

OMB # 0925-XXXX

Expiration Date: XX/XXXX

IMMUNOLOGY KNOWLEDGE CHECK

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- 1) Which of the following is true about immune responses in females compared to males?
 - a. **Adult females typically mount stronger innate and adaptive immune responses than males to microbes and allergens.**
 - b. Adult males develop greater memory immune responses, antibody responses, and have greater vaccine efficacy than females.
 - c. Females have faster clearance of microbes due to greater immune responses.
 - d. Sex differences in immune responses can change over the life course, often being most pronounced during the post-menopausal period in females.

Explanation: The correct answer is A. Generally, adult females develop higher immune responses than adult males, which improves responses to vaccines but also increases susceptibility to autoimmune and inflammatory diseases.

- 2) Sex differences in inflammatory and antibody response vary over the life course. In which of the following life stages do females have a higher level of response?
 - a. In utero & old age
 - b. Childhood & post-puberty/adulthood
 - c. **Post-puberty/adulthood & old age**

- d. All life stages (in utero, childhood, post-puberty/adulthood, old age)

Explanation: The correct answer is C. Males have a higher level of response in utero and during childhood/pre-puberty. Females have a higher level of response during post-puberty/adulthood and in old age.

- 3) Multiple Sclerosis is an autoimmune disease of the central nervous system, with early inflammatory relapses of temporary clinical deficits, late neurodegeneration, and gradual progression of permanent disability. Which of the following is FALSE about sex differences in MS?
- a. Higher incidence of MS in women is thought to be due to a more robust immune response in women compared to men.
 - b. **Women are more likely to get MS and have worse permanent disability progression.**
 - c. The sex ratio (women:men) of MS has been increasing over the past 6 decades due to an increased incidence in women, not a decrease in men.
 - d. The sex ratio (women:men) of MS ranges from 2:1 to 3:1 with variance due to geographical region (i.e., greater ratio at lower latitudes)

Explanation: Answer B is false. Women are more likely to get MS, but men have worse permanent disability progression.

- 4) Estriol is produced by the fetal placental unit during pregnancy, gradually increasing over time with highest concentrations during the 3rd trimester, correlating with the 70% reduction in relapses during the 3rd trimester of pregnancy. In phase II clinical trials, which of the following is not shown to be an effect of estriol on women with MS?
- a. Estriol treatment reduced enhancing lesions.
 - b. Estriol treatment was immunomodulatory in peripheral blood cells
 - c. **Estriol treatment in combination with glatiramer acetate did not reduce relapses.**
 - d. Oral contraceptives containing high vs. low dose estradiol in combination with interferon- β showed no effect on relapses

The correct selection is “C” -- Estriol treatment in combination with glatiramer acetate **has** been shown to reduce relapses, with improved cognitive test performance, reduced fatigue, and sparing of cortical gray matter atrophy as exploratory outcomes.

- 5) The epidemiology of asthma shows:
- a. Among children, the prevalence of asthma is higher for females than males.
 - b. After puberty, there is a predominance of asthma cases among males as compared with females.
 - c. The lowest prevalence of asthma in males is seen around age 80
 - d. In older adults, sex differences are less pronounced or even reversed during the seventh and eighth decades of life.**

Answer D is correct. In children, the prevalence of asthma is higher for males than females. After puberty, there is a preponderance of asthma cases in females as compared to males. The lowest prevalence of asthma in males is seen around age 40. In older adults, sex differences are less pronounced or even reversed during the seventh and eighth decades of life.

- 6) In relation to sex differences, preclinical asthma studies show all the following except:
- a. Female mice are more susceptible to developing allergic airway inflammation than males in animal models of asthma.
 - b. Allergic lung inflammation is worse in male than female mice.**
 - c. Castration of male mice reduces airway responsiveness to cholinergic challenge in mouse models of allergic asthma
 - d. Progesterone administration increases Th2 cytokine responses and eosinophilic airway inflammation in mouse models of allergic asthma

The correct answer is B. Preclinical asthma studies show that female mice are more susceptible to developing allergic airway inflammation than males in animal models of asthma; allergic lung inflammation is worse in **female** than **male** mice; castration of male mice reduces airway responsiveness to cholinergic challenge in mouse models of allergic asthma; and progesterone administration increases Th2 cytokine responses and eosinophilic airway inflammation in mouse models of allergic asthma

- 7) Men and women have different clinical presentations of asthma. An example is:

- a. **Asthma symptoms change in approximately 30-40% of women throughout the menstrual cycle, with a worsening of asthma during the pre- and peri-menstrual period of the cycle.**
- b. Decreased asthma symptoms have been reported in peri and post-menopausal women.
- c. During pregnancy, approximately 1/3 of women with asthma report decreased asthma symptoms.
- d. Men presenting with asthma exacerbations at emergency rooms are more likely to be hospitalized than women.

The correct answer is A. Approximately 30-40% of women with asthma report changes throughout the menstrual cycle, with a worsening of asthma during the pre- and peri-menstrual period of the cycle.

- 8) Which of the following gender differences are observed in influenza vaccine acceptance?
- a. Men are less likely to accept influenza vaccines
 - b. Women are less likely to accept influenza vaccines**
 - c. Men and women are equally likely to accept influenza vaccines

The correct answer is B. In addition to sex differences in vaccine efficacy, gender differences are observed in vaccine acceptance. Women are less likely to accept the influenza vaccine than men.

- 9) Sex differences are evident in mice inoculated with influenza vaccines. Female mice vaccinated with influenza vaccines mount a greater immune response and show greater cross protection against novel influenza viruses than male mice.
- a. True**
 - b. False

The correct answer is A. Female mice vaccinated with influenza vaccines mount a greater immune response and show greater cross protection against novel influenza viruses than male mice.

10) At present, sex is always considered a biological variable in the design and clinical implementation of vaccines.

a. True

b. False

The correct answer is B. Although sex should be considered in the formulation and dosages of vaccines and the evaluation of vaccine effectiveness, this is not always the case.