# Age distribution of circulating α-interferon

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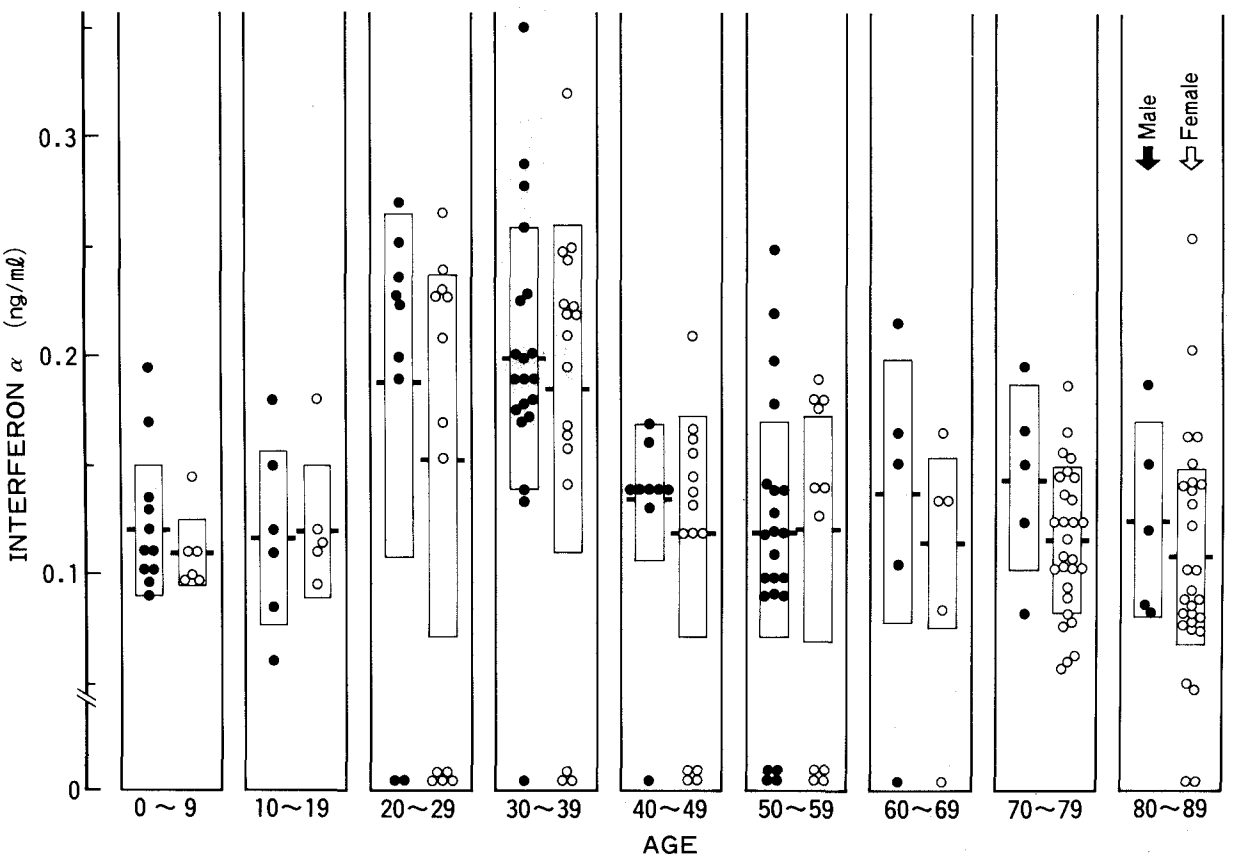
*Summary.* A sensitive radioimmunoassay showed that circulating α-interferon in the plasma of healthy individuals was low in children and reached the highest level in the young adult, then declined gradually with age. Circulating α-interferon was 0.201 ± 0.059 ng/ml in males (n = 19) and 0.184 ± 0.076 ng/ml in females (n = 14) at ages 30–39 years old. It was noted that circulating α-interferon was maintained up to a certain level even in elderly individuals.
*Key words.* α-Interferon; aging.

