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Database Programming with PL/SQL

3-2

Retrieving Data in PL/SQL

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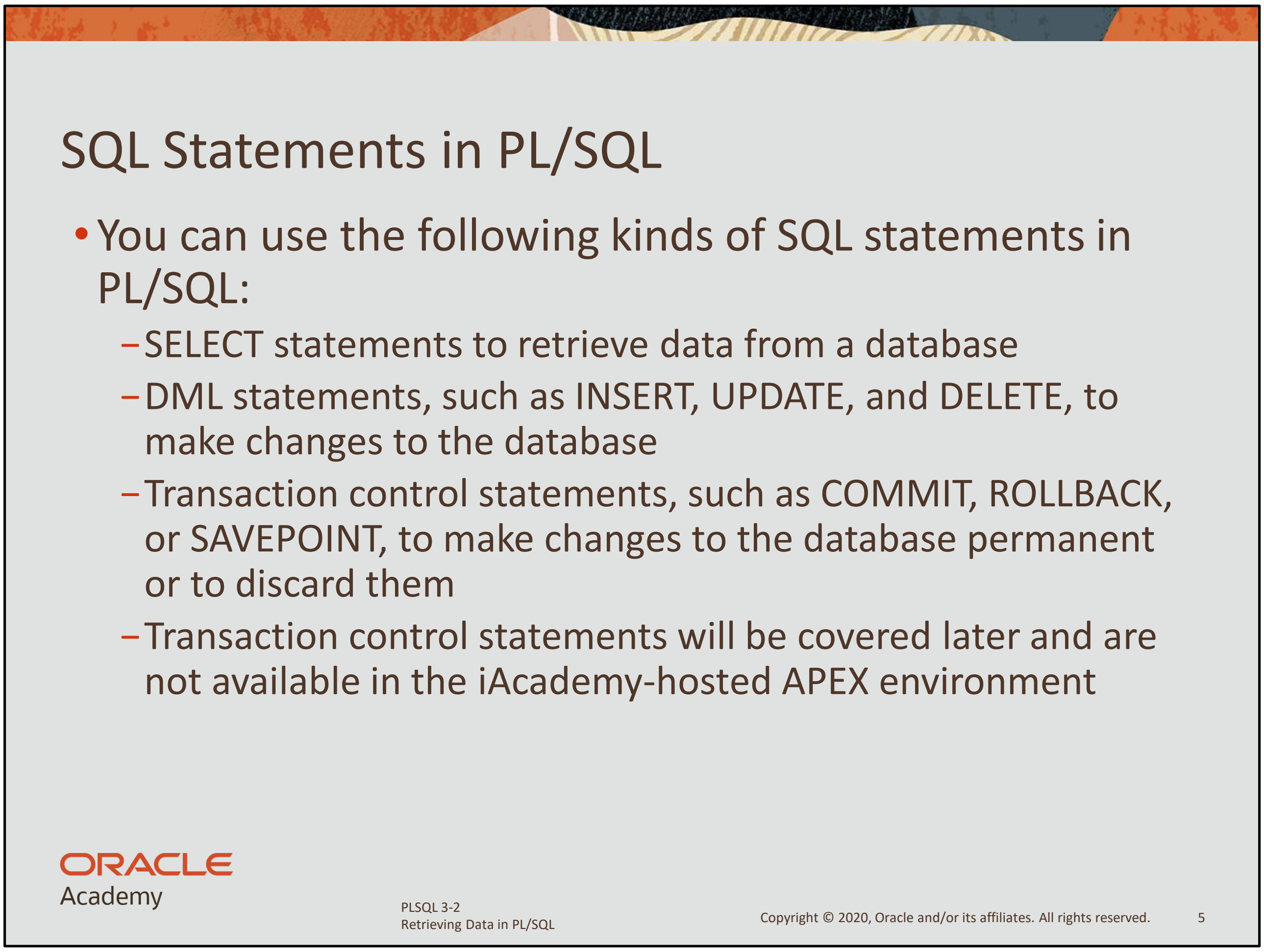
Objectives

- This lesson covers the following objectives:
  - Recognize the SQL statements that can be directly included in a PL/SQL executable block
  - Construct and execute an INTO clause to hold the values returned by a single-row SQL SELECT statement
  - Construct statements to retrieve data that follow good practice guidelines
  - Construct statements that apply good practice guidelines for naming variables

Purpose

- In this lesson, you learn to embed standard SQL SELECT statements in PL/SQL blocks
- You also learn the importance of following usage guidelines and naming convention guidelines when retrieving data
- Blocks can be a good method for organizing your code
- When you review code written by someone else, it is easier to read chunks of a program than it is to read one long continuous program



SQL Statements in PL/SQL

- You can use the following kinds of SQL statements in PL/SQL:
  - SELECT statements to retrieve data from a database
  - DML statements, such as INSERT, UPDATE, and DELETE, to make changes to the database
  - Transaction control statements, such as COMMIT, ROLLBACK, or SAVEPOINT, to make changes to the database permanent or to discard them
  - Transaction control statements will be covered later and are not available in the iAcademy-hosted APEX environment

