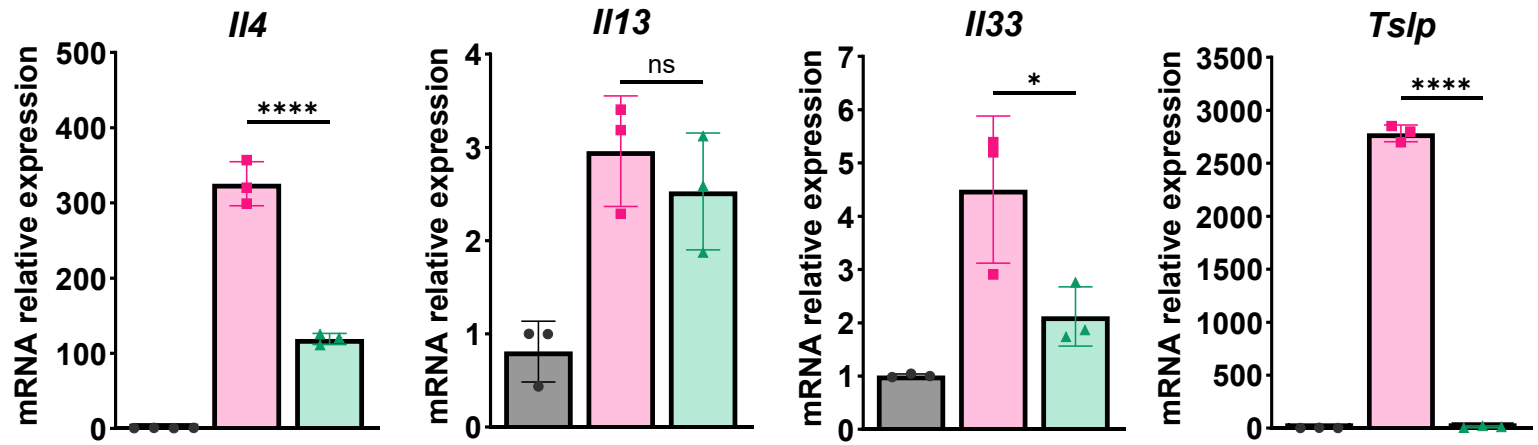
Sedentary + AD induction

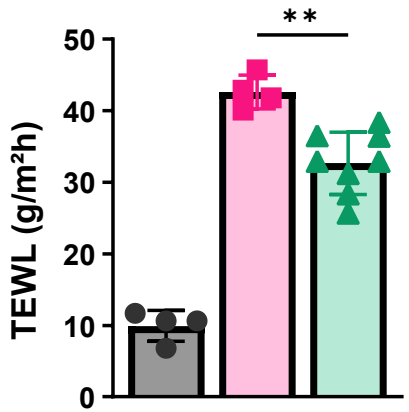


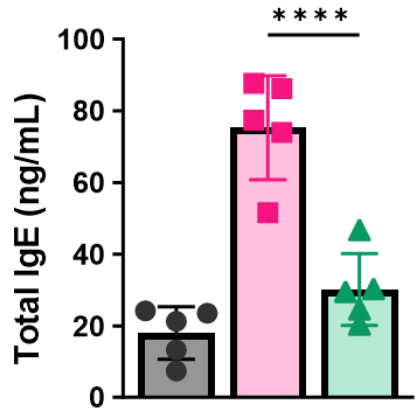
Pre-exercise + AD induction











Co-housing with exercised mice alleviates AD symptoms

Co-housing → **Gut microbiota modulation**

