Swine Dysentery (SD) is an acute or chronic mucohemorrhagic diarrheal disease caused by *Brachyspira hyodysenteriae* and which causes enormous economic losses. Pigs with SD have been legally rejected by Japanese slaughter houses since 2004 in accordance with government regulations. It was necessary for prefecture government officers to develop a rapid and accurate diagnostic technique for SD.

Chapter 2 describes the typical techniques currently in use at slaughter houses, i.e., culture, biochemical tests, and ordinary PCR amplification of the NADH oxidase (*nox*) gene. The *nox* gene is well-characterized and more suitable for differentiation of genus *Brachyspira* than 16S and 23S rRNA. A total of 67 specimens from pigs of 8 farms in Japan with clinical signs of SD were brought to a slaughter house in Shibaura meat market, Tokyo, Japan. *B. hyodysenteriae* was isolated from 49 of the pigs and was detected by ordinary PCR in 49 of the pigs which were exhibiting typical clinical signs. All isolates had typical characteristics of indole production and the absence of hippurate hydrolysis.

Chapter 3 describes the development and accurate diagnostic real-time PCR technique. New primers and a TaqMan probe were designed to optimize the novel method. The method is suitable for quick-turnaround diagnosis and has high sensitivity and accuracy. Furthermore, the TaqMan probe is specific to the *nox* gene, and has been optimized for specificity. The new method detected 54 SD-affected pigs.
To evaluate the specificity of the real-time PCR assay, 13 other bacterial strains including genus *Brachyspira* and 10 mucosal colon specimens derived from 10 clinically normal pigs were used. Only one species, *B. hyodysenteriae*, was detected by the novel real-time PCR technique.

To confirm the sensitivity of the real-time PCR assay, a DNA standard curve was produced based on DNA extracted from $10^6$ to $10^7$ CFU/mL of *B. hyodysenteriae* ATCC 27164$^T$. The results of DNA standard analysis showed that the detection limit of the real-time PCR method was over $10^1$ CFU/mL. In 67 slaughter house pig specimens, 4 of 67 specimens were detected by the real-time PCR but not by ordinary PCR. Furthermore, the time to complete real-time PCR analysis is about 1 hour 30 min, which is 1-2 hours faster than ordinary PCR because of the effective amplification cycles and the lack of post-PCR manipulation.

Finally, this novel real-time PCR technique was the most specific and sensitive among three techniques. It was very easy and quick to detect *B. hyodysenteriae* because it was not necessary to perform any additional post-PCR tasks. Furthermore, the method enables the use of a DNA standard curve and quantitation of *B. hyodysenteriae* cells in all positive specimens. The rapid diagnostic technique established in this study was useful for the detection of *B. hyodysenteriae* and could contribute to the eradication of SD in pig herds contaminated with *B. hyodysenteriae*. Furthermore, mucosal specimens should be used for this type of diagnosis in pigs. It may be very useful for the rapid detection of the cause of SD.