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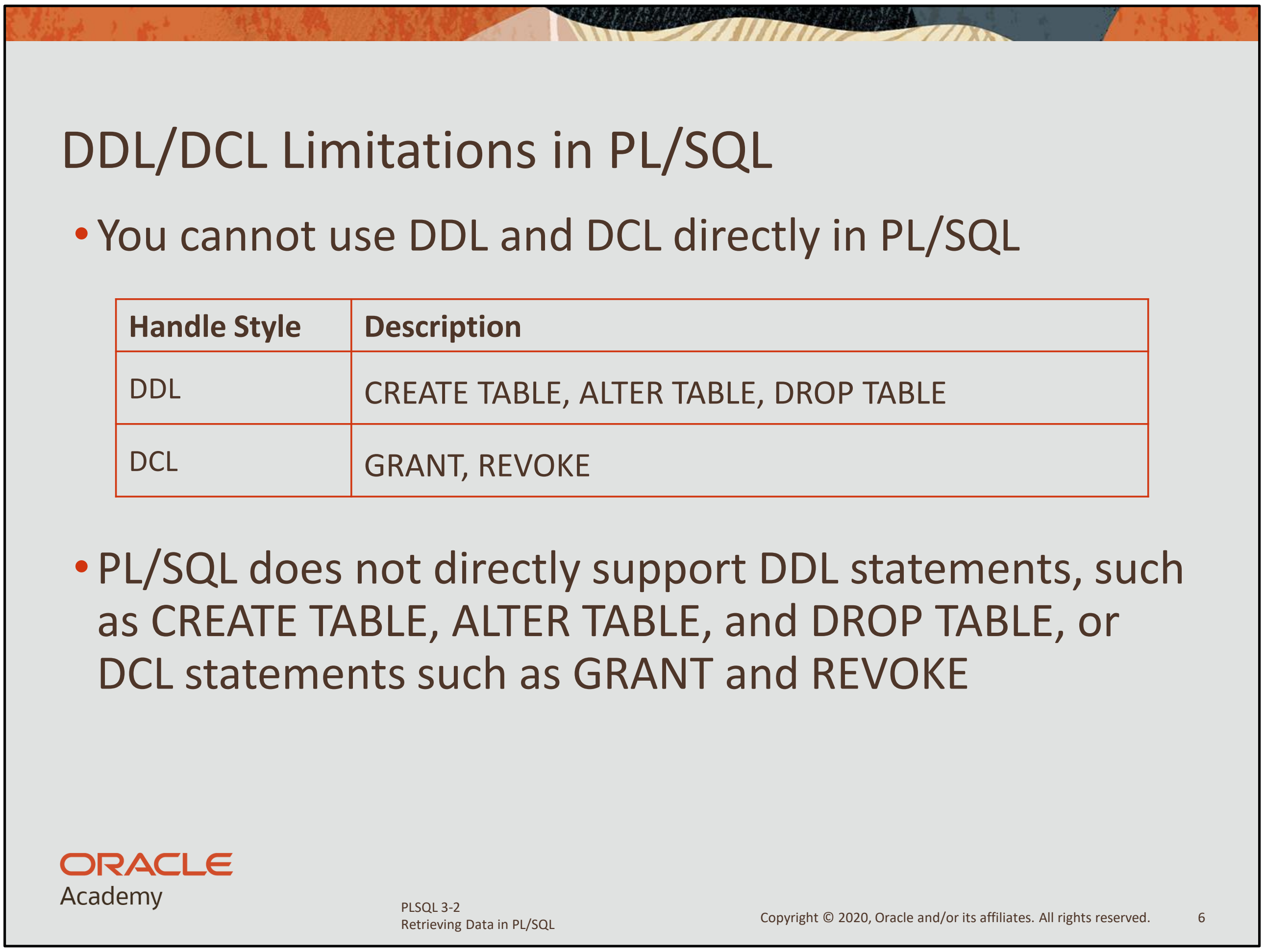
PL/SQL is tightly integrated with SQL and therefore the database.

If using the online APEX environment through iAcademy, all SQL statements are automatically committed. The transaction control statements, COMMIT, ROLLBACK, and SAVEPOINT, are NOT available through iAcademy.



DDL/DCL Limitations in PL/SQL

- You cannot use DDL and DCL directly in PL/SQL

Handle Style	Description
DDL	CREATE TABLE, ALTER TABLE, DROP TABLE
DCL	GRANT, REVOKE

- PL/SQL does not directly support DDL statements, such as CREATE TABLE, ALTER TABLE, and DROP TABLE, or DCL statements such as GRANT and REVOKE