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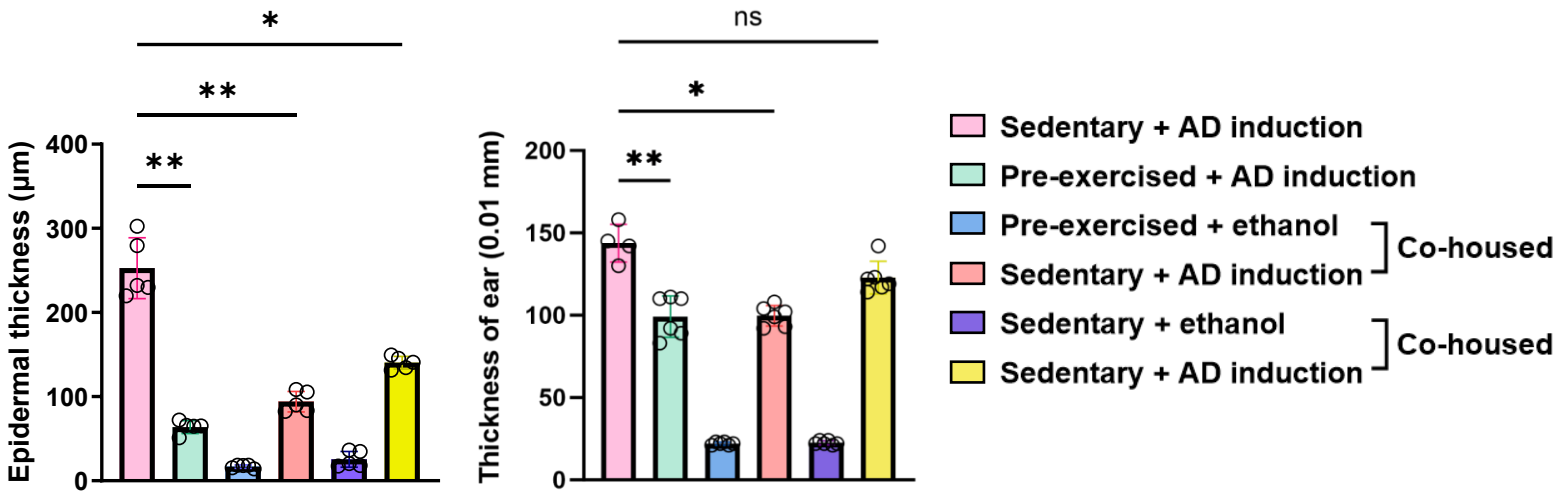
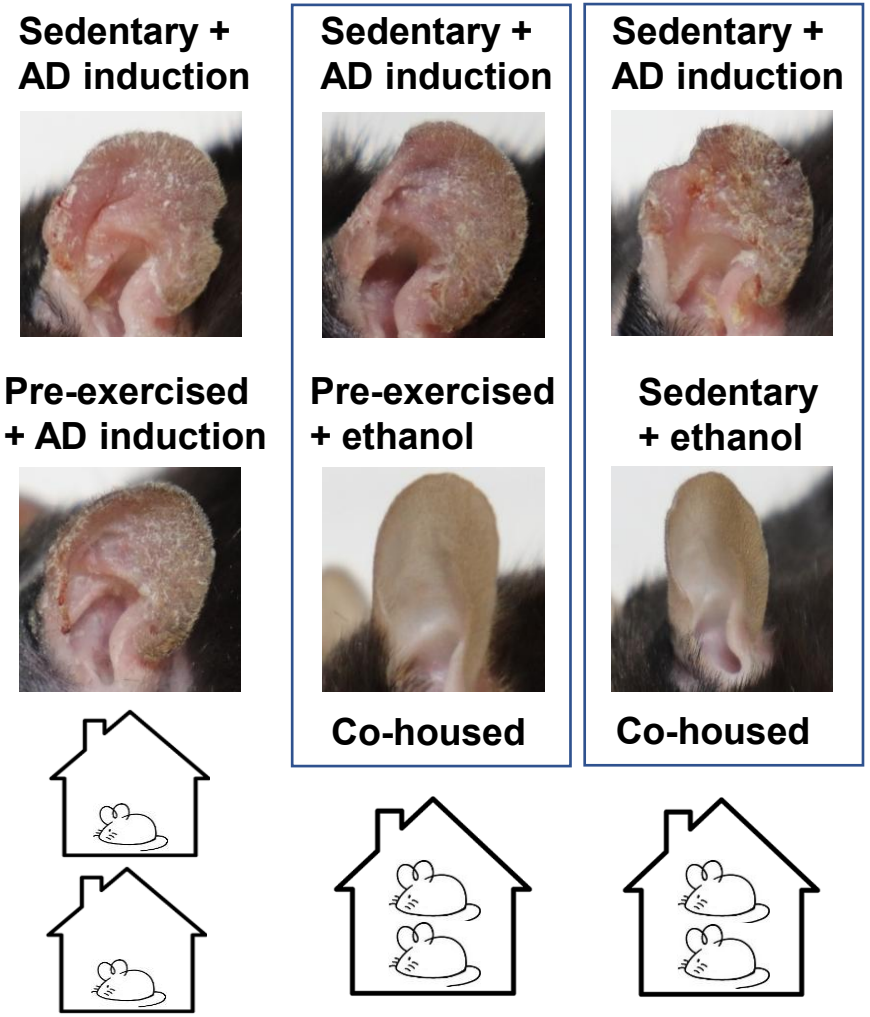
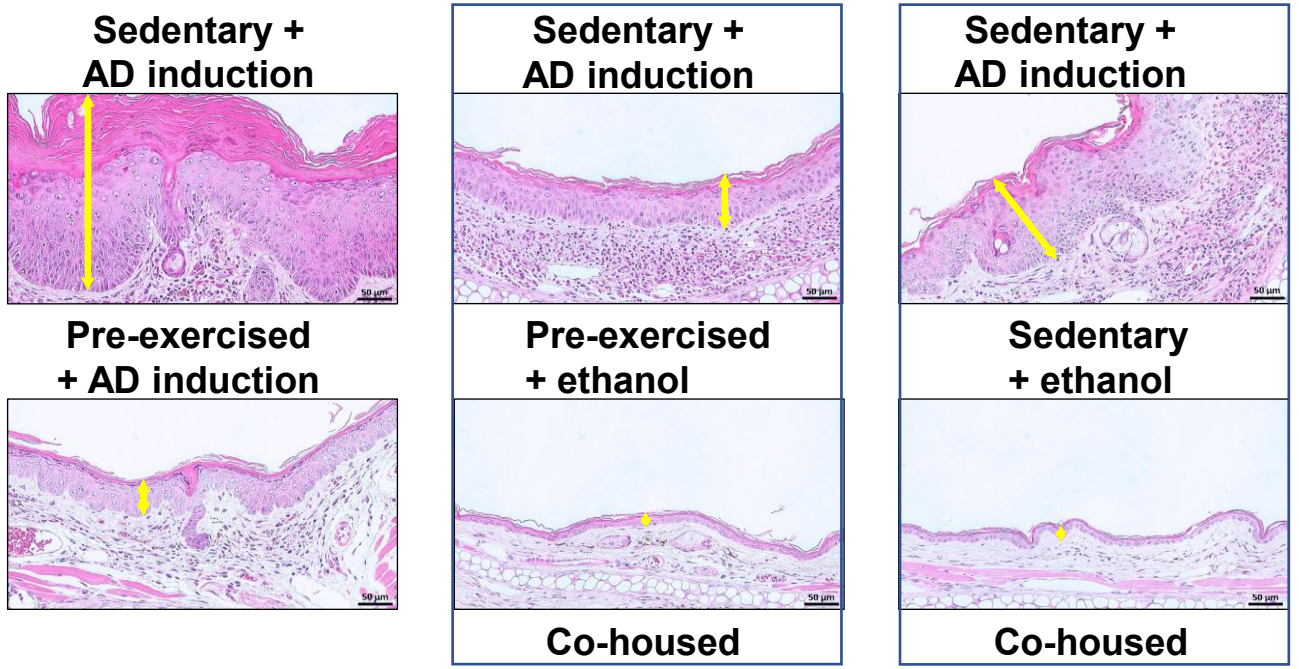
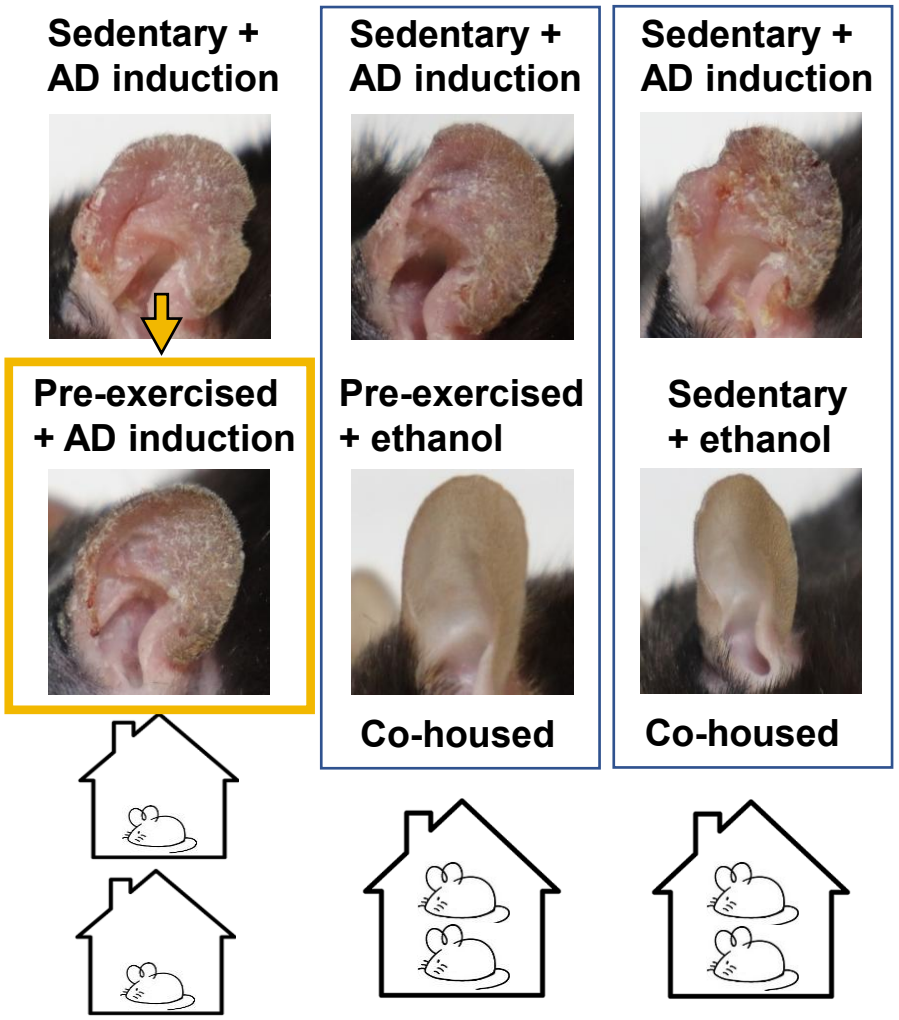
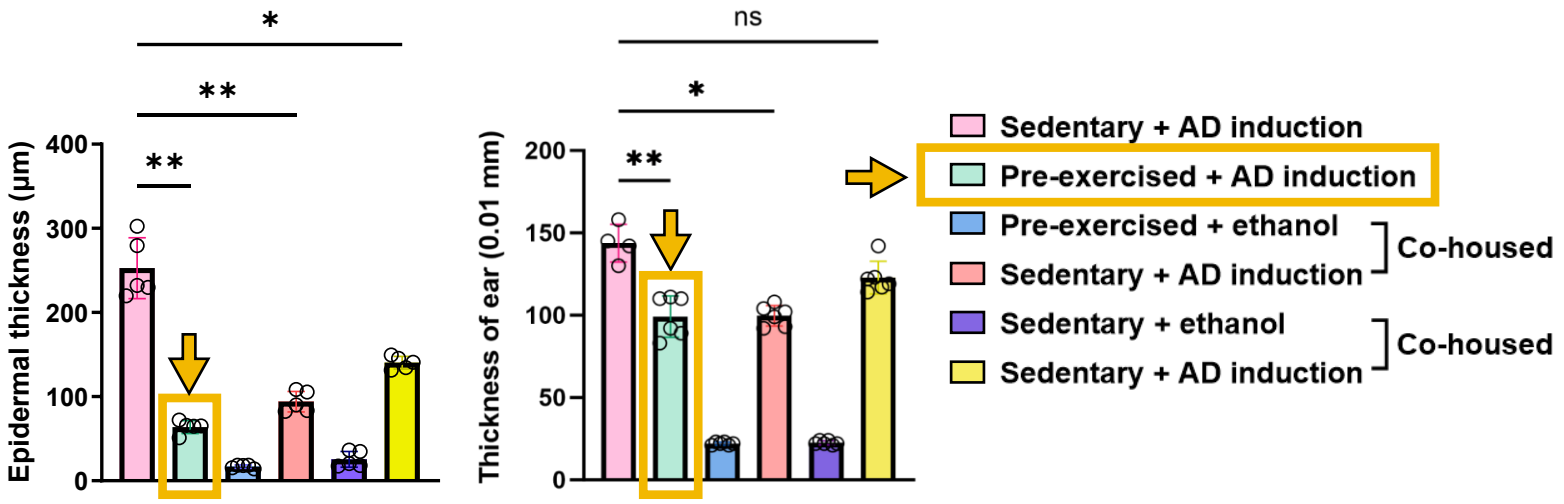


