$\mathbf{X}_{p\times 1}$ has mean μ_x and covariance matrix $\Sigma_x = Cov(\mathbf{X})$
$= E[(\mathbf{X}-\mu_x)(\mathbf{X}-\mu_x)^T]$. Consider $Z = C\mathbf{X}$.

Then
$$E(Z) = C\mu_x \quad \text{and} \quad Cov(Z) = C\,\Sigma_x\,C^T$$

PROOF:

$$\mu_Z = E(Z) = E(C\mathbf{X}) = E(C\mathbf{X}I)$$

$E(A\mathbf{X}B)$ where $B = I$

$$= C\,E(\mathbf{X})\,I = C\,E(\mathbf{X}) = C\mu_x$$

$$Cov(Z) = E[(Z-\mu_Z)(Z-\mu_Z)^T]$$

$$= E\left((C\mathbf{X} - C\mu_x)(C\mathbf{X} - C\mu_x)^T\right)$$

$$= E\left(C\underbrace{(\mathbf{X}-\mu_x)(\mathbf{X}-\mu_x)^T}_{Y_{p\times p}}C^T\right)$$

use $E(A\mathbf{X}B) = A\,E(\mathbf{X})\,B$ with $A \leftarrow C$, $\mathbf{X} \leftarrow Y$, $B \leftarrow C^T$

$$= C\,\underbrace{E\left((\mathbf{X}-\mu_x)(\mathbf{X}-\mu_x)^T\right)}_{\text{def. of } Cov(\mathbf{X})}\,C^T = \underline{\underline{C\,Cov(\mathbf{X})\,C^T}}$$