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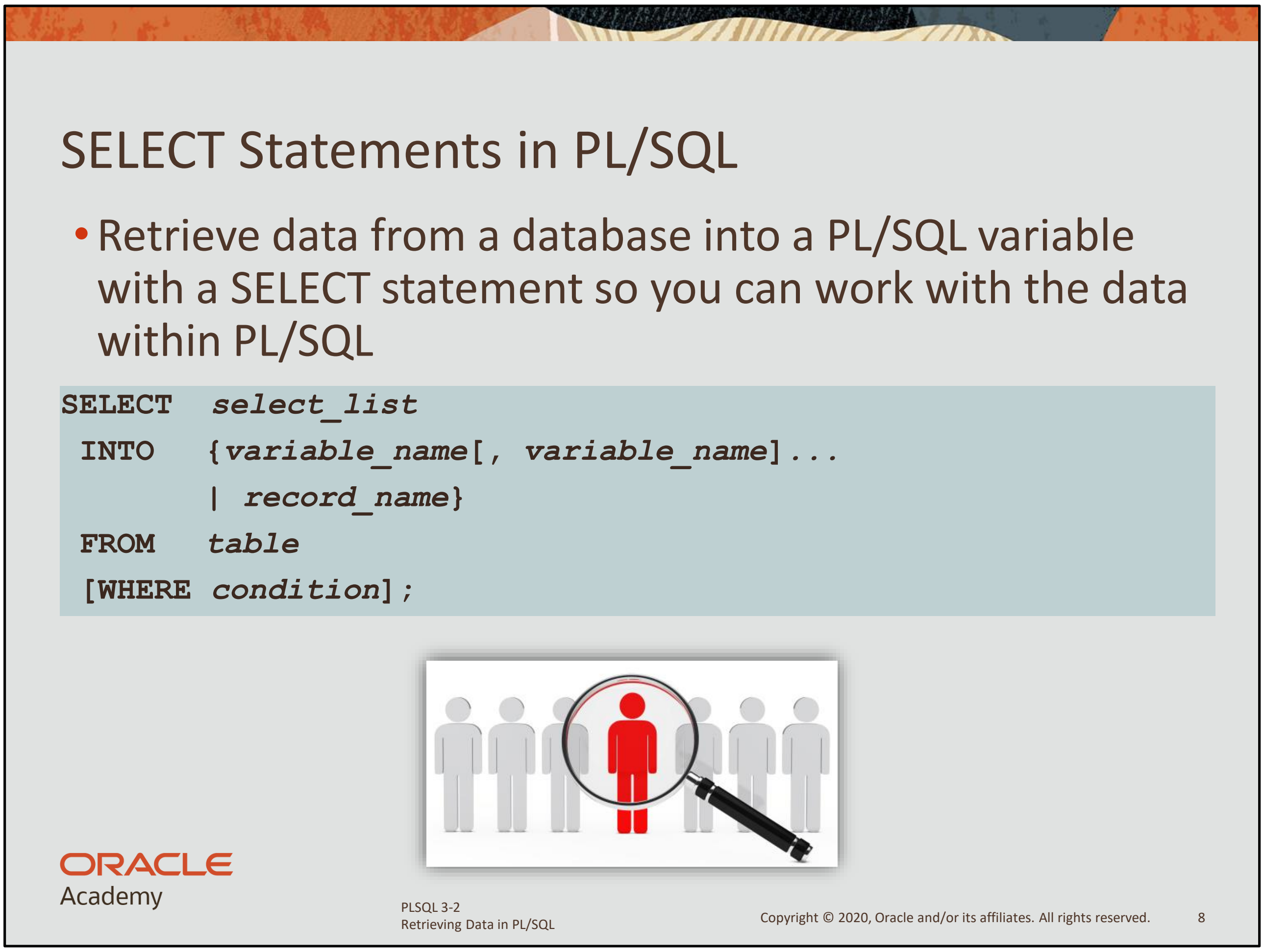
DDL/DCL Limitations in PL/SQL

- You cannot directly execute DDL and DCL statements because they are constructed and executed at run time—that is, they are dynamic
- There are times when you may need to run DDL or DCL within PL/SQL
- The recommended way of working with DDL and DCL within PL/SQL is to use Dynamic SQL with the EXECUTE IMMEDIATE statement
- This will be discussed later in the course

DDL and DCL statements cannot simply run within the executable section of a PL/SQL block of code.



SELECT Statements in PL/SQL

- Retrieve data from a database into a PL/SQL variable with a SELECT statement so you can work with the data within PL/SQL

```
SELECT   select_list
 INTO    {variable_name[, variable_name]...
         | record_name}
 FROM    table
 [WHERE  condition];
```

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Use the SELECT statement to retrieve data from the database. In the syntax:

select_list is a list of at least one column and can include SQL expressions, row functions, or group functions

variable_name is a scalar variable that holds a retrieved value

record_name is the PL/SQL record that holds the retrieved values

table specifies the database table name

condition is composed of column names, expressions, constants, and comparison operators, including PL/SQL variables and constants

Using the INTO Clause

- The INTO clause is mandatory and occurs between the SELECT and FROM clauses
- It is used to specify the names of PL/SQL variables that hold the values that SQL returns from the SELECT clause

```
DECLARE
 v_emp_lname employees.last_name%TYPE;
BEGIN
 SELECT last_name
  INTO v_emp_lname
  FROM employees
  WHERE employee_id = 100;
 DBMS_OUTPUT.PUT_LINE('His last name is ' || v_emp_lname);
END;
```