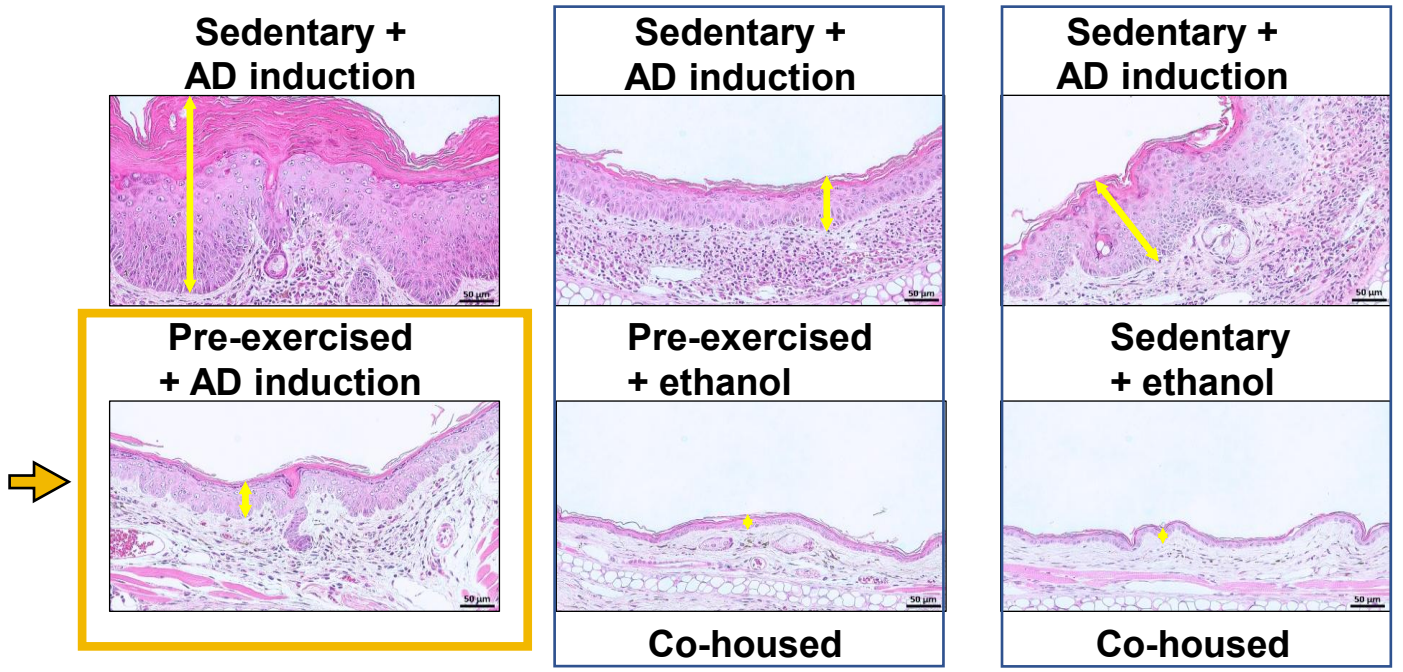




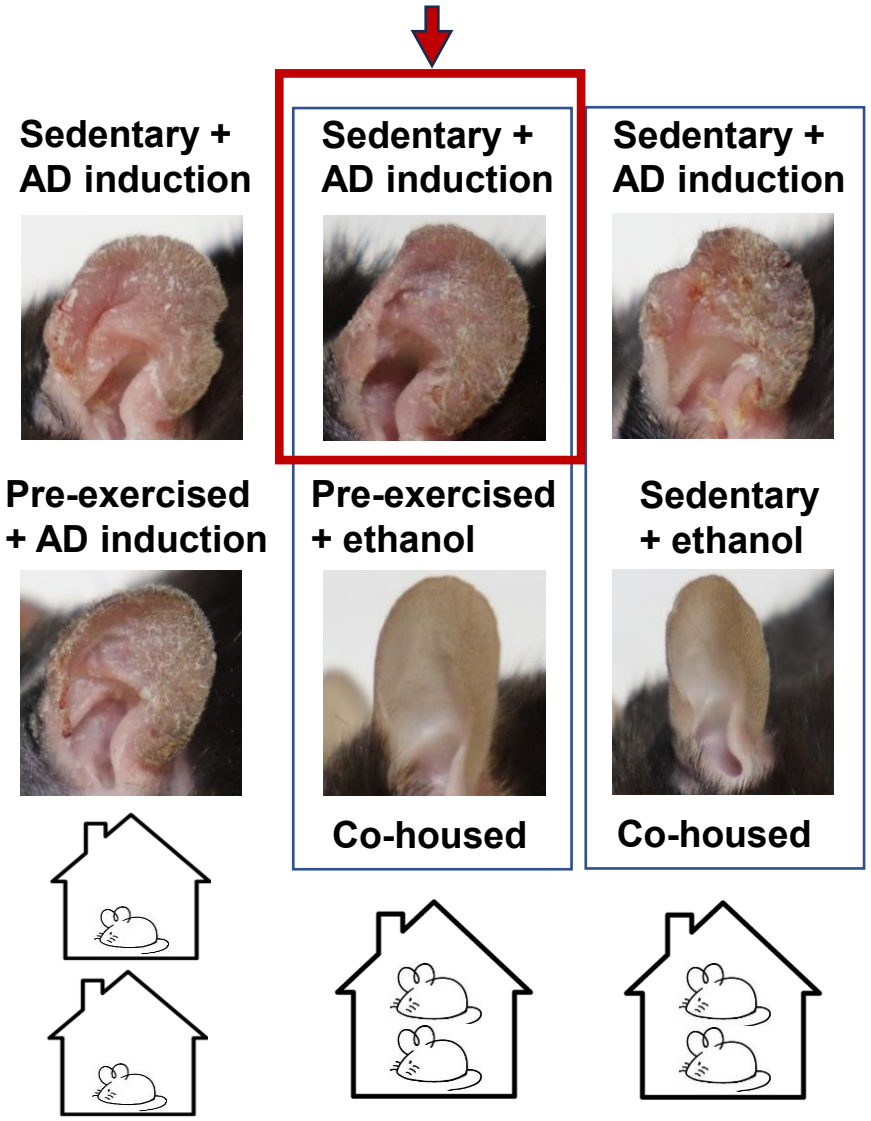
Co-housing with exercised mice alleviates AD symptoms

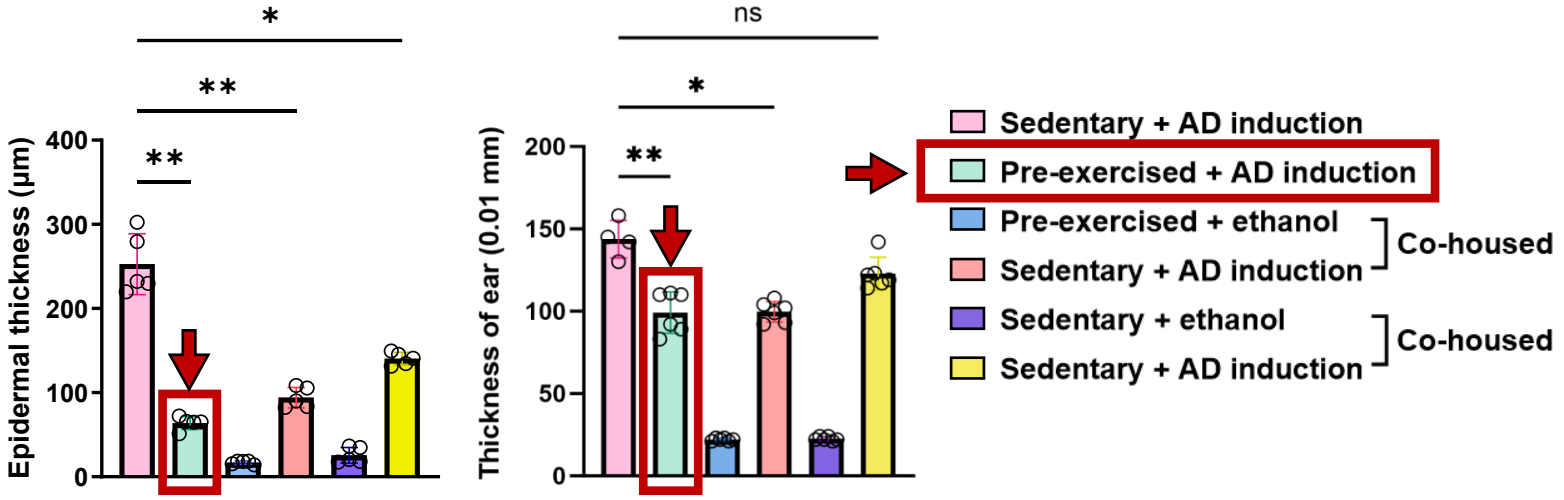


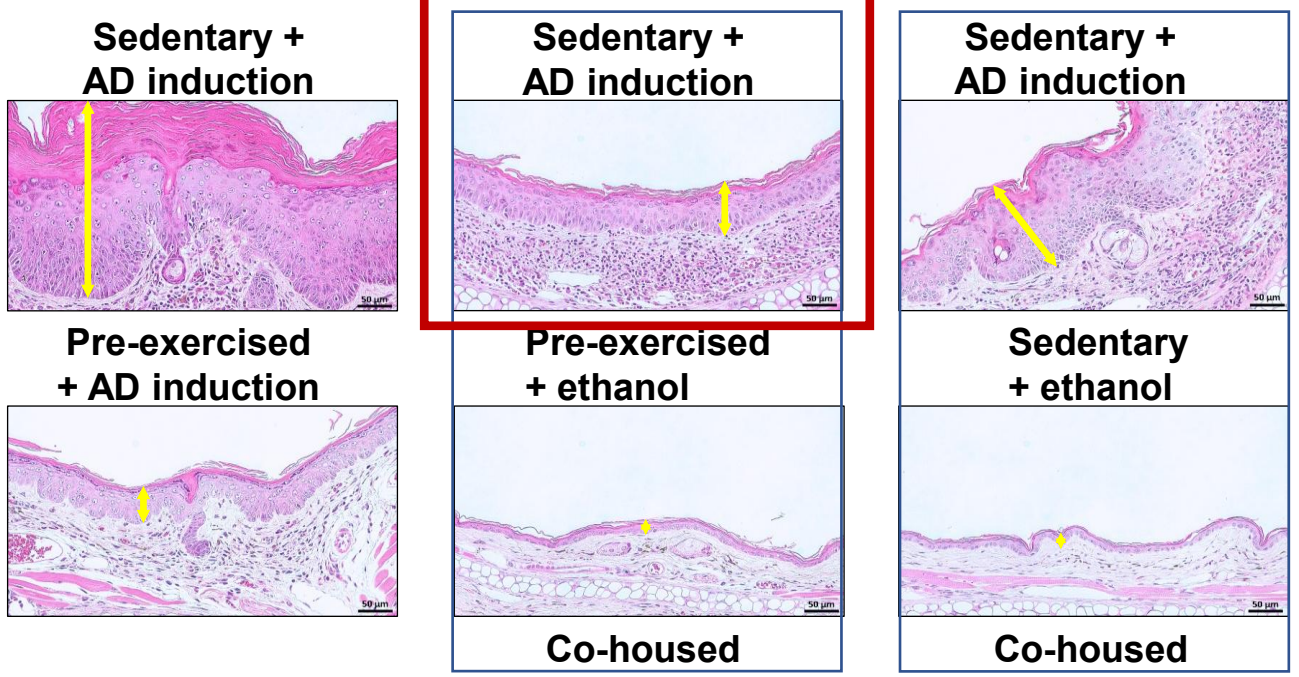




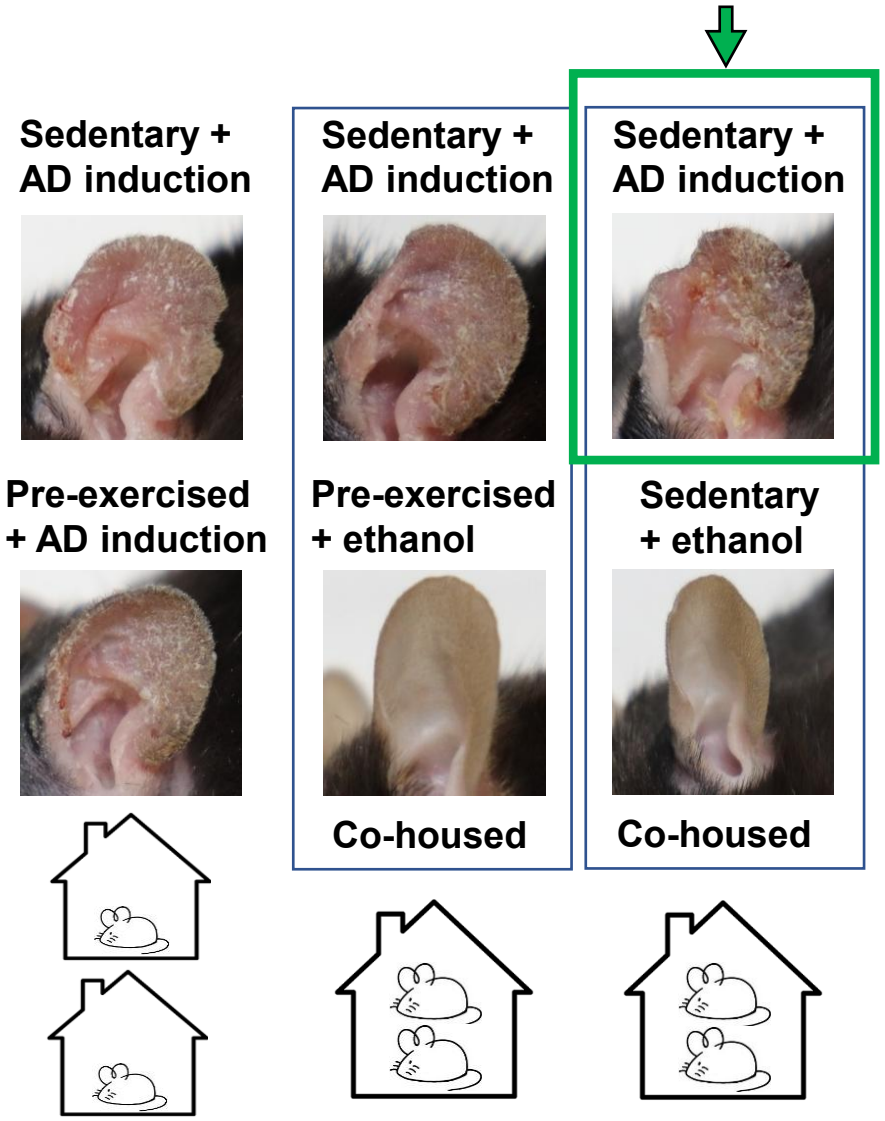
Co-housing with exercised mice alleviates AD symptoms