Alpha-interferon plays an important role in the immune response of the host, especially in the maintenance of natural killer cell activities[1–6]. In a previous study, utilizing a sensitive radioimmunoassay which enabled measurement of circulating α-interferon, we found that circulating α-interferon existed in a fragmented form, inactive in the virus inhibition assay, in the plasma of healthy individuals[7,8]. This explained why biological α-interferon is often undetectable by virus assay in the plasma of healthy donors, yet is detectable by radioimmunoassay. The present study extends the previous result and shows the variation with age of the circulating level of α-interferon in the plasma of healthy individuals. The results show that circulating α-interferon is low in children and reaches the highest level in the young adult, then declines gradually with age.

*Methods*

A radioimmunoassay was carried out as described[7]. Alpha-interferon was produced from human leukemic BALL-1 cells by infection with Sendai virus. Antibody to α-interferon was raised by immunizing rabbits with this antigen. Alpha-interferon was radioiodinated using the lactoperoxidase technique, and $^{125}$I-α-interferon had an




Age distribution of circulating α-interferon. Each point represents the mean ± SEM of determinations performed in duplicate.

approximate specific activity of 0.3 mCi/μg. The minimal detectable quantity of α-interferon was 0.05 ng/ml. The specificity of the radioimmunoassay was confirmed; a) the assay did not cross-react with β-interferon, γ-interferon, or ACTH; b) the recombinant α-interferon Ro 22-8181 inhibited the binding of $^{125}$I-α-interferon to a level comparable with inhibition by BALL-1 cell α-interferon[7]. A linear correlation existed between the radioimmunoassay (y) and the virus inhibition assay (x), with a regression line of y on x as $y = 0.659x + 245$ (u) ($p < 0.01$). Circulating α-interferon was extracted and concentrated from plasma either by silicic acid or antibody immunoadsorption, and the dilution curves of plasma and extracted samples of plasma were completely parallel to the standard curve[7]. Each assay was standardized by introducing appropriate concentrations of internal standard α-interferon, and the inter-assay variation in our hands was 4.12%[7]. The values below the sensitivity limit of the assay were calculated as 0.05 ng/ml, according to the previous results of extraction studies[7]. Peripheral blood was drawn heparinized, and plasma was immediately separated and stored at − 20 °C until assayed.

*Results and discussions*

Circulating α-interferon in the plasma of healthy individuals was low in children and reached the highest level in the young adult, subsequently declining gradually with age (fig.). Circulating α-interferon was highest at ages 30–39 years; 0.201 ± 0.059 ng/ml in males (n = 19) and 0.184 ± 0.076 ng/ml in females (n = 14). These results seem to reflect a gradual change in immune surveillance of the host during aging.

Previous studies have shown that, although circulating α-interferon did not change significantly after measles virus infection[8], circulating α-interferon did increase after hepatitis A virus infection (Shiozawa K. et al., submitted). Circulating α-interferon was, however, significantly low (below 0.05 ng/ml, the sensitivity limit in this assay) in certain diseases such as rheumatoid arthritis[7], and in some patients with adult T cell leukemia, for whom α-interferon therapy was highly effective[9]. This is in contrast with the present finding that circulating α-interferon is maintained up to a certain level even in very elderly individuals, unless they suffer from certain diseases. These findings appear to suggest that circulating α-interferon, the concentration of which may reflect that of endogenous α-interferon, is kept to a certain level, and to maintain the level of endogenous α-interferon would often be mandatory for the host's intact immune protection. There is evidence that endogenous α-interferon is indeed required for protection against tumor growth in vivo[10] and replication of retroviruses in vitro[11,12].

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## Genetic structure and division of labor in honeybee societies

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*Summary.* Recent studies have demonstrated a genotypic component to the division of labor among worker honeybees. However, these studies used artificially-selected strains of bees or colonies derived from queens that were instrumentally inseminated with the semen from very few males. We present evidence for genotypic variability among groups of workers performing tasks in colonies with naturally-mated queens. These results demonstrate that genetic structure is a level of social organization in honeybees.
*Key words.* Social behavior; honeybee; division of labor; behavior genetics.

Division of labor is fundamental to the complex organization of insect societies[1,2]. The prevailing model of division of labor explains behavioral differentiation among individual workers solely on the basis of age and environmental factors[1–3]. However, nestmates may differ from one another genetically as a consequence of polyandry,