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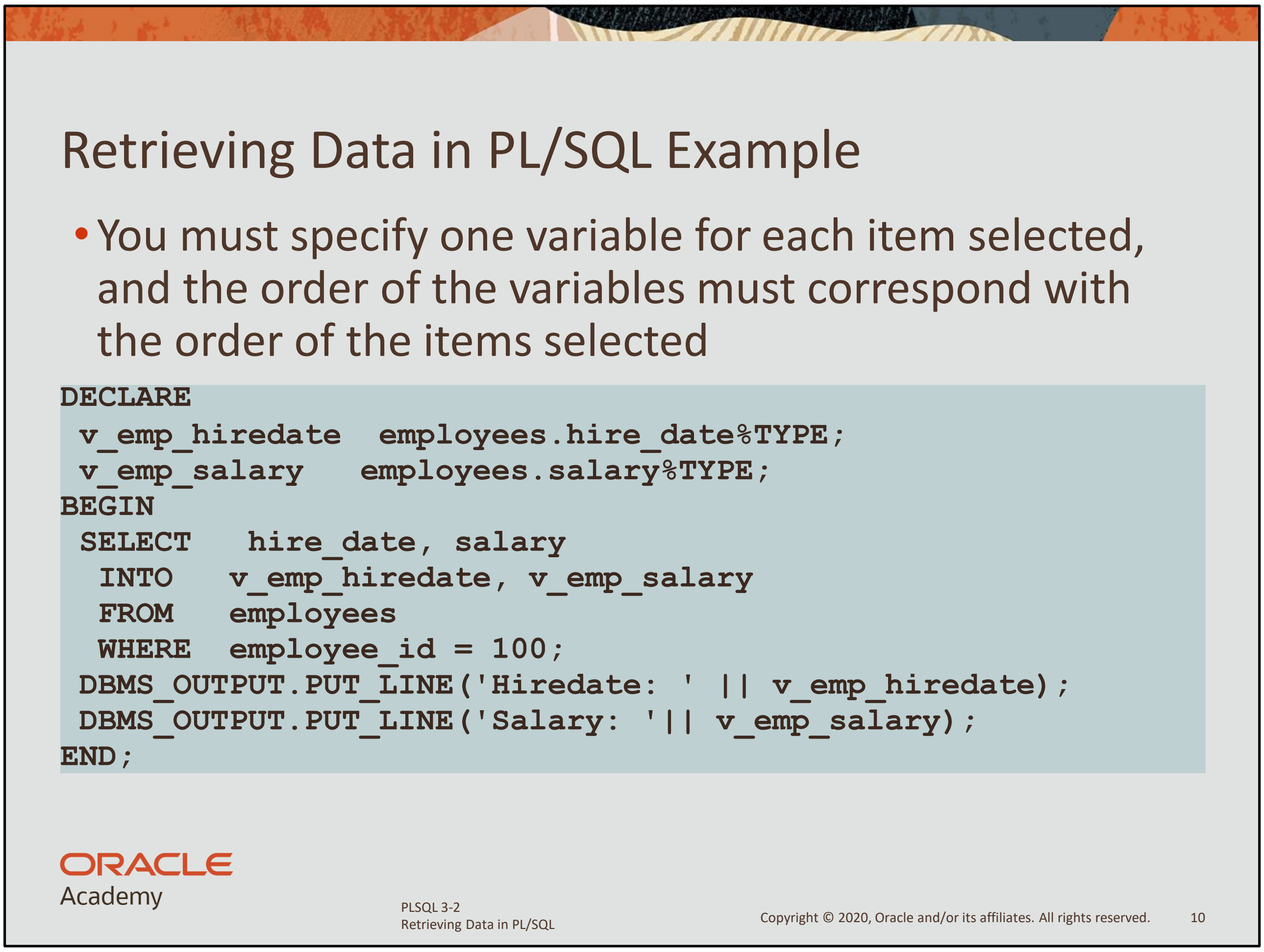

Retrieving Data in PL/SQL Example

- You must specify one variable for each item selected, and the order of the variables must correspond with the order of the items selected

```
DECLARE
 v_emp_hiredate   employees.hire_date%TYPE;
 v_emp_salary    employees.salary%TYPE;
BEGIN
 SELECT   hire_date, salary
  INTO   v_emp_hiredate, v_emp_salary
  FROM   employees
  WHERE  employee_id = 100;
 DBMS_OUTPUT.PUT_LINE('Hiredate: ' || v_emp_hiredate);
 DBMS_OUTPUT.PUT_LINE('Salary: '|| v_emp_salary);
END;
```

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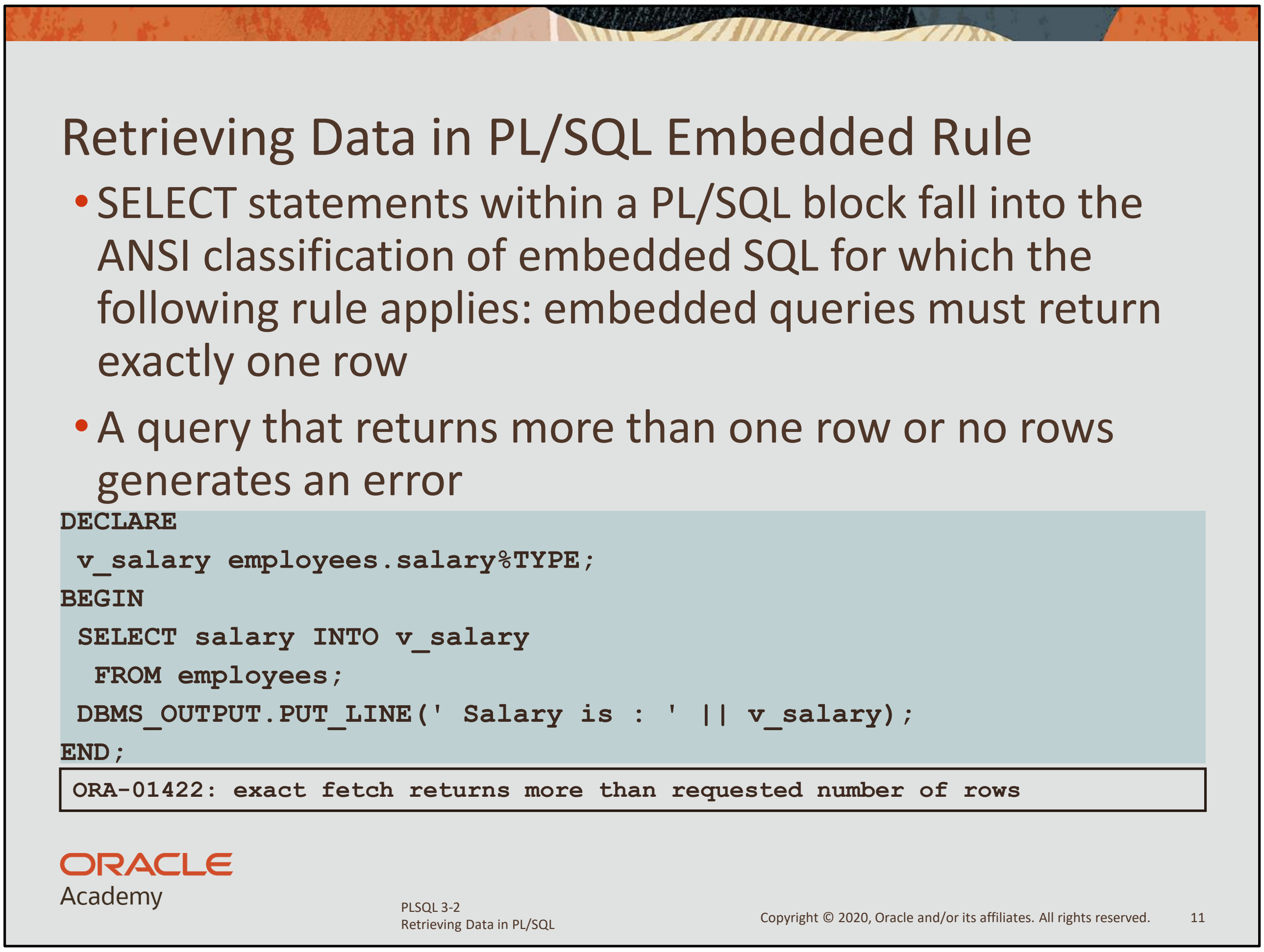
In the example in the slide, the v_emp_hiredate and v_emp_salary variables are declared in the declarative section of the PL/SQL block. In the executable section, the values of the columns hire_date and salary for the employee with the employee_id 100 is retrieved from the employees table and stored in the v_emp_hiredate and v_emp_salary variables, respectively. Observe how the INTO clause, along with the SELECT clause, retrieves the database column values into the PL/SQL variables.