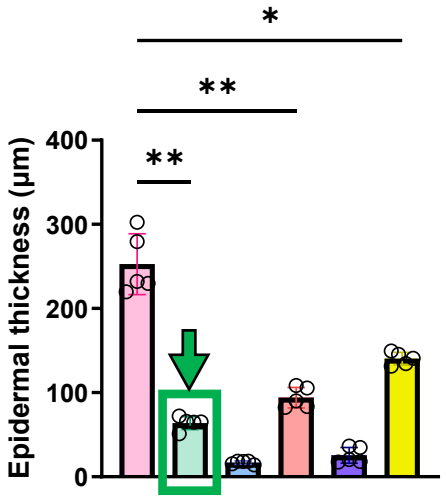


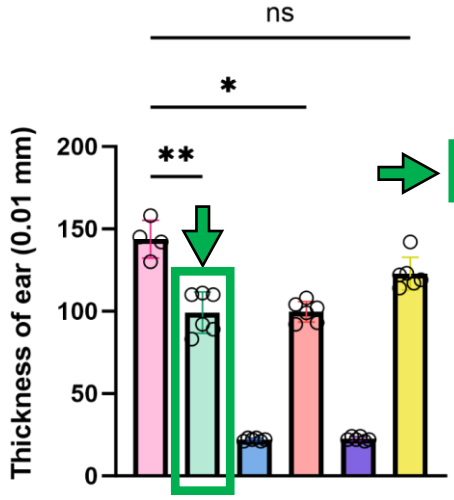


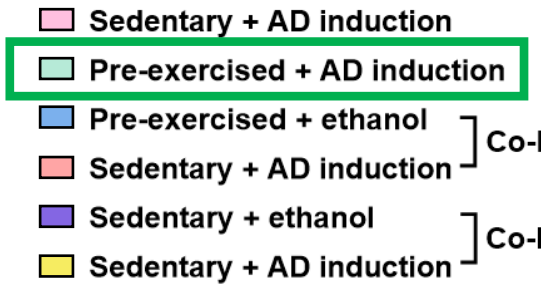


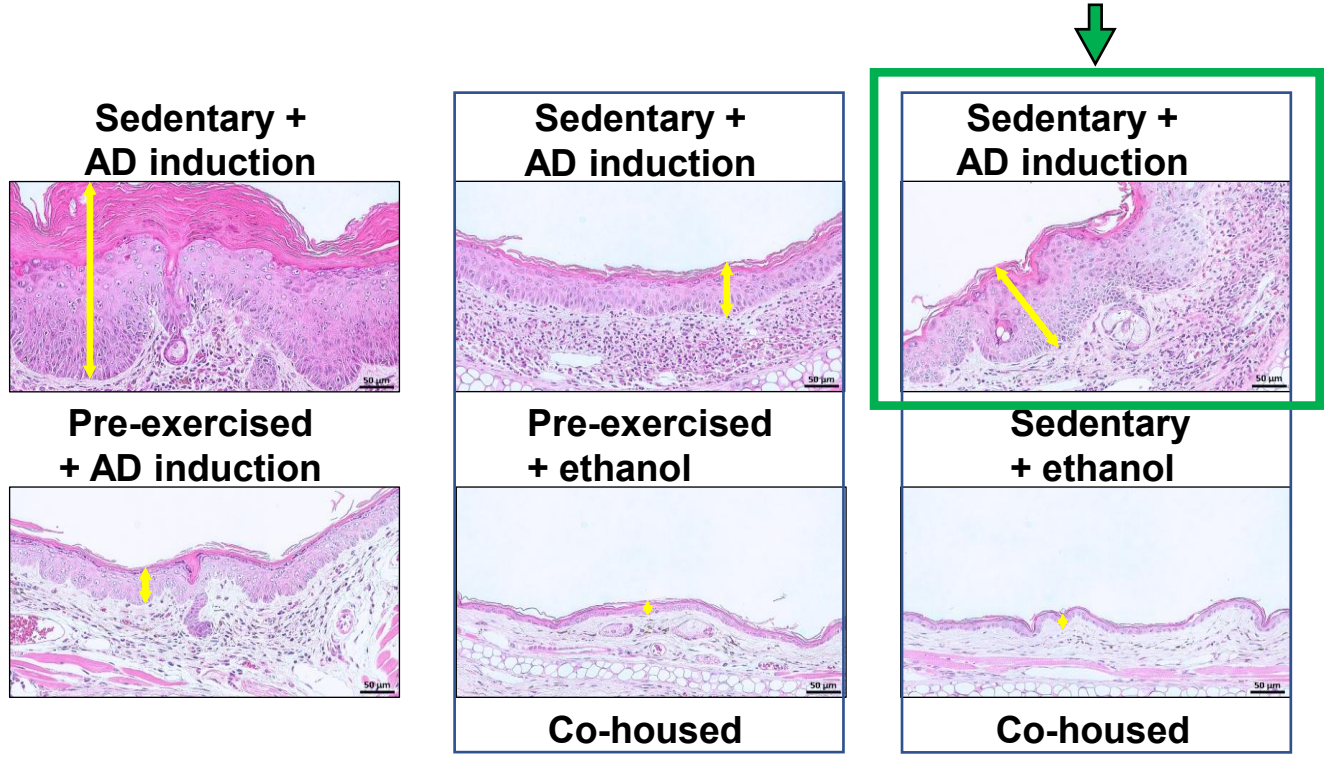
Co-housing with exercised mice alleviates AD symptoms



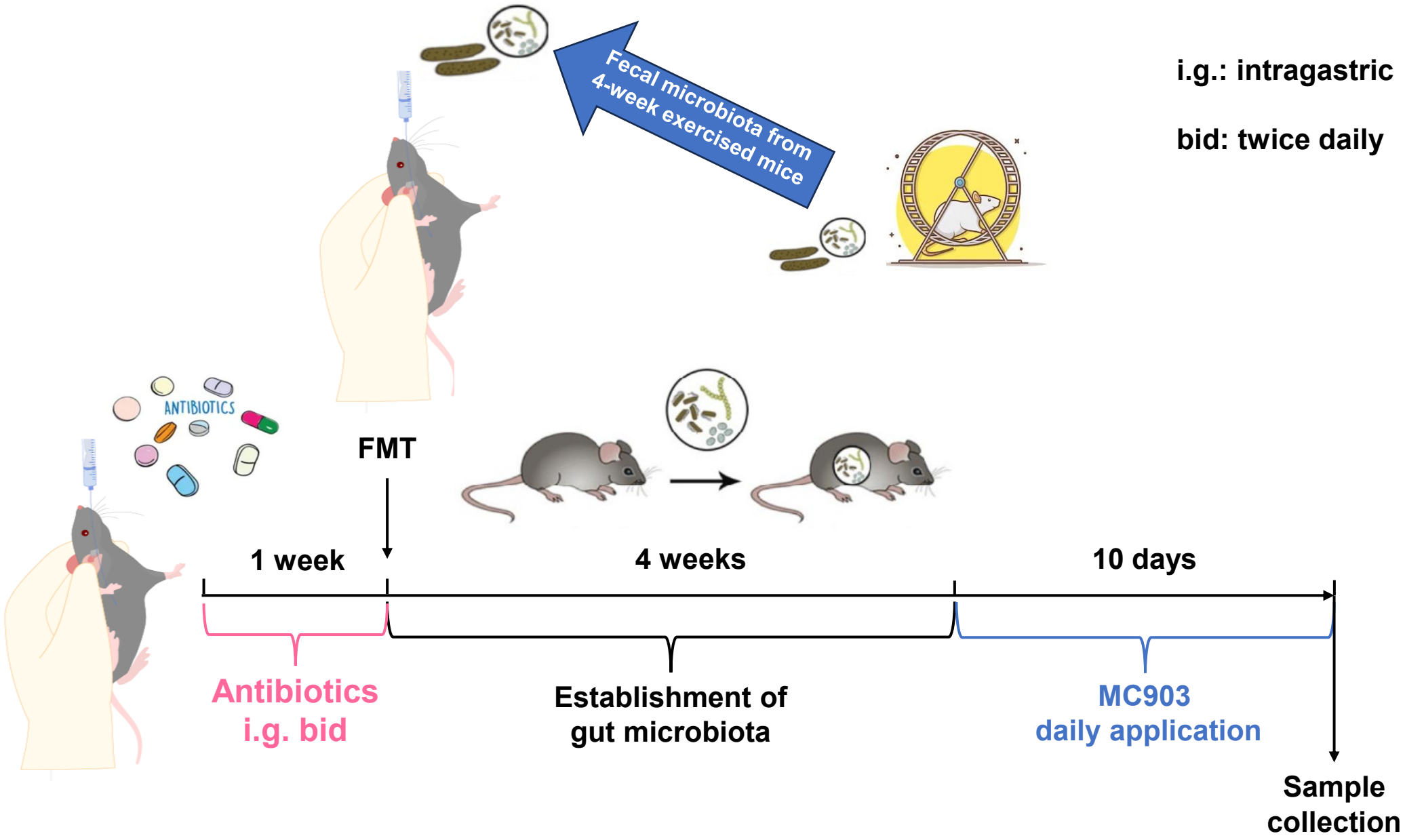






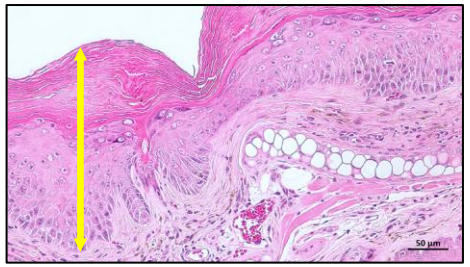


Fecal microbiota transplantation (FMT) from exercised mice

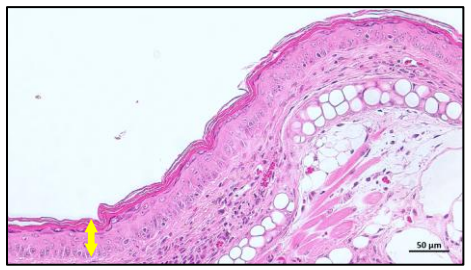


FMT from exercised mice improves AD

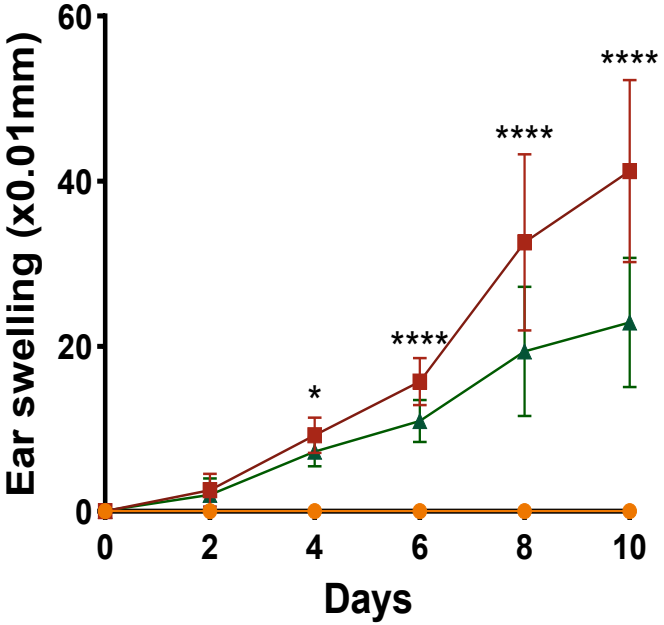
Sedentary fecal transplantation before ethanol application

