**Supplementary Table 1.**

**Body weight changes after hyperoxia and/or rituximab treatment (X ±SD).** All samples were weighted at postnatal days 7, 12, and 17 and displayed mean ± SD gram. LDR: Low-dosage (20 mg/kg) rituximab and reared in hyperoxia (75% oxygen). HDR: High-dosage (40 mg/kg) of rituximab and reared in hyperoxia. PBS: Received placebo (PBS) and reared in hyperoxia. CTL: Received placebo (PBS) and reared in conventional environment (21% oxygen) as healthy control. LHE: Lactating mice reared in hyperoxia. LCE: Lactating mice reared in conventional environment.

| Group | Sample size | Weight P7 (g) | Weight P12 (g) | Weight P17 (g) |
|-------|-------------|---------------|---------------|---------------|
| CTL   | 12          | 3.00±0.24     | 3.93±0.33     | 6.64±0.18*    |
| LDR   | 12          | 2.97±0.42     | 3.95±0.46     | 6.33±0.32*    |
| HDR   | 12          | 3.03±0.16     | 3.89±0.28     | 6.17±0.38**   |
| PBS   | 9           | 3.06±0.24     | 4.02±0.32     | 6.42±0.25     |
| LCE   | 3           | 21.83±0.62    | 21.67±1.25    | 21.67±1.25    |
| LHE   | 3           | 20.83±0.94    | 20.97±0.86    | 21.33±0.94    |

Compared with PBS: *P < 0.05; **P < 0.01
Supplementary Table 2.

Relative abundances of key taxa confronting hyperoxia and/or rituximab.

All Arabic numerals represent relative abundance (%). LDR: Low-dosage (20 mg/kg) rituximab and reared in hyperoxia (75% oxygen). HDR: High-dosage (40 mg/kg) of rituximab and reared in hyperoxia. PBS: Received placebo (PBS) and reared in hyperoxia. CTL: Received placebo (PBS) and reared in conventional environment (21% oxygen) as healthy control.

| Name               | LDR  | HDR   | PBS   | CTL   | LCE  | LHE  |
|--------------------|------|-------|-------|-------|------|------|
| **Phylum**         |      |       |       |       |      |      |
| Bacteroidetes      | 49.54| 59.43 | 37.69 | 32.74 | 28.05| 23.16|
| Firmicutes         | 24.98| 20.92 | 35.63 | 39.23 | 58.02| 61.51|
| Proteobacteria     | 9.87 | 3.60  | 8.65  | 5.39  | 2.23 | 2.37 |
| Verrucomicrobiota  | 3.20 | 5.40  | 0.10  | 6.51  | 0.82 | 0.09 |
| Campylobacterota   | 4.54 | 2.92  | 6.70  | 2.69  | 1.11 | 1.22 |
| **Class**          |      |       |       |       |      |      |
| Bacteroidia        | 49.18| 59.10 | 37.05 | 31.90 | 27.64| 22.82|
| Bacilli            | 10.06| 8.06  | 15.12 | 14.23 | 46.77| 47.00|
| Firmicutes-Clostridia | 14.92| 12.78 | 20.33 | 24.99 | 11.08| 13.36|
| Verrucomicrobiae   | 3.20 | 5.40  | 0.10  | 6.51  | 0.82 | 0.09 |
| **Order**          |      |       |       |       |      |      |
| Bacteroidales      | 48.47| 58.51 | 36.42 | 30.79 | 27.31| 22.33|
| Lactobacillales    | 5.21 | 3.12  | 7.11  | 6.74  | 33.88| 39.80|
| Enterobacterales   | 7.91 | 1.42  | 5.28  | 0.95  | 0.34 | 0.60 |
| Lachnospirales     | 11.45| 8.24  | 12.51 | 21.03 | 7.33 | 9.00 |
| **Family**         |      |       |       |       |      |      |
| Tannerellaceae     | 22.71| 29.29 | 7.61  | 11.05 | 2.23 | 0.89 |
| Muribaculaceae     | 16.83| 5.46  | 21.85 | 14.21 | 20.55| 18.31|
| Bacteroidaceae     | 7.89 | 21.85 | 5.88  | 3.55  | 2.52 | 1.02 |
| Genus          | Species                          | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---------------|----------------------------------|------|------|------|------|------|------|
| Lactobacillaceae |                                 | 3.53 | 2.64 | 6.14 | 6.24 | 33.57| 38.89|
| Akkermansiaceae |                                 | 3.18 | 5.38 | 0.06 | 6.47 | 0.80 | 0.06|
| **Parabacteroides** |                                 | 22.71| 29.29| 7.61 | 11.05| 2.22 | 0.89|
| Akkermansia     |                                 | 3.18 | 5.38 | 0.06 | 6.47 | 0.80 | 0.06|
| Bacteroides     |                                 | 7.89 | 21.85| 5.88 | 3.55 | 2.52 | 1.02|
| Blautia         |                                 | 0.55 | 0.92 | 0.41 | 7.22 | 0.33 | 0.14|
| Helicobacter    |                                 | 4.54 | 2.92 | 6.69 | 2.69 | 1.10 | 1.22|
| Lactobacillus   |                                 | 3.53 | 2.63 | 6.15 | 6.24 | 33.57| 38.89|
| **Akkermansia_mucinis** | hila                             | 3.18 | 5.38 | 0.06 | 6.47 | 0.80 | 0.06|
| **Parabacteroides_sp_CT06** |                          | 11.47| 12.64| 5.29 | 3.11 | 0.67 | 0.50|
| **Ligilactobacillus** | murinus                          | 2.01 | 1.74 | 4.18 | 5.27 | 6.16 | 5.60|
| **Helicobacter_hepaticus** |                              | 1.13 | 0.75 | 6.11 | 0.92 | 0.11 | 0.27|
Supplementary Figure 1

An oxygen controller used for neonate breast-feeding in hyperoxia environment. Both lactating mice and littles were located within this instrument and the oxygen concentration was automatically maintained at 75% oxygen. A. Animal cages located in a hyperoxia chamber. B. Breast-feeding over a layer of spongy shavings. C. An oxygen controller (made in Shanghai, China) that maintain the oxygen concentration within a hyperoxia chamber.
**Supplementary Figure 2**

**Hyperoxia combined with rituximab significantly altered the gut microbiota of newborns.** The heatmap showed the differences of intestinal flora among the three groups (PBS, LDR and HDR) at level of genus. LDR: low dose (20mg/kg) of rituximab, reared in hyperoxic (75% oxygen) . HDR: high dose (40 mg/kg) of rituximab, reared in a hyperoxic environment. PBS: with placebo (PBS) received, reared in a hyperoxic environment.
**Supplementary Figure 3**

**Dysbiosis of intestine microbiota induced by hyperoxia.** The heatmap showed the differences of intestinal flora between CTL and PBS. CTL: Received placebo (PBS) and reared in conventional environment (21% oxygen) PBS: Received placebo (PBS) and reared in hyperoxia.
Supplementary Figure 4
Dysfunctional intestinal microbiota of lactating mice rearing in hyperoxia environment. The heatmap showed the differences of intestinal flora between LCE and LHE. LCE: Lactating mice reared in conventional environment. LHE: Lactating mice reared in hyperoxia.