Note: The SELECT statement is retrieving hire_date and then salary, That means the variables in the INTO clause must be in the same order.



Retrieving Data in PL/SQL Embedded Rule

- SELECT statements within a PL/SQL block fall into the ANSI classification of embedded SQL for which the following rule applies: embedded queries must return exactly one row
- A query that returns more than one row or no rows generates an error

```
DECLARE
 v_salary employees.salary%TYPE;
BEGIN
 SELECT salary INTO v_salary
  FROM employees;
 DBMS_OUTPUT.PUT_LINE(' Salary is : ' || v_salary);
END;
```

```
ORA-01422: exact fetch returns more than requested number of rows
```

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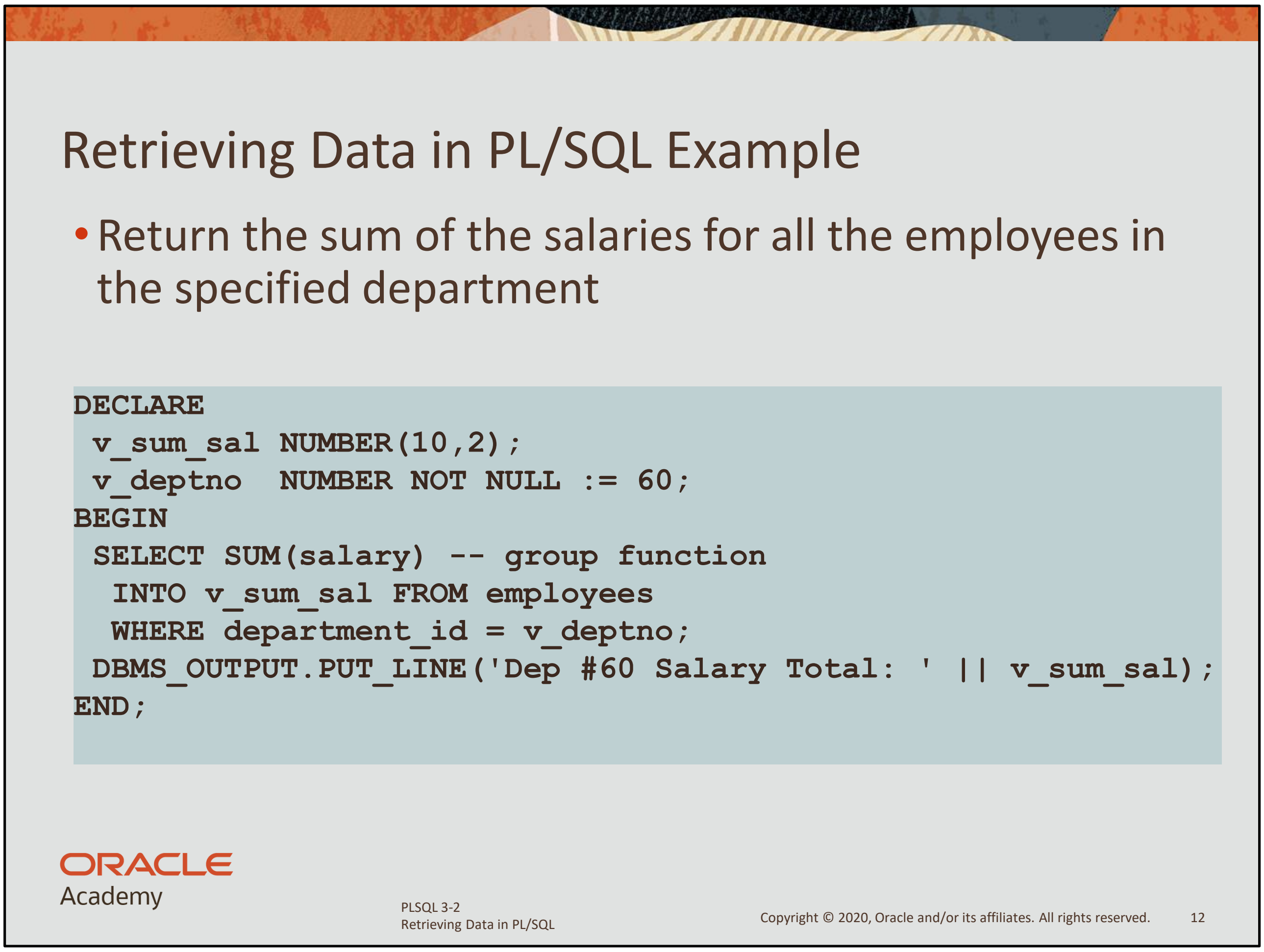
A SELECT statement with the INTO clause can retrieve only one row at a time. If your requirement is to retrieve multiple rows and operate on the data, then you can make use of explicit cursors. PL/SQL explicit cursors will be discussed in upcoming lessons.