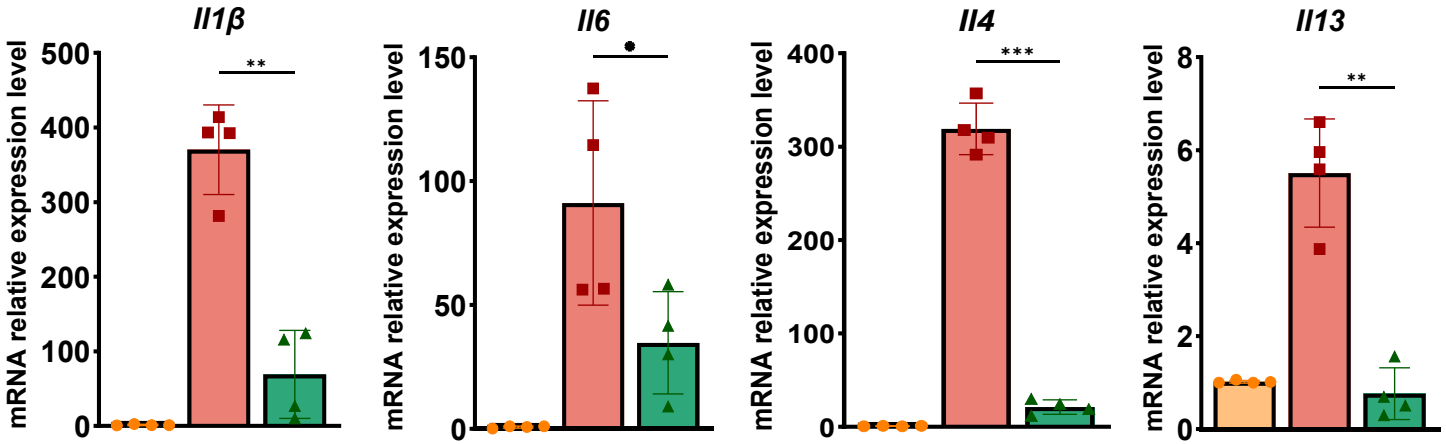


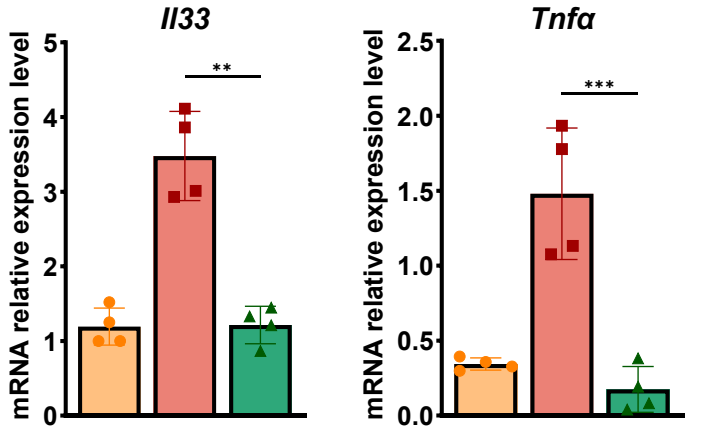
Sedentary fecal transplantation before AD induction



Pre-exercised fecal transplantation before AD induction



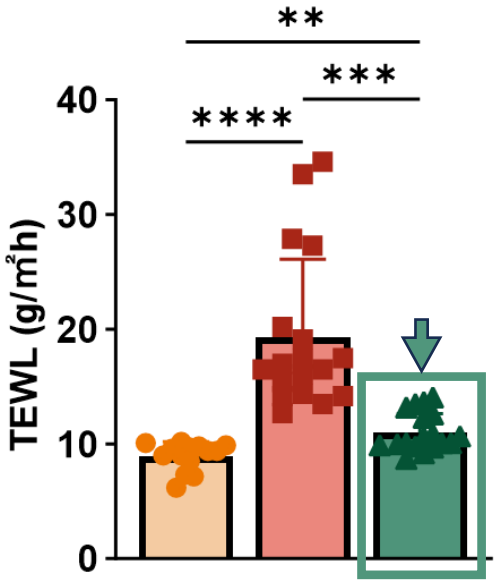




Sedentary fecal transplantation before ethanol application

Sedentary fecal transplantation before AD induction

Pre-exercised fecal transplantation before AD induction

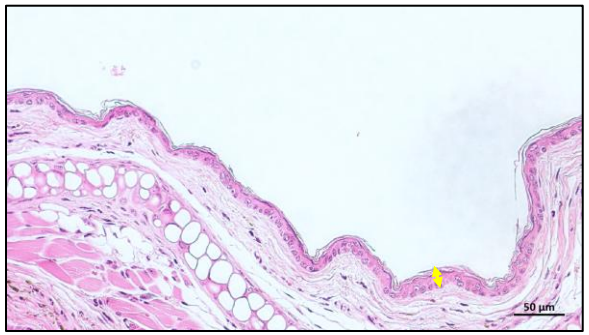


Depletion of gut microbiota in exercised mice

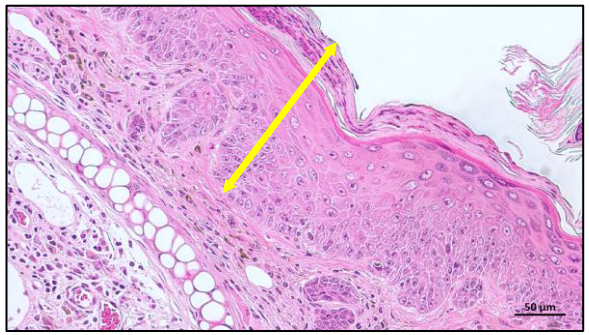
i.g.: intragastric

bid: twice daily

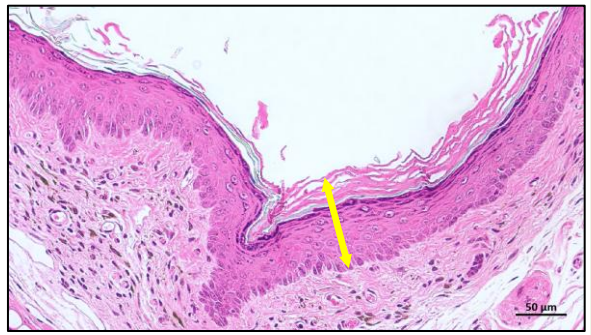
Gut microbiota is necessary for the protective effect of exercise in AD