Retrieving Data in PL/SQL Example

- Return the sum of the salaries for all the employees in the specified department

```
DECLARE
 v_sum_sal NUMBER(10,2);
 v_deptno  NUMBER NOT NULL := 60;
BEGIN
 SELECT SUM(salary) -- group function
  INTO v_sum_sal FROM employees
  WHERE department_id = v_deptno;
 DBMS_OUTPUT.PUT_LINE('Dep #60 Salary Total: ' || v_sum_sal);
END;
```

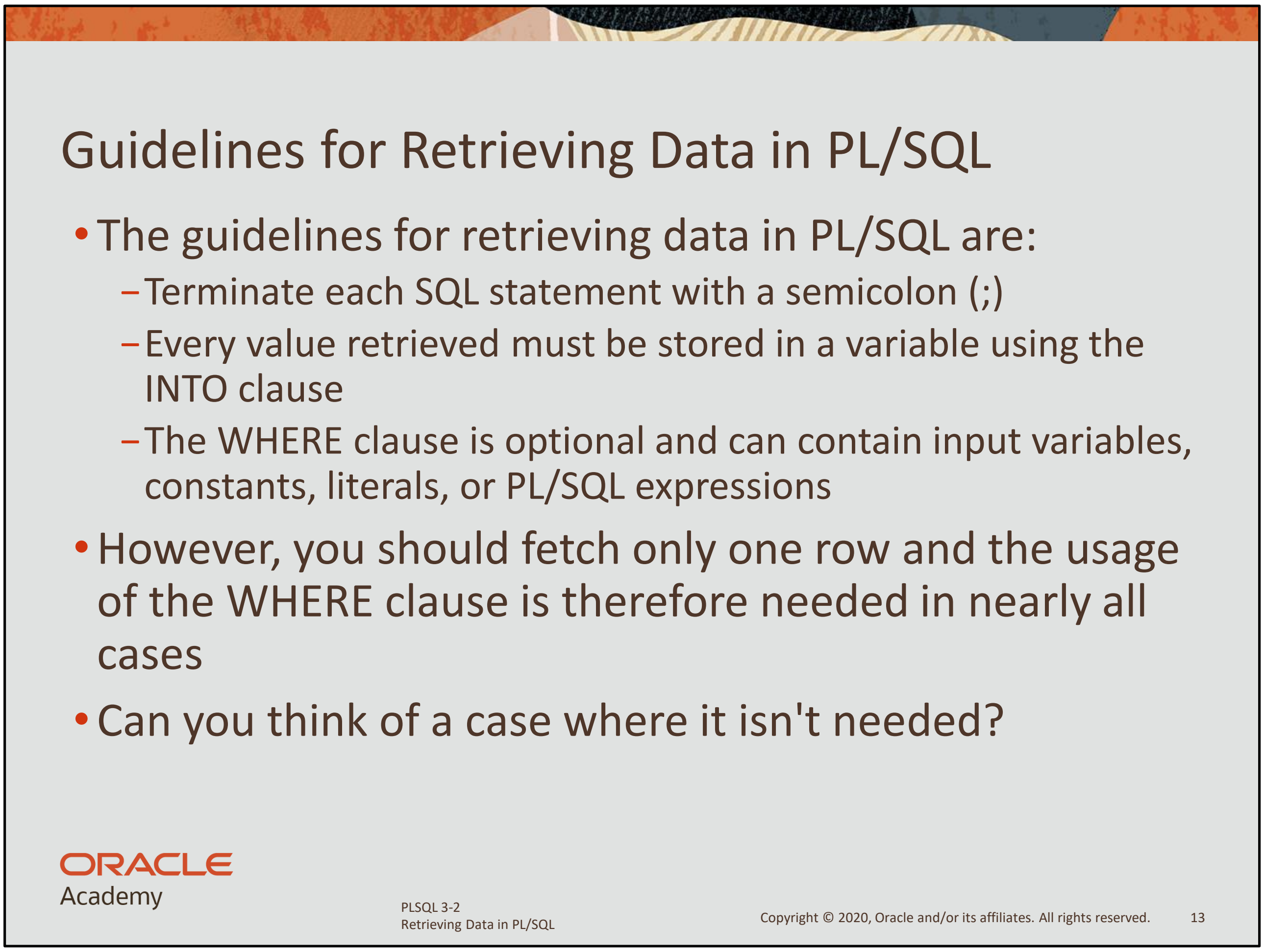
In this example, the v_sum_sal and v_deptno variables are declared in the declarative section of the PL/SQL block. In the executable section, the total salary for the employees in the department with the department_id 60 is computed using the SQL group function SUM. The calculated total salary is assigned to the v_sum_sal variable.

Group functions cannot be used directly in PL/SQL syntax.

For example, the following code does not work:

v_sum_sal := SUM(employees.salary);

Group functions must be part of a SQL statement within a PL/SQL block.



Guidelines for Retrieving Data in PL/SQL

- The guidelines for retrieving data in PL/SQL are:
  - Terminate each SQL statement with a semicolon (;)
  - Every value retrieved must be stored in a variable using the INTO clause
  - The WHERE clause is optional and can contain input variables, constants, literals, or PL/SQL expressions
- However, you should fetch only one row and the usage of the WHERE clause is therefore needed in nearly all cases
- Can you think of a case where it isn't needed?

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Answer: when "retrieving" data from the DUAL table as in:

```
DECLARE
 v_date DATE;
BEGIN
 SELECT SYSDATE
  INTO v_date
  FROM DUAL;
 DBMS_OUTPUT.PUT_LINE('The date is ' || v_date);
END;
```

Guidelines for Retrieving Data in PL/SQL

- Specify the same number of variables in the INTO clause as database columns in the SELECT clause
- Be sure the columns and variables are in the same positional order and their data types are compatible
- To insure data type compatibility between columns and variables, declare the receiving variables using %TYPE

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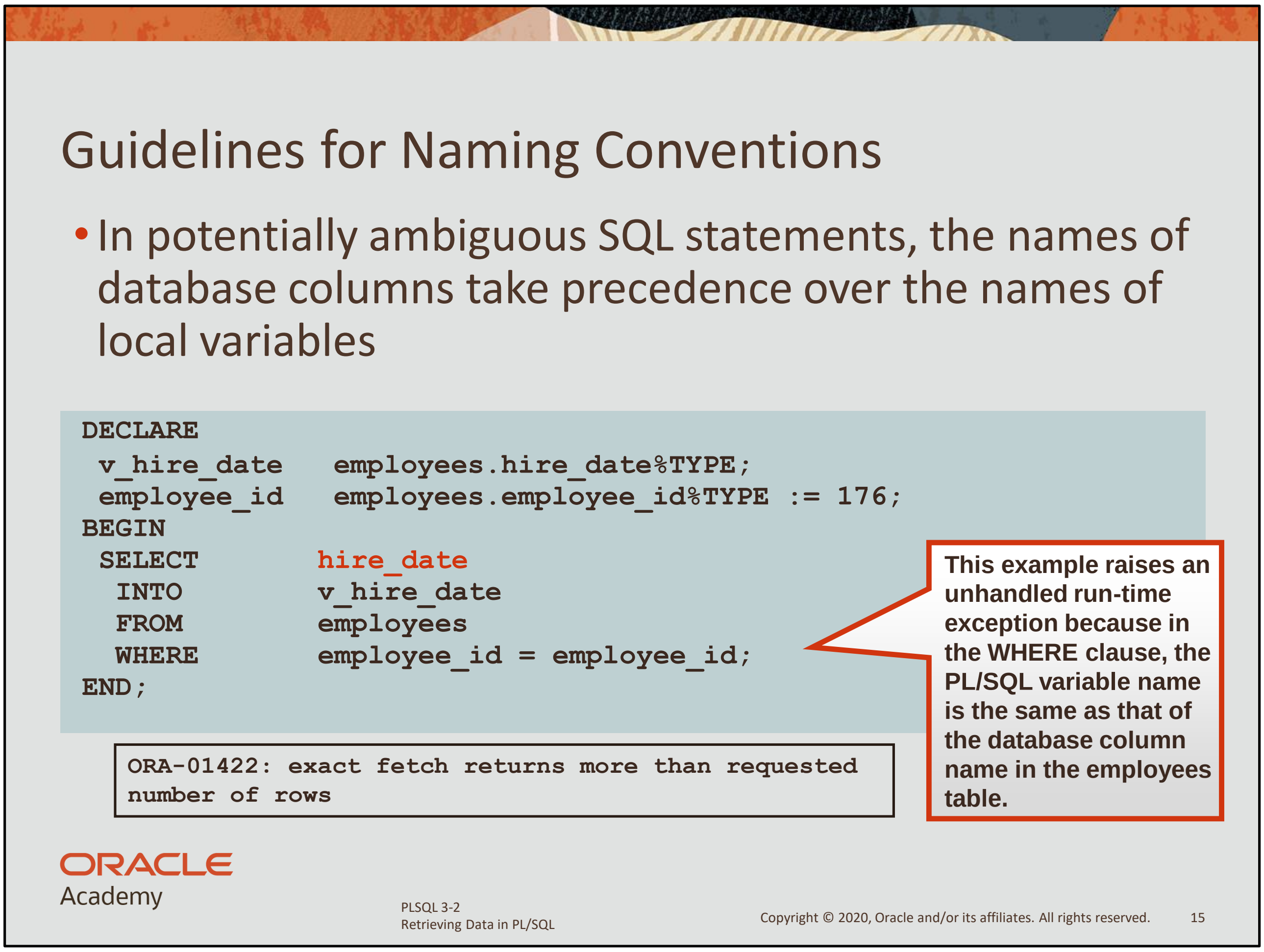

Guidelines for Naming Conventions

- In potentially ambiguous SQL statements, the names of database columns take precedence over the names of local variables

```
DECLARE
 v_hire_date    employees.hire_date%TYPE;
 employee_id    employees.employee_id%TYPE := 176;
BEGIN
 SELECT        hire_date
  INTO         v_hire_date
  FROM         employees
  WHERE        employee_id = employee_id;
END;
```

```
ORA-01422: exact fetch returns more than requested
number of rows
```

This example raises an unhandled run-time exception because in the WHERE clause, the PL/SQL variable name is the same as that of the database column name in the employees table.