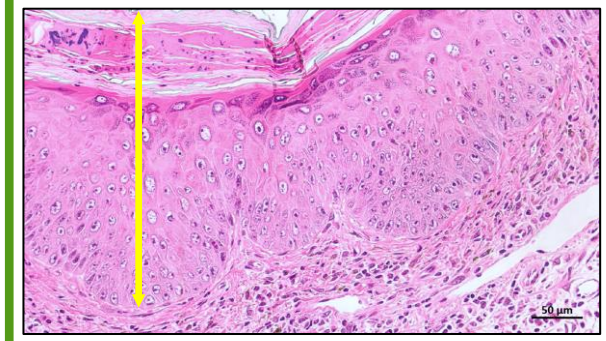
Sedentary + ethanol



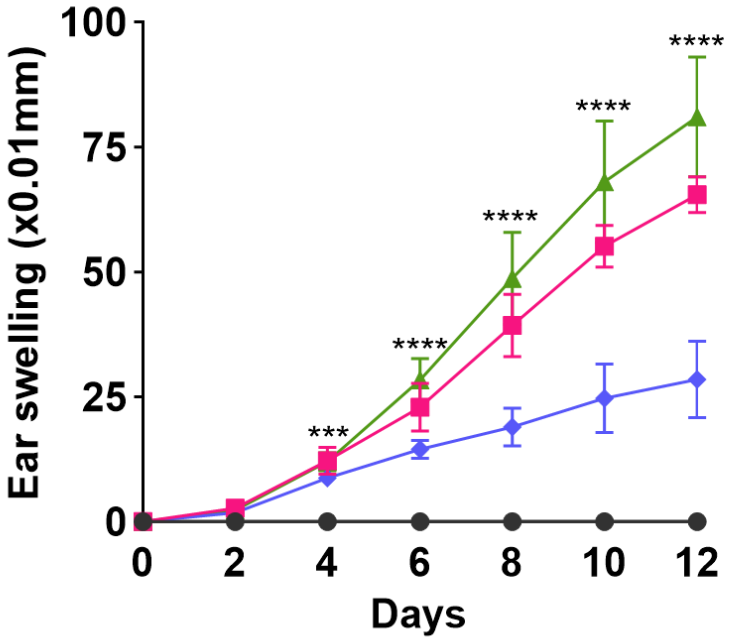
Sedentary + AD induction



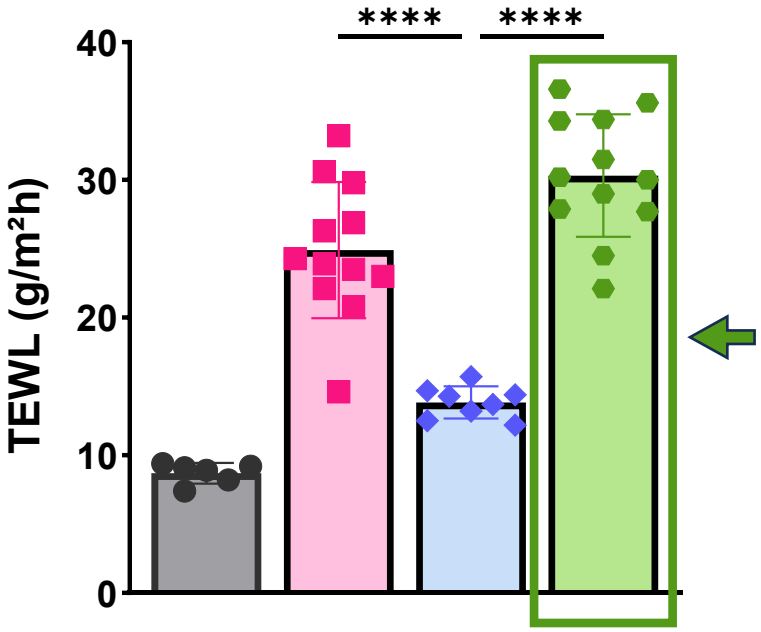
Pre-exercised + AD induction



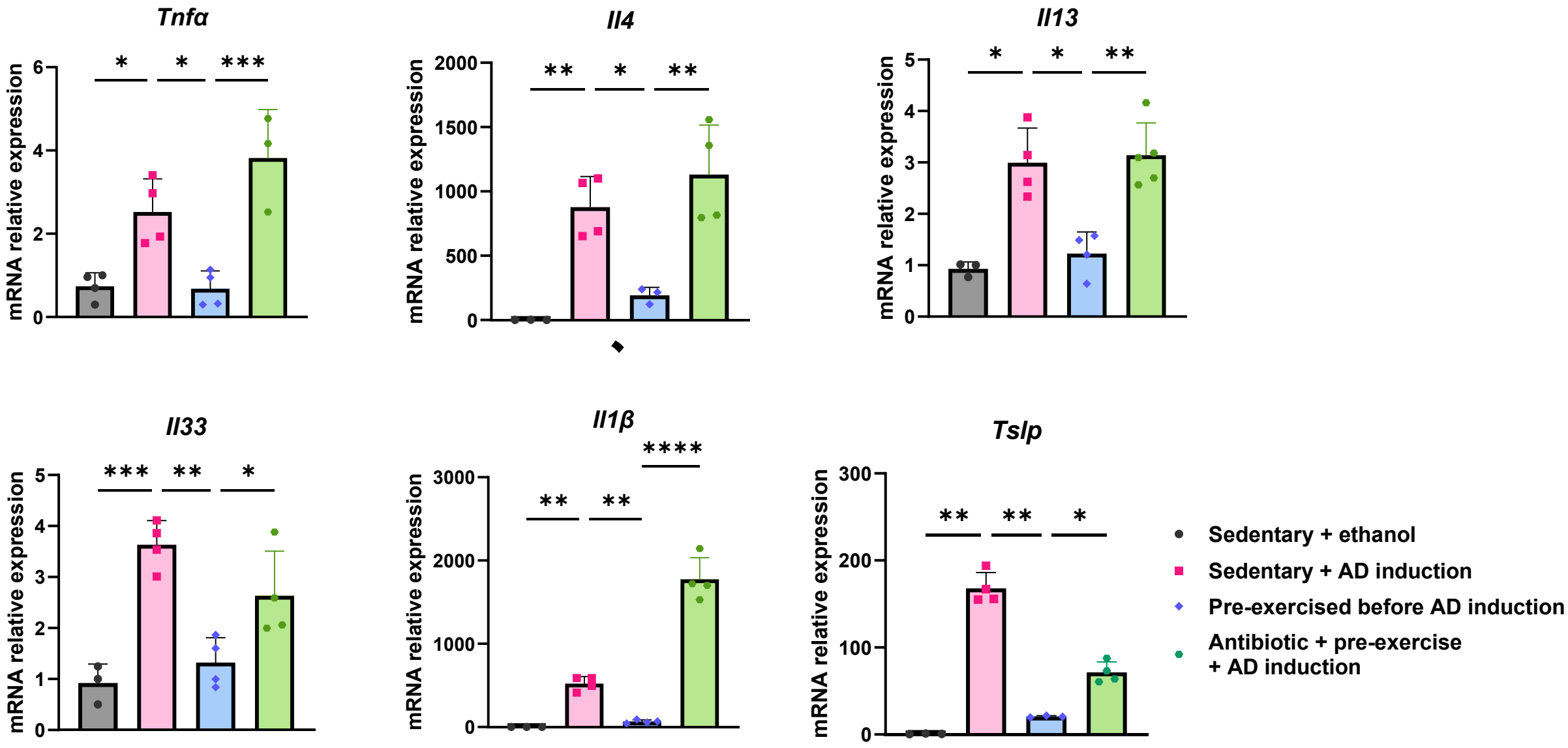
Antibiotic + pre-exercised + AD induction



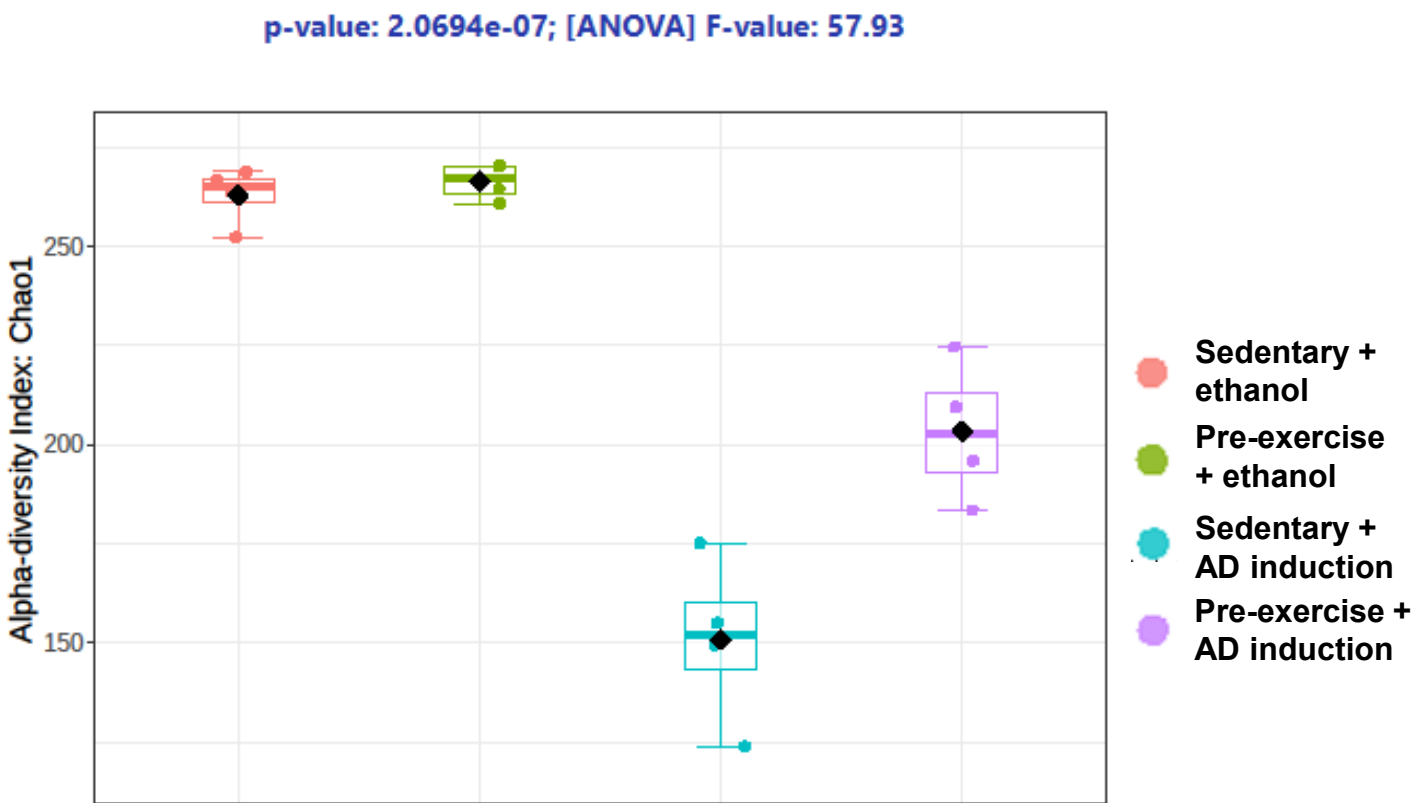
- Sedentary + ethanol
- Sedentary + AD induction
- Pre-exercised + AD induction
- Antibiotic + pre-exercised + AD induction

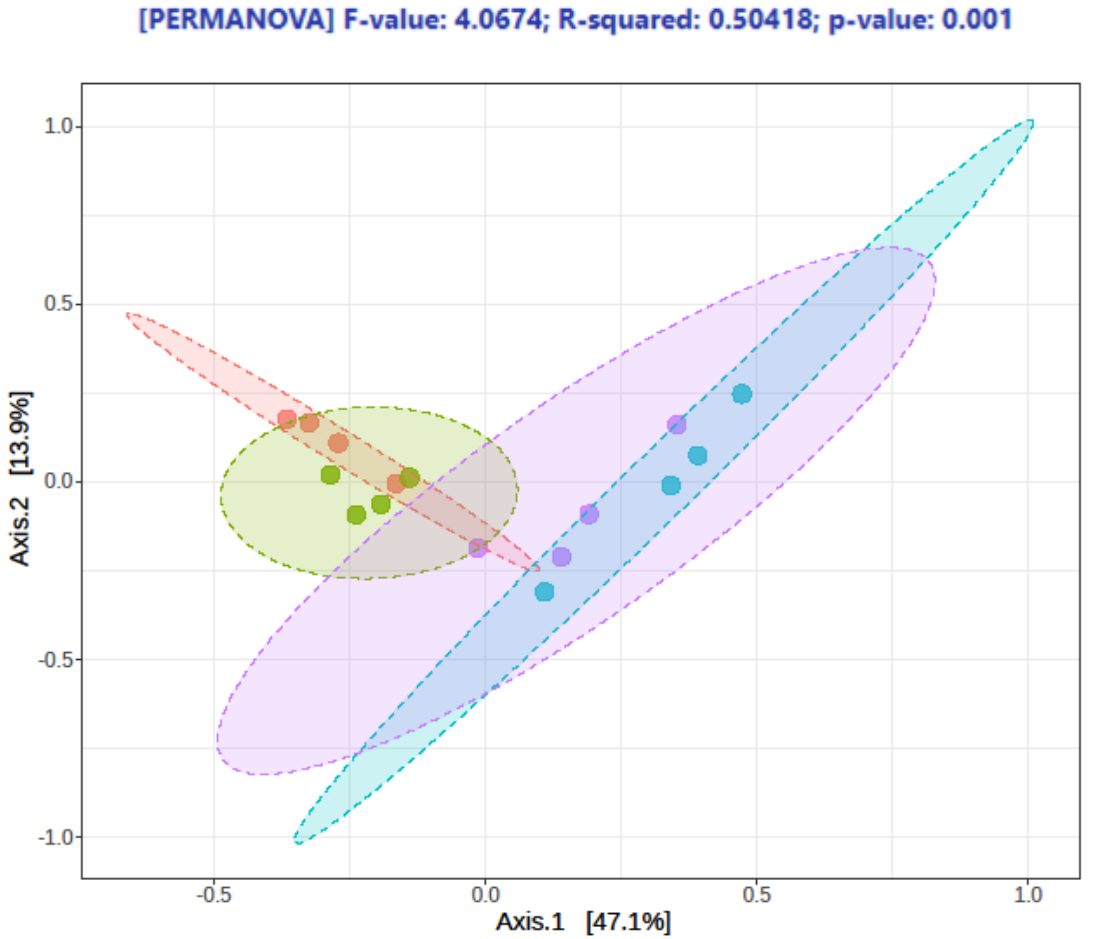


Gut microbiota is necessary for the protective effect of exercise in AD



Exercise modulates the gut microbiota

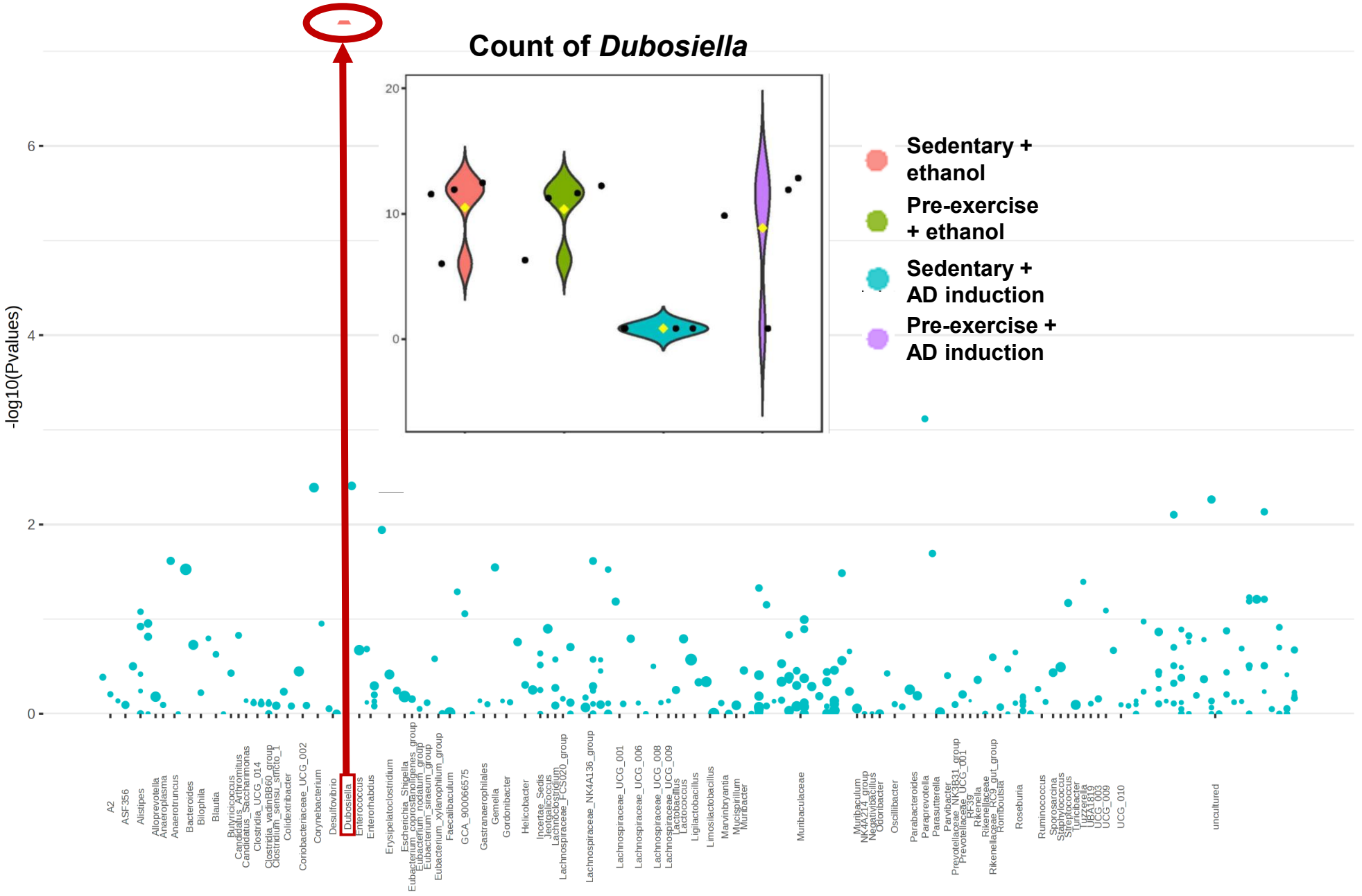




α-diversity analysis: reflects the richness and evenness of microbial species present in a given community

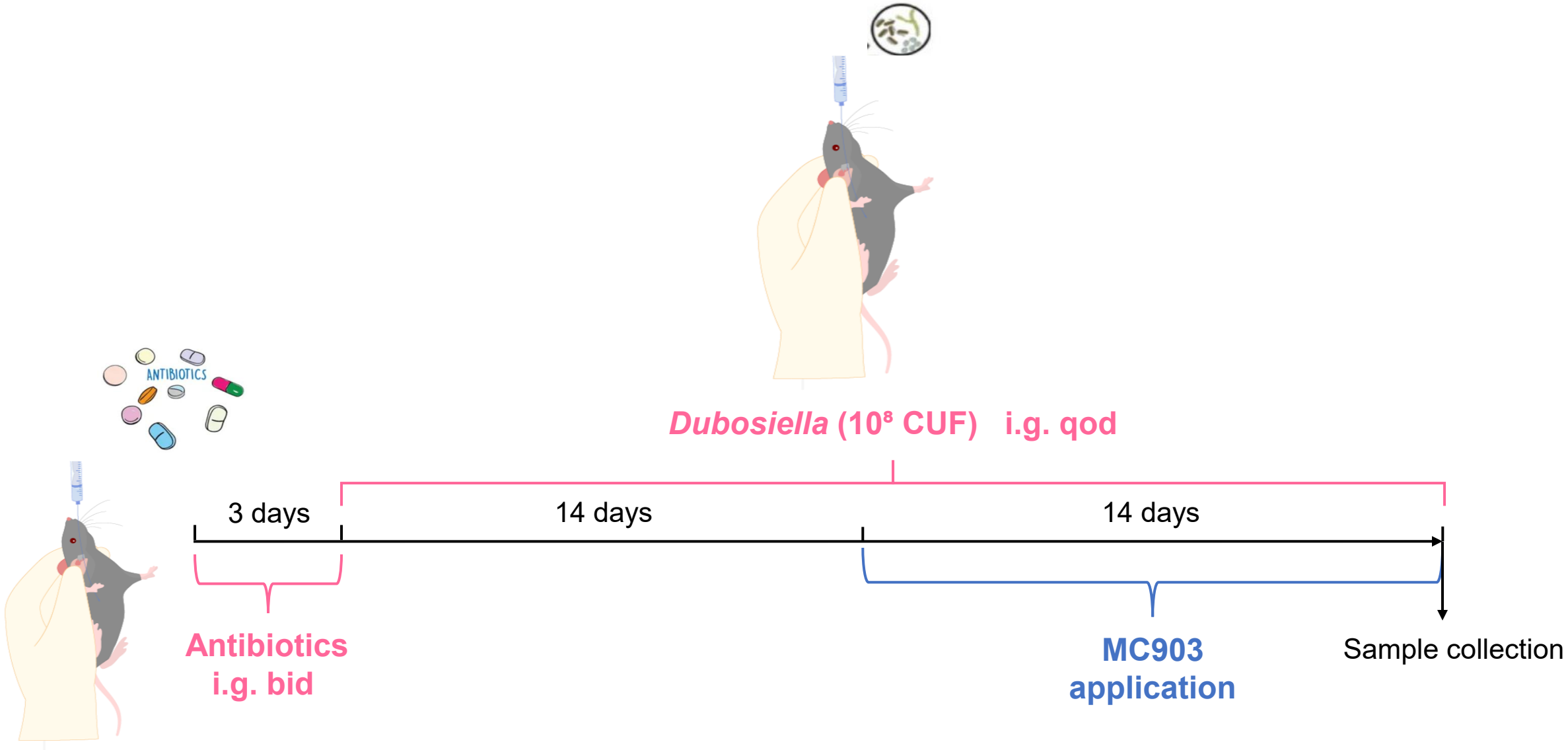
β-diversity analysis: helps to understand how microbial communities differ from one another in terms of species composition, structure, and abundance