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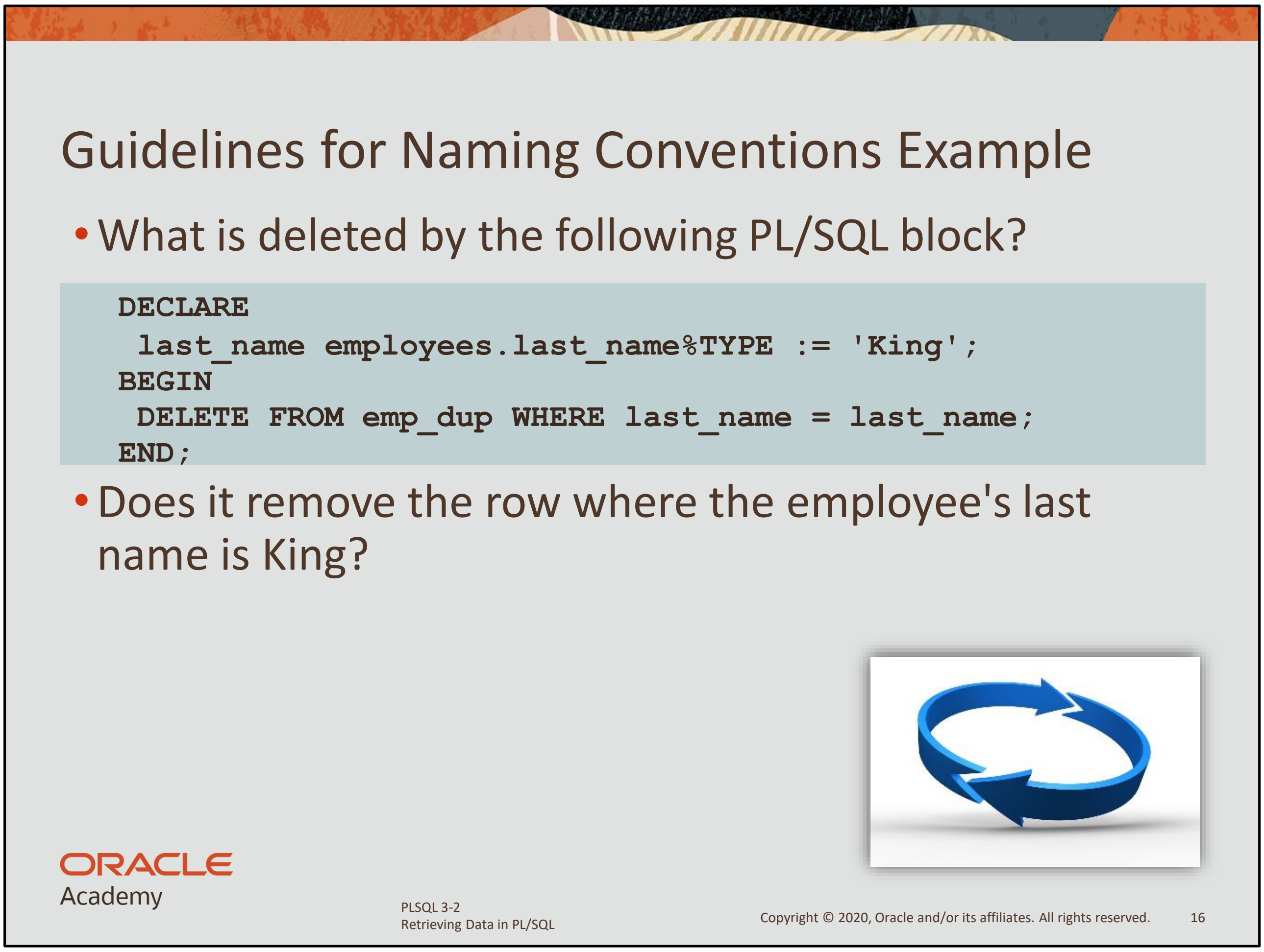
Try running the SELECT statement from the slide (without the INTO clause) outside of a PL/SQL block and you will see it returns more than one row, which we know violates the embedded query rule.

SELECT hire_date FROM employees
 WHERE employee_id = employee_id;



Guidelines for Naming Conventions Example

- What is deleted by the following PL/SQL block?

```
DECLARE
 last_name employees.last_name%TYPE := 'King';
BEGIN
 DELETE FROM emp_dup WHERE last_name = last_name;
END;
```

- Does it remove the row where the employee's last name is King?

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Answer:

The DELETE statement will remove ALL employees from the emp_dup table as opposed to just the row(s) that contain the last name “King.” This is because the Oracle server first resolves WHERE clause data items to the table in the FROM clause. Since last_name is in the table, and the last_name column in each row is "equal" to itself, the DELETE statement deletes ALL rows in the emp_dup table. Had the variable in the declarative section been named v_last_name as our naming convention suggests, this mistake would not have happened.

Guidelines for Naming Conventions Details

- Guidelines for naming conventions:
  - Use a naming convention to avoid ambiguity in the WHERE clause (for example, ensure all variable names begin with v_)
  - Avoid using database column names as identifiers
  - Errors can occur during execution because PL/SQL checks the database first for a column in the table
  - The names of local variables and formal parameters take precedence over the names of database tables (in a PL/SQL statement)
  - The names of database table columns take precedence over the names of local variables

There is no possibility for ambiguity in the SELECT clause because any identifier in the SELECT clause must be a database column name. There is no possibility for ambiguity in the INTO clause because identifiers in the INTO clause must be PL/SQL variables. There is the possibility of ambiguity or confusion only in the WHERE clause.

Summary

- In this lesson, you should have learned how to:
  - Recognize the SQL statements that can be directly included in a PL/SQL executable block
  - Construct and execute an INTO clause to hold the values returned by a single-row SQL SELECT statement
  - Construct statements to retrieve data that follow good practice guidelines
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