Dubosiella is depleted in AD but recovered by exercise

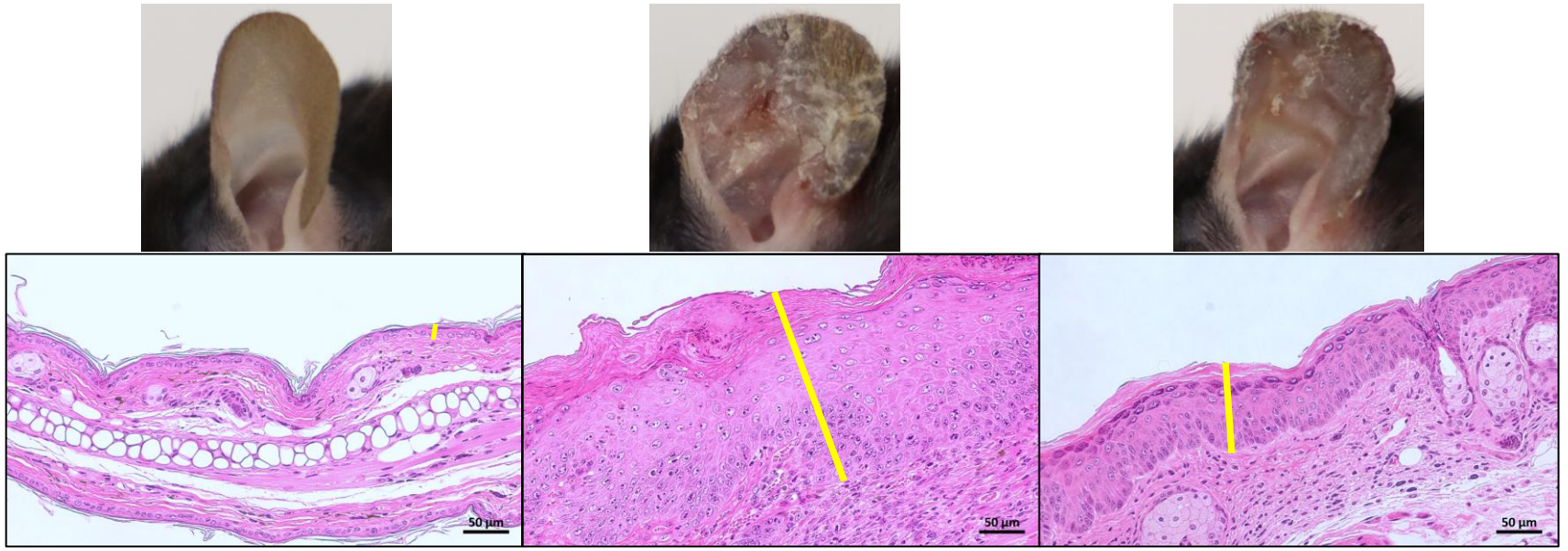


Dubosiella transplantation in AD mice

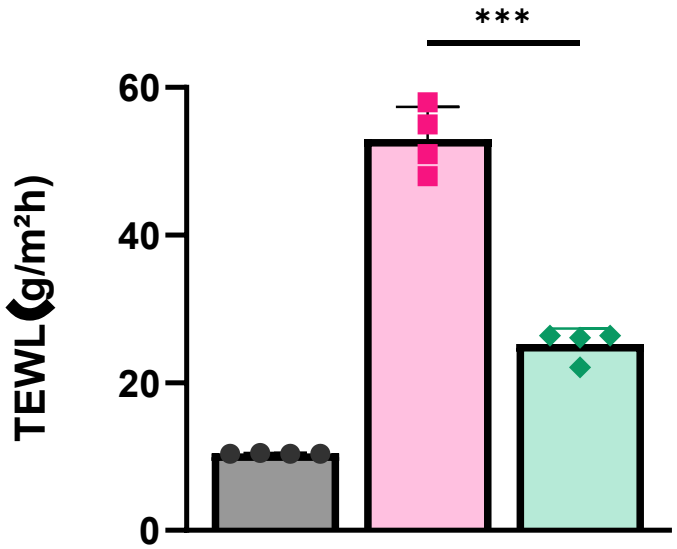
i.g.: intragastric administration

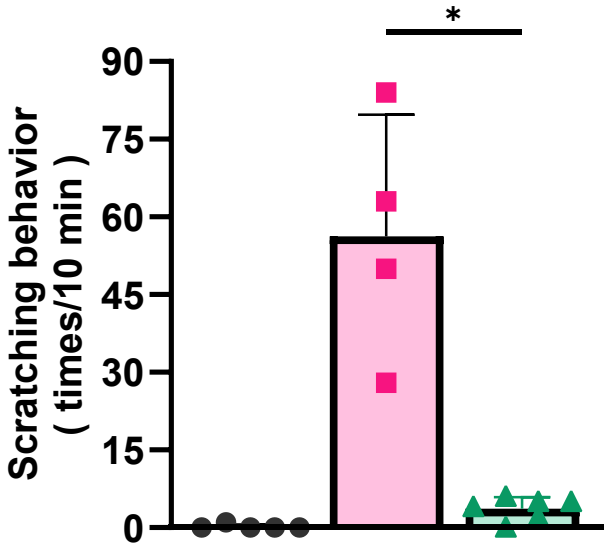


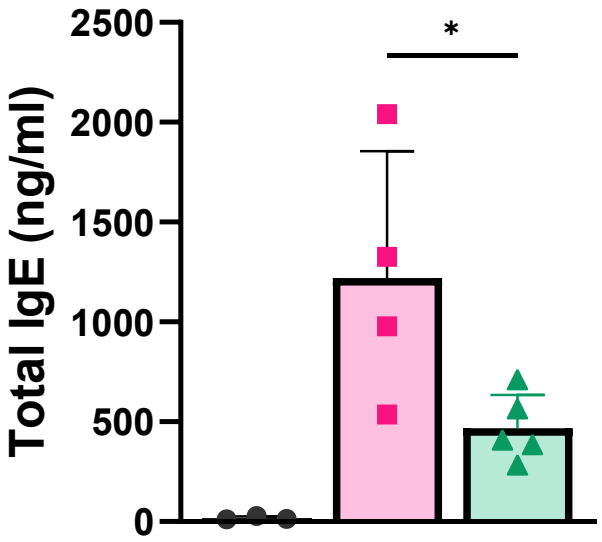
Dubosiella transplantation alleviated inflammation symptoms

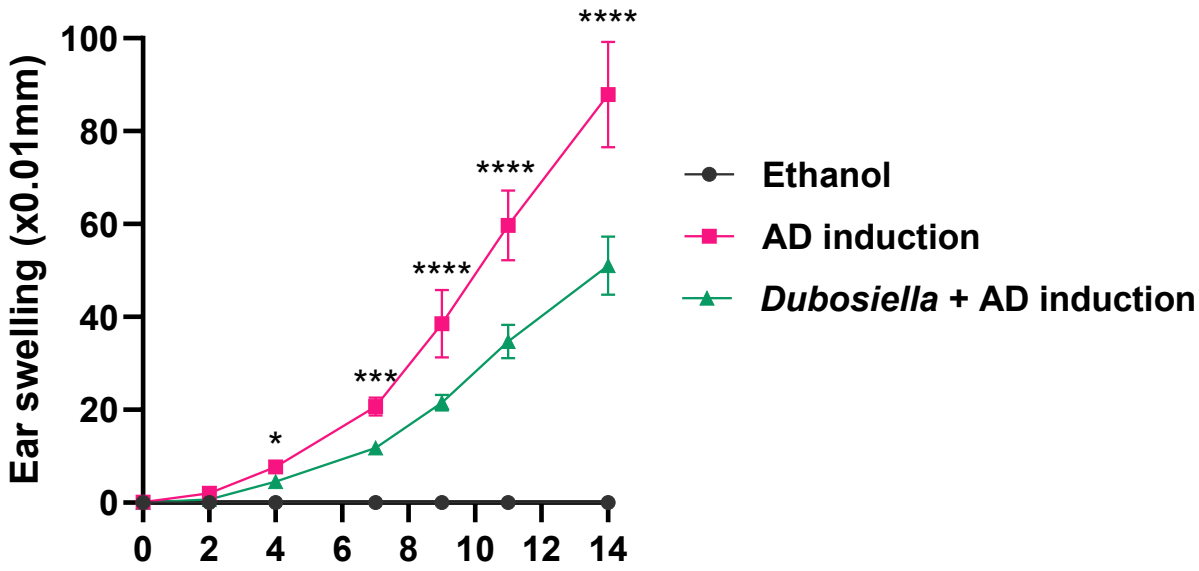


Ethanol | AD induction | *Dubosiella* + AD induction

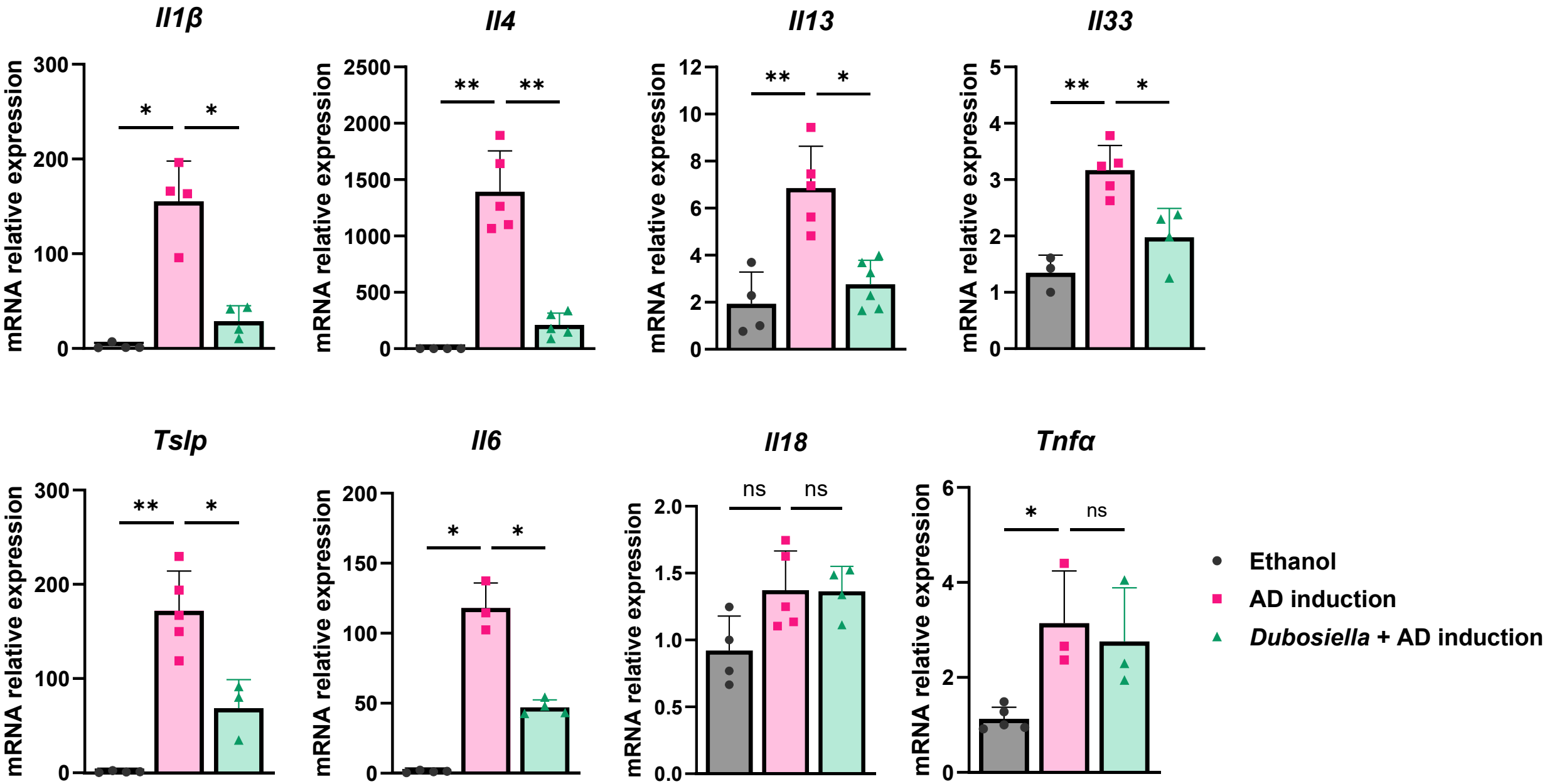








Dubosiella transplantation alleviated inflammation symptoms



Conclusion

- Exercise may prevent AD by regulating the gut microbiota.
- *Dubosiella* transplantation alleviated inflammation in AD mouse model.

Exercise may serve as a preventive approach for AD.

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Prof. Ko Okumura,
Prof. Hideoki Ogawa,
Prof. François Niyonsaba

JSPS 科研費 KAKENHI

アトピー疾患研究センター
Atopy Research Center

Thank